Department of Biophysics
Govt. Institute of Science, Aurangabad.MS

M. Sc. Biophysics
(Two Year Post Graduate Program)
Program outcomes, program specific outcomes and course outcomes

❖ M.Sc. Biophysics program Objectives & Outcomes :

➢ Program Objectives:

- To develop the Human Resource with the interdisciplinary approach in the field of Science & Technology.
- Learning objectives set the goal to create future researchers, Scientist and expertise in the field of Structural biology and Biophysics that are excellently trained and excited to work on various important medical & health problems.
- The course bridges physical sciences (physics, chemistry, mathematics) and biological sciences (Botany, Zoology, Microbiology etc). and highlights the various applications of physical sciences to biology.
- Adequately emphasizes on the applications of physics, chemistry, mathematics, statistics and computer science to biological sciences needed to develop the new approach in the academic and industrial research.
- Make the Students capable to design research and industrial projects to solve the problems of biological complexity and resolve various health & environmental issues.

❖Program specific outcomes and course outcomes:

M.Sc. I Year: Semester 1			
Sr. No.	**Name of the Course**	**Credits**	**Course Outcomes**
1.	**BPT – 101: Molecular Biophysics**	**03**	**Students will understand the basic Concept of:** ➢ Atomic & molecular structure, ➢ Thermodynamic & Bioenergetic in biological systems ➢ Structural & molecular properties of different biomolecules
2.	**BPT -102 Biophysical Chemistry**	**03**	**Students get acquainted with different:** ➢ Physicochemical properties & biological significance of ➢ Nucleic acids, proteins, polysaccharides, carbohydrates, vitamins, ➢ Hormones ➢ Intra molecular interactions.
3.	**BPT - 103 Cellular Biophysics**	**03**	**Students can understand the concept of:** ➢ Cell organization, growth, division, cell cycle & its control, ➢ Intracellular interactions, ➢ Tissue culture concept. ➢ Different microscopic techniques.
4.	**BPT-104 Molecular Enzymology**	**03**	**Students get acquainted with the concept of:** ➢ Chemical Kinetics, ➢ Enzyme kinetics, ➢ Types of enzymes and enzyme technology.
5.	**BPT-105 Biostatistics & Computer Fundamentals.**	**03**	**Students can understand the concept of:** ➢ Utility of Statistical methods needed to data analysis in biological studies ➢ Mean, mode, median, ➢ Small sample test, chi-Square test, F test, large sample test (z-test), ➢ Concept of probability and probability distributions, ➢ Studies in Binomial, Poison and Normal

			distribution with illustrative examples. ➢ Computer fundamentals to make students equipped with documentation & presentation etc.
6.	**BPP-111 Lab Course -1 (Based on BPT-101 & 102)**	**03**	**Students will learn the techniques:** ➢ Verification of the Lambert Beer's law. ➢ Study of the Spectral characterization of the biomolecules ➢ Molecular titrations. ➢ Isolation & characterization of proteins. ➢ Estimation of different biomolecules etc.
7.	**BPP-112 Lab Course -2 (Based on BPT - 103)**	**03**	**Students will learn the techniques:** ➢ Microscopic characterization of different cells bacteria fungi etc. ➢ Study of morphology of different cells & blood cells etc.
8.	**BPP-113 Lab Course -3 (Based on BPT - 104)**	**03**	**Students will learn the techniques of:** ➢ Determination of energy of activation, ➢ isolation, purification & characterization of enzymes. ➢ To determine the effect of temperature, pH, metal ions on Enzyme activity & Kinetics. ➢ Determination of kinetic parameters as Km & Vmax.
9.	**BPP-114 Lab Course -4 (Based on BPT- 105)**	**02**	**Students will learn:** ➢ Biological data generation. ➢ Data processing & presentation as well as required computer skills.

Sr. No.	Name of the Course	Credits	Course Outcomes
1.	**BPT – 201 Physiology & Biophysics**	**03**	➢ **Students get knowledge of Biophysics of human physiology viz,** ➢ Brain& neurophysiology physiology, nerve impulse, Synaptic transmission, ➢ Signal transduction membrane potential, Resting and action potential & its propagation ➢ Voltage clamp and patch-clamp techniques, memory and neuropeptides ➢ Vision & Audition, ➢ Cardiovascular and Pulmonary physiology, PFT & it's significance. ➢ Renal & Reproduction physiology, IUI, IVF techniques etc.
2	**BPT -202 Membrane & Ion channel Biophysics**	**03**	**Students can clear the concept of:** ➢ Membrane Structure & dynamics, ➢ Membrane potential, ➢ Osmosis, Surface tension, ➢ Active & Passive transport ➢ Membrane energetics etc.
3	**BPT - 203 Physicochemical Techniques**	**03**	**Students will understand:** ➢ The principle, methodology ➢ Applications of various analytical techniques like Chromatography, ➢ Electrophoresis ➢ Spectroscopy.
4	**BPT- 204 Molecular Biology & Genetics**	**03**	**Students get specified knowledge of:** ➢ Molecular biology of gene ➢ Genome Organization ➢ Gene Expression& regulation ➢ Mutation & repairs ➢ Genetic Recombination etc.
5	**BPT-205 Research Methodology**	**01**	**Students will be introduced with:** ➢ Research objectives and motivation ➢ Types and methods of Research ➢ Research approaches ➢ Significance of research ➢ Research Ethics ➢ Literature review etc. ➢ Motivated for future research carrier.

6.	**BPP- 211 Lab Course-5 (Based on BPT-201 & 202)**	**03**	**Students can learn the following aspects of Physiological Biophysics :** ➢ Recording the Respiratory movements in man using stethograph. ➢ Determination of the Breath holding time, maximum voluntary ventilation and other respiratory parameters in man & study of the vavious physiological changes under extreme conditions (high RCF, low oxygen pressure, zero gravity conditions.) via 15 Assignments on various aspects using signal acquisition systems. ➢ To study the Erythrocytes Membrane Permeability and Transport effects of Hypotonic & Hypertonic shock. To determine the osmotic fragility of RBC. To determine the partial characteristics of Membrane Protein by SDS-PAGE. ➢ To analyze the Erythrocytes membrane lipids by TLC. To determine Osmolarity of solutions using Osmometer. Passage of molecule through dialysis membrane and demonstrations of Donnan Membrane equilibrium. ➢ To study the interactions of Detergent and other Membrane active agents with RBC membrane & effect of incubation time, Temperature & concentration. ➢ To study the Permeability of model membrane (Liposome) anions. To study the effect of cholesterol on the anion permeability of a Phospholipid membrane. Preparation of Liposome
7.	**BPP-212 Lab Course -6 (Based on BPT - 203)**	**03**	**Students will be trained:** ➢ In various analytical techniques like needed by the various pharma and research industries. ➢ Spectroscopy ➢ Chromatography ➢ Electrophoresis ➢ Viscosity etc.
8.	**BPP-213 Lab Course-7 (Based on BPT- 204)**	**03**	**Students learn the techniques:** ➢ Isolation, characterization of DNA from various ➢ sources such as plants, animals & microbes etc. Blotting techniques, ➢ Isolation & characterisation of m-RNA ➢ Isolation and study of various mutants. ➢ Demonstration of recombination processes like transformation, conjugation etc

9.	**BPP-214 Science Communication Skills**	**02**	**Students learn the skills:** ➢ Needed to develop their research aptitude like Literature surfing, ➢ Review writing, ➢ preparing research proposal, ➢ Writing of conference/ symposium report, ➢ Group discussion & presentation etc.

M.Sc. I Year: Semester 3			
Sr. No.	Name of the Course	Credits	Course Outcomes
1.	**BPT - 301 Biophysical & Bio-analytical Techniques**	03	**Students can understand basic techniques:** ➢ Fluorescence spectroscopy ➢ Fluorimetry, ➢ FRET, & Applications, ➢ NMR principles & applications ➢ ESR principles & applications ➢ Mass Spectroscopy & its applications ➢ Various Diffraction Techniques etc.
2	**BPT -302 Immunology & Immunotechniques**	03	**Students will get aware about:** ➢ The immune system & its specificity , ➢ Various physical , biological factors affecting individual's immunity, ➢ Organs & cells involved in the development of immunity ➢ Histocompactibility & transplantation immunology ➢ Immunological techniques like immunoelectrophoresis, Immunodiffusion, counter current immnuno electrophoresis, Immunoassay , ➢ Blotting techniques, ELISA etc
3	**BPT - 303 Elective Group -A (Environmental Biophysics)**	03	**Students can learn the various aspects of Biophysical Ecology:** ➢ Nonionizing radiation, ➢ Sources, consequences of UV absorption by living system, ➢ biological effects at molecular, cellular and organism level. ➢ Protective standards and measures. ➢ Physical aspects of of sound pollution, sources, sound measurement, its effect on CNS, Sleep disorders, reproductive, cardiovascular and endocrine system etc.

			➢ Biophysics at Low and High temperature, Thermophiles and Thermo resistance mechanism, Thermo stability of enzymes and other biomolecules, Heat hardening of plant cells. ➢ Analytical methods in environmental studies. Principle, instrumentation, method spectrum interpretation and application of mass spectrometry, Atomic absorption, Flame emission, Plasma emission, Spectrometry, X-ray fluorescence, PIXE, Neutron and proton activation analysis etc.
4	**BPT- 304 Elective Group-B (Recombinant DNA Technology)**	03	**Students will be competent in RDT research tools:** ➢ Gene cloning, ➢ Construction of various libraries ➢ Gene identification ➢ Gene expression analysis by PCR -, ➢ Hybridization-, and Sequencing- based techniques. ➢ various techniques to engineer and express recombinant proteins, for studying the dynamics of protein- protein and protein-DNA interaction proteome analysis
5	**BPP-311 Lab Course-8 (Based on BPT–301 & 302)**	03	**Students will learn various various immunological techniques:** ➢ Useful for diagnosis in pathological labs ➢ Which are the key markers in the research areas of the molecular biology ➢ Useful in pharma industries and revealing various aspects of medical sciences.
6	**BPP-312 Lab Course-9 (Based on BPT -303)**	03	**Students will learn:** ➢ Analytical methods in environmental studies. Principle, instrumentation, method ➢ Spectrum interpretation of ➢ mass spectrometry and its application, ➢ Atomic absorption, Flame emission, Plasma emission, Spectrometry, ➢ X-ray fluorescence, PIXE,
➢ 7	**BPP-313 Lab Course-10 (Based on BPT -304)**	03	**Student will gain the skills of :** ➢ Isolation, estimation of DNA, RNA and protein ➢ Isolation and purification of plasmid DNA- i. Mini preparation, ii. Purification by LMP agarose, iii. Purification using DE81 cellulose. ➢ Preparation and transformation of competent E.coli, Restriction enzyme analysis- restriction mapping ➢ Agarose gel electrophoresis and PAGE of DNA and RNA – Southern blotting – RFLP analysis ➢ Gene cloning-cloning a DNA fragment in Blue script vector. Blue White selection of transformed colonies ➢ Characterization of transformants:

			➢ Complementation, ii. Insertional inactivation, iii. Screening by hybridization. ➢ Isolation of DNA from bacteriophage
8	**BPMP Mini Project**	03	**Students will learn the skills like:** ➢ Defining the research topic ➢ Designing & making research proposal. ➢ Planning & Execution of the research work ➢ Making of research project report ➢ Presentation of the research work ➢ Publishing the research paper.

M.Sc. I Year: Semester 4

Sr. No.	Name of the Course	Credits	Course Outcomes
1.	**BPT-401 Bioinformatics & Structural Biology**	03	**Students will learn :** ➢ Information theory, Biological data exploration through various Resources –EMB net, NCBI, BTIS network, ➢ Bioinformatics, Cheminformatics & medical informatics. ➢ Sequence databases, Protein sequence databases, Structural databases, PDBs, Motif databases, Protein motif database, Genome databases, Proteome databases etc. ➢ Functional Genomics DNA sequence analysis, Gene bank, CDNA library pharmaco Genomics, ESTs analysis method for recognition viz. ➢ Pair wise Alignment, Alignment algorithms, sequence analysis tools, BLAST (Basic Logical Alignment Search Tool) FASTA, Multiple Alignment, ➢ Sequence analysis using EMBOSS, DNA micro array technique. ➢ Molecular modelling,
2	**BPT-402 Radiation Biophysics**	03	**Learners get acquainted with :** ➢ Radiological Physics. Isotope, Radioactivity, laws of Radioactivity, Alfa, Beta, Gamma rays, Properties of Electromagnetic radiation,

			➢ Particle accelerate absorbed cyclotrons & synchrotrons, ➢ Radiation Units- Units of radioactivity, exposure & dose, Dose equivalent Unit, ➢ Particle flux & fluence, X & Gamma ray interaction with matter, ➢ Interactions, absorption & scattering of electron, Heavy charged particles ➢ Neutrons, attenuation coefficient linear, mass, electronic & atomic, HVL, mean free path, Absorption edges, LET. etc ➢ Interactions of various kinds of radiations with biological systems & its consequences.
3	**BPT - 403 Elective Group - A (Medical Biophysics)**	03	**Students will learn Principles & instrumentation of :** ➢ Electrocardiography, Electroencephalographic waveforms, Standard lead systems, ECG preamplifiers, ECG readout devices, ECG machine, Measurements Other electrophysiological recordings, EMG, ERG, EOG & their applications. ➢ Medical-imaging, techniques as of X-ray imaging, Mammography, Xeroradiography, Fluoroscopy, Computerized Axial Tomography, Angiography, Myelography, Magnetic resonance imaging, Ultrasonography. Etc ➢ Basic principles of Nuclear Medicine & its Diagnostic uses. ➢ Principles & scope of Radiotherapy., ➢ Concepts of teletherapy & Brachytherapy, Co-60 Therapy, brachytherapy, Sources, Calibrations, Dose distribution implant dosimetry. ➢ Biomechanics and Ergonomics.
4	**BPT - 404 Elective Group - B (IPR, Bio-safety & Bioethics)**	03	**Students get aware of :** ➢ To Intellectual Property ➢ Types of IP: Patents, Trademarks, Copyright & Related Rights, Industrial Design, Traditional Knowledge, Geographical Indications, ➢ Protection of GMOs IP as a factor in R&D; IPs of relevance to Biotechnology and few Case Studies

			➢ Agreements and Treaties ➢ History of various Agreement PCT; Indian Patent Act 1970 & recent amendments ➢ Introduction to Patents; ➢ Databases; Country-wise patent searches (USPTO, esp@cenet(EPO), PATENT Scope(WIPO), IPO, etc.) ➢ Patent filing procedures ➢ National & PCT filing procedure ➢ Biosafety & Bioethics- Ethical implications of biotechnological products and techniques.
5	**Lab Course -11** **(Based on BPT-401)**	03	**Students will develop the practical approach:** ➢ Internet search for Bioinformatics resources. ➢ DNA and Protein sequence, file format conversion. ➢ EST's Contig assembly and ORF analysis. ➢ Nucleic acids and Protein sequence database search. ➢ Biophysical parameters and Protein diagnostics. ➢ Multiple sequence alignment and Conserved Amino acid residues. ➢ Cladograms and Dendrograms and evolutionary relationship. ➢ The PROSITE Database. ➢ Conserved Domains and Protein super families. ➢ Two-dimensional and three-dimensional structure, Prediction resources. ➢ Protein structure model from x-ray diffraction and NMR data.
6	**Lab Course -12** **(Based on BPT-402)**	03	**Students come to learn the different** techniques related : ➢ Determination of the Dose rate of Gamma Source using with Detection, analysis of the radiation by Actinometry , Fricke Dosimeter. Methyl Orange Dosimeter, Free Radical Dosimeter (Alanine and Glutamine.) FBX Dosimeter& Cerric Sulphate Dosimeter. Evaluation of Radiation effects (gamma rays) on various biomolecules ➢ Student also learn to measure the Central axis of Dose, Depth of Dose, Plotting at

			isodose curves. & determine the value of LD50.
7	**Lab Course -13** **(Based on BPT-403)**	03	Students learn to record and analyze : ➢ The physiological parameters like, Electrocardiogram (ECG) and to draw the mean Electrical axis, to measure the Evoked potentials, to record and analyze ,Electroencephalographic (EEG) activity from the cortical areas of the brain, Electromyography, to evaluate the auditory responses, to assess the ventilatory functions using pulmonary function tests. ➢ To measure the Output of Gamma ray teletherapy units, Beam collimation and alignment, Electron contamination of beam, Electron build up in the wall of Dosimeter. to measure the central axis depth dose and plotting of isodose curves For a teletherapy unit using ion chamber &/or film, Treatment planning procedures of Brachytherapy source ,Isotope calibration, Plotting of Isodose curves using Ion chamber and/or film. ➢ Brachytherapy treatment planning for 1) Manual after loading applicator, 2) Remote after loading applicator, Techniques for organ Scanning (Bone, Liver, Brain, Whole Body). ➢ Assignments on various aspects using signal acquisition systems. AD Instruments-LAB Tutor and other protocols
8	**Lab Course -14** **(Based on BPT-404)**	03	**Students are learn :** ➢ By practicing Case studies to be revealed and analyzed emphasizing the procedural aspects of IPR, biosafety & bioethics. ➢ Practiced via mock exercises to be performed related with IPR procedures.
9	**Service Course***	04	**The student will register** ➢ The service course of his /her interest at the start of semester in the concerned college/ University department

Department of Biotechnology
Government Institute of Science, Aurangabad (M.S.)

Year M.Sc. I / II	Program/name of the Paper (Theory & practical)	After successful completion of the program the student should be able to know: (Program Outcome)
I	Biostatistics and Biomathematics Theory Course BT1001	• Basic mathematical calculations which are useful for students especially in research and development in industry and academia • All basic methods of sampling, collection and analysis of data. • All statistical methods which are important for every step of R & D. • How to select a specific statistical tool for a particular problem or data analysis
	Biostatistics and Biomathematics Practical Course BTP1001	• Practically solve the problems and learn the preparation of graph and charts by using a data followed by drawing an inference. • To perform a particular statistical method and its significance.
I	Biomolecules and Bioenergetics Theory Course BT1002	• That biomolecules play indispensable roles in all life processes • That these molecules perform or trigger important biochemical reactions in living organisms. • The physiological function that regulates the proper growth and development of a human body.
I	Biomolecules and Bioenergetics Practical course BTP1002	• To perform qualitative and quantitative analysis of the molecules. • Sources of these molecules.
I	Microbiology Theory Course BT1003	• Understanding the core basics and differences between prokaryotes and eukaryotes • Gain theoretical knowledge of different classes of stains and • Understand the principles of different staining procedures.

		• Learn different biochemical identification techniques in microbiology. • Understand common groups of bacteria and archaea in different ecosystems • Study different approaches used in microbial taxonomy • To get acquainted with genomic-based methods to study microbial diversity in nature and for the mechanisms behind it. • To understand microbial adaptation in extreme environmental conditions. • To understand the concept of growth and bacterial cell division. • To get acquainted with different microbial growth curves and related mathematical expression. • To learn microbial growth assessment methods • To gain knowledge about different methods to control microbial growth • To understand the role of nutrients in microbial growth • To learn pure culture techniques • To study metabolism and nutritional requirements in microbes • To classify different nutritional requirements of microbes • Construction method of microbial media, and • Learn preservation methods of microbes • To study the cytological and macromolecular changes during sporulation. • To understand the nature and mode of action of different microbial toxins • To Gain knowledge about microbial stress protein and • To study the two-component microbial system.
I	Microbiology Practical Course BTP1003	• Aseptic and pure culture techniques. • Preparation of and viewing samples for microscopy using different staining procedures, • Use appropriate methods to identify

		microorganisms, • Estimate the number of microorganisms in a sample, • Use common lab equipment. • Demonstrate key practical skills/competencies in working with microbes • Interpret results from a variety of microbiological methods, and apply these methods to analogous situations, and • Demonstrate and employ practical skills of assay with antibiotics
I	Inheritance Biology Theory Course BT1004	• Understanding the concept of gene • Study Mendelian principles of Inheritance • To learn extensions and variations to Mendel's Law. • To understand biological system of sex Determination • To understand the role of the X and Y chromosomes in determining sex and how they are inherited • Gain knowledge about mutations and its causes • To understand why mutations that occur outside of coding regions of structural genes can influence gene expression. • To get acquainted with mutation detection methods • Gain insight about transposon mediated mutation. • Understanding of fundamental concepts in microbial genetics • Gain Insight into genetic transfer methods. • To learn gene mapping methods • To understand S. Benzer study: on substructure of the gene. • To study Linkage maps and Tetrad analysis, • To learn about molecular markers for gene mapping • Know the methods of development of mapping population in plants. • Mapping by using somatic cell hybrids • To gain better understanding about

		chromosomal inheritance • To understand and identify Chromosomal Theory of Inheritance • To learn about Inheritance of mitochondrial and chloroplast genes • To study plasmid inheritance.
I	Inheritance Biology Practical Course BTP1004	• Illustrates the standard approach used in linkage analysis. • Study one, two and three factor crosses • Learn the methods of plasmid, mitochondrial and chloroplast DNA isolation, • Design hypothesis and interpret Fluctuation test, • Use common lab equipment. • Study UV induced mutagenesis and graphically learn to plot survival curve • Interpret results from a variety of chemical mutagens and analyze respective results • To learn the technique for Isolating antibiotic resistance spontaneous mutant
I	Molecular Biology Theory Course BT2001	• Exhibit an understanding for significance of DNA repair Systems • Gain of clear and concise understanding about microbial DNA repair systems • To learn eukaryotic complex system of DNA repair mechanisms. • Co-relate between defective DNA repair system and genetic abnormalities associated with it. Comprehend the key process of genetic recombination • To reflect the understanding about recombination and genetic diversity. • To get acquainted with the principle proteins involved • To learn the resolution of genetic recombinants. Elucidation of the structure of the double helix and phase of replication process • To understand DNA synthesis and related it to cell cycle. • To learn about the important enzymes involved and its role in replication

		• To understand different DNA polymerases and its function • To associate Telomerase with End Problem of Linear DNA Replication. • : Understanding about central dogma of molecular biology, • CO2: To gain thorough knowledge about three stages of transcription • CO3: Know about RNAP of Prokaryotes and eukaryotes and its function. • CO4: To understand about Promoter elements for three polymerases • CO5: To learn about RNA editing, splicing, polyadenylation • Understand the "one gene-one protein" hypothesis • Learn the key differences in prokaryotes and eukaryotes translation process • Understand the properties of the genetic code • Understand post-translational modifications that occur before a protein becomes fully functional. • Deducing the molecular structure of the ribosome
I	Molecular Biology Practical Course BTP2001	• To implement observational strategies to formulate hypothesis for spontaneous mutations • Learn to apply statistical methods when analyzing their data. • To generate and interpret graphs displaying experimental results., • Study UV induced mutagenesis and graphically learn to plot survival curve • Interpret results from a variety of chemical mutagens and analyze respective results • To learn ampicillin enrichment method for autotrophs • Formulate experiments to learn DNA repair mechanisms in E. coli and Yeast • To study chromosomal aberrations using Physical mutagen • To Isolate different auxotrophic mutants by using selective plate method

I	Enzyme Technology Theory Course BT2002	• Chemical nature, mode of action and types and classes of enzymes. • To measure enzyme activity. • Types and kinetics of enzyme inhibition. • Different methods and advantages of enzyme immobilization. • Name and role of different industrially important enzymes.
I	Enzymology Practical Course BTP2002	• Role of enzymes in catalyzing chemical reaction and their applications
I	Cell Biology Theory Course BT2003	• To understand the concept of cell and its diversity • To learn about intracellular membranous compartments where different cellular functions can take place • Learn the structure and functions of each of organelles and relate to specific known genetic diseases. • To coordinate functions of several organelles that bring about cellular functions such as secretion and flow of genetic information from DNA to protein • To know how the fluid mosaic model of membrane structure explains each experimental finding • To understand the fluidity of the components of a cell membrane Distinguish between peripheral and integral membrane proteins • To understand the functioning of different ion pumps and channels. • To Understand that cell division functions in reproduction, growth, renewal and repair. • To understand molecular control of cell division • To learn about Cell differentiation in prokaryotic cells & Morphogenesis • To understand the roles of checkpoints, cyclin, Cdks, and MPF in cell cycle control • To learn about abnormal cell division and apply the principles of genetics to cancer • Predict the possible outcomes of various mistakes in meiosis. • Extract information about genes,

		alleles, and gene functions, • To gain knowledge about Chromosomal organization • To understand transposons • Learn about histone proteins and its function in chromosomal organization • To acquire understanding about general principles of cell communication • To learn about cell adhesion and roles of different adhesion molecules, • Understand neurotransmitters and its function • To gain an insight about G-protein coupled receptors, signal transduction pathways, • Study bacterial chemotaxis and quorum sensing.
I	Cell Biology Practical Course BTP2003	• Design experimentation to study Transport across membranes. • To study Effect of detergents on membrane permeability. • Learn method for Isolation of cellular organelles • Acquire the skills for preparing liposomes • Understand the effect of Colchicine on Chromosome movements during Mitosis
I	Basic Immunology Theory Course BT2004	• The basic principle of Immunology. • Cells & Organs involved in host immune system • Molecular and cellular mechanism of antibody production. • The function of T cells and role of MHC in immune response. • Immunology based diagnostic techniques.
I	Basic Immunology Practical Course BTP2004	• The importance and technique of blood group. • About how to isolate Protein A and what is its importance in industry. • About how to isolate the bacterial antigens • Different methods to quantify antigens.
II	Applied Immunology & Virology Theory Course BT3001	• the specific immune response against different types of pathogen. • How pathogen evolves to cause infection.

		• Details of vaccine development. It will be useful to them to develop the strategy of vaccine development. • The general cause of cancer and how we can prevent and treat the cancer. • Types of virus and what diseases they cause to human, plants and other organisms.
II	Applied Immunology & Virology Practical Course BTP3001	• the antibody based methods of diagnosis of diseases. • To culture and count the viruses *in vitro*. • the immunodiagnostic assays and virus culture methods and their enumeration.
II	Gene Expression & Genetic engineering Theory Course BT3002	• To explain the basic principles and the tools and techniques of genetic engineering • To describe the applications of genetic engineering in various fields. • About DNA manipulation enzymes, genome and transcriptome analysis and manipulation tools, gene expression regulation, production and characterization of recombinant proteins. • The debate on ethical issues concerned with Genetic engineering • Profiling of gene expression in eukaryotic and prokaryotic organisms. • about advances in biotechnology-healthcare, agriculture and environment cleanup via recombinant DNA technology.
II	Gene Expression & Genetic engineering Practical Course BTP3002	• to perform basic genetic engineering experiments at the end of course. • to become familiar with the tools and techniques of genetic engineering • the applications of genetic engineering in biological research and pharma sector
II	Developmental Biology Theory Course BT3003	• and can use the terminology in genetics and developmental biology • and have an understanding of the main concepts in developmental biology and their mechanisms and principles • the main morphological principles for development and reproduction in classical model organisms • the genetic and molecular mechanisms that

		operate in development and reproduction • and have insight in and understanding of how connections between genes and genomes play a role in genetics and developmental biology
	Developmental Biology Practical Course BTP3003	• and will be able to identify different stages in the embryo development • and will be able to rear in lab the model organisms and will be able to manipulate different embryos • and will be able to understand the effect of different molecules and environmental conditions on embryo development and morphogenesis
II	Bioinstrumentation Theory Course BT3004	• Mechanism of qualitative and quantitative determination of any reaction product. • To study structural features and other properties of biological samples. •
II	Bioinstrumentation Practical Course BTP3004	• Principal of working of given instrument. • Different important component of given instrument. • Hands on practice of handling the given instrument. •
II	Industrial Technology Theory Course BT4001	• Bioreactor designs and its applications in fermentation process • the best approaches to mass transfer during fermentation • different methods to strain improvement • the kinetics of biomass production • the different types of fermentation carried out industrially
II	Industrial Technology Practical Course BTP4001	• to set up, monitor and carry out downstream processes of different fermentation • methods of media optimization • the culture preservation and revival techniques
II	Recombinant DNA Technology Theory Course BT4002	• To understand the steps involved in recombinant DNA technology. • To explain the construction of DNA & c DNA library and their applications,

		Cloning, GMO • The Principles & applications of Proteomics • About Protein Engineering and site directed Mutagenesis • Explain the basics of NGS.
II	Recombinant DNA Technology Practical Course BTP4002	• Apply the technical skills learnt in pharma sector and research. • Students will be able to perform basic RDT experiments at the end of course.
II	Tissue Technology Theory Course BT4003	• Certain introductory aspects of plant and animal cell culture • media constituents and its role, Assessment of growth, measurement of cell death, totipotecny etc. • Various methods of plant and animal tissue culture. • Plants and animal cell transformation methods. • Application of plant cell Science in various fields such as o Production of biodegradable plastics, o Synthesis of primary and secondary metabolites with desirable properties. o Bio-Pharmaceutical, edible vaccines production, o Enhanced nutrient utilization, o tolerance to abiotic stress and improved disease resistance. o Production of crop plant with enhanced nutrition contents • Application of animal cell science for o Production of vaccines, o Interferons and antibiotics, o embryonic stem cell and gene therapy, o Production transgenic mice, cattle, sheep and fish. • Tissue engineering, Ethical issues related with use of above techniques.
II	Introduction to Bioinformatics Theory Course BT4004	• will have awareness of the basic principles and concepts of molecular biology and information technology • an understanding of the intersection of life and information sciences, the ability to

		speak the language of structure-function relationships, information theory, gene expression, and database queries • existing software tools effectively to extract information from large biological databases and to use this information in making new discoveries and knowledge
II	Dissertation	• about how to seek guidance from project guide • to identify a problem based on interest and through referenced research articles published in various scientific journals • to set limited clear cut objectives to address the identified problem • the nuances of setting up experiments to address a problem • to record and present the results in form of dissertation thesis • to successfully defend the short research work executed by the student • to meet project goals set mutually by the student and the mentoring project guide

पुष्पं पुष्पं विचिन्वीत मूलच्छेदं न कारयेत्

Pick the Flowers, do not uproot the plants

DEPARTMENT OF BOTANY

GOVERNMENT INSTITUTE OF SCIENCE
AURANGABAD

M. Sc. Botany Program and Coures Outcome

On completion of program students will be able to

1. Think Critically - Get ability to apply the process of science by formulating hypotheses and design experiments based on the scientific method.
2. Analyze and interpret results generated through studies in botany, taxonomical treatments, field studies, excursion tours and laboratory techniques used in the subject.
3. Use quantitative reasoning by using mathematical calculations and graphing skills to solve problems in plant science (Botany)
4. Effective Communication and collaborate with other disciplines by effectively communicating the fundamental concepts of Botany in written and oral format.
5. Identify credible scientific sources to interpret and evaluate the evidences
6. Understand the relationship between science and society by recognizing and discussing logical, scientific and ethical issues in Botany subject.
7. Environment and Sustainability: Understand the issues of environmental contexts and sustainable development with respect to assessment, conservation and utilization of floral diversity

Program specific outcomes

On completion of program students will be specifically able to

1. Identify classify the plants by using the key characters.
2. Prepare and view specimens for examination using light microscopy
3. Use pure culture and selective techniques to isolate fungi, plant pathogens, algae and identify them growing on media.
4. Qualitative and quantitative estimate the number of floral components by using enumeration and suitable sampling and techniques.
5. Use appropriate plant molecular techniques and use of instrumentation realated to it.
6. Practice safe laboratory procedures, using appropriate protective, biosafety and emergency procedures.
7. Documentation and report writing on experimental protocols, results and conclusions, study tours and filed visits etc.

BOT 401 CELL BIOLOGY

COURSE OBJECTIVES

The main objective of the course is to make students aware of -

- **Prokaryotic and eukaryotic Cell:** The ultra-structural details and comparative assessment.
- **Plasma membrane:** Molecular .organization, current models and functions. Cell wall architecture, biosynthesis, assembly, growth and cell expansion.
- **Plasmodesmata:** Structure and role in movement of molecules and macromolecules.
- **Cytoskeleton:** Organization and role of microtubules and microfilaments. Implications in flagellate and other movements.
- **Plant vacuole:** Tonoplast membrane, ATPases, transporters, as storageorganelle.
- **Chloroplast and Mitochondria:** Ultrastructure, function and biogenesis. Theorganization of genome and patterns of gene expression.
- **Nucleus:** Microscopic and submicroscopic organization. Structure and function of nuclear
- Envelope. The ultrastructure of nucleolus and its role in rRNA biosynthesis.
- **Ribosomes:** Structure and site of protein synthesis. Mechanism of translation,details of initiation, elongation and termination. The structure and role of RNA.

COURSE OUTCOMES

After successful completion of this course, students will be able to understand :

- The cell structures in relation to function of cells the fundamental unit of life, are concerned in this course along with molecules present in cells.
- Apply the principles of cell biology in designing experiment, statistical analysis, and interpretation of results
- Operate and solve exercise using computation statistics software.
- Get acquitted with basic approach in the research methodology.

BOT 402 MOLECULAR BIOLOGY

COURSE OBJECTIVES

- To understand the concepts in prokaryotic, eukaryotic Plant system with respect to-
- To study the central dogma of molecular biology (replication, transcription, and translation)
- **Cell signaling**
- **Protein sorting**
- **Cell Cycle and its molecular aspects**
- **Molecular Cytogenetics**
- **Restriction mapping**
- **Laboratory Techniques**:

COURSE OUTCOMES

- After successful completion of this course, students will be able to:
- Acquaint with concepts in prokaryotic, eukaryotic, and viral genetics
- Explain central dogma of molecular biology (replication, transcription, and translation)
- Enlist and explain types of mutation, gene regulation and transposable element
- **Conversant with Laboratory Techniques** *viz.* Microscopy, SEM & TEM, Ultracentrifugation, fractionation, Electrophoresis, PCR, GISH, FISH and Immunochemical techniques. The flow cytometry and confocal microscopy in karyotype analysis.
- Isolation of plant DNA and its quantification.
- Isolation of RNA and its quantitation, Estimation of seed proteins

BOT 403 BIOLOGY AND DIVERSITY OF VIRUS, PHYTOPLASMA, BACTERIA, ALGAE AND FUNGI

COURSE OBJECTIVES

- To understand the phycology with special reference to Indian work.
- Algae in diversified habitats (Terrestrial, fresh water, marine) Criteria used in classification of algae, Role of algae in human welfare
- General account of thallus organization, reproduction and life history of algae.
- Study of important groups of algae **Cyanophyta , Chlorophyta, Xanthophyta , Bacillariopyta, Phaeophyta & Rhodophyta**
- **Fungi:** General Characters, Classification., Economic importance of fungi in medicine, Agriculture (Biopesticide an biofertilizer), food (SCP Mushrooms)
- Fungi as plant pathogen – General account of different groups and type study of fungi as pathogen**. Mastigomycotina , Zygomycotina, Ascomycotina, Basidiomycotina & Deuteromycotina**
- **Bacteria:** General characters, ultrastcture, classification, Role of bacterium in crop improvement and bacterial disease of plants.
- **Phytoplasma:** General characters, economic uses, classification, role and disease of plants.
- **Viruses:** General account, ultrasturcture and economic importance of viruses.

COURSE OUTCOMES

- Comprehend the diversity of lower cryptogams (Algae, Fungi, Bacteria, Phytoplasma and viruses. Collection and study of algae, fungi, bacteria from different localities, Identification up to generic level.
- Recognize the morphology, anatomy , physiology, reproduction and lifecycle pattern.
- Their diversification and familiarize with various ecological niche.
- Positive and negative values.

BOT 404 TAXONOMY OF ANGIOSPERMS

COURSE OBJECTIVES

- Deals with naming and classification of plants their interrelationships and evolution.
- Deals with recent developments in plant systematic and phylogenetics
- Criteria used for classification; phases of plant classification and brief history on account
- Botanical Nomenclature: Concept of nomenclature, Binomial nomenclature and its advantages.
- Taxonomic literatures and Use of computers in angiosperms taxonomy.
- Taxonomic evidences: Morphology, anatomy, embryology, palynology, cytology, phytochemistry and numerical taxonomy
- Angiosperm Families: Nymphaeaceae, Hydatellaceae, Magnoliaceae, Papaveraceae, Malvaceae, Sapotaceae, Apiaceae, Asteraceae, Arecaceae and Poaceae

COURSE OUTCOMES

After successful completion of this course, students will be able to:

- Study plant morphology
- Description of a plant specimen.
- Study of at least 20 locally available families of flowering plants.
- Identification of genus and species of locally available wild plants.
- Preparation of botanical keys at generic level by locating key characters.
- Knowledge of at least 10 medicinal plant species.
- Knowledge of secondary metabolites and its use in taxonomy.

BOT 405 CYTOLOGY AND GENETICS

COURSE OBJECTIVES

To understand the concepts and details of heredity and variation at molecular and cellular levels.

Deals with more recent development which have taken place in the field of genetics besides providing introduction to methods of plant breeding of improvement of crop plants with respect to --

- Genetics of prokaryotic and eukaryotic organelles
- Chromatin organization
- Structural and Numerical alterations in chromosomes
- Mutation
- DNA Damage and repair mechanism
- Cytogenetics of aneuploids and structural heterozygotes:

COURSE OUTCOMES

After successful completion of this course, students will be able to:

- Know about the induction of polyploidy in plants using colchicines, methods of application of colchicine.
- Isolation of biochemical mutants following physical and chemical mutagenic
- Isolation of chlorophyll mutants following physical and chemical mutagenic treatments.
- Isolation of morphological mutants following physical and chemical mutagenic treatments.
- Karyotype analysis , Meiosis of complex translocation heterozygotes.
- Meiotic behaviour of monosomy, trisomy in plants and its effect.
- Chromosomal behaviour in mutagen treated plants.
- Chromatin organization, Structural and Numerical alterations in chromosomes

BOT 406 PLANT DEVELOPMENT AND REPRODUCTION

COURSE OBJECTIVES

Deals with regulation of growth and development of plant as affected by various growth regulations, thus cross talk and extrinsic biotic and abiotic factors.

To know the various structural and anatomical components of plant tissue and reproductive parts ***viz.***

- **Meristems:** Organization of shoot and root apical meristem its structure and function,
- **Tissue systems:** Differentiation and functions of epidermis, parenchyma, chlorenchyma, sclerenchyma, laticifers and glands.
- **Vascular tissues:** Origin, structure and functions its taxonomic significance, development of wood in relation to environment.
- **Leaf:** Growth and differentiation, differentiation of epidermis (with special reference to
- stomata and trichomes) and mesophyll.
- **Root:** Initiation and development
- **Structure and development of** Flower, Male gametophyte, Female gametophyte , Seed development and fruit growth
- Mechanism of pollination

COURSE OUTCOMES

After successful completion of this course, students will be able to:

- Know about plants anatomical structure, their developmental patterns.
- Plant reproductive parts development of male, female gametophytes and fruits.
- Vascular tissues and its constituents by sections and maceration, wood anatomy, TS, TLS and RLS
- Mechanical tissues (Collenchyma, Sclerenchyma, Stone cells and Xylem) , Secretary tissues (Mucilage Canals, Resin canals, Nectaries, and oil glands), laticifers (Latex cells and Vessels).
- Normal and abnormal secondary growth etc.

BOT 407 BIOTECHNOLOGY

COURSE OBJECTIVES

Provides a detailed view of the visualizing concepts and technique for genetic engineering and biotechnology.

Deals mainly with science, methodology and applications of plant tissue culture methods in

- Cell and organ culture
- Practical approaches of single cell culture
- Applications of tissue culture
- Somatic embryogenesis, protoplast isolation, regeneration of protoplasts and protoplasts fusion, Synthetic seeds, generation of cybrid and hybrids.
- Cryopreservation technique.
- Recombinant DNA technology Gene cloning, Vectors, Role of *Agrobacterium*, Gene cloning techniques.

COURSE OUTCOMES

After successful completion of this course, students will be able to:

- Know about Equipment's required in Tissue culture Lab
- Media preparation techniques for different plants
- Sterilization techniques for media as well as for explants
- Explant Culture.- Anther culture Pollen culture, Micropropagation. Embryo rescue technique.
- Somaclonal variation. *In vitro* mutation. Isolation of plant protoplasts and viability testing.
- Protoplast fusion techniques.
- Tissue culture of important Horticultural, medicinal plants

BOT 408 PLANT PHYSIOLOGY AND METABOLISM

COURSE OBJECTIVES

Deals with selected topics of high important plant Physiology and Biochemistry.

- Plant water relations
- Enzyme
- Photosynthesis
- Respiration
- Nitrogen Metabolism
- Lipid Metabolism
- Plant Growth
- Plant Development

COURSE OUTCOMES

- After completion of the course the students are familiar with various physiological aspects involved in the plant development.
- Also the role of enzymes in it and mechanism of photosynthesis, respiration, nitrogen and lipid metabolism.
- The students are able to isolate starch, pectine and various nutritive products from the plants.
- Qualitative and quantification of the plant contents and its biochemistry and mode /mechanism of synthesis etc.

BOT 501 BIOLOGY AND DIVERSITY OF BRYOPHYTES, PTERIDOPHYTES AND GYMNOSPERMS

COURSE OBJECTIVES

- Highlights advances made in diversity analysis, developmental biology, reproductive biology and phylogenetics of the lower plants with female organ being archegoniuous present in bryophytes, pteridophytes and some most gymnosperms.
- Adaptive mechanism of the lower plant.
- Economic importance of the bryophytes, pteridophytes and gymnosperms

COURSE OUTCOMES

After successful completion of this course, students will be able to:

- To know about morphological, anatomical and developmental patterns in the bryophytes, pteridophytes and gymnosperms.
- To know about the reproductive parts their development and mechanism of reproduction and life cycle pattern.
- Thallus and wood anatomy, Mechanical tissues (Collenchyma, Sclerenchyma, Stone cells and Xylem) , Secretary tissues (Mucilage Canals, Resin canals, Nectaries, and oil glands), laticifers (Latex cells and Vessels).
- Economic values of the lower plants.

BOT 502ECOLOGY AND CONSERVATION

COURSE OBJECTIVES

Strategies adopted by the organisms under clanging environment in relation to their biogeographic distribution. The students are made conversant with the following topics-

- **Structure of ecosystem:**
- **Functions of ecosystem:**
- **Community ecology:**
- **Biogeography:**
- Environmental pollution in relation to air, water and soil. Use of fertilizer, pesticides and other chemicals in agriculture and hygiene and their disposal.
- **Climate change:** Greenhouse gases, their sources, trends and role, Ozone layer and its

depletion (Global warming, Sea level rise, UV radiation) acid rain, Bioindicator and biomarkers of environmental health.

- **Biodiversity:** Concept, types and situation in India. IUCN categories. Strategies of conservation: *In situ* conservation & *Ex situ* conservation measures.
- Various act related to Bio Diversity conservation and protection and international conventions.

Knowledge on ecology, and ecological dynamics CO2 Ability to correlate ecological dynamics and regulation of vital processes on earth as biogeochemical cycles CO3 Ability to interpret ecosystem services, ecological resilience, ecological economics, and landscape ecology CO4 Set up experiments to appreciate concepts of Ecology CO5 Critically examine the forces impacting ecosystems viz., climate change, stress, population, consumerism, globalization, land use change

COURSE OUTCOMES

- On completion of this course the students are able to analyze various types of ecosystems, correlate different ecosystems.
- To analyze the threat and suggest conservative measures.
- The students are also trained in the environmental impact analysis
- Students are able to analyze, monitor various physical, chemical and biological properties of soil water and air.

BOT 521 E APPLIED MYCOLOGY –I

COURSE OBJECTIVES

- Understanding the concept of fermentation and various fermentation techniques.
- Use of fungi in food feed and various industrial products.
- Various types of Mushroom cultivation practices and its importance and economics.
- Screening techniques of the fungi for various industrial application.

COURSE OUTCOMES

- Describe the microorganisms that participate in fermentation – production & processes.
- Evaluate the impact of different types of microorganisms on the final characteristics of the product.
- Identify the origin of the principal microorganisms of importance in the industrial environment.

- Know procedures and strategies for mushroom cultivation.
- Know the role of microorganisms in different production processes in order to improve these processes and ensure their success.

BOT 522E APPLIED MYCOLOGY –II

COURSE OBJECTIVES

- Detection and assay of fermentation products
- Principal and working process of instruments used in fermentation industry.
- Role of fungi in cheese production, its types and process

COURSE OUTCOMES:

After completion of the course the students are able to –

- Handle instruments related to fermentation
- Conversant with Spectroscopic, Chromatographic, techniques, HPLC, HPTLC, and various techniques,
- Screening of fungi for acid, alcohol, cellulose, amylase and various organic acid production

BOT 521 F BIODIVERSITY –I

COURSE OBJECTIVES

- Biodiversity concept, Origin and evolution of diversity, Types of biodiversity,Estimation of known floras and faunas, Importance of Biodiversity, Revision of ecosystem: organization, structure, function and energetics.
- **Genetic Diversity:** Definition, Concept and importance, Nuclear centre and regional centres of origin, Germ-plasm,
- **Species diversity:** Species concept and definition, estimation and plant global status and with India, taxonomic procedure, taxa delimitation.
- **Ecological Diversity:** Types ecosystem diversity(Terrestrial and aquatic), Forest eco-sytem types(Tropical, Subtropical, temperate and alpine).
- **Agricultural and cropland diversity:** Agricultural and cropland diversity concept, Crop domestication, India's status for primary and secondary agricultural crops.

COURSE OUTCOMES

- Systematically understand biodiversity and its vital role in ecosystem function
- Identify the importance of biodiversity in natural environments Critically examine biodiversity and human linkages, and help policy formulating for conservation Application of knowledge in general communication for public extension

BOT 522 F BIODIVERSITY –II

COURSE OBJECTIVES

- **Diversity Distribution**: Mega diversity regions, Endemism concept and its types, World Hots spots, Western Ghats and Eastern Himalayas.
- **Modern methods in taxonomy:** Comparative morphology, Cytological methods, dermal studies, root and stem anatomy, vessel study, Chemotaxonomy, Embryology And Palynology.
- **Numerical Taxonomy:** Numerical treatment data generation: Similarity concept, matrix building, assessment, correlation, distance calculation duster method, dendrograms, computer programs.
- **Cladistics and Phenetics:** Introduction, definition of Cladistics and phenetics, methodology of genetics, diversity concept and importance of gene mapping, DNA finger printing and its applications.

COURSE OUTCOMES

- Appreciate the need of biodiversity conservation in the context of various developmental pathways and policy framework that the mankind has been undergoing
- Concepts of Hotspots, megadivsrsity regions of the world.
- Use of modern methods in plant taxonomy viz. Cytological, chemical, embryological pollen characters along with micromorphological features.
- Concept of numerical taxonomy
- Concept and use of cladistics, phonetics, and molecular tool in biodiversity studies.

BOT 525/ BOT 526 SERVICE COURSE

- This course is an optional but compulsory for completion of the degree.
- The students are supposed to take any one of the course of their interest other than the course offered in their Principle subject (Botany) subject.
- This is to learn addition subject other than the principle subject.

COURSE OUTCOMES

- The students can correlate the knowledge gain in this subject with his principle subject .
- This gives an opportunity to learn other subjects of his interest which is not offered in his principle subject

BOT 503 BIOPROSPECTING AND PLANT RESOURCE UTILIZATION

COURSE OBJECTIVES

: Is to apprises students of conventional and non-conventional plant resources being used by human, their effective and sustainable utilization and improvement by biotechnological tools.

- **Medicinal Plants:** Bioprospecting/ Pharmaceutical Bioprospecting: for new drugs, assays in Bioprospecting, Antioxidant assay – NO free radical scavenging assay, Antigenotoxicity assay – MTT assay, Antiviral activities of plants – SRB assay.
- **Marine Bioprospecting**: Sources of marine planktons and their bioprospecting, Isolation and cultivation of marine bioresources, Isolation of Marine Yeast and its industrial applications, bioactive chemicals from seaweeds and their applications. Understand the common cultivation methods of microalgae including photobioreactors and open ponds.
- Analyze the major cultivation methods of seaweeds, along with detailed life history of selected high-value seaweed species from India
- **Microbial Bioprospecting**: Isolation of microbial metabolites and their bio-activity, endophytic microbial products as antibiotics.
- **Origin, evolution, cultivation and uses** - food, fodder, fibers, oil yielding crops, wood and timber (at least 5 examples each), Non-wood forest products (NWFPS): Bamboos, Gums, Dyes, Resins, Fruits etc.
- **Medicinal and Aromatic plants:** Morphological peculiarities, chemical properties and uses (at least 5 examples each)
- **Phytochemistry:** Separation techniques – column chromatography and HPLC technique, secondary metabolites, pharmacognostic procedures, authentication of specimens, Preservation of plants and plants products.

COURSE OUTCOMES

On completion of this course, the students will be able to:

- Understand core concepts of Economic Botany and relate with environment, populations, communities, and ecosystems
- Develop critical understanding on the evolution of concept of organization of apex new crops/varieties, importance of germplasm diversity, issues related to access and ownership.
- Develop a basic knowledge of taxonomic diversity and important families of useful plants.
- Understand the common cultivation methods of microalgae including photobioreactors and open ponds, Seaweed bioresources etc.
- Appreciate the diversity of plants and the plant products in human use.
- Understand the concept of IPR, various legal issues related to IPR.
- Exploring the potential of Marine bioresources, Microbial , medicinal plants etc.
- Varoius phytochemical techniques, industrial process, pharmacognostic procedures, authentication of specimens, Preservation of plants and plants products

BOT 504 GENETIC ENGINEERING AND BIOINFORMATICS

COURSE OBJECTIVES

Deals with fundamentals of bioinformatics tools, computational biology and statistical methods utmost necessary for contemporary research in plant science.

- To get introduced to the basic concepts of genetic engineering0
- To get introduces to Bioinformatics and its significance in Biological data analysis.
- Describe the history, scope and importance of Genetic Engineering, Bioinformatics and role of internet in Bioinformatics.
- Explain about the methods to characterize and manage the different types of Biological data.
- Classify different types of Biological Databases. Introduction to the basics of sequence alignment and analysis.
- Explain about different types of protein and other organism specific databases.

COURSE OUTCOMES

On completion of this course, the students will be able to:

- To use genetic engineering tools in crop improvement
- Use the Bioinformatics toll in Biological data analysis.
- Able to explain the methods used for characterizing and managing Biological data.
- Classify different types of Biological Databases.

BOT 523€ APPLIED MYCOLOGY –III

COURSE OBJECTIVES

- Deals with all microbes especially fungi and the technologies for their effective uses in industry and mitigation of environmental concerns.

- Introduction to fungi & their significance to human
- Cultivation of Food related, fermentation, SCP and other microbial products
- Fermentation of Alcohol - Microorganism, Alcohol as fuel Source, Use of ethanol in vehicles as fuel, Sugar containing raw material, Starch raw materials

COURSE OUTCOMES

- Ideas about use of fungi and exploring the fungal organisms for their valuable products
- Cultivation of fungi for food, fermentation, SCP and other microbial products
- Familiar with Fermentation technology

BOT 523 (F) BIODIVERSITY –III

COURSE OBJECTIVES

- **Introduction of Angiosperms:** Definition, scope, salient features of Angiosperms, Comparative study with Gymnosperms. Concept of Taxonomy, Origin and evolution in relation to Geological time scale.
- **Plant Systematics:** Concept of Artificial, Natural and Phylogenetic systems of classifications. Systems of Classifications A.P.de Candolle, Hutchinson and Cronquests's and its merits and demerits.
- **Study of Families:** Ranunculaceae, Papavaraceae, Malvaceae, Fabaceae, Rubiaceae, Asteraceae, Solanaceae, Verbenaceae, Euphorbiace, Liliaceae and Orchicaceae.
- **Taxonomic tools in Angiosperms:** Keys, Plant inventory and exploration, Herbarium techniques, Cryo preservation, Botanical Garden , Major herbaria of the World and India.

COURSE OUTCOMES

The course will empower the students by:

- Gaining in-depth knowledge salient features of angiosperms, comparative studies of Gymnosperms, concept of origin and evolution of angiosperms.
- Understanding various systems of classifications
- Detailed studies on commonly growing families
- Development of taxonomic tools in plants systematics.

BOT 524 (E) APPLIED MYCOLOGY –IV

COURSE OBJECTIVES

- Fermentation Media - Media Composition, Growth Factors, Precursors, Antifoaming Agents, Inoculums Media, Media Economics
- Scaleup-Off Fermentation- Fermentation tank, Laboratory fermenters, Pilot-Plant fermenters, Designing of fermenters
- Industrial Effluent- Application of Industrial waste, Management of Industrial waste, Management of Industrial waste disposal
- Biological waste management -Objectives of Biological treatment, Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Imhoff-tanks, Slude-Digestion tanks
- Culture Maintenance - Slants and broths, Freezing liquid Nitrogen, Importance of Culture maintenance with reference to R&D laboratories

COURSE OUTCOMES

After completion of the course the students are able to-

- Design the media for fermentation.
- Maintain the interested fungal organism in the proper condition.
- Pilot to large scale production techniques.
- Application and management of industrial effluents

BOT 524 (F) BIODIVERSITY -IV

COURSE OBJECTIVES

- **Ecological Aspects:** Role of Ecological parameters, Concept of estimation of quadrat methods, density, abundance, frequency concept and estimation.
- **Analysis of Characters:** Characters weighing: Concept and definition, primitive and advanced characters, good vs bad characters, qualitative vs quantitative characters.
- **RET categorisation:** Impacts on Diversity depleting resources: RET, Threatened species and their impacts, global warming impact, Red data book IUCN and Species extinction.
- **Biodiversity Conservations:** Causes and consequences of loss of Biodiversity, Biodiversity its commercial value campaign, awareness, conservation methods, role of pollution control board, Public awareness, NGOs and Industries in conservation.

COURSE OUTCOMES

- In-depth studies on ecological parameters in biodiversity studies.
- Concept of characters and character weighing
- Identification of Rare, Endengered and Threatened species from the region
- Developing critical thinking for the conservation of biodiversity and stratigies used for the conservation of plant diversity
- Developing critical thinking for shaping strategies *viz*. scientific, social, economic and legal issues; for environmental protection and conservation of biodiversity, social equity and sustainable development.
- Adopting sustainability as a practice in life, society and industry

BOT 525 PROJECT WORK

COURSE OBJECTIVES

- Each student complete a dissertation on a topic mutually agreed between him/her and a faculty member, who asks as a mentor.
- The objective is to train students in basics of research, literature recession, analysis and expression of their understanding of the topic in their own words.
- To create research oriented thought process and basic training

COURSE OUTCOMES

On completion of the research project the students will be able to-

- Design the experiments of his interest and execute it
- Trained in handling of the basic and advance instruments
- Generate the data, compile and analyze and interpret the data.
- Presentation skill is developed in the students
- The student is ready to work in any R&D setup

Department of Geology

Government Institute of Science, Aurangabad (M.S.

M.Sc. Programme outcome:

After completion of this Post Graduate program (M.Sc. Geology), students will be able to – apply to Union Public Service Commission's (UPSC) Geoscientists Examinations and they can join Geological Survey of India (GSI) and Central Ground Water Board (CGWB) as Geologist or Hydrogeologist.

Students will be eligible to apply for Graduate Aptitude Test in Engineering (GATE) for taking admission for Master's programs or direct doctoral programs in various IITs. The score of GATE is being considered valid for 3 years. GATE successful candidates become eligible for employment in Public Sector Undertakings (PSUs) such as Gas Authority of India Limited (GAIL), Indian Oil Corporation Limited (IOCL); National Thermal Power Corporation (NTPC), Nuclear Power Corporation of India Limited (NPCIL) and Oil and Natural Gas Corporation (ONGC). Direct Group 'A' level posts in Central Government, such as Senior Research Officer (S&T) in Cabinet Secretariat. Besides this some other government of India organizations have also expressed their interest to utilize GATE score for their recruitment purpose.

Students can also apply to Mineral Exploration Corporation Limited (MECL), Indian Bureau of Mines (IBM) and to specialized post of National Agricultural Banking and Rural Development (NABARD).

Students will also become eligible to apply for Maharashtra Public Service Commission's (MPSC) Examinations for the post of Geologist- Group B (Gaz). Successful candidates will be

recruited in Groundwater Survey's and Development Agency (GSDA) and in Directorate of Geology and Mining (DGM).

Besides this, they will be eligible to apply for the post of Geologist in government or private mining companies such as metallic, non-metallic mines and Coal mines. Geotechnical soil and

rock investigating agencies and oil exploration agencies are also recruiting M.Sc. Geology students as Geologists or as Mud loggers.

Students become eligible to apply for National Eligibility Test (NET), which enables students to go either for lectureship or for doctoral research depending on their merit and eligibility .i.e. either Lecturereship (LS) or Junior Research Fellowship (JRF) in various central and state universities, central or state research institutes. They become eligible to appear for State Eligibility Test (SET), which enables them to go for Lectureship in state universities.

Students can think about self-employment by establishing their own set up for Geological investigation such as hydrogeological surveys for selecting sites of bore-wells and dug-wells for irrigation and drinking purposes; They can start consultancy for geotechnical investigations, EIA and similar consultancy to various government or private mining companies. They can also start nongovernmental organization (NGO) which deals with water conservation and watershed management.

Outcome of M.Sc. Geology courses

Students have to complete four semesters during their M.Sc.(Geology) Programme. Each semester is having four courses along with their respective practical. The outcome of each course of these 16 courses is given in following table.

Sr.No	Course Name and Code	Course outcome
1	**Mineralogy CCGL 101**	As a part of M.Sc. Geology curriculum, Mineralogy is a basic and core course of programme. In this course students study about the minerals and their different groups in hand specimens and in more detail under the microscope. Besides this students also learn about crystallography of minerals. This enables the students to identify the minerals and identification of rock forming minerals is the basic outcome of this course. As the rocks are aggregate of minerals, their identification in the field is a basic and fundamental task of a geologist. This course enables students to identify minerals and rocks independently in field and he can confirm them by doing microscopic studies.
2	**Stratigraphy and palaeontology CCGL102**	Stratigraphy and palaeontology is the backbone of geology; this course gives knowledge about 'bed', its time of origin, composition and a condition in which it was formed. Further the order of superposition of strata can be firmly known. Besides this, study of palaeontology enables students to familiar with the evolutionary history of different animals and plants which lived on the earth in past and now available as fossils; Students will be able to comment on the palaeoecology, sea level changes, biostratigraphy, relative ages of associated rocks and reasons behind the dispersal patterns of organisms from one part of continent to another.
3	**Structural Geology CCGL103**	Generally rocks show very striking structures like folds, faults, joints, fractures and unconformities. Through this course students become skillful regarding identification of these features in field and interpret them with confidence. Their logical interpretation is very much essential as the features are the results of certain processes which happen below the surface under very typical conditions. The interpretation of rocks in which these structural features are present, becomes significant from the civil engineering point of view. This course also enables students to comment on the various processes of mountain building. The knowledge of these features is basic requisite for a geologist.
4	**Sedimentary Petrology CCGL104**	Interpretation of sedimentary processes like weathering, transportation and deposition of sediments and their final conversion in rocks in various smaller or bigger basins; textural studies, petro-genetic study, sedimentary facies, rocks classification, paleocurrent analysis, etc, will be useful in knowing the different sedimentary environments in which these rocks were formed. This enables student to think about logical relationships between formation

		conditions of sedimentary rocks and fossil fuels, i.e. coal and hydrocarbon reserves. Students can comment on the sequence stratigraphy very confidently which makes them ready to work in oil industries.
5	**Igneous Petrology CCGL201**	It is very much essential to know by a student of geology that- What is magma? How magma was formed? What is its composition? Whether magma is responsible for continental crust and the oceanic crust. The magma results into various rocks known as igneous rocks. This course enables students to know their composition, their thermodynamics, phase equilibrium, geochemistry etc, Besides this, students reassure themselves with plate tectonic history of the earth which they began to learn in other course during first semester. This course also gives basic ideas regarding formational conditions of different economical minerals, about which he will learn in more details in other course, i.e. Ore Geology.
6	**Metamorphic Petrology CCGL 202**	As one of the core course, this gives students an opportunity to learn about metamorphism which is one of the important processes which takes place below the surface of the earth and alters pre-existing igneous and sedimentary rocks under certain pressure and temperature conditions. Understanding how metamorphism transforms rocks and brings changes, such as granularity, schistosity, foliatiation, and lineation etc. under various pressures and temperatures conditions; how volatile actions evolved through metamorphism and leads to formation of various economic minerals deposits? are essential requisites to a student. This course enables students to interpret all these processes through the study of metamorphic rocks, their structures, textures in hand specimens and under the microscope and makes them confident.
7	**Geochemistry CCGL 203**	It is very much essential to a student to know the chemical composition of a mineral or rock and under which condition such composition can be possible. This Geochemistry course gives ideas about chemical composition of minerals and rocks, their EH, pH, chemical bonding etc. further, it also helps in knowing the composition and properties of earth's layers as well as surrounding atmosphere. This is very useful in meteorology as well as in mining. Isotopic studies give the absolute ages of the rocks where fossils were absent.
8	**Ore Geology and Instrumentation and Analytical Techniques CCGL 204**	Ore geology is a very important branch of geology. This course enables students to know about ore genesis, spatial and temporal distribution of ore deposits, relationship with plate tectonics, global occurrence of ore deposits, their host rocks, chemical composition, REE patterns; By knowing global patterns of ores students can correlate them with Indian ore deposits. This will help students in identifying ore bearing rocks during actual field or mining work for ore deposits in his professional life. Besides this, by learning this course students become well familiar with various instruments such as SEM,TEM, AAS, and laboratory techniques such as, XRD, XRF, ICPMS, cathode-luminescence, EPMA,

		cutting, polishing, preparing samples for lab analysis, etc. and can work on some instruments in laboratories without special training confidently.
9	**Hydrogeology CCGL 301**	Water is a prime necessity of the mankind, so it becomes very essential to know details about the water availability at surface and subsurface. This course enables students to know about groundwater provinces of India, subsurface occurrence of water, its distribution, movement of water and reservoirs, quality of water. Course also familiarizes students with methods of artificial groundwater recharge; method of rainwater harvesting, problems of overexploitation, saltwater intrusion in aquifers, groundwater legislation etc. groundwater and watershed management, artificial recharge and groundwater exploration methods, etc. By studying all these aspects he becomes ready to work as professional hydrogeologists.
10	**Fuel Geology CCGL302**	This course enables students to know details of petroleum such as composition and different fractions, origin, nature and migration (primary and secondary) of oil and gas; transformation of organic matter into kerogen; occurrence of petroleum. Characteristics of reservoir rocks and traps, Prospecting for oil and gas, drilling and logging procedures; oil-bearing basins of India and future prospects. This knowledge makes him ready to work in petroleum industries as professional geologists. This course also gives detailed ideas about coal, origin, rank, grade and type of coal; Sedimentology of coal bearing strata; classifications of coal; Laboratory studies which includes-macroscopic and microscopic constituents; concept of maceral and micro lithotypes, coal petrology and its application in solving industrial and geological problems; preparation of coal for industrial purposes; These aspects of this course help students in future in professional life.
11	**Geoexploration CCGL303**	It is very difficult to observe the ores, water and oil available at subsurface, that is why this course is designed to understand this. This course familiarizes students about the methods of collection of gravity data, magnetic data, electrical data, seismic data and geophysical logs and their interpretation for subsurface geology purpose, in mineral exploration, utility of seismic reflection data in recognition of subsurface structures; interpretation of seismic data. The knowledge gathered by students through this course enables him to work for various explorations such as groundwater, minerals, petroleum and coal, etc. being carried out by various government and private organizations.
12	**Geomorphology, Remote Sensing and GIS CCGL 304**	This paper enables students to know the important tool of geological investigations before going to the fields i.e. aerial photographs, the study includes the observation of characteristics of photographs for determination of geomorphic units present in that aerial photographs. Nowadays it becomes mandatory to a geologist he must be equipped with modern tools and techniques such as

		Remote Sensing and GIS. This course equips the students to understand and interpret satellite imageries and their use in various explorations such as groundwater, mineralization, oil, engineering, natural hazards and for other planning. This course also enables students to understand what observations are necessary when he reaches to field, especially about geomorphic processes and resulting landform, how to map and digitize them with the help of Geographic Information System software (GIS) and make models for strategies. The knowledge gathered from this course helps students in their professional life in Govt. and Pvt. sector.
13	**Environmental Geology CCGL 401**	This course familiarizes students about fundamental concepts of environmental geology and Environmental protection – legislative measures adopted in India; Green house gases, causes of global warming, Earth system cycles, Natural hazards and risks their preventive and precautionary measures; Environmental Impact analysis, degradation of water and soil, water logging problems etc, and their preventive and remedial measures. By studying this course he becomes confident about assessing all the environmental degradation concerns and their precautionary and remedial measures. This course makes him ready to work in Govt. and Pvt. Organizations which deals with environment its protection.
14	**Engineering Geology CCGL 402**	Role of geology in civil engineering is unavoidable because before the construction of any civil engineering structure like dam, tunnel, bridges, water canal, roads, airports, seaports, highways, buildings it is customary to do detail geological and geotechnical investigations. This course familiarize students about the dams, tunnels, their types and engineering problems, foundation problems of highways, airports, seaports, bridges and other buildings; Landslides their causes and preventive measures and other engineering problems related to precautionary measures and mitigations of hazards; beach engineering. This course makes students ready to work for pre-construction geological and geotechnical investigations and save form damage and loss of national property.
15	**Mining Geology CCGL 403**	This course facilitates students to understand the mineral exploration, target areas for ore minerals, their estimation and strategies for exploitation. Basis for mining, their types and other factors which enable the mining organizations to move forward for mining. Students will know from this course how geology is one of the main factors and how it influences on mining activities. Various elements of surface and underground mining; various sampling and sampling calculations pertaining to present and future cost and valuation of mines; estimation of life of mine, future cost and profit from mine; writing valuation reports. By knowing all these aspects of mining through this course, students become ready to work in mining sector with confidence.

16	**Statistical Geology and Computer Applications in Geology and Research Methods ECGL 404**	This course familiarize the students with statistical parameters such as histograms, cumulative curves, scatter diagrams; problems on the student,'t' test, chi square test, mean; median and mode; standard deviation; skewness and kurtosis and their inter-relationship. Computer applications in geology such as, application to petrological and geochemical problems; use of standard software analysis and interpretation of geological data; writing of simple programs to apply some elementary statistical techniques to geological data, use of GIS software. Through this course students will also come to know about literature consultation and research methodology which encompasses-analysis of scientific report, compilation of data, interpretation and presentation of experimental data; preparation of research schemes proposals and types of other scientific writings, this enables students to pursue for research in any geological field.

Department of Microbiology Government Institute of Science, Aurangabad (M.S.)

M.Sc.MicrobiologyProgram and CourseOutcome

Program Outcomes

On completion of program students will be able to

1. **Get ability to apply the process of science by formulating hypotheses and design experiments based on the scientific method.**
2. **Analyze and interpret results from a variety of microbiological methods**
3. **Use quantitative reasoning by using mathematical calculations and graphing skills to solve problems in microbiology.**
4. **Communicate and collaborate with other disciplines by effectively communicating the fundamental concepts of microbiology in written and oralformat.**
5. **Identify credible scientific sources to interpret and evaluatethe evidences**
6. **Understand the relationship between science and society by recognizing and discussing logical, scientific and ethical issues in microbiology.**

Program specificoutcomes

On completion of program students will be specifically able to

1. **Prepare and view specimens for examination using light microscopy**
2. **Use pure culture and selective techniques to isolate microorganisms. Identify microorganisms (media-based, molecular and serological).**
3. **Estimate the number of microorganisms in a sample by suitable enumeration technique**
4. **Use appropriate microbiological and molecular lab equipment and methods.**
5. **Practice safe microbiology, using appropriate protective, biosafety and emergency procedures.**
6. **Document and report on experimental protocols, results and conclusion**

Course Outcomes

Course I BIOSTATISTICS COMPUTER APPLICATIONS AND RESEARCH METHODOLOGY

Course Objectives

To understand various statistics terminologies and their significance in microbiology

To get familiar with various computation tools of biostatistics

To know- how about research methodology

Outcomes

After successful completion of this course, students will be able to:

- Apply the principles of statistics for designing microbiological experiment, statistical analysis, and interpretation of results
- Operate and solve exercise using computation statistics software
- Get acquitted with basic approach of research methodology

Course II BIOENERGETICS AND ENZYMOLOGY

Course Objectives

- To understand concepts of bioenergetics and metabolic pathways of microorganisms
- To study the metabolic pathways of industrially important fermentation product
- To know the properties, kinetics, and significance of microbial enzymes

Outcomes

- After successful completion of this course, students will be able to:
- Elucidate the bioenergetics and microbial metabolic pathways
- Cognizant about the metabolic pathways of industrially important fermentation product
- Demonstrate the properties, kinetics, and significance of microbial enzymes

Course III BIOINSTRUMENTATION TECHNIQUES AND APPLICATIONS

Course Objectives

- To study the principles, need and care of laboratory instruments
- To understand theory, principles of chromatographic, electrophoretic, spectrophotometric and radioisotope techniques
- Get detail applications of various instrument and techniques in microbial field

Outcomes

After successful completion of this course, students will be able to:

- Explain the principles, need and SOP of laboratory instruments
- Pertain the theory, principles of chromatographic, electrophoretic, spectrophotometric and radioisotope techniques
- Demonstrate various instruments and techniques

Course IV INDUSTRIAL FOOD AND DAIRY MICROBIOLOGY

Course Objectives

- To understand concepts in milk microbiology
- To complement the students with the basic knowledge of food microbiology
- To acquaint the students with food preservation techniques

Outcomes

After successful completion of this course, students will be able to:

- Know the concepts related to popular milk products, milk examination and spoilage.
- Comprehend knowledge regarding fermented food products, food spoilage and infection
- Understand diverse strategies for food preservation

Course V RECENT TRENDS IN VIROLOGY

Course Objectives

- To aware the virus, classification, and their significance
- To understand the vail multiplication and pathogenic role of viruses
- To abreast about control of virus and newly emerging virus

Outcomes

- After successful completion of this course, students will be able to:
- Explicate the virus, classification, and their significance
- Comprehend the vail multiplication and pathogenic role of viruses
- Realize about control of virus and newly emerging virus

Course VI MOLECULAR IMMUNOLOGY

Course Objectives

- To study the concepts related to antigen and antibody
- To study the various immune cells and organs functional in a body at molecular level
- To get knowledge of immunoassays and diagnostic tests

Outcomes

- After successful completion of this course, students will be able to:
- Get acquainted with knowledge about immune system
- Know about the role of immune cells and organs and the functional mechanisms of each
- Demonstrate the immunoassay and diagnostic test

Course VII MICROBIAL PHYSIOLOGY.

Course Objectives

- To acquaint various life process like photosynthesis, respiration and fermentation, anaerobic respiration, and bacterial sporulation
- To understand bacterial membrane transport
- To understand the concept of chemolithotrophy and nitrogen metabolism

Outcomes

- After successful completion of this course, students will be able to:
- Get well versed with various life process like photosynthesis, respiration and fermentation, anaerobic respiration, and bacterial sporulation
- Elucidate bacterial membrane transport
- Discuss the concept of chemolithotrophy and nitrogen metabolism

Course VIII MICROBIAL DIVERSITY AND

Course Objectives

- To understand the microbial biodiversity
- To acquaint with ecology
- To understand the morphology, physiology, and significance of extremophilic microbes

Outcomes

- After successful completion of this course, students will be able to:
- Comprehend the biodiversity
- Familiarize with various ecological niche and microbial interactions (positive and negative)
- Recognize the morphology, physiology, and significance of extremophilic microbes

Course IX ENZYME TECHNOLOGY

Course Objectives

- To study enzyme extraction and purification methods
- To understand the enzyme inhibition kinetics
- To acquaint with concepts - enzyme immobilization, enzyme engineering and clinical enzymology

Outcomes

- After successful completion of this course, students will be able to:
- Demonstrate the enzyme extraction and purification methods
- Explain the enzyme inhibition kinetics
- Familiarize with concepts - enzyme immobilization, enzyme engineering and clinical enzymology

Course X BIOPROCESS ENGINEERING AND TECHNOLOGY.

Course Objectives

- To survey the scope, Principle and types of various bioprocess engineering and techniques
- To understand to features and types of bioreactor
- To understand the mass transfer, sterilization, and downstream processes

Outcomes

- After successful completion of this course, students will be able to:
- Grasp the scope, Principle and types of various bioprocess engineering and techniques
- Demonstrate the features and types of bioreactor
- Explain the mass transfer, sterilization, upstream and downstream processes

Course XI MOLECULAR MICROBIAL GENETICS.

Course Objectives

- To understand the concepts in prokaryotic, eukaryotic, and viral genetics
- To study the central dogma of molecular biology (replication, transcription, and translation)
- To acquaint types of mutation, gene regulation and transposable element

Outcomes

- After successful completion of this course, students will be able to:
- Acquaint with concepts in prokaryotic, eukaryotic, and viral genetics
- Explain central dogma of molecular biology (replication, transcription, and translation)
- Enlist and explain types of mutation, gene regulation and
- transposable element

Course XII ENVIRONMENTAL MICROBIAL TECHNOLOGY

Course Objectives

- To learn the environment, ecosystem, and eutrophication
- To understand bioremediation, xenobiotics, and effluent treatment methods
- To acquaint the students with global environmental problems

Outcomes

- After successful completion of this course, students will be able to:
- Understand the environment, ecosystem, and eutrophication
- Explain bioremediation, xenobiotics, and effluent treatment methods
- Connect about global environmental problems

Course XIII RECOMBINANT DNA TECHNOLOGY

Course Objectives

- To learn about core technique of rDNA technology and enzyme required for it.
- To understand the tools and techniques used in rDNA technology
- To aware about various rDNA products in various field

Outcomes

- After successful completion of this course, students will be able to:
- Explain about core technique of rDNA technology and enzyme required for it.
- Demonstrate the tools and techniques used in rDNA technology
- cognizant about various rDNA products in various field

Course XIV FERMENTATION TECHNOLOGY

Course Objectives

- To acquaint with various microbial fermentation processes
- To apply the concept of these processes for commercially valuable products
- To aware about IPR and patents

Outcomes

- After successful completion of this course students will be able to:
- Understand the fermentation processes involved for various products and investigate the applications of various techniques for fermentation products
- Inculcate the salient features of quality management and regulatory processes
- informed about IPR and patents

Course XV BIOINFORMATICS,MICROBIAL GENOMICS AND PROTEOMICS.

Course Objectives

- To understand basic and advanced tools of bioinformatics
- To perform sequence and whole genome analysis
- To learn various computational technique and online tools of bioinformatics

Outcomes

- After successful completion of this course students will be able to:
- Explain basic and advanced tools of bioinformatics
- Demonstrate sequence and whole genome analysis
- familiarize various computational technique and online tools of bioinformatics

Course XVI PHARMACEUTICAL MICROBIOLOGY

Course Objectives

- To develop practical skills involved in interpretation of microbiological materials and data
- To promote development of entrepreneurship and build up Professionals in Pharmaceutical Analysis, and R&D work
- To understand quality assurance validation

Outcomes

- After successful completion of this course, students are expected to:
- Conversant in practical skills involved in interpretation of microbiological materials and data
- Explain the development of entrepreneurship and build up Professionals in Pharmaceutical Analysis, and R&D work
- Acquire knowledge in quality assurance validation

Program outcomes and course outcomes/Govt. Institute of Science, Aurangabad

DISSERTATION COURSE (PROJECT WORK)
Course Objectives • To develop research skills involved execution of microbiological proposal • To use appropriate microbiological methods and lab equipment • Aware about safe microbiology, using appropriate protective, biosafety, and emergency procedures. • To prepare document and report on experimental protocols, results, and conclusions.
Outcomes After successful completion of this course, students are expected to: • Have research skills involved execution of microbiological proposal • Make use of appropriate microbiological methods and lab equipment • Abide by safe microbiology, using appropriate protective, biosafety, and emergency procedures. • Create document and report on experimental protocols, results, and conclusions.

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