

## **Ph.D. in Biological Sciences:**

### **Program outcomes**

- Obtain domain and technical knowledge in basic subject of Biological Sciences
- Learn Essential Biological research/experimental skills
- Foster Research Aptitude required for biological research
- Learn effective scientific communication

### **Program specific outcomes**

- Develop basic knowledge in Cell Biology, Research methods, Bioinformatics, Biostatistics and Analytical Techniques
- Strengthen analytical and technical skills.
- Develop core competence and problem solving approach
- Learn different bioinformatics and Statistical tools
- Recognize, understand and apply basic ethical principles in biological research.
- Develop creative problem-solving skills and analytical thinking
- Ability to identify a problem and design laboratory experiments, perform Good Laboratory Practice, Ability to inspect data, interpret observations and apply statistical tools for their analysis.
- Learn and apply fundamental concepts of Intellectual Property Rights (IPR) in biological research
- Read, understand, interpret and critically evaluate scientific literature/information/data.
- Ability to communicate (both oral and written) scientific information clearly and in a well-organized approach.
- Ability to write research proposals for procuring intra or extramural research funding.

### **Course outcomes**

After taking the course the student would pursue career in

- Academia: Post-Doctoral research in National/International Institutions, research Scientist/officer
- Sales and R&D: Application/Technical expert in Pharmaceutical and Biotech companies
- Scientific communication/Editing

## Subject Wise Expected Outcome

| Sl. No | Semester | Course/module                    | Expected outcomes  |
|--------|----------|----------------------------------|--|
| 1      | I        | Cell Biology                     | After completion of the course, students would be able to describe<br>1) Cellular organization<br>2) Cell cycle regulation<br>3) Cell communication<br>4) Techniques involved in cell biology  |
|        |          | Analytical Techniques in Biology | After completion of the course, students would be able to describe the principle and operation of biological instrumentation methods and techniques of<br>1)Centrifugation and Electrophoresis b)<br>2)Chromatography<br>3)Spectroscopy  |
|        |          | Research Methodology             | 1)The course will help to make students productive member of their supervisor's lab without repetitive training across lab groups.   |
|        |          | Biostatistics                    | After completion of the course, students would be able to:<br>1)Understand types of data, and appropriate statistical tools for their analysis.<br>2)Describe data using tables, graphs, or numbers<br>3)Understand and use probability distributions<br>4)Use statistics for generalizations and decision making<br>Evaluate statistical conclusions based on experimental design   |
|        |          | Practical Paper 1                | After completion of the course, students would be able to:<br>1) Perform cell culturing<br>2) Handle cell lines<br>3) Characterizing cell cultures<br>4) Perform immunological assays that are routinely used in the field of immunology.<br>5) Calibrate analytical instruments<br>6) Operate and use UV spectrophotometer, HPLC, IR spectrophotometer<br>1)Analyse NMR and MS data |
|        |          | Practical Paper 2                | After completion of the course, students would be able to:<br>1)Perform transcription and mobility shift assay.<br>2)Understand importance of performing literature review for writing a scientific research proposal.<br>7) Make a poster or powerpoint presentation suitable for scientific conference   |

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| II | Bioinformatics    | <p>After completion of the course, students would be able to describe</p> <ol style="list-style-type: none"> <li>1) bioinformatics databases, tools and soft wares</li> <li>2) Information access for DNA, protein and metabolites</li> <li>8) 3) Sequence and structure analysis and predictions</li> </ol>  |
|    | IPR and Patenting | <p>After completion of the course, students would be able to:</p> <ol style="list-style-type: none"> <li>1) Have fair understanding of types of Intellectual Property Rights</li> <li>2) Gain knowledge about the International arrangements for protection of various IPRs, Have insight into Patent system and Indian Patents Act and Rules</li> <li>3) Understand International Patent Application Procedure and Timelines</li> <li>4) Will have through understanding of patentability criteria, Fair skill of conducting prior art searches, analysing search results and form preliminary opinion on patentability of invention, Draft patent applications and claims.</li> <li>5) Have understanding of Patent examination process, timelines and preparing response to the examination report,</li> <li>3) Prepare representation/opposition</li> </ol> |
|    | Research Seminar  | <p>After completion of the course, students would be able to:</p> <ol style="list-style-type: none"> <li>1) Find latest scientific literature published in peer reviewed journal</li> <li>2) Understand and critically discuss the findings in research articles</li> <li>3) Communicate scientific finding effectively</li> </ol>  |
|    | Practical Paper 1 | <p>After completion of the course, students would be able to:</p> <ol style="list-style-type: none"> <li>1) Access bioinformatics databases</li> <li>2) Use different bioinformatics tools</li> <li>3) Analyse DNA/protein sequence and structure</li> </ol>  |