

## **Program: B. Tech in Mechanical Engineering**

### **I. Program Outcomes:**

#### **Engineering Graduates will be able to:**

**1.Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

**2.Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

**3.Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

**4.Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

**5.Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

**6. The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

**7.Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

**8. Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

**9.Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

**10.Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**11. Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

**12. Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

### **II. Program Specific Outcomes:**

**PSO1:** Our graduate engineers will apply all the basic principles of mechanical engineering required in both private and public sector organizations. They can contribute to all national level research projects viz DST, SERB, CSIR, DRDO etc.

**PSO2:** We produce graduate engineers specialized in Thermal, Manufacturing and Design.

**PSO3:** Our students are well equipped with industrial management skills, and interdisciplinary technologies.

## **Course Outcomes:**

### **CO Statement of M-504B: Production Engineering**

- M-504.1. The students will be able to define and recall basic concepts of process planning, jigs & fixtures, press tools, gear & thread manufacturing, abrasive machining and cost estimation.
- M-504.2. The students will be able to fully understand the various aspects of process planning, jigs & fixtures, press tools, gear & thread manufacturing, abrasive machining and cost estimation.
- M-504.3. The students will be able to apply the understood principles for various production operations.
- M-504.4. The students will be able to fully analyze the results obtained by selecting different strategies of production engineering for specific applications.
- M-504.5. The students will be able to select the optimal production strategies for different real-life applications.
- M-504.6. The students will be able to appreciate and communicate the learning for catering to professional ethics and societal needs.

### **CO Statement of M-604: Heat Transfer**

- M-606.1. The students will be able to remember and define the basic principles of heat transfer including conduction, convection and radiation. They will also be able to outline the working principles of heat exchangers.
- M-606.2. The students will be able to understand the concepts of different modes of heat transfer and heat exchangers.
- M-606.3. The students will be able to apply the basic understanding of heat transfer modes and heat exchangers to estimate the expressions of heat transfer through various shapes and surfaces.
- M-606.4. The students will be able to analyze the expressions of heat transfer through various shapes/ surfaces and also the boundary conditions.
- M-606.5. The students will be able to evaluate the heat transfer in different real life thermal systems.
- M-606.6. The students will be able to design and develop newer designs for effective heat transfer. They will also be able to appreciate and communicate the learning for catering to professional ethics and societal needs.

### **CO Statement of M-835A: Modern Machining Methods**

- M-835.1. The students will be able to remember various advanced machining operations and outline their characteristic features.
- M-835.2. The students will be able to understand the working of different machining methods and compare their features, applications, advantages and limitations.
- M-835.3. The students will be able to apply the known principles of different modern machining methods to demonstrate their practical uses.
- M-835.4. The students will be able to analyze the processes for calculating material removal rates in various modern machining methods based upon known principles of Mathematics, Physics and Chemistry.
- M-835.5. The student will be able to evaluate the material removal rates obtained for different modern machining methods and compare their analysis.
- M-835.6. The students will be able to design and create newer modern machining methods and understand the operation of various hybrid modern machining methods. They will also be able to appreciate and communicate the learning for catering to professional ethics and societal needs.

## **CO Statement of HM-823: Project Management**

- HM-823.1. The students will be able to describe and relate to various concepts of project management like its planning, appraisal, monitoring, teams, termination/closing and the inventory management.
- HM-823.2. The students will be able to review and estimate the requirements of managing various aspects of project related to its planning, appraisal, monitoring, teams, termination/closing and the inventory management.
- HM-823.3. The students will be able to apply the concepts of project management for estimating project life cycles, setting feasible goals, undertaking feasibility study, scheduling and monitoring projects, managing effective teams, predicting conditions of closing/terminating projects and managing project inventory.
- HM-823.4. The students will be able to differentiate various approaches of project management based upon gained knowledge.
- HM-823.5. The students will be able to judge suitable strategies for various aspects of managing projects for optimal results.
- HM-823.6. The students will be able to develop case studies for new projects and thus create optimal strategies for various aspects of projects. They will also be able to appreciate and communicate the learning for catering to professional ethics and societal needs.

## **Program: B.Tech in Electronics & Communication Engineering**

### **I. Program Outcomes:**

#### **Engineering Graduates will be able to:**

- 1. Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- 2. Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- 3. Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- 4. Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- 5. Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- 6. The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- 7. Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- 8. Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

**9. Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

**10. Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**11. Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

**12. Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

## **II. Program Specific Outcomes:**

**PSO1:** Connect learning from Core and Disciplinary/Interdisciplinary elective courses of Electronics and Communication Engineering to assimilate technological advancements in the field for analyzing and designing subsystem processes to arrive at the solution to real world problems.

**PSO2:** Acquire hardware and software skills pertinent to research and industry practices in the field of Electronics & Communications while acquiring soft skills like persistence, proper judgment through projects and industrial interactions.

**PSO3:** Ability to identify indigenous processes and components for producing high quality, compact, energy efficient and eco-friendly solutions at affordable prices for existing and new applications directly and indirectly related to Electronics & Communication industry.

**PSO4:** Focus on acquiring right blend of aptitude and attitude so as to be the candidate of first choice for placements and higher education or to become a successful Entrepreneur and a worthy global citizen.

## **III. Course Outcomes:**

### **CO Statement of EC-201: Analog Electronics**

EC-201.1. The students will be able to understand the concepts of semiconductor diodes & their applications.

EC-201.2. The students will be able to understand the Bipolar junction transistor & its application.

EC-201.3. The students will be able to work on various biasing arrangements and compensation technique of transistor.

EC-201.4. The students will be able to understand the Field Effect transistor & its characteristics for different mode of FET.

EC-201.5. The students will be able to understand the concept of regulated power supply.

EC-201.6. The students will be able to appreciate and communicate the learning for catering to professional ethics and societal needs.

### **CO Statement of EC-202: Digital Electronics And Circuits**

EC-202.1. The students will be able to know various types of digital techniques.

EC-202.2. The students will be able to get knowledge of various types of combinational and sequential circuits.

EC-202.3. The students will be able to understand the concepts of various Flip Flops & synchronous and asynchronous counters.

EC-202.4. The students will be able to understand the concepts of A/D and D/A converters & their types.

EC-202.5. The students will be able to understand logic families like TTL, ECL, NMOS, PMOS and CMOS and will be able to appreciate interfacing between TTL and CMOS.

EC-202.6. The students will be able to appreciate and communicate the learning for catering to professional ethics and societal needs.

**CO Statement of EC-303A: Signals & Systems**

- EC-303A.1. The students will be able to characterize and analyze the properties of continuous time and discrete time signals.
- EC-303A.2. The students will be able to characterize and analyze the properties of continuous time and discrete time systems.
- EC-303A.3. The students will be able to understand the concept of time domain and frequency domain signals.
- EC-303A.4. The students will be able to appreciate the analysis of LTI systems with the help of Laplace transform.
- EC-303A.5. The students will be able to appreciate the analysis of LTI systems with the help of Fourier transform
- EC-303A.6. The students will be able to appreciate and communicate the learning for catering to professional ethics and societal need.

**CO Statement of EC-401B: Microprocessor And Interfacing**

- EC-401B.1. The students will be able to understand the basics of 8085 microprocessor.
- EC-401B.2. The students will be able to understand the basics of 8086 microprocessor.
- EC-401B.3. The students will be able to comprehend the concept of memory and I/O interfacing with microprocessor.
- EC-401B.4. The students will be able to implement various data transfer schemes and interface the microprocessor with the peripheral devices like 8255, 8259, 8237 and 8253 chips.
- EC-401B.5. The students will be able to visualize optimal design of a computer for control and data acquisition applications based on available microprocessors, memory interfacing, logic circuits and other peripheral function circuits.
- EC-401B.6. The students will be able to appreciate and communicate the learning for catering to professional ethics and societal needs

**CO Statement of EC-422: Hardware Digital Design**

- EC-422.1. The students will be able to learn computer aided design tools for hardware design of digital systems.
- EC-422.2. The students will be able to understand various modeling styles of VHDL i.e. structural, behavioral and dataflow models.
- EC-422.3. The students will be able to implement the hardware description programming language (VHDL) used for modeling digital systems.
- EC-422.4. The students will be able to understand the advanced programming skills of VHDL and implement basic circuits with SPLD; CPLD's.
- EC-422.5. The students will be able to understand FSM and FPGA.
- EC-422.6. The students will be able to appreciate and communicate the learning for catering to professional ethics and societal needs.

**CO Statement of EC-502B: Digital Signal Processing**

- EC-502B.1. The students will be able to explain various application areas of digital signal processing and its advantages.
- EC-502B.2. The students will be able to understand basics of Z transform and its need for calculating transforms.
- EC-502B.3. The students will be able to understand basics of Discrete Fourier Transform and Fast Fourier Transform and the need for calculating transforms.
- EC-502B.4. The students will be able to design & realize FIR filters using various techniques.
- EC-502B.5. The students will be able to do mapping of analog filter in digital domain to design IIR filter.
- EC-502B.6. The students will be able to appreciate and communicate the learning for catering to professional ethics and societal needs.

**CO Statement of EC-622: Communication Systems-II**

- EC-622.1. The students will be able to understand various fundamentals of digital communication Systems.
- EC-622.2. The students will be able to appreciate different types of pulse modulation and digital modulation techniques.
- EC-622.3. The students will be able to understand the theory of optimum filters /matched receivers and its probability of error.
- EC-622.4. The students will be able to understand the concept of entropy, mutual information and source encoding techniques.
- EC-622.5. The students will be able to get knowledge of the theory and relevance of random variables and processes.
- EC-622.6. The students will be able to appreciate and communicate the learning for catering to professional ethics and societal needs.

**CO Statement of EC-541: Microcontroller And Interfacing Lab**

- EC-541.1. The students will be able to use development tools for 8051 microcontroller and Assembly language programming style.
- EC-541.2. The students will be able to write the programs for various arithmetic operations, factorial of a number and to segregate two nibbles of a byte.
- EC-541.3. The students will be able to get practical exposure about programs to flash LEDs and to display a string on LCD display.
- EC-541.4. The students will be able to generate square waveform using timers and interrupts.
- EC-541.5. The students will be able to interface different peripherals with 8051.
- EC-541.6. The students will be able to appreciate and communicate the learning for catering to professional ethics and societal needs.

**CO Statement of EC-623: VLSI Technology & Circuits**

- EC-623.1. The students will be able to understand the integrated circuit technology and discuss better approaches for the designing of Integrated Circuits.
- EC-623.2. The students will be able to understand the methodology of designing and fabrication of MOS and CMOS ICs.
- EC-623.3. The students will be able to understand the fundamental concepts of MOSFET including the mathematical analysis along their physical significance required for the designing of VLSI circuits.
- EC-623.4. The students will be able to understand the realization of basic combinational and sequential digital circuits using CMOS.
- EC-623.5. The students will be able to understand the design rules and stick diagrams of combinational and sequential circuits
- EC-623.6. The students will be able to appreciate and communicate the learning for catering to professional ethics and societal needs.

**CO Statement of EC-848: Advanced VLSI Lab**

- EC-848.1. The students will be able to understand the technological aspects, their impact and mapping with the design process of integrated circuits.
- EC-848.2. The students will be able to understand the various design rules and will be able to apply them to develop effective layouts.
- EC-848.3. The students will be able to implement the physical design of various combinational circuits.
- EC-848.4. The students will be able to implement the physical design of various sequential circuits.
- EC-848.5. The student will be able to understand the various considerations and trade-offs to be taken into account a various technological implementations.
- EC-848.6. The students will be able to implement and communicate the learning for catering to professional ethics and societal needs.

## **Program: B. Tech in Computer Science & Engineering**

### **I. Program Outcomes:**

#### **Engineering Graduates will be able to:**

**1.Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

**2.Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

**3.Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

**4.Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

**5.Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

**6. The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

**7.Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

**8. Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

**9.Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

**10.Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**11. Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

**12. Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

### **II. Program Specific Outcomes:**

**PSO1: Legacy Software:** Upgrade and maintain legacy software systems by using modern techniques, programming skills, and tools.

**PSO2: Development of Software Systems:** Develop, test and maintain Software systems for business and other applications that meet the automation needs of the society and industry.

**PSO3: Research and Development:** Cultivate the field of computing and its latest trends, to pursue teaching, research & development activities and to work effectively in a team.

### **III. Course Outcomes:**

#### **CO Statements of CS-101: Elements of Computer Programming**

- CS-101.1. The students will be able to learn and explain various components of a computer system.
- CS-101.2. The students will be able to identify different features of programming languages along with the need of algorithm and flowchart.
- CS-101.3. The students will be able to understand the basics of C programming language.
- CS-101.4. The students will be able to implement the programs in C language.
- CS-101.5. The students will be able to develop projects using C programming language.
- CS-101.6. The students will be able to design and implement solutions to real life applications using C programming language.

#### **CO Statements of CS-203: Discrete Structures**

- CS-203.1. The students will be able to understand the exposure of basic discrete mathematical techniques widely used in Computer Science.
- CS-203.2. The students will be able to learn a number of Discrete Mathematical Structures (DMS) found to be serving as tools even today in the development of theoretical computer science.
- CS-203.3. The students will be able to understand and define the syntax and semantics of propositional and predicate logic.
- CS-203.4. The students will be able to translate statements from a natural language into its symbolic structures in logic.
- CS-203.5. The students will be able to acquaint with the concept of algebraic structures.
- CS-203.6. The students will be able to understand the basic concepts of computations and probability.

#### **CO Statements of CS-302: Data Structures & Algorithms**

- CS-302.1 The students will be able to decide the appropriate data structure for a given problem and compare it with respect to time and space complexity.
- CS-302.2 The students will be able to select the best algorithm to solve a problem by considering various problem characteristics, such as the data size, the type of operations, etc.
- CS-302.3 The students will be able to design and implement abstract data types such as linked list, stack, queue and tree by using C as the programming language
- CS-302.4 The students will be able to demonstrate use of algorithm design methods such as divide and conquer.
- CS-302.5 The students will be able to explain essential graph algorithms, their analyses and usage of graphs to solve problems.
- CS-302.6 The students will be able to apply advance C programming techniques such as pointers, dynamic memory allocation, structures to develop solutions for particular problems.

#### **CO Statements of CS-304A: Object Oriented Programming Systems**

- CS-304A.1. The students will be able to understand the basic Object Oriented concepts like Class, Object, Data Abstraction, Encapsulation, Polymorphism, Inheritance, Reusability, Dynamic Binding and Message Passing.
- CS-304A.2. The students will be able to understand and implement constructors, destructors, friend function, polymorphism in suitable scenarios.
- CS-304A.3. The students will be able to understand and implement abstract class, virtual base class, container class, inheritance in suitable scenarios.



- CS-304A.4. The students will be able to understand and implement templates, File Handling using functions and their corresponding pointers also learn to handle errors in file handling.
- CS-304A.5. The students will be able to implement Try, Catch blocks and handle exceptions using throw and re-throw, suitably.
- CS-304A.6. The students will be able to develop applications and implement features of object oriented programming to solve real world problems using C++.

#### **CO Statements of CS-402: Analysis & Design of Algorithms**

- CS-402.1. The students will be able to understand the programs and it's working.
- CS-402.2. The students will be able to analyze the programs based on the time and space complexity and different notations.
- CS-402.3. The students will be able to select algorithms according to the need.
- CS-402.4. The students will be able to familiarize with different types of solutions for solving the same problem.
- CS-402.5. The students will be able to learn how to solve any problem with different approaches.
- CS-402.6. The students will be able to learn how to correlate between different techniques.

#### **CO Statements of IT-402: Java Programming**

- IT-402.1. The students will be able to read, analyze and explain intermediate level Java programs.
- IT-402.2. The students will be able to increase and demonstrate the efficiency, in terms of lines-of-code, of O-O programming using the containers.
- IT-402.3. The students will be able to control the scope of a variable or method. He will be able to use the concept of Abstract Methods and Interfaces to amplify and further demonstrate O-O inheritance and polymorphism.
- IT-402.4. The students will be able to create exception handling in Java programs, and they will be able to respond to requests for exception handling when using someone else's code.
- IT-402.5. The students will be able to place GUI components onto a computer screen and to respond to events such as a mouse click or the push of a button and database connections of GUI components.
- IT-402.6. The students will be able to create files and read from computer files using Java. In particular, students will be able to create or read from files in the ASCII text format.

#### **CO Statements of CS-502A: Computer Graphics**

- CS-502A.1. The students will be able to understand the basic concept of Computer Graphics, circle Drawing Methods, concept of polygon filling algorithms.
- CS-502A.2. The students will be able to understand the concept of 2-Dimensional primitives, 2-D transformation Techniques, 2-Dimensional viewing pipeline, windows, viewports and Clipping algorithms.
- CS-502A.3. The students will be able to understand 3-Dimensional Graphic Concepts, 3-Dimensional transformation concepts and their matrix representation, 3-Dimensional Viewing, projection, its types and mathematical formulation.
- CS-502A.4. The students will be able to comprehend curve representation methods, Bezier Curves, B-Spline Curves, representation of curve using Hermite Interpolation method and parametric representation of surface using Bezier and B- Spline Curve.
- CS-502A.5. The students will be able to understand concept of hidden surface, the Z- buffer algorithm, scan line algorithm and Area Subdivision algorithm.
- CS-502A.6. The students will be able to understand concept of Image, image filtering, image processing, its geometric transformation and image manipulation models.

### **CO Statements of CS-701: Compiler Design**

- CS-701.1. The students will be able to understand the different phases of the compilation process and be able to describe the purpose and implementation approach of each phase.
- CS-701.2. The students will be able to make use of formal attributed grammars for specifying the syntax and semantics of programming languages.
- CS-701.3. The students will be able to apply the knowledge of LEX tool & YACC tool to develop a scanner & parser.
- CS-701.4. The students will be able to deal with different language translators.
- CS-701.5. The students will be able to learn the new code optimization techniques to improve the performance of a program in terms of speed & space.
- CS-701.6. The students will be able to use the knowledge of patterns, tokens & regular expressions for solving a problem in the field of data mining

### **CO Statements of CS-801: Artificial Intelligence**

- CS-801.1. The students will be able to understand the basic concepts of Artificial Intelligence techniques.
- CS-801.2. The students will be able to appreciate how heuristics are used to provide adequate solutions to hard search problems.
- CS-801.3. The students will be able to understand about various methods of knowledge representation.
- CS-801.4. The students will be able to learn about various reasoning & learning systems.
- CS-801.5. The students will be able to learn the concepts of knowledge acquisition in expert system and intelligent agents.
- CS-801.6. The students will be able to understand the concepts of natural language processing and its applications.

### **CO Statements of IT-822: Data Warehouse & Data Mining**

- IT-822.1 To understand the concept of Data Warehouse, multidimensional data model, Data cubes and the difference between DBMS and Data Warehouse.
- IT-822.2 To understand schemas for Multidimensional Database like stars, snowflakes and fact constellation.
- IT-822.3 To understand three-tier Data Warehouse architecture and the types of OLAP Servers.
- IT-822.4 To understand data cubes, data warehouse backend tools, utilities and data preprocessing. Also various Data Mining techniques like association rule, clustering, classification will be introduced.
- IT-822.5 To understand pattern presentation & visualization specification, data mining languages and architectures of Data Mining systems.
- IT-822.6 To understand spatial databases, multimedia databases along with time series and sequence data.

## **Program: B.Tech in Biotechnology**

### **I. Program Outcomes:**

#### **Engineering Graduates will be able to:**

- 1. Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- 2. Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

- 3. Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- 4. Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- 5. Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- 6. The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- 7. Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- 8. Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- 9. Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- 10. Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- 11. Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- 12. Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

## **II. Program Specific Outcomes:**

**PSO1:** Acquire knowledge on the fundamentals of biotechnology for sound and solid base which enables them to understand the emerging and advanced engineering concepts in life sciences.

**PSO2:** Acquire knowledge in domain of biotechnology enabling their applications in industry and research.

**PSO3:** Empower the students to acquire technological knowhow by connecting disciplinary and interdisciplinary aspects of biotechnology.

**PSO4:** Recognize the importance of Bioethics, IPR, entrepreneurship, Communication and management skills so as to usher next generation of Indian industrialists.

### **III. Course Outcomes:**

#### **CO Statement of Cell Biology (BT-301A)**

- BT-301A.1. The students will develop understanding of cellular mechanisms by correlating the structural organization of cell to its functions.
- BT-301A.2. The students will be able understand the dynamic nature of cellular membranes in relation to its functions
- BT-301A.3. The students will be able to understand the microstructure of cell organelles, events in cell cycles and behaviors of the cytoskeleton.
- BT-301A.4. The students will be able to assimilate significance of cell communication.
- BT-301A.5. The students will be able to understand cross talk leading holistic cellular communication and cell-cell interaction.
- BT-301A.6. The students will be able to correlate the anatomical histological and physiological events in muscle contraction and nerve transmission.

#### **CO Statement of Cell Biology Lab (BT-311A)**

- BT-311A.1. The students will be able to learn the usage of microscope in cytology.
- BT-311A.2. The students will be able to observe the difference between prokaryotes and eukaryotes.
- BT-311A.3. The students will be able to determine cell viability.
- BT-311A.4. The student will be able to learn the technique of cytometry.
- BT-311A.5. The students learn and implement the technique of cryofixation.
- BT-311A.6. The students learn and implement the technique of microtomy.

#### **CO Statement of Molecular Biology (BT-401A)**

- BT-401A.1. The student will be able to understand the organization of biomolecules and their interaction in cells and eukaryotic systems to carry out specific functions and form cellular structures.
- BT-401A.2. The student will learn the basic strategies and experimental principles to study macromolecule structure, function and interactions in cells.
- BT-401A.3. The student will be able to distinguish the molecular basis of cellular processes and interrelationships in living systems
- BT-401A.4. The students will understand the regulation of molecular systems in cells and their significance in biology, medicine and agriculture.
- BT-401A.5. The students will gain the fundamental insights to initiate and further develop the ability of inquiry-based learning.
- BT-401A.6. The students will be able to exhibit clear and concise communication of scientific data in molecular biology.

#### **CO Statement of Recombinant DNA Technology (BT-501A)**

- BT-501A.1. The students will gain an understanding of the basic principles underlying molecular cloning and the various enzymes required for gene manipulations.
- BT-501A.2. The students will be able to compare and contrast different types of vectors and describe practical features of vectors and their applications in molecular biology.
- BT-501A.3. The student will be able to discuss how DNA libraries are created and screened to clone a gene of interest.
- BT-501A.4. The student will gain an extensive knowledge about the various physical, chemical and biological methods for introducing a foreign gene in the cell.
- BT-501A.5. The student will be able to explain the steps involved in cloning and expression of mammalian and plant genes in bacteria.
- BT-501A.6. The student will be able to describe the various practical applications of recombinant DNA technology in agriculture, industry, medicine and environmental protection.

**CO Statement of Animal Biotechnology (BT-506A)**

- BT-506A.1 The student will develop the understanding of general techniques and applications of animal cell culture.
- BT-506A.2 The student will be familiarized with the techniques that will enable stocks of *cells* to be stored to prevent the need to have all *cell lines* in culture at all times.
- BT-506A.3 The students will be able to explain what a *transgenic animal* is, how they are created, and their uses.
- BT-506A.4 The student will have knowledge on the applications of tools of molecular biology and biotechnology for the improved production and protection of animals, animal products.
- BT-506A.5 The student will be able to explain the pathophysiology of cancer and understand the existing line of treatment.
- BT-506A.6 The student will develop the understanding of different types of stem cells, how they are derived and the extent of their plasticity.

**CO Statement of Plant Biotechnology (BT-601A)**

- BT-601A.1 The students will develop understanding of the basic concept of plant tissue culture.
- BT-601A.2 The students will be able understand the concept of somatic hybridization its applications.
- BT-601A.3 The students will be able to understand the growth promotion by bacteria including nitrogen fixation.
- BT-601A.4 The students will be able to assimilate genomics and proteomics.
- BT-601A.5 The students will be able to understand different methods of gene transfer in plants.
- BT-601A.6 The students will also be aware of application of transgenics in crop improvement

**CO Statement of Environment Biotechnology (BT-602A)**

- BT-602A.1 The students will be able to assimilate significant knowledge of environmental resources and global environmental issues.
- BT-602A.2 The students will be able to understand the different types of bioreactors for waste water treatment.
- BT-602A.3 The students will develop understanding of classification of hazardous wastes.
- BT-602A.4 The students will be able to understand the use of microorganisms and their processes to improve environmental quality.
- BT-602A.5 The students will be able to appreciate different in situ and ex situ technologies of bioremediation.
- BT-602A.6 The students will also be aware of the concept of generating valuable resources and eco-friendly technologies for human society.

**CO Statement of Industrial Training (BT-800)**

- BT-800.1 The students will be able to apply the theoretical knowledge to real life industrial problems.
- BT-800.2 The students will be able to improve the requisite skills in biotechnology.
- BT-800.3 The students will be able to acquire ability to do research on relevant problems.
- BT-800.4 The students will be able to know about the ethical practices in industry.
- BT-800.5 The students will be able to develop preparedness for the challenges of professional life.
- BT-800.6 The students will be able to communicate effectively with seniors and peers.

**CO Statement of Stem Cells and its Applications (BT-803)**

- BT-803.1 The students will be able to understand the control of stem cell fate specification and differentiation.
- BT-803.2 The students will be able to understand the stem cell pattern.
- BT-803.3 The students will aware of pluripotent stem cells and their presence in male germ line.

- BT-803.4 The students will be able to understand the molecular diversification of hematopoietic stem cells.
- BT-803.5 The students will be able to understand the therapeutic applications of stem cells in neural disorder.
- BT-803.6 The students will be able to appreciate the mechanisms of stem cell renewal in adult tissues.

**CO Statement of Major Project (BT- 851)**

- BT- 851.1 The students will be able to formulate research problems.
- BT- 851.2 The students will be able to know about the method for review of literature.
- BT- 851.3 The students will be able to learn to design the experiment and interpret their results.
- BT- 851.4 The students will be able to develop advanced skills required in the biotechnology industry.
- BT- 851.5 The students will be able to develop research acumen and lay a foundation for lifelong learning.
- BT- 851.6 The students will be able to learn technical writing and develop effective presentation skills.