



**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:

<b>M.Sc. I Year: Semester 1</b>			
<b>Sr. No.</b>	<b>Name of the Course</b>	<b>Credits</b>	<b>Course Outcomes</b>
1.	BPT – 101: Molecular Biophysics	<b>03</b>	<p><b>Students will understand the basic Concept of:</b></p> <ul style="list-style-type: none"> <li>➤ Atomic &amp; molecular structure,</li> <li>➤ Thermodynamic &amp; Bioenergetic in biological systems</li> <li>➤ Structural &amp; molecular properties of different biomolecules</li> </ul>
2.	BPT -102 Biophysical Chemistry	<b>03</b>	<p><b>Students get acquainted with different:</b></p> <ul style="list-style-type: none"> <li>➤ Physicochemical properties &amp; biological significance of</li> <li>➤ Nucleic acids, proteins, polysaccharides, carbohydrates, vitamins,</li> <li>➤ Hormones</li> <li>➤ Intra molecular interactions.</li> </ul>
3.	BPT - 103 Cellular Biophysics	<b>03</b>	<p><b>Students can understand the concept of:</b></p> <ul style="list-style-type: none"> <li>➤ Cell organization, growth, division, cell cycle &amp; its control,</li> <li>➤ Intracellular interactions,</li> <li>➤ Tissue culture concept.</li> <li>➤ Different microscopic techniques.</li> </ul>
4.	BPT-104 Molecular Enzymology	<b>03</b>	<p><b>Students get acquainted with the concept of:</b></p> <ul style="list-style-type: none"> <li>➤ Chemical Kinetics,</li> <li>➤ Enzyme kinetics,</li> <li>➤ Types of enzymes and enzyme technology.</li> </ul>
5.	BPT-105 Biostatistics & Computer Fundamentals.	<b>03</b>	<p><b>Students can understand the concept of:</b></p> <ul style="list-style-type: none"> <li>➤ Utility of Statistical methods needed to data analysis in biological studies</li> <li>➤ Mean, mode, median,</li> <li>➤ Small sample test, chi-Square test, F test, large sample test (z-test),</li> <li>➤ Concept of probability and probability distributions,</li> <li>➤ Studies in Binomial, Poisson and Normal distribution with illustrative examples.</li> </ul>

			<ul style="list-style-type: none"> <li>➤ Computer fundamentals to make students equipped with documentation &amp; presentation etc.</li> </ul>
6.	<b>BPP-111 Lab Course -1 (Based on BPT-101 &amp; 102)</b>	<b>03</b>	<p><b>Students will learn the techniques:</b></p> <ul style="list-style-type: none"> <li>➤ Verification of the Lambert Beer's law.</li> <li>➤ Study of the Spectral characterization of the biomolecules</li> <li>➤ Molecular titrations.</li> <li>➤ Isolation &amp; characterization of proteins.</li> <li>➤ Estimation of different biomolecules etc.</li> </ul>
7.	<b>BPP-112 Lab Course -2 (Based on BPT - 103)</b>	<b>03</b>	<p><b>Students will learn the techniques:</b></p> <ul style="list-style-type: none"> <li>➤ Microscopic characterization of different cells bacteria fungi etc.</li> <li>➤ Study of morphology of different cells &amp; blood cells etc.</li> </ul>
8.	<b>BPP-113 Lab Course -3 (Based on BPT - 104)</b>	<b>03</b>	<p><b>Students will learn the techniques of:</b></p> <ul style="list-style-type: none"> <li>➤ Determination of energy of activation, isolation, purification &amp; characterization of enzymes.</li> <li>➤ To determine the effect of temperature, pH, metal ions on Enzyme activity &amp; Kinetics.</li> <li>➤ Determination of kinetic parameters as Km &amp; Vmax.</li> </ul>
9.	<b>BPP-114 Lab Course -4 (Based on BPT- 105)</b>	<b>02</b>	<p><b>Students will learn:</b></p> <ul style="list-style-type: none"> <li>➤ Biological data generation.</li> <li>➤ Data processing &amp; presentation as well as required computer skills.</li> </ul>

Sr. No.	Name of the Course	Credits	Course Outcomes
1.	<b>BPT – 201 Physiology &amp; Biophysics</b>	<b>03</b>	<ul style="list-style-type: none"> <li>➤ Students get knowledge of Biophysics of human physiology viz,</li> <li>➤ Brain&amp; neurophysiology physiology, nerve impulse, Synaptic transmission,</li> <li>➤ Signal transduction membrane potential, Resting and action potential &amp; its propagation</li> <li>➤ Voltage clamp and patch-clamp techniques, memory and neuropeptides</li> <li>➤ Vision &amp; Audition,</li> <li>➤ Cardiovascular and Pulmonary physiology, PFT &amp; it's significance.</li> <li>➤ Renal &amp; Reproduction physiology, IUI, IVF techniques etc.</li> </ul>
2	<b>BPT -202 Membrane &amp; Ion channel Biophysics</b>	<b>03</b>	<p><b>Students can clear the concept of:</b></p> <ul style="list-style-type: none"> <li>➤ Membrane Structure &amp; dynamics,</li> <li>➤ Membrane potential,</li> <li>➤ Osmosis, Surface tension,</li> <li>➤ Active &amp; Passive transport</li> <li>➤ Membrane energetics etc.</li> </ul>
3	<b>BPT - 203 Physicochemical Techniques</b>	<b>03</b>	<p><b>Students will understand:</b></p> <ul style="list-style-type: none"> <li>➤ The principle, methodology</li> <li>➤ Applications of various analytical techniques like Chromatography,</li> <li>➤ Electrophoresis</li> <li>➤ Spectroscopy.</li> </ul>
4	<b>BPT- 204 Molecular Biology &amp; Genetics</b>	<b>03</b>	<p><b>Students get specified knowledge of:</b></p> <ul style="list-style-type: none"> <li>➤ Molecular biology of gene</li> <li>➤ Genome Organization</li> <li>➤ Gene Expression&amp; regulation</li> <li>➤ Mutation &amp; repairs</li> <li>➤ Genetic Recombination etc.</li> </ul>
5	<b>BPT-205 Research Methodology</b>	<b>01</b>	<p><b>Students will be introduced with:</b></p> <ul style="list-style-type: none"> <li>➤ Research objectives and motivation</li> <li>➤ Types and methods of Research</li> <li>➤ Research approaches</li> <li>➤ Significance of research</li> <li>➤ Research Ethics</li> <li>➤ Literature review etc.</li> <li>➤ Motivated for future research carrier.</li> </ul>
6.	<b>BPP- 211 Lab Course-5 (Based on BPT-201 &amp;</b>	<b>03</b>	<p><b>Students can learn the following aspects of Physiological Biophysics :</b></p> <ul style="list-style-type: none"> <li>➤ Recording the Respiratory movements in man</li> </ul>

	202)		<p>using stethograph.</p> <ul style="list-style-type: none"> <li>➤ Determination of the Breath holding time, maximum voluntary ventilation and other respiratory parameters in man &amp; study of the various physiological changes under extreme conditions (high RCF, low oxygen pressure, zero gravity conditions.) via 15 Assignments on various aspects using signal acquisition systems.</li> <li>➤ To study the Erythrocytes Membrane Permeability and Transport effects of Hypotonic &amp; Hypertonic shock. To determine the osmotic fragility of RBC. To determine the partial characteristics of Membrane Protein by SDS-PAGE.</li> <li>➤ 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.</li> <li>➤ To study the interactions of Detergent and other Membrane active agents with RBC membrane &amp; effect of incubation time, Temperature &amp; concentration.</li> <li>➤ 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 .</li> </ul>
7.	BPP-212 Lab Course -6 (Based on BPT - 203)	03	<p><b>Students will be trained:</b></p> <ul style="list-style-type: none"> <li>➤ In various analytical techniques like needed by the various pharma and research industries.</li> <li>➤ Spectroscopy</li> <li>➤ Chromatography</li> <li>➤ Electrophoresis</li> <li>➤ Viscosity etc.</li> </ul>
8.	BPP-213 Lab Course-7 (Based on BPT- 204)	03	<p><b>Students learn the techniques:</b></p> <ul style="list-style-type: none"> <li>➤ Isolation, characterization of DNA from various sources such as plants, animals &amp; microbes etc. Blotting techniques,</li> <li>➤ Isolation &amp; characterisation of m-RNA</li> <li>➤ Isolation and study of various mutants.</li> <li>➤ Demonstration of recombination processes like transformation, conjugation etc</li> </ul>
9.	BPP-214 Science	02	<p><b>Students learn the skills:</b></p> <ul style="list-style-type: none"> <li>➤ Needed to develop their research aptitude like</li> </ul>

	<b>Communication Skills</b>		Literature surfing, ➤ Review writing, ➤ preparing research proposal, ➤ Writing of conference/ symposium report, ➤ Group discussion & presentation etc.
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## M.Sc. I Year: Semester 3

Sr. No.	Name of the Course	Credits	Course Outcomes
1.	<b>BPT - 301 Biophysical &amp; Bio-analytical Techniques</b>	03	<b>Students can understand basic techniques:</b> <ul style="list-style-type: none"> <li>➤ Fluorescence spectroscopy</li> <li>➤ Fluorimetry,</li> <li>➤ FRET, &amp; Applications,</li> <li>➤ NMR principles &amp; applications</li> <li>➤ ESR principles &amp; applications</li> <li>➤ Mass Spectroscopy &amp; its applications</li> <li>➤ Various Diffraction Techniques etc.</li> </ul>
2	<b>BPT -302 Immunology &amp; Immunotechniques</b>	03	<b>Students will get aware about:</b> <ul style="list-style-type: none"> <li>➤ The immune system &amp; its specificity ,</li> <li>➤ Various physical , biological factors affecting individual's immunity,</li> <li>➤ Organs &amp; cells involved in the development of immunity</li> <li>➤ Histocompatibility &amp; transplantation immunology</li> <li>➤ Immunological techniques like immunoelectrophoresis, Immunodiffusion, counter current immuno electrophoresis, Immunoassay ,</li> <li>➤ Blotting techniques</li> <li>➤ ELISA etc</li> </ul>

3	<b>BPT - 303 Elective Group -A (Environmental Biophysics)</b>	03	<b>Students can learn the various aspects of Biophysical Ecology:</b> <ul style="list-style-type: none"> <li>➤ Nonionizing radiation,</li> <li>➤ Sources, consequences of UV absorption by living system,</li> <li>➤ biological effects at molecular, cellular and organism level.</li> <li>➤ Protective standards and measures.</li> <li>➤ Physical aspects of sound pollution, sources, sound measurement, its effect on CNS, Sleep disorders, reproductive, cardiovascular and endocrine system etc.</li> <li>➤ Biophysics at Low and High temperature, Thermophiles and Thermo resistance mechanism, Thermo stability of enzymes and other biomolecules, Heat hardening of plant cells.</li> <li>➤ 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.</li> </ul>
4	<b>BPT- 304 Elective Group-B (Recombinant DNA Technology)</b>	03	<b>Students will be competent in RDT research tools:</b> <ul style="list-style-type: none"> <li>➤ Gene cloning,</li> <li>➤ Construction of various libraries</li> <li>➤ Gene identification</li> <li>➤ Gene expression analysis by PCR -,</li> <li>➤ Hybridization-, and Sequencing- based techniques.</li> <li>➤ various techniques to engineer and express recombinant proteins, for studying the dynamics of protein- protein and protein-DNA interaction proteome analysis</li> </ul>
5	<b>BPP-311 Lab Course-8 (Based on BPT–301 &amp; 302 )</b>	03	<b>Students will learn various immunological techniques:</b> <ul style="list-style-type: none"> <li>➤ Useful for diagnosis in pathological labs</li> <li>➤ Which are the key markers in the research areas of the molecular biology</li> <li>➤ Useful in pharma industries and revealing various aspects of medical sciences.</li> </ul>
6	<b>BPP-312 Lab Course-9</b>	03	<b>Students will learn:</b> <ul style="list-style-type: none"> <li>➤ Analytical methods in environmental studies.</li> </ul>



	<b>(Based on BPT -303)</b>		<p>Principle, instrumentation, method</p> <ul style="list-style-type: none"> <li>➤ Spectrum interpretation of</li> <li>➤ mass spectrometry and its application,</li> <li>➤ Atomic absorption, Flame emission, Plasma emission, Spectrometry,</li> <li>➤ X-ray fluorescence, PIXE,</li> </ul>
➤ 7	<b>BPP-313 Lab Course-10 (Based on BPT -304)</b>	<b>03</b>	<p><b>Student will gain the skills of :</b></p> <ul style="list-style-type: none"> <li>➤ Isolation, estimation of DNA, RNA and protein</li> <li>➤ Isolation and purification of plasmid DNA- i. Mini preparation, ii. Purification by LMP agarose, iii. Purification using DE81 cellulose.</li> <li>➤ Preparation and transformation of competent E.coli, Restriction enzyme analysis- restriction mapping</li> <li>➤ Agarose gel electrophoresis and PAGE of DNA and RNA – Southern blotting – RFLP analysis</li> <li>➤ Gene cloning-cloning a DNA fragment in Blue script vector. Blue White selection of transformed colonies</li> <li>➤ Characterization of transformants:</li> <li>➤ Complementation, ii. Insertional inactivation, iii. Screening by hybridization.</li> <li>➤ Isolation of DNA from bacteriophage</li> </ul>
<b>8</b>	<b>BPMP Mini Project</b>	<b>03</b>	<p><b>Students will learn the skills like:</b></p> <ul style="list-style-type: none"> <li>➤ Defining the research topic</li> <li>➤ Designing &amp; making research proposal.</li> <li>➤ Planning &amp; Execution of the research work</li> <li>➤ Making of research project report</li> <li>➤ Presentation of the research work</li> <li>➤ Publishing the research paper.</li> </ul>

<b>Sr. No.</b>	<b>Name of the Course</b>	<b>Credits</b>	<b>Course Outcomes</b>
1.	<b>BPT-401 Bioinformatics &amp; Structural Biology</b>	03	<p><b>Students will learn :</b></p> <ul style="list-style-type: none"> <li>➤ Information theory, Biological data exploration through various Resources – EMB net, NCBI, BTIS network,</li> <li>➤ Bioinformatics, Cheminformatics &amp; medical informatics.</li> <li>➤ Sequence databases, Protein sequence databases, Structural databases, PDBs, Motif databases, Protein motif database, Genome databases, Proteome databases etc.</li> <li>➤ Functional Genomics DNA sequence analysis, Gene bank, CDNA library pharmaco Genomics, ESTs analysis method for recognition viz.</li> <li>➤ Pair wise Alignment, Alignment algorithms, sequence analysis tools, BLAST (Basic Logical Alignment Search Tool) FASTA, Multiple Alignment,</li> <li>➤ Sequence analysis using EMBOSS, DNA micro array technique.</li> <li>➤ Molecular modelling,</li> </ul>
2	<b>BPT-402 Radiation Biophysics</b>	03	<p><b>Learners get acquainted with :</b></p> <ul style="list-style-type: none"> <li>➤ Radiological Physics. Isotope, Radioactivity, laws of Radioactivity, Alfa, Beta, Gamma rays, Properties of Electromagnetic radiation,</li> <li>➤ Particle accelerate absorbed cyclotrons &amp; synchrotrons,</li> <li>➤ Radiation Units- Units of radioactivity, exposure &amp; dose, Dose equivalent Unit,</li> <li>➤ Particle flux &amp; fluence, X &amp; Gamma ray interaction with matter,</li> <li>➤ Interactions, absorption &amp; scattering of electron, Heavy charged particles</li> <li>➤ Neutrons, attenuation coefficient linear, mass, electronic &amp; atomic, HVL, mean free path, Absorption edges, LET. etc</li> <li>➤ Interactions of various kinds of radiations with biological systems &amp; its consequences.</li> </ul>

3	BPT - 403 Elective Group -A ( Medical Biophysics)	03	<p><b>Students will learn Principles &amp; instrumentation of :</b></p> <ul style="list-style-type: none"> <li>➤ Electrocardiography, Electroencephalographic waveforms, Standard lead systems, ECG preamplifiers, ECG readout devices, ECG machine, Measurements Other electrophysiological recordings, EMG, ERG, EOG &amp; their applications.</li> <li>➤ Medical-imaging, techniques as of X-ray imaging, Mammography, Xeroradiography, Fluoroscopy, Computerized Axial Tomography, Angiography, Myelography, Magnetic resonance imaging, Ultrasonography. Etc</li> <li>➤ Basic principles of Nuclear Medicine &amp; its Diagnostic uses.</li> <li>➤ Principles &amp; scope of Radiotherapy.,</li> <li>➤ Concepts of teletherapy &amp; Brachytherapy, Co-60 Therapy, brachytherapy, Sources, Calibrations, Dose distribution implant dosimetry.</li> <li>➤ Biomechanics and Ergonomics.</li> </ul>
4	BPT - 404 Elective Group -B (IPR, Bio-safety & Bioethics)	03	<p><b>Students get aware of :</b></p> <ul style="list-style-type: none"> <li>➤ To Intellectual Property</li> <li>➤ Types of IP: Patents, Trademarks, Copyright &amp; Related Rights, Industrial Design, Traditional Knowledge, Geographical Indications,</li> <li>➤ Protection of GMOs IP as a factor in R&amp;D; IPs of relevance to Biotechnology and few Case Studies</li> <li>➤ Agreements and Treaties</li> <li>➤ History of various Agreement PCT; Indian Patent Act 1970 &amp; recent amendments</li> <li>➤ Introduction to Patents;</li> <li>➤ Databases; Country-wise patent searches (USPTO, esp@cenet(EPO), PATENT Scope(WIPO), IPO, etc.)</li> <li>➤ Patent filing procedures</li> <li>➤ National &amp; PCT filing procedure</li> <li>➤ Biosafety &amp; Bioethics- Ethical implications of biotechnological products and techniques.</li> </ul>
5	Lab Course -11 (Based on BPT-401 )	03	<p><b>Students will develop the practical approach:</b></p>

			<ul style="list-style-type: none"> <li>➤ Internet search for Bioinformatics resources.</li> <li>➤ DNA and Protein sequence, file format conversion.</li> <li>➤ EST's Contig assembly and ORF analysis.</li> <li>➤ Nucleic acids and Protein sequence database search.</li> <li>➤ Biophysical parameters and Protein diagnostics.</li> <li>➤ Multiple sequence alignment and Conserved Amino acid residues.</li> <li>➤ Cladograms and Dendrograms and evolutionary relationship.</li> <li>➤ The PROSITE Database.</li> <li>➤ Conserved Domains and Protein super families.</li> <li>➤ Two-dimensional and three-dimensional structure, Prediction resources.</li> <li>➤ Protein structure model from x-ray diffraction and NMR data.</li> </ul>
6	Lab Course -12 (Based on BPT-402)	03	<p><b>Students come to learn the different techniques related :</b></p> <ul style="list-style-type: none"> <li>➤ 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&amp; Cerric Sulphate Dosimeter. Evaluation of Radiation effects (gamma rays) on various biomolecules</li> <li>➤ Student also learn to measure the Central axis of Dose, Depth of Dose, Plotting at isodose curves. &amp; determine the value of LD50.</li> </ul>
7	Lab Course -13 (Based on BPT-403)	03	<p><b>Students learn to record and analyze :</b></p> <ul style="list-style-type: none"> <li>➤ 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</li> </ul>

			<p>ventilatory functions using pulmonary function tests.</p> <ul style="list-style-type: none"> <li>➤ 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 &amp;/or film, Treatment planning procedures of Brachytherapy source ,Isotope calibration, Plotting of Isodose curves using Ion chamber and/or film.</li> <li>➤ Brachytherapy treatment planning for 1) Manual after loading applicator, 2) Remote after loading applicator, Techniques for organ Scanning (Bone, Liver, Brain, Whole Body).</li> <li>➤ Assignments on various aspects using signal acquisition systems. AD Instruments-LAB Tutor and other protocols</li> </ul>
8	Lab Course -14 (Based on BPT-404)	03	<p><b>Students are learn :</b></p> <ul style="list-style-type: none"> <li>➤ By practicing Case studies to be revealed and analyzed emphasizing the procedural aspects of IPR, biosafety &amp; bioethics.</li> <li>➤ Practiced via mock exercises to be performed related with IPR procedures.</li> </ul>
9	Service Course*	04	<p><b>The student will register</b></p> <ul style="list-style-type: none"> <li>➤ The service course of his /her interest at the start of semester in the concerned college/ University department</li> </ul>