

B.TECH. - BIOMEDICAL ENGINEERING PROGRAMME LEARNING OUTCOME

PLO 1: An ability to apply knowledge of mathematics (including multivariable calculus, differential equations, linear algebra, and statistics), science (including chemistry, calculus-based physics, and the life sciences), and engineering.

PLO 2: An ability to design and conduct experiments, as well as to analyze and interpret data.

PLO 3: An ability to design and realize a biomedical device, component, or process to meet desired needs.

PLO 4: An ability to function on multi-disciplinary teams.

PLO 5: Broaden the education necessary to understand the impact of engineering solutions in a global and societal context.

PLO 6: An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice to find solution.

ELEMENTARY MATHEMATICS (ONLY FOR BIO MEDICAL ENGINEERING)	
Course Code:21AS104	Continuous Evaluation:40 Marks
Credits: 4	End Semester Examination:60 Marks
L T P : 3 1 0	
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP).

After completion of course, students would be able to:

1. Differentiate between consistent and inconsistent matrix systems and get knowledge of eigen values and eigen vectors.
2. Understand De-Moivre's theorem and expansions of different trigonometrical functions.
3. Find successive differentiation and apply Leibnitz theorem.
4. Understand proper integrals and their properties.
5. Find tangent, normal, velocity and area using differentiations and integrations.

ELEMENTARY BIOLOGY (ONLY FOR BIO MEDICAL ENGINEERING)	
Course Code: 21AS105	Continuous Evaluation:40 Marks
Credits: 4	End Semester Examination:60 Marks
L T P : 3 1 0	
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP).

After completion of course, students would be able to:

1. Explain the complicated relationship between different cellular structures and their roles.
2. Employ experimental ways to solve genetic problems.
3. Explain how animals respond to changes in their environment.
4. When dealing with biological impediments and challenges, problem-solving abilities should be applied.
5. Analyse and interpret the data using appropriate biological methods.
6. Make connections between the various portions of the topics covered in the course.

ENGINEERING PHYSICS (COMMON TO ALL BRANCHES)	
Course Code:21AS102/202	Continuous Evaluation:40 Marks
Credits: 3	End Semester Examination:60 Marks
L T P : 3 1 0	
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. The student is expected to be familiar with broader areas of Physics such as mechanics of solids, optics, mechanical and electromagnetic waves oscillations and their relevance in Engineering.
2. An understanding of Physics also helps engineers understand the working and limitations of existing devices and techniques, which eventually leads to innovations and improvements.
3. The student would be able to learn the fundamental concepts on Quantum behavior of matter in its micro state.
4. The course also helps the students to be exposed to the phenomena of electromagnetism and also to have exposure on semiconductor devices such as solar cell.

ENGINEERING CHEMISTRY (COMMON TO ALL BRANCHES)	
Course Code:21AS103/203	Continuous Evaluation:40 Marks
Credits: 4	End Semester Examination:60 Marks
L T P : 3 1 0	
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Understand to identify the quality of water and how to improve the quality of water.
2. Rationalize bulk properties and processes using thermodynamic considerations.
3. Get preliminary understanding on introductory idea about nano materials.
4. Analyze the quantitative aspects of fuel combustion, spectroscopy and the mechanism

of corrosion.

BASIC ELECTRICAL ENGINEERING (COMMON TO ALL BRANCHES)	
Course Code:21EE101/201	Continuous Evaluation:40 Marks
Credits: 3	End Semester Examination:60 Marks
L T P : 3 0 0	
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP).
After completion of course, students would be able to:

1. Learn about transient analysis of RLC circuits with DC excitation.
2. Realize the requirement of transformers in transmission and distribution of electric power and other applications.
3. Develop an idea on Magnetic circuits, Electromagnetism.
4. Learn about measuring instruments, single phase and polyphase AC circuits.

BASIC ELECTRONICS ENGINEERING (COMMON TO ALL BRANCHES)	
Course Code:21EC101/201	Continuous Evaluation:40 Marks
Credits: 3	End Semester Examination:60 Marks
L T P : 3 0 0	
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP).
After completion of course, students would be able to:

1. To learn the fundamental concepts of semiconductor devices.
2. An ability to apply the concept of diode in clipper and clamper circuits.
3. Acquire the skills of constructing the different transistors configurations.
4. To learn the basic concepts of integrated circuits.
5. To Compile the different building blocks in digital electronics using logic gates and implement simple logic function using basic universal gates.
6. To acquire the knowledge of microprocessors.

ENGINEERING MECHANICS (Common to all Branches)	
Course Code:21ME101/201	Continuous Evaluation:40 Marks
Credits: 3	End Semester Examination:60 Marks
L T P : 3 0 0	
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP).

After completion of the course, students would be able to:

1. Understand the concepts of force and moments in equilibrium.
2. Apply principles of mechanics to real engineering problems.
3. Understand the basics of Centroids and MOI.
4. Grasp the elements of rigid body kinematics and kinetics.
5. Understand the mechanics of deformable bodies.

UNDAMENTALS OF COMPUTER & C PROGRAMMING (COMMON TO ALL BRANCHES)	
Course Code:21CS101/201	Continuous Evaluation:40 Marks
Credits: 3	End Semester Examination:60 Marks
L T P : 3 0 0	
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

After the completion of course, students will be able to:

1. Understand the fundamental concepts of computers, both hardware and software.
2. Learn and understand the major system software's that help in developing of an application.
3. Apply and analyse the basic programming constructs in context of C programming language.
4. Analyse and evaluate the derived datatypes (array) and the operations that can be performed on them, along with the concept of modularity through functions
5. Create and manipulate a database or data storage through files.
6. Develop a methodological way of problem solving.
7. Learn a programming approach to solve problems.

COMMUNICATIVE ENGLISH (COMMON TO ALL BRANCHES)	
Course Code:21HS101/201	Continuous Evaluation:40 Marks
Credits: 2	End Semester Examination:60 Marks
L T P : 2 0 0	
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP).

After completion of course, students would be able to:

1. Learners will be able to write effectively using correct grammatical structures.
2. Learners will be able to read and speak fluently in English.
3. Learners will know the nuances of effective presentations.
4. Learners will be able to engage in group discussions, debate, deliver speeches and such others.
5. Learners will be able to write project reports, research papers, prepare MoM and agendas, and such other documents required to be created in any work place.

INDIAN POLITY & CONSTITUTION (COMMON TO ALL BRANCHES EXCEPT BIO MEDICAL ENGINEERING)	
Course Code: 21HS102/202	Continuous Evaluation:40 Marks
Credits: 2	End Semester Examination:60 Marks
L T P : 2 0 0	
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP).

After completion of course, students would be able to:

1. Identify and explore basic concepts in the Constitution and understand their applicability & scope and the importance of the role of judiciary in ensuring checks and balances.
2. Differentiate different aspects of Indian Legal System and its related bodies.
3. To appreciate the critical Interface between fundamental Rights and directive principles of state policy and apply the rationale to emerging issues and challenges.

4. Know about the enforcement remedies available under the Constitution of India.
5. To apply Intellectual Property Law principles to real problems and analyse the social impact of Intellectual Property Law and Policy.
6. To apply the very dynamics of IP Law to the individuals, MNC's and other possible stakeholders.

Environmental Bioengineering	
Course Code: 20BM101/201	Continuous Evaluation: 40 Marks
Credits: 2	End Semester Examination:60 Marks
L T P : 2 0 0	
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO):

1. Improve biological concepts using an engineering approach.
2. Explain the importance of measuring characteristics.
3. Learn to understand the different biophysical signal measurement.
4. Able to understand the interdependence of living organisms and environment.

BASICS OF CIVIL ENGINEERING AND EARTH SCIENCES	
Course Code: 21CE101/21CE201	Continuous Evaluation: 40 Marks
Credits: 2	End Semester Examination:60 Marks
L T P: 2 0 0	
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLOs):

1. Students will understand about importance and role of civil engineering.
2. Students will understand about basic areas in civil engineering.
3. Students will understand about earth interior, rocks & its types, and earthquakes.
4. Students will learn about various construction materials.

ENGINEERING PHYSICS LAB (COMMON TO ALL BRANCHES)	
Course Code: 21AS152/252	Continuous Evaluation:60 Marks

Credits: 1	End Semester Examination:40 Marks
L T P : 0 0 2	
Prerequisite: NIL	

LAB LEARNING OUTCOMES (LLO)

The syllabus has been prepared in accordance with National Education Policy (NEP).

After completion of course, students would be able to:

1. Use the different measuring devices and meters to record the data with precision.
2. Develop basic communication skills through working in groups in performing the laboratory experiments and by interpreting the results.
3. Apply the mathematical concepts/equations to obtain quantitative results.

ENGINEERING CHEMISTRY LAB (COMMON TO ALL BRANCHES)	
Course Code:21AS153/253	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Practical Examination: 40 Marks
L T P : 0 0 2	
Prerequisite: NIL	

LAB LEARNING OUTCOMES (LLO)

The syllabus has been prepared in accordance with National Education Policy (NEP).

After completion of course, students would be able to:

1. Understand the basic concepts of measurement techniques.
2. The synthesis, dynamics, chemical transformation and their applications.

BASIC ELECTRICAL ENGINEERING LAB (COMMON TO ALL BRANCHES)	
Course Code:21EE151/251	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Practical Examination: 40 Marks
L T P : 0 0 2	
Prerequisite: Nil	

LAB LEARNING OUTCOMES (LLO)

The syllabus has been prepared in accordance with National Education Policy (NEP).

After completion of course, students would be able to:

- Verify fundamental laws like Ohm's Law, KCL, KVL, etc.
- Understand the calibration of energy meter.
- Understand open circuit and short circuit test of single-phase transformer.
- Analyse RLC series and parallel circuits.

BASIC ELECTRONICS ENGINEERING LAB (COMMON TO ALL BRANCHES)	
Course Code:21EC151/251	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Examination:40 Marks
L T P : 0 0 2	
Prerequisite: NIL	

LAB LEARNING OUTCOMES (LLO)

The syllabus has been prepared in accordance with National Education Policy (NEP).

After completion of course, students would be able to:

1. Measure voltage, frequency and phase of any waveform using CRO.
2. Generate sine, square and triangular waveforms with required frequency and amplitude using function generator.
3. Analyze the characteristics of different electronic devices such as diodes, transistors and operational amplifiers.
4. To develop skill to build and verify digital circuits.

BASIC MECHANICAL ENGINEERING LAB (Common to all Branches)	
Course Code:21ME151/251	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Practical Examination: 40 Marks
L T P : 0 0 2	
Prerequisite: NIL	

LAB LEARNING OUTCOMES (LLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. The working of thermal powerplants.

2. The working of 2 and 4 stroke IC engines.
3. Different automobile parts, gears and geartrains.
4. The working of Refrigeration and Air Conditioning cycles.
5. The working principles of flow meters and U-tube manometers.

C PROGRAMMING LAB (COMMON TO ALL BRANCHES)	
Course Code:21CS151/251	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Examination: 40 Marks
L T P : 0 0 2	
Prerequisite: NIL	

LAB LEARNING OUTCOMES (LLO)

The syllabus has been prepared in accordance with National Education Policy (NEP).

After completion of course, students would be able to:

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

1. To understand the concepts of Programming language.
2. To learn the basics of C declarations, operators and expressions.
3. To learn on the manipulation of strings, functions and pointers.
4. To enable students to have skills that will help them to solve complex real-world problems and introduce them to a new world of emerging technologies.

COMMUNICATIVE ENGLISH LAB (COMMON TO ALL BRANCHES)	
Course Code:21HS151/251	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Practical Examination: 40 Marks
L T P : 0 0 2	
Prerequisite: NIL	

LAB LEARNING OUTCOMES (LLO)

The syllabus has been prepared in accordance with National Education Policy (NEP).

After completion of course, students would be able to:

- Learners will be able to write effectively using correct grammatical structures.
- Learners will be able to read and speak fluently in English.
- Learners will know the nuances of effective presentations.

- Learners will be able to engage in group discussions, debate, deliver speeches and such others.
- Learners will be able to write project reports, research papers, prepare MoM and agendas, and such other documents required to be created in any work place.

NATIONAL SERVICE SCHEME (COMMON TO ALL BRANCHES EXCEPT)	
Course Code:	Continuous Evaluation:60 Marks
Credits: 1	End Semester Examination:40 Marks
L T P: 0 0 2	
Prerequisite: Nil	

COURSES LEARNING OBJECTIVES:

Course aims at evoking social consciousness among students through various activities viz., working together, constructive and creative social work, to be skillful in executing democratic leadership, developing skill in programme development to be able for self-employment, reducing gap between educated and uneducated, increasing awareness and desire to help sections of society.

YOGA & PHYSICALEDUCATION Practices (COMMON TO ALL BRANCHES)	
Course Code: 21SE151/251	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Examination: 40 Marks
L T P: 0 0 2	
Prerequisite: Nil	

Learning Outcomes:

By the end of course a student will have:

1. Increased balance, strength, and flexibility.
2. A beginning sense of alignment in the body.
3. Competence of all five breath techniques and variations.
4. An internal sense of focus and clarity in the movement meditation.
5. Understanding of the cultural and philosophical approaches to yoga.
6. Desire to learn, excel and continue studies on the art of yoga.

- Basic knowledge of basketball, cricket, football, volleyball, badminton & table tennis.

MECHANICAL WORKSHOP LAB (Common to all Branches)	
Course Code:21ME152/252	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Practical Examination: 40 Marks
L T P : 0 0 2	
Prerequisite: NIL	

LAB LEARNING OUTCOMES (LLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Use different manufacturing (Fitting, carpentry, sheet metal, welding, smithy working etc.) processes required to manufacture a product from the raw materials.
- Use different measuring, marking, cutting tools used in the workshop.
- Be aware of the safety precautions while working in the workshop.

ENGINEERING GRAPHICS & DESIGN LAB (Common to all Branches)	
Course Code:21ME153/253	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Practical Examination: 40 Marks
L T P : 0 0 2	
Prerequisite: NIL	

LAB LEARNING OUTCOMES (LLO)

Once the course is completed, the students will be able to

- Understand ortho graphic projections of points and lines in any position through AutoCAD.
- Imagine and convert isometric view into orthographic projections and vice versa.
- Should be able to understand the simple machine components and draw its projections.

BIOSTATISTICS

(Only for Bio Medical Engineering)	
Course Code: 21AS206	Continuous Evaluation:40 Marks
Credits: 4	End Semester Examination:60 Marks
L T P : 3 1 0	
Prerequisite: Nil	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP).

After completion of course, students would be able to explain

1. All descriptive statistics
2. Basic statistical concepts of probability.
3. Basics of probability, discrete & continuous distribution.
4. Correlation and Regression analysis
5. Testing of hypothesis.

FRENCH LANGUAGE PHASE I	
Course Code: 22FLFR-I	Continuous Evaluation: 40 Marks
Credits: 2	End Semester Examination: 60Marks
L T P : 2 0 0	
Prerequisite: Nil	

COURSE LEARNING OUTCOMES (CLO)

1. After completion of this student will be able to read and write short, simple texts.
2. After completion of this course the student will be able to speak simple/basic French sentences used in daily conversations.
3. After completion of this student will have fluency in listening, speaking, reading, writing.
4. After completion of this student will be able understand a dialogue between two native speakers and to take part in short, simple conversations using the skills acquired.
5. Student will able to know the culture of the countries where French language is spoken.

GERMAN LANGUAGE PHASE I	
Course Code: 21LE0205	Continuous Evaluation: 40 Marks

Credits: 2	End Semester Examination: 60 Marks
L T P: 2 0 0	
Prerequisite: Nil	

COURSE LEARNING OUTCOMES (CLO)

1. After completion of this student will be able to read and write short, simple texts.
2. After completion of this student will have Fluency in reading and writing.
3. After completion of this student will be able understand a dialogue between two native speakers and to take part in short, simple conversations using the skills acquired.
4. student will able to know the culture of the countries where the German language is spoken.
5. Developing pronunciation so that they can read the text and e-mail during their employment, instructing them to write their own CV and developing a fundamental conversation with any German national.

Application of Mathematics in BME	
Course Code: 21MA301	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination:60 Marks
L T P : 3 1 0	
Prerequisite: Nil	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Solve different types of partial differential equations.
2. Find solutions of boundary value problems including heat and wave equations.
3. Apply and analyze Fourier transforms with different applications.
4. Evaluate the problems using z-transforms.
5. Understand linear algebra and its application to Engineering.

TRANSDUCERS AND BIOSENSOR	
Course Code: 21BM302	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks

L T P : 3 0 0	
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP).
After completion of course, students would be able to:

1. Understand various measurement devices and techniques, including the underlying biological processes that generate the quantities to be measured or controlled.
2. Explain different display and recording devices for various applications.
3. Analyze the characteristics of different transducers.
4. Have a broad understanding of the applications of various sensors and transducers available for physiological and cellular measurements.
5. Get the clear domain knowledge about various measurement systems includes different types of sensors, electrodes, signal conditioning circuits for acquiring and recording various physiological parameters.
6. Be capable of critically reviewing the literature in the application area and apply knowledge gained from the course to analyse simple biosensing and transduction problems.

INTRODUCTION TO MATLAB	
Course Code: 21BM303	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: Nil	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP).
After completion of course, students would be able to:

1. Familiarize with the fundamentals of MATLAB.
2. To make mathematical operations in MATLAB.
3. Apply MATLAB Programming to solve diverse problems.
4. Apply bioinformatics tool box modules efficiently.
5. Data handling in MATLAB and applications of various algorithms to solve real life

problems.

MICROBIOLOGY	
Course Code: 21BM304	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: NIL	

COURSE LEARNING OUTCOME

Students should be able to:

1. Identify categories of microorganisms and analyse their classification and diversity.
2. Identify and demonstrate structural, physiological, genetic similarities and differences of major categories of microorganisms.
3. Understand, how they cause different diseases and its control.
4. Demonstrate how to control microbial growth and their applications.

Human Anatomy & Physiology	
Course Code: 21BM305	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP).

After completion of course, students would be able to:

1. Describe the fundamentals of human anatomy and physiology.
2. Make a comparison and contrast between living and non-living things.
3. Describe the major structures that make up the human body.
4. Explain the physiology of digestive systems, respiratory, musculoskeletal, and excretory systems.
5. Classify distinct types of tissue to explain the anatomy and physiology of the skeletal system, ear, eye and endocrine systems.

BIOMEDICAL CIRCUITS AND NETWORK	
Course Code: 20BM306	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Understand, Describe, Analyze and Design Graph and Trees for a given network and build network matrices and solve related problems.
2. Analyze circuits using Node Voltage & Mesh Current Analysis in electrical networks and solve related problems.
3. Apply and Analyze Network Theorems to electrical networks to evaluate network parameters in simplified ways.
4. Understand, Describe and Analyze the frequency response and Transients in electrical networks and solve related problems.
5. Understand Describe, Analyze and Design Coupled (Magnetic and Electromagnetic) Circuits and solve related problems.
6. Apply Laplace Transform, and able to Analyze the two Port network parameters and Stability of Network and solve related problems.
7. Select proper network reduction techniques, circuital laws and theorems for magnetic / electric circuit solution considering economic, performance, efficiency and availability constraints.

MATLAB LAB	
Code: 21BM353	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Practical Examination: 40 Marks
L T P : 0 0 2	
Prerequisite: NIL	

LAB LEARNING OUTCOMES (LLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Handle the basic MATLAB operations.

2. Familiarize with Bioinformatics toolbox and its applications.
3. Able to handle and analyse the data using graphical systems.
4. Able to formulate stepwise implementation of a MATLAB script (from developing a pseudo-code to execute a successful bug-free code) for a given problem in Biological problem.

TRANSDUCER AND BIOSENSOR LAB	
Course Code: 21BM352	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Examination: 40 Marks
L T P : 0 0 2	
Prerequisite: NIL	

LAB LEARNING OUTCOMES (LLO):

The syllabus has been prepared in accordance with National Education Policy (NEP).

After completion of course, students would be able to:

1. Design and understand characteristics and calibration of various transducers.
2. Students can design a measurement system for various applications.
3. Understand various read out and display devices.
4. Students will able to learn various transducers as Potentiometer transducer, Strain Gauge, LVDT.
5. Able to design various sensors with application in biomedical equipment and critically evaluate sensor and transducer options for a particular biomedical application.
6. Explain the different diagnostic methods for identification of human bio-potentials and their necessary instrumentation.

MICROBIOLOGY LAB	
Course Code: 21BM354	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Examination: 40 Marks
L T P : 0 0 2	
Prerequisite: NIL	

LAB LEARNING OBJECTIVES (LLO)

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

1. Understand advancement of techniques for healthcare.

2. Learn Aseptic techniques.
3. Industrial production of desired chemicals.
4. AMR and MIC.
5. Microbes uses in various industries.

CIRCUIT AND NETWORK LAB	
Course Code: 21BM352	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Examination: 40 Marks
L T P : 0 0 2	
Prerequisite: NIL	

LAB LEARNING OUTCOMES (LLO):

The syllabus has been prepared in accordance with National Education Policy (NEP).

After completion of course, students would be able to:

1. The student will analyze the characteristics of Electrical circuits and networks.
2. Students will able to perform Laboratory Experiments practically.
3. Students will gain ability to measure three phase voltages, current, active and reactive powers.
4. Students will understand the working of oscilloscope.
5. Able to design electrical circuits.

EFFECTIVE COMMUNICATION SKILLS	
Course Code: 21SS351	Continuous Evaluation: 70 Marks
Credits: 1	End Semester Examination: 30 Marks
L T P : 0 0 2	
Prerequisite: Basic English	

Training Learning Outcomes (TLO)

After the completion of the training, the student will have ability:

1. To communicate effectively and interact with people with confidence.
2. To demonstrate and differentiate between various forms of communication.
3. To apply effective communication skills confidently which a student need to get ahead in job and life.

Essentials of BlockChain & IoT	
Course Code:21CS0201	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Examination: 40 Marks
L T P : 0 0 1	
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

1. To understand and learn how bitcoin and other coins work in real world.
2. Understand the vision of IoT and communication protocols from a global context.
3. To evaluate the applications of IoT in agriculture, healthcare, smart grid, factory.

FRENCH LANGUAGE PHASE II	
Course Code:21LE0202	Continuous Evaluation: 40 Marks
Credits: 2	End Semester Examination: 60 Marks
L T P : 2 0 0	
Prerequisite: Nil	

COURSE LEARNING OUTCOMES (CLOs)

1. After completion of this student will be able to read and write short, simple texts.
2. After completion of this student will have Fluency in reading and writing.
3. After completion of this student will able to use language creatively and spontaneously.
4. After completion of this student will able to know the culture of the countries where the French language is spoken.

GERMAN LANGUAGE PHASE II	
Course Code:21LE206	Continuous Evaluation: 40 Marks
Credits: 2	End Semester Examination: 60 Marks
L T P: 2 0 0	
Prerequisite: Nil	

COURSE LEARNING OUTCOMES (CLO)

1. After completion of this student will be able to read and write short, simple texts.
2. After completion of this student will have Fluency in reading and writing.
3. After completion of this student will able to use language creatively and

spontaneously.

4. Students will get awareness of cross-cultural and intercultural difference.

BIOCHEMISTRY	
Course Code:20BM401	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP).
After completion of course, students would be able to:

1. Student will be able to understand the structure, composition and function of protein, carbohydrate, lipids and nucleic.
2. Student will be able to understand the glycolysis, Krebs cycle, electron transport and photosynthesis.
3. Student will be able to understand the anabolism and catabolism of macromolecules.
4. Student will be able to understand the principles of thermodynamics and its application in living organisms.

BIOMEDICAL INSTRUMENTATION	
Course Code: 21BM402	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: Transducer knowledge	

COURSE LEARNING OUTCOMES (CLO)

1. Describe and characterize the sources of biomedical signals and needs of using biomedical instruments & their limitations.
2. Understand & describe pc based medical instrumentation & regulation of medical devices.
3. Describe and characterize medical instruments as per their specifications, static & dynamic characteristics and understand data acquisition system.

4. Understand, describe, characterize and design various medical recording systems & their components.
5. Understand and describe patient monitoring systems and its necessity in healthcare system.
6. Understand the patient safety aspect.

LINEAR INTEGRATED CIRCUITS	
Course Code: 21BM403	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

1. Understand the fundamentals and areas of applications for the integrated circuits.
2. Analyze important types of integrated circuits.
3. Demonstrate the ability to design practical circuits that perform the desired operations.
4. Understand the differences between theoretical, practical & simulated results in integrated circuits.
5. Understand the concept of application of filters and converters with applications.
6. Ability to design linear circuits and develop linear IC based Systems.

ELECTRONICS DEVICES AND CIRCUITS	
Course Code: 21BM404	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP).
After completion of course, students would be able to:

1. Understand the current voltage characteristics of semiconductor devices
2. Ability to analyze PN junctions in semiconductor devices under various conditions.
3. Ability to design and analyze simple BJT and MOSFET circuits.
4. Design amplifier circuits and apply negative feedback principle to amplifier stages.
5. Understand the specifications of regulators and power supply circuits.

BIOCHEMISTRY LAB	
Course Code: 20BM451	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Examination: 40 Marks
L T P : 0 0 2	
Prerequisite: NIL	

LAB LEARNING OUTCOMES (LLO)

The syllabus has been prepared in accordance with National Education Policy (NEP).

After completion of course, students would be able to learn:

1. The titration of amino acids.
2. Reactions of amino acids, sugars and lipids.
3. Quantitation of proteins and sugars.
4. Analysis of oils- iodine number, saponification value, acid number.

BIOMEDICAL INSTRUMENTATION LAB	
Course Code: 21BM452	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Examination: 40 Marks
L T P : 0 0 2	
Prerequisite: NIL	

LAB LEARNING OUTCOMES (LLO)

The syllabus has been prepared in accordance with National Education Policy (NEP).

After completion of course, students would be able to:

1. Design and understand characteristics and calibration spirometer.
2. Students can design a measurement system for various applications.
3. Understand various methods to measure heart, muscles and brain signals.
4. Able to design various oximeter for a particular biomedical application.
5. Explain the spectrophotometer with its application in analysis.

INTEGRATED CIRCUITS LAB	
Course Code: 21BM453	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Examination: 40 Marks
L T P : 0 0 2	
Prerequisite: NIL	

LAB LEARNING OUTCOMES (LLO)

The syllabus has been prepared in accordance with National Education Policy (NEP).

After completion of course, students would be able to:

1. Understand and describe Digital ICs of different logic gates.
2. Describe, design and analyze Filters.
3. Describe, design and analyze OP AMPS circuits.
4. Use of timers and counters.
5. Understand the fundamentals and areas of applications for the Integrated Circuits.
6. Analyze important types of integrated circuits of day-to-day requirements.

DEVICES AND CIRCUITS LAB	
Course Code: 21BM454	Continuous Evaluation: 40 Marks
Credits: 1	End Semester Examination: 60 Marks
L T P : 0 0 2	
Prerequisite: NIL	

LAB LEARNING OUTCOMES (LLO)

The syllabus has been prepared in accordance with National Education Policy (NEP).

After completion of course, students would be able to:

1. Explain the structure of basic electronic devices.
2. Ability to design and analyze simple rectifiers and voltage regulators using diodes.
3. Design and analyze of electronic circuits and mini projects.
4. Apply positive feedback principle and design oscillators.
5. Compare ideal op. amp and practical op. amp.
6. Know about the multistage amplifier using BJT and FET in various configuration to determine frequency response and concept of voltage gain

Live Project	
Course Code: 21BMXXX	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Examination: 40 Marks
L T P : 0 0 1	
Prerequisite: NIL	

LIVE PROJECT LEARNING OUTCOMES (LPLO)

LPLO1: Integration of the theoretical aspects learned in the classroom in to the practical world.

LPLO2: Learning new skills and supplement knowledge.

LPLO3: Practice communication and teamwork skills. Illustrate the future perspective of human machine interface

LPLO4: Makes a valuable addition to their resume.

LPLO5: An opportunity to get hired by the Industry/ organization

TEAMWORK & INTERPERSONAL SKILLS	
Course Code: 21SS452	Continuous Evaluation: 70 Marks
Credits: 1	End Semester Examination: 30 Marks
L T P : 0 0 2	
Prerequisite: NIL	

Training Learning Outcomes (TLO)

After the completion of the training, the student will have ability:

1. To be confident working in a team and leading it as well.
2. To categorize the work and achieve expected performance within the time frame & will be able to adapt himself to work under various kinds of stress and re-energize himself to bounce back from such situations.
3. To get benefitted from Emotional Quotient in building stronger professional relationships and achieving career and personal goals.
4. To face complex problems and effectively deal with it in the job due to Critical Thinking & Problem-Solving Skills.

Artificial Intelligence and Machine Learning	
Course Code:21CS0202	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Examination: 40 Marks
L T P : 0 0 1	
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

1. To understand the basics and need of Machine learning in global view.
2. To understand, apply and evaluate the supervised learning techniques.
3. To apply, analyze and evaluate the ensemble learning.

4. To implement the machine learning techniques for building different applications.

BIOMATERIALS AND ARTIFICIAL ORGANS	
Course Code:21BM501	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: Nil	

COURSE OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP).

After completion of course, students would be able to:

1. Analyse different types of Biomaterials and its classification.
2. Perform combinations of materials that could be used as a tissue replacement implant.
3. Know about the various polymeric materials used for medical applications
4. About bio-ceramics and its applications in medicine
5. Applications and properties of materials in orthopaedics.

DIGITAL SIGNAL PROCESSING AND ITS APPLICATIONS	
Course Code:21BM505	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: Nil	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP).

After completion of course, students would be able to:

1. Understand various types of discrete time signals and systems.
2. Use the FFT and DFT for various signals.
3. Learn about design of IIR and FIR Filters.
4. familiar with the most important methods in DSP, including digital filter design, transform-domain processing and importance of Signal Processors.

NUMERICAL METHODS IN BME	
Course Code:21MA501	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 3 1 0	
Prerequisite: Nil	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Find solutions by various numerical methods to get approximation solutions of algebraic a transcendental, simultaneous linear equations.
2. Get interpolating values by different numerical methods.
3. Do differentiation and integrations of tabular data.
4. To find numerical solutions of ordinary and partial differential equations.
5. Understand curve fitting and find largest and smallest eigen values according to use in applications.

MOLECULAR BIOLOGY & GENETICS	
Course Code:21BM502	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: Nil	

COURSE LEARNING OUTCOME (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Explain how the structure and chemistry of nucleic acids relate to their functions, their relative stability, and their interactions with proteins.
2. Understand the regulation of protein and nucleic function by structure-function relationships and macromolecular interactions.
3. Know the complete structures of DNA/RNA components, the different forms of nucleic acids (A, B, Z) and the types of amino acids that mediate backbone and sequence-specific binding. Relate DNA structure to forms of DNA damage.
4. Compare & contrast mechanisms of DNA replication, repair, recombination, transcription, gene regulation, RNA processing and translation in bacteria & eukaryotes.

5. Explain how recent genomics and functional genomics advances are altering our views of molecular biology in, for example, eukaryotic transcription and chromatin function.

MEDICAL ETHICS IPR AND REGULATION	
Course Code: 22BM504	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: Elementary knowledge of physics and human physiology	

COURSE LEARNING OUTCOMES(CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP).
After completion of course, students would be able to:

1. Legal and professional guidelines for the health professions.
2. Social responsibility in healthcare systems.
3. Bioethics and engineer's role.
4. Medical device maintenance.
5. Understand safety aspects.
6. Understanding about Patent Laws and objects

MOLECULAR BIOLOGY LAB	
Code: 21BM552	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Practical Examination: 40 Marks
L T P : 0 0 2	
Prerequisite: NIL	

LAB LEARNING OUTCOMES (LLO)

1. Knowledge and practice of basic laboratory safety.
2. Be able to isolate and purify DNA from different sources.
3. Be able to perform and analyze a PCR reaction.
4. Be able to manipulate RNA in the laboratory including isolation, quantification, and detection of a specific mRNA using RT-PCR.
5. Be able to use readily available databases for the modern molecular biology.
6. Learn to write scientific reports.

DIGITAL SIGNALS PROCESSING LAB	
Course Code: 22BM555	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Examination: 40 Marks
L T P : 0 0 2	
Prerequisite: Nil	

LAB LEARNING OUTCOMES(LLO):

The syllabus has been prepared in accordance with National Education Policy (NEP).

After completion of course, students would be able to:

1. To apply algorithms for signal processing.
2. To analyze biomedical signals and systems.
3. Able to design and implement biomedical signal conditioning circuits.
4. Able to evaluate biomedical signal acquisition and processing systems.

BIOMATERIAL & SIMULATIONS LAB	
Code: 21BM551	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Practical Examination: 40 Marks
L T P : 0 0 2	
Prerequisite: NIL	

LAB LEARNING OUTCOMES (LLO)

1. Perform Mechanical characterization of biomaterials using destructive and non destructive methods.
2. Measure Surface roughness
3. *invitro* haemo compatibility of biomaterials
4. Perform pH determination, viscosity and Conductivity measurement of any body fluid.

LIVE PROJECT-II	
Course Code: 21BM561	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Examination: 40 Marks
L T P : 0 0 1	
Prerequisite: Nil	

LIVE PROJECT LEARNING OUTCOMES

LPLO1: Integration of the theoretical aspects learned in the classroom in to the practical world.

LPLO2: Learning new skills and supplement knowledge.

LPLO3: Practice communication and teamwork skills. Illustrate the future perspective of human machine interface

LPLO4: Makes a valuable addition to their resume.

LPLO5: An opportunity to get hired by the Industry/ organization.

PRESENTATION & SPEAKING SKILLS	
Course Code: 21SS553	Continuous Evaluation: 70 Marks
Credits: 1	End Semester Examination: 30 Marks
L T P : 0 0 2	
Prerequisite: Nil	

TRAINING LEARNING OUTCOMES (TLO)

After the completion of the training, the student will have ability:

1. To be confident in presenting himself in front of audience.
2. To become professional in his approach towards work culture.
3. To enhance the level of communication skills while interacting with others.

Design Thinking and Augmented Virtual Reality-Level-1	
Course Code: 21CS0301	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Examination: 40 Marks
L T P : 0 0 2	
Prerequisite: Nil	

COURSE LEARNING OUTCOMES (CLOS)

1. Understand and critically apply the concepts and methods of business processes.
2. To understand and apply IBM Blueworks live and process designer tool concepts.
3. Understand and analyzing design thinking history and its various concepts.
4. Understand, analyzing and create models with users collaboration to apply design thinking concepts.

- Understand the technical and experiential design foundation required for the implementation of immersive environments in current and future virtual, augmented and mixed reality platforms.

ASSIST DEVICES	
Course Code: 21BM601	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: Transducers and Sensors	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Have knowledge about various types of assist devices.
- Students will have the ability to choose which type of assist device is suitable for various disorders and legal aspects related to rehabilitation.
- Students will have the urge to develop new devices based on the basic knowledge gained in different assisting devices.

MEDICAL IMAGING	
Course Code:21BM602	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: Nil	

COURSE LEARNING OUTCOME (CLO)

- Students will learn about instruments used for imaging technique.
- To clear view on medical imaging and its physics
- Clear understanding of image construction
- To learn about Quality assurance and image improvement in diagnostic radiology with X-Rays
- To learn about Development of NMR, relaxation processes and their measurements, MRI-Image

BIOINFORMATICS FOR BME	
Course Code: 21BM603	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: Nil	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP).

After completion of course, students would be able to:

1. Develop an understanding of basic theory of these computational tools.
2. Gain working knowledge of these computational tools and methods
3. Appreciate their relevance for investigating specific contemporary biological questions;
4. Understanding the applications in various applied areas of biology.

MANAGEMENT AND ORGANISATIONAL BEHAVIOUR	
Course Code: 21HSXXX	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: Nil	

Course Learning Outcomes (CLO)

On completion of the course, it is expected that students will be able to:

1. Understand the concept of management
2. Learn about different management skills requirements for the corporate world.
3. Demonstrate application of previous knowledge testing of Principles of Management in solving business problems.
4. Understand the human behaviour and its contribution at work place
5. Understand the competitiveness in businesses.

ASSIST DEVICES LAB	
Code: 22BM651	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Practical Examination: 40 Marks
L T P : 0 0 2	
Prerequisite: NIL	

LAB LEARNING OUTCOME (LLO)

1. Understand the measurement of physiological parameters
2. Describe the functional characteristics of therapeutic equipment
3. Understand & describe the basic operation of diathermy unit
4. Study about various parameters used for respiratory measurement

MEDICAL IMAGING LAB	
Code: 22BM652	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Practical Examination: 40 Marks
L T P : 0 0 2	
Prerequisite: NIL	

LAB LEARNING OUTCOME (LLO)

1. Understand about working and construction of various imaging instruments
2. Deep understanding of X-Ray Machine
3. Understand & describe the basic operation of tomography
4. Knowledge about ultrasound

BIOINFORMATICS LAB	
Course Code: 21BM653	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Examination: 40 Marks
L T P : 0 0 2	Course Type: Core
Prerequisite: Nil	

LAB LEARNING OUTCOMES (LLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of practical course, students would be able to:

1. To use and develop bioinformatics programs for comparing & analyzing biological sequence data to identify probable function.
2. Gain working knowledge of these computational tools and methods
3. To understand the methodologies used for database searching, and determining the accuracies of database search.
4. Analysis and development of models for better interpretation of biological data to extract knowledge.

LIVE PROJECT-III AND INDUSTRIAL VISIT	
Course Code: 21BM659	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Examination: 40 Marks
L T P : 0 0 2	
Prerequisite: Nil	

LIVE PROJECT LEARNING OUTCOMES

LPLO1: Integration of the theoretical aspects learned in the classroom in to the practical world.

LPLO2: Learning new skills and supplement knowledge.

LPLO3: Practice communication and teamwork skills. Illustrate the future perspective of human machine interface

LPLO4: Makes a valuable addition to their resume.

LPLO5: An opportunity to get hired by the Industry/ organization

PROFESSIONAL WRITING SKILLS	
Course Code: 21SS655	Continuous Evaluation: 70 Marks
Credits: 1	End Semester Examination: 30 Marks
L T P : 0 0 2	
Prerequisite: Nil	

Training Learning Outcomes (TLO): -

After the completion of the training, the student will have ability:

1. To understand the importance of professional writing required in workplace.
2. To explore different formats in resume, cover letters & other business-related letters.
3. To develop knowledge, skills and understanding people in-group and individually.
4. To apply communication strategies either in-group or one on one basis and will be confident to lead the discussion among them.

Big Data Analytics, Tools and Techniques-Level-III	
Course Code:21CS0302	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Examination: 40 Marks
L T P : 0 0 1	
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus adhere to all Bloom's Taxonomy Levels and has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Understand the vision of Big Data from a global context.
2. To understand and apply Hadoop in Market perspective of Big Data.
3. Applying and analyzing architecture and APIs with use of Devices, Gateways and Data Management in Big data.
4. To evaluate the application of Big Data in Industrial and Commercial Building Automation, evaluating Big Data performance using MapReduce and Real-World Design Constraints.

DIGITAL IMAGE PROCESSING	
Course Code: 21BM701	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P: 3 0 0	
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Understand the image enhancement and image restoration techniques.
2. Describe the various image enhancement and image restoration techniques.
3. Apply various image segmentation methods and analysis in medical images.
4. Illustrate the basic concepts of wavelets and image compression techniques.
5. Explain the different types of reconstruction techniques applied to various medical Images

MICROPROCESSOR AND MICROCONTROLLERS	
Course Code: 21BM702	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P: 3 0 0	
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

1. Elucidate the 8085-microprocessor architecture, programming and its applications.
2. Elucidate the architecture and addressing modes of PIC microcontroller
3. Program the microcontrollers for a given application.
4. Hardware interfacing of PIC microcontroller and sensor interfacing to develop solutions of real world problems.

BIOMECHANICS AND REHABILITATION ENGINEERING	
Course Code: 21BM703	Continuous Evaluation:40 Marks
Credits: 3	End Semester Examination:60 Marks
L T P : 3 0 0	
Prerequisite: Nil	

COURSE LEARNING OUTCOMES (CLO):

1. Understanding of the molecular and cellular contributions to the biomechanics of tissues.
2. Develop the pressure flow relationship in blood vessels for the idealized case.
3. Familiarity of biomechanics problems in various organs in the human body at various hierarchical levels and to learn prosthetics and orthotics and their applications.
4. Derive the pressure volume relationship for lung and interprets its Diagnostic significance.

HOSPITAL SAFETY & MANAGEMENT	
Course Code: 21BM704	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: Nil	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP).
After completion of course, students would be able to:

1. Learn the fundamentals of hospital management;
2. Recognize the value of human resource management;
3. Know the information management systems and their applications;

4. Understand the safety protocols followed in hospitals.

MICROPROCESSOR AND MICROCONTROLLER LAB	
Course Code: 21BM752	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Examination: 40 Marks
L T P : 0 0 2	
Prerequisite: Nil	

LAB LEARNING OUTCOMES (LLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Identify relevant information to supplement to the Microprocessor and Microcontroller course.
2. Set up programming strategies and select proper mnemonics and run their program on the training boards.
3. Practice different types of programming keeping in mind technical issues and evaluate possible causes of discrepancy in practical experimental observations in comparison.
4. Develop testing and experimental procedures on Microprocessor and Microcontroller analyze their operation under different cases.
5. Prepare professional quality textual and computational results, incorporating accepted data analysis and synthesis methods, simulation software, and word-processing tools

DIGITAL IMAGE PROCESSING LAB	
Course Code: 21BM751	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Examination: 40 Marks
L T P : 0 0 2	
Prerequisite: Nil	

LAB LEARNING OUTCOMES (LLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Understand the image enhancement and image restoration techniques.
2. Describe the various image enhancement and image restoration techniques.

3. Apply various image segmentation methods and analysis in medical images.
4. Illustrate the basic concepts of wavelets and image compression techniques.
5. Explain the different types of reconstruction techniques applied to various medical Images

MINOR PROJECT	
Course Code: 21BM757	Continuous Evaluation: 60 Marks
Credits: 4	End Semester Examination: 40 Marks
L T P : 0 0 8	
Prerequisite: Nil	

MINOR PROJECT LEARNING OUTCOMES

MPLO1: Integration of the theoretical aspects learned in the classroom in to the practical world.

MPLO2: Learning new skills and supplement knowledge.

MPLO3: Practice communication and teamwork skills. Illustrate the future perspective of human machine interface

MPLO4: Makes a valuable addition to their resume.

MPLO5: An opportunity to get hired by the industry/ organization

LIVE PROJECT IV AND INDUSTRIAL VISIT	
Course Code: 21BM759	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Examination: 40 Marks
L T P : 0 0 1	
Prerequisite: Nil	

LIVE PROJECT LEARNING OUTCOMES

LPLO1: Integration of the theoretical aspects learned in the classroom in to the practical world.

LPLO2: Learning new skills and supplement knowledge.

LPLO3: Practice communication and teamwork skills. Illustrate the future perspective of human machine interface

LPLO4: Makes a valuable addition to their resume.

LPLO5: An opportunity to get hired by the Industry/ organization

INTERPERSONAL SKILLS: STRATEGIES	
Course Code: 21SS756	Continuous Evaluation: 70 Marks
Credits: 1	End Semester Examination: 30 Marks
L T P : 0 0 2	
Prerequisite: Nil	

TRAINING LEARNING OUTCOMES (TLO):

After the completion of the training, the student will have ability:

1. To develop knowledge, skills and understanding people in-group and individually.
2. To learn to apply communication strategies either in-group or one on one basis and will be confident to lead the discussion among them.
3. To work with people even with conflicts and reducing the differences among them by reaching to an equilibrium.

DATA STRUCTURES AND ALGORITHM USING C++	
Course Code: 21CS0401	Continuous Evaluation: 50 Marks
Credits: 1	End Semester Examination: 50 Marks
L T P : 0 0 1	
Prerequisite: Nil	

COURSE LEARNING OUTCOMES (CLO)

1. To prepare object-oriented design for small/medium scale problems, to demonstrate the differences between traditional imperative design and object-oriented design
2. To explain class structures as fundamental, modular building blocks, to understand the role of inheritance, polymorphism, dynamic binding and generic structures in building reusable code.
3. To write small/medium scale C++ Programs.
4. For a given algorithm student will able to analyze the algorithms to determine the time and computation complexity and justify the correctness.
5. For a given problem of Stacks, Queues and linked list student will able to implement it and analyze the same to determine the time and computation complexity.
6. For a given Search problem (Linear Search and Binary Search) student will able to implement it.

MAJOR PROJECT	
Course Code: 21BM857	Continuous Evaluation: 60 Marks
Credits: 12	End Semester Examination: 40 Marks
L T P : 0 0 24	
Prerequisite: Nil	

MAJOR PROJECT LEARNING OUTCOMES

MPLO1: Integration of the theoretical aspects learned in the classroom in to the practical world.

MPLO2: Learning new skills and supplement knowledge.

MPLO3: Practice communication and teamwork skills. Illustrate the future perspective of human machine interface

MPLO4: Makes a valuable addition to their resume.

MPLO5: An opportunity to get hired by the industry/ organization.

TISSUE ENGINEERING	
Course Code: 21BMP41	Continuous Evaluation:40 Marks
Credits: 3	End Semester Examination:60 Marks
L T P : 3 0 0	
Prerequisite: Nil	

COURSE LEARNING OUTCOME (CLO):

The Students will be able to:

1. Comprehend the structural organization of cells and tissues
2. Know the role of cell interaction, cell migration, wound healing and cellular processes
3. Describe the different biomaterials and its properties, design, fabrication and biomaterials selection criteria for tissue engineering scaffolds.
4. Comprehend applications of tissue engineering.

COMMUNICATION ENGINEERING	
Course Code: 22BMP42	Continuous Evaluation:40 Marks
Credits: 3	End Semester Examination:60 Marks
L T P : 3 0 0	
Prerequisite: Nil	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP).

After completion of course, students would be able to

1. Explain the concept and need of modulation and demodulation
2. Measure the frequency deviation of FM wave for different modulating signals
3. Use different types of modulators and demodulators
4. Use different types of Pulse Modulation Techniques (PAM, PPM, PWM)

OPTICAL INSTRUMENTATION	
Course Code: 21BMP43	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: Nil	

COURSE LEARNING OUTCOMES (CLO)

1. Explain the basic concepts of optical transmitting and receiving
2. Describe different opto- electronic devices
3. Elucidate different methods of interferometry and crystal system.
4. Describe selection of the appropriate optical fiber sensors for industrial application.

IMMUNOLOGY	
Course Code:21BMP51	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: Nil	

COURSE LEARNING OUTCOME (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP).

After completion of course, students would be able to:

1. The immune system, their structure and classification.
2. The fundamental concepts of immunity and the contribution of organs and cells in the development of immune response.
3. The role of genetics in generation of antibody diversity
4. Gain insight into the various aspects of immunogenetics, molecular immunology, clinical immunology & immune response to infectious diseases, auto immunity

CONTROL SYSTEM	
Course Code: 21BMP52	Continuous Evaluation:40 Marks
Credits: 3	End Semester Examination:60 Marks
L T P : 3 0 0	
Prerequisite: Nil	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP).
After completion of course, students would be able to explain

1. Understand fundamentals of control system.
2. Understand the different type of control system and to analyse feedback characteristics of linear control system to reduce the disturbance.
3. Analyse the stability/behaviour of closed loop systems using various tools routh array, root locus and bode plot.
4. Learn about the transfer function and analyse different methods to find the transfer function.

NUCLEAR MEDICINE	
Course Code: 21BMP53	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: Nil	

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP).
After completion of course, students would be able to:

1. Understand the fundamentals of physics, and radiopharmaceutical principles.
2. Know the application of nuclear medicine in diagnosis and therapy.
3. Learn clinical applications of nuclear medicine.
4. Realize the importance of radiation protection and the disposal of nuclear waste.

OMICS FOR BME	
Course Code: 21BMP61	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: NIL	

Course Learning Outcomes (CLO)

Students should be able to acquire

1. Knowledge and understanding of fundamentals of genomics and proteomics, transcriptomics and metabolomics.
2. Information of the structure and functions of the genomes together with the computational approaches to analyse the genomes & proteome.
3. Understanding of the gene expression and functional genomics.
4. Understanding the applications in various applied areas of biology.

NEURAL NETWORK	
Course Code: 21BMP62	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: Nil	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. To learn the various ANN Models
2. To gain knowledge about the neural networking process such as back propagation
3. To know the fundamentals of pattern recognition and its application
4. To familiarize about the principle component analysis and self-organizing map
5. To Understand the basic concepts of genetic algorithm

PERL PROGRAMMING AND BIO PERL	
Course Code: 21BMP63	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P: 3 0 0	
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Familiarize with Unix and Linux commands.

2. Write and execute a script in Perl.
3. Enable routine and module calls and their implementation using Bioperl.
4. Able to formulate stepwise implementation of a Perl script (from developing a pseudo-code to execute a successful bug-free code) for a given problem in Bioinformatics.

ANALYTICAL AND CLINICAL INSTRUMENTS	
Course Code: 21BMP71	Continuous Evaluation:40 Marks
Credits: 3	End Semester Examination:60 Marks
L T P : 3 0 0	
Prerequisite: Nil	

COURSE LEARNING OUTCOMES (CLO):

- 1.Students will gain understanding of various techniques used in clinical and research laboratories.
- 2.Understanding of analysis of various gases by using various methods
- 3.To learn the application and construction of Biosensors.
- 4.Understanding of various methods to characterize the samples.

BIOMEDICAL LASER INSTRUMENTATION	
Course Code: 21BMP72	Continuous Evaluation:40 Marks
Credits: 3	End Semester Examination:60 Marks
L T P : 3 0 0	
Prerequisite: Nil	

COURSE LEARNING OUTCOMES (CLO):

1. To understand the working and basic principles involved in functioning of the laser
2. To learn the applications of laser in ophthalmology, dermatology, urology, gynaecology and neurology, orthopaedic surgery.
3. To describe the surgical applications of lasers
4. Precautionary method in laser safety to be taken

ARTIFICIAL INTELLIGENCE AND MEDICAL INFORMATICS	
Course Code: 21BMP73	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P: 3 0 0	
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO): The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able:

1. To understand the basic concepts of Artificial intelligence structures and strategies
2. To understand the concepts of knowledge representation in AI.
3. To give an insight knowledge about the patient-assisted techniques.
4. To formulate a ML model for disease classification.

Sustainable Growth & Development	
Course Code:21ESUG202	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P C : 2 0 2 3	Course Category: UOE
Prerequisite: Basics understanding of environment and natural ecosystems	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. To develop an awareness about our environment and elicit collective response for its protection.
2. Able to understand the different types of environmental pollution problems and their sustainable solutions.
3. Able to work in the area of sustainability for research and education.
4. Having a broader perspective in thinking for sustainable practices by utilizing the engineering knowledge and principles gained from this course

Waste Management	
Course Code:21ESUG203	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P C : 202 3	Course Category: UOE
Prerequisite: Basics understanding of about waste	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP).

After completion of course, students would be able to:

1. To develop an awareness about solid waste and management practices
2. Able to design feasible solutions for waste management
3. Students will have understanding of waste management practices, law and regulation related to solid waste management.

CONSUMER ELECTRONICS	
Course Code: 22ESUG205	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P: 3 0 0	
Prerequisite: NIL	

COURSE LEARNING OUTCOMES(CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP).

After completion of course, students would be able to:

1. Students will able to learn about microphones and loud speakers' mechanism.
2. Can differentiate between analog and digital signals.
3. Will learn about video signal transmission to television.
4. Understand the various type of consumer goods.

NANOTECHNOLOGY	
Course Code: 21ESUG206	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P: 3 0 0	
Prerequisite: NIL	

COURSE LEARNING OUTCOMES(CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP).

After completion of course, students would be able to:

1. Understand novel function resulted from the nanoscale structures using scientific concepts.
2. Learn a variety of nanoscale fabrication and characterization techniques.
3. Learn the characteristics of nanostructured materials for biomedical applications.

4. Understand the applications of nano medicine.

INTRODUCTION TO PYTHON	
Course Code:21ESUG207	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P: 3 0 0	
Prerequisite: Computer Concepts and C Programming	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP).

After completion of course, students would be able to:

1. Familiarize with basic Python syntax and able to understand common codes.
2. Able to create and manipulate Python programs by utilizing the data structures
3. Understand the Pandas and Numpy library for data science operation and plotting various Biosignal using Matplotlib.
4. Able to formulate stepwise implementation of a python script (from developing a pseudo-code to execute a successful bug-free code) for a given biological problem.

INTRODUCTION TO R	
Course Code:21ESUG208	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P: 3 0 0	
Prerequisite: Computer Concepts and C Programming	

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP).

After completion of course, students would be able to:

1. Familiarize with basic R syntax and able to understand common codes.
2. Able to create and manipulate R programs by utilizing the data structures.
3. Understand how data is analysed and visualized using statistic functions
4. Able to formulate stepwise implementation of a R script as per given biological problem.

MEDICAL PHYSICS	
Course Code: 21ESUG209	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: Elementary knowledge of physics and human physiology	

COURSE LEARNING OUTCOMES (CLO)

Students should be able to acquire

1. Knowledge about physical statics of human body.
2. Knowledge about the physics laws applicable for functioning of various organ system.
3. Knowledge of speech and hearing system.
4. Knowledge about the application of physics in biomedical instrumentation.

TELEMEDICINE	
Course Code: 21ESUG211	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: Elementary knowledge of physics and human physiology	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP).

After completion of course, students would be able to:

1. Illustrate the current system of tele-health and mobile health.
2. Understand the different types of modes of communication and networks.
3. Understand the encryption and decryption of medical data.
4. Learn about telesurgery, robotic surgery and tools used in telesurgery.
5. Understand the future perspectives for telemedicine.

SIMULATION AND AUTOMATION	
Course Code: 21ESUG212	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: None	

COURSE LEARNING OUTCOMES(CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP).

After completion of course, students would be able to:

1. Know about System level modelling.
2. Learn the Physical simulation and process control.
3. Know data manipulation and manual simulation of system.
4. Learn about statistical model and different distributions in it.
5. Learn about interactions and learning in living systems.