

CO-PO Articulation Matrix

B. Tech IInd Year Sem A (4 YDC)

BM- 29007: Bioelectricity and Transducers

Course Outcomes: -

At the end of this course students will be able to:

1. Identify sources of biopotential generation and their propagation in the human body.
2. Classify different electrodes based on their working principle.
3. Illustrate selection procedure of transducer for various medical applications.
4. Describe the various temperature and pressure transducers.
5. Understand the working of reference electrodes and chemical electrodes.
6. Remember and understand the concepts, types, working and practical applications of important biosensors and optical sensors.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	1	2	1	2	-	-	-	-	1
CO2	2	2	3	2	3	-	2	-	-	-	-	2
CO3	3	3	3	2	3	-	3	-	-	-	-	3
CO4	3	2	3	2	3	-	1	-	-	-	-	1
CO5	3	2	3	2	2	-	1	-	-	-	-	2
CO 6	2	2	2	2	2	-	1	-	-	-	-	2
Average	2.5	2.0	2.5	1.8	2.5	1.0	1.7	-	-	-	-	1.8

LABORATORY OUTCOMES

1. Understand the concepts of measurement, error and uncertainty.
2. Understand the static and dynamic characteristics of measuring instruments
3. Gain knowledge about the principle of operation and characteristics of different types of resistance, capacitance and inductance transducers.
4. Ability to interpret the results and draw meaningful conclusions
5. Ability to work as a member of a team while carrying out experiments.

Lab Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	3	-	-	-	-	-	-	-	3	-	-
2	2	3	-	-	3	-	-	2	-	3	-	-
3	3	3	-	1	-	-	-	-	-	3	-	-
4	-	-	-	-	3	-	-	2	2	-	-	1
5	-	-	-	-	-	-	-	2	2	3	-	1
Average	2.7	3.0	-	1.0	3.0	-	-	2.0	2.0	3.0	-	1.0

BM- 29003: Human Anatomy and Physiology

Course Outcomes: -

At the end of this course students will be able to:

- CO1: Classify different types of cell based on their structure and functionality.
- CO2: Explain physiology of cardiovascular and respiratory systems and their implications.
- CO3: Describe the interdependence and interactions of nervous and musculoskeletal systems.
- CO4: Describe the physiology and anatomy of digestive and excretory systems..
- CO5: Recognise organs of the reproductive system and other special organs.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	-	-	-	3	-	-	-	2	-	2
CO2	2	2	-	-	-	3	-	-	-	3	-	2
CO3	2	2	-	-	-	3	-	-	-	2	-	2
CO4	1	1	-	-	-	3	-	-	-	3	-	2
CO5	1	1	-	-	-	3	-	-	-	2	-	2
Average	1.4	1.6	-	-	-	3	-	-	-	2.4	-	2

LABORATORY OUTCOMES

1. To get acquainted with anatomy and physiology of the human body.
2. To set up biomedical instruments and measure the key human body parameters such as temperature, blood pressure etc.
3. To analyze the blood group of the subject.
4. To understand the working of a microscope and observe the blood cell differentiation.

Lab Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	1	-	-	-	-	-	-	2	3	-	-
2	3	1	-	-	2	-	-	-	2	3	-	-
3	3	1	-	-	1	-	-	-	2	3	-	-
4	3	1	-	-	3	-	-	-	2	3	-	-
Average	3	1	-	-	3	-	-	-	2	3	-	-

MA- 29024: Mathematics- III

Course Outcomes:-

At the end of this course students will be able to:

1. Modeling of biological systems through ordinary differential equations, solution of differential equations.
2. Calculus of finite differences, different rules.
3. Formation of partial differential equations of different orders.
4. Euler's Equation.
5. Fourier series & Integral Transforms.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	-	-	-	-	-	-	-	-	3
CO2	3	3	3	-	-	-	-	-	-	-	-	3
CO3	3	3	3	-	-	-	-	-	-	-	-	3
CO4	3	3	3	-	-	-	-	-	-	-	-	3
CO5	3	3	3	-	-	-	-	-	-	-	-	3
Average	3	3	3	-	-	-	-	-	-	-	-	3

EE- 29011: Network Analysis

Course Outcomes:-

After completing the subject student will be able to:

1. Apply the knowledge of basic physics and mathematics to develop an approximate circuit model of practical elements. Formulation of circuit equations using Kirchhoff's law and network topology
2. Infer and evaluate transient response, steady state response in time and frequency domain, determine different network functions.
3. Develop and evaluate two-port model and its parameters.
4. To perform Steady state analysis, and analyze the series and parallel resonant circuit.
5. Analysis of polyphase circuits, neutral shift concept and power factor improvement.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	1	-	-	-	-	-	-	-
CO2	3	3	2	2	1	-	-	-	-	-	-	-
CO3	3	-	2	-	1	-	-	-	-	-	-	-
CO4	3	3	2	2	1	-	-	-	-	-	-	-
CO5	3	-	2	-	1	-	-	-	-	-	-	-
Average	3	3	2	2	1	-	-	-	-	-	-	-

LABORATORY OUTCOMES

1. Analyze complicated circuits using different network theorems.
2. Apply the knowledge of basic circuit law and simplify the network.
3. Infer and evaluate transient response, Steady state response, and network functions.
4. Obtain the maximum power transfer to the load, and analyze the series resonant and parallel resonant circuit.
5. Evaluate two port network model and its parameters

Lab Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	2	3	3	-	3	-	-	-	-	3	-	-
2	2	3	3	-	3	-	-	-	-	3	-	-
3	-	3	3	3	3	-	-	-	-	3	-	-
4	-	3	3	-	3	-	-	-	-	3	-	-
5	-	-	3	3	3	-	-	-	-	3	-	-
Average	2	3	3	3	3	-	-	-	-	3.0	-	-

EE-xxxxx: Electrical Workshop

Course Outcomes:-

After completing the subject student will be able to:

CO1: The main objective is to make the students able to understand, design and prepare electrical circuit using basic concepts.

CO2: To focus on Electrical safety and equipment earthing.

CO3: To address the underlying concepts of wiring of various electrical installations.

CO4: In this lab, students are expected to get hands-on experience in using the electrical tools and develop communication skills through manual with written descriptions of procedure, result and analysis

LABORATORY OUTCOMES

The student will able to:

- 1.To get acquainted with various tools, symbols used in the electrical system.
2. Prepare estimates for electrical wiring in domestic applications.
3. Provide effective earthing solutions in domestic as well as industrial domain.
4. Suggest suited illumination devices as per application requirement.
5. Repair and maintain electrical appliances and make robust joint in electrical connection.

Lab Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	1	-	-	-	-	-	-	-	-	-	-
2	3	-	3	-	-	-	-	-	-	-	-	3
3	3	-	-	3	-	-	-	-	-	-	-	3
4	3	-	3	-	-	-	-	-	-	-	-	-
5	3	1	-	3	1	-	-	-	1	-	-	3
Average	3	1	3	3	1	-	-	-	1	-	-	3

EI 29572: Fundamentals of Measurement System

Course Outcomes:-

At the end of this course students will be able to:

1. Understand fundamentals of measuring instruments theoretically as well as practically.
2. Study of cathode ray oscilloscope in detail with its applications and probe compensation.
3. Attain basic knowledge about analog instruments.
4. Study measurement of low resistances, voltage, current, phase frequency etc.
5. Understand compensation, calibration and testing of measuring instruments.
6. Gain knowledge about A.C. bridges and its applications.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO7	PO8	PO9	PO10	PO11	PO6	PO12
CO1	3	2	2	-	-	-	-	-	-	-	-	-
CO2	3	2	3	-	2	-	-	-	-	-	-	-
CO3	3	2	1	3	-	-	-	2	-	-	-	-
CO4	3	3	3	2	2	2	-	-	-	-	-	-
CO5	2	2	3	2	1	-	-	2	-	-	-	-
CO6	3	3	3	2	2	-	-	-	-	-	-	-
Average	2.8	2.3	2.5	2.3	1.8	2.0	-	2.0	-	-	-	-

EC- 29562/EC-29509- : Digital Electronics

Course Outcomes

At the end of this course students will be able to:

1. Analyze the digital circuits through basic logic gates.
2. Analyse and design computational digital circuit which can perform logical and arithmetic operation.
3. operation.
4. Analyze and design finite state machines and data storage elements.
5. Analyse and design digital integrated circuits.
6. Analyse and design converters which facilitate the conversion of real world analog signals to digital and vice versa.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO7	PO8	PO9	PO10	PO11	PO6	PO12
CO1	3	3	2	-	-	-	-	1	1	-	-	-
CO2	3	2	3	-	2	-	-	1	1	-	-	-
CO3	3	3	2	3	-	-	-	1	1	-	-	-
CO4	3	3	2	2	2	2	-	1	1	-	-	-
CO5	3	2	1	2	1	-	-	1	1	-	-	-
CO6	3	2	2	2	2	-	-	1	1	-	-	-
Average	3.0	2.5	2.0	2.3	1.8	2.0	-	1.0	1.0	-	-	-

LABORATORY OUTCOMES

1. Learn the basics of gates and implement logic functions.
2. Construct basic combinational circuits such as arithmetic circuits, code converter circuits and parity generator & checker and verify their functionalities.
3. Learn about magnitude comparator and multiplexers.
4. Apply the design procedures to design basic sequential circuits

Lab Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	2	1	-	-	-	-	-	-	-	3	-	-
2	3	3	2	-	-	-	-	-	-	3	-	-
3	3	3	2	3	-	-	-	-	-	3	-	-
4	3	3	2	-	-	-	-	-	-	3	-	-
Average	2.5	2.8	2	2	-	-	-	-	-	3	-	-

BM- 29508/BM-29551: Analog Electronics

Course Outcomes: -

At the end of this course students will be able to:

1. Analyse and design different BJT Circuits i.e. amplifiers and oscillator circuits.
2. Explain concepts and applications of power amplifiers and Tuned amplifiers.
3. Compare and apply different concepts of feedback methods in practical circuits.
4. Classify different OP-Amp configurations based on their design and working.
5. Design of different Op- Amp circuits for practical electronic project design.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	--	1	--	--	-	-	-	-	-
CO2	2	3	3	1	-	-	-	-	-	-	-	1
CO3	3	2	3	2	--	-	-	-	-	-	-	-
CO4	2	3	1	-	-	-	-	-	-	--	-	1
CO5	3	2	2	2	1	-	-	-	1	1	-	1
Average	2.6	2.4	2.2	1.7	1	-	-	-	1	1	-	1

LABORATORY OUTCOMES

1. Operate CRO, Function generator and digital multimeter effectively.
2. Understand the concept of external circuit parameters and their importance.
3. Understand the concept of BJT and OP AMP based circuits.
4. Acquire enough understanding to build a comprehensive foundation for later higher-level courses such as Major & Minor Projects
5. Construct meaning from oral, written and graphical plotting through the experiments.

Lab Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	-	-		1	-	-	1	1	-	-	-
2	1	-	1		-	-	-	-	1	-	-	-
3	1	-	2		-	-	-	-	2	-	-	-
4	-	1	-		-	2	-	2	1	-	-	1
5	-	-	-		2	-	-	2	1	3	-	2
Average	1	1	1.5	-	1.5	2	-	1.7	1.2	3	-	1.5

MA- 29501: Mathematics-IV

Course Outcomes:-

At the end of this course students will be able to:

1. To perform the contour integration.
2. Understanding of random variables and stochastic processes.
3. Understand stages of the Markov chain.
4. Demonstrate the basic concepts of reliability.
5. Demonstrate the basic concepts of graph theory

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	-	-	-	-	-	-	-	3
CO2	3	3	3	3	-	-	-	-	-	-	-	3
CO3	3	3	3	3	-	-	-	-	-	-	-	3
CO4	3	3	3	3	-	-	-	-	-	-	-	3
CO5	3	3	3	3	-	-	-	-	-	-	-	3
Average	3	3	3	3	-	-	-	-	-	-	-	3

BM-39254: Programming Tools & Techniques

Course Outcomes: -

At the end of this course students will be able to:

1. To understand the basic concepts of OOPS and various programming platforms.
2. To get acquainted with basic Python and MATLAB programming.
3. To apply the concepts of OOPs in Python.
4. To apply Python programming and MATLAB for solving standard engineering problems.
5. To evaluate and compare the performance of different existing platforms.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	3	-	1	-	1	1	-	1
CO2	-	3	3	-	3	-	1	-	1	1	-	1
CO3	-	-	-	-	3	-	1	-	1	1	-	1
CO4	-	-	-	-	3	-	1	-	1	1	-	1
CO5	-	-	-	-	3	-	1	-	1	1	-	1
Average	3	3	3	-	3	-	-	-	1	1	-	1

LABORATORY OUTCOMES

1. To develop basic concepts scripting and the contributions of scripting language
2. Write, Test and Debug Python Programs, Implement Conditionals and Loops for Python Programs
3. Use functions and represent Compound data using Lists, Tuples and Dictionaries
4. Read and write data from & to files in Python and develop Applications.
5. Ability to explore python especially the object oriented concepts, and the built in objects of Python.

Lab Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	2	3	-	2	-	-	-	-	-	-	2
2	3	3	3	-	2	-	-	-	-	-	-	2
3	3	3	3	-	2	-	-	-	-	-	-	2
4	3	2	2	-	2	-	-	-	-	-	-	2
5	3	3	3	-	3	-	-	-	-	-	-	2
Average	3	2.6	2.8	-	2.25	-	-	-	-	-	-	2

BM- 39011/BM-39001: Signals and System

Course Outcomes: -

At the end of this course students will be able to:

1. To familiarize students with different types of signals & systems and their applications
2. To make students aware of the problems in analysis and manipulation of various signals and their processing through linear shift invariant systems.
3. To make students understand the concept of different types of systems and their applications and relate to real world problems.
4. To make students understand the techniques of using specific transforms for different signals, their importance and applications.
5. To equip students with convolution and correlation techniques applicable in Biomedical Signal Processing Course.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	-	-	-	-	-	-	-	-	1
CO2	3	2	2	1	1	-	-	-	-	-	-	1
CO3	2	1	1	2	1	-	-	-	-	-	-	1
CO4	2	2	1	1	1	-	-	-	-	-	-	1
CO5	3	2	2	2	1	-	-	-	-	-	-	1
Average	2.4	1.6	1.4	1.5	1	-	-	-	-	-	-	1

LABORATORY OUTCOMES

1. Work with MATLAB tools for signal processing.
2. Understand the representation of continuous and discrete time signals and systems in time domain and frequency domain using MATLAB commands.
3. Understand the concept of different transforms in analyzing signals and systems (Fourier, Laplace and z transform).
4. Acquire enough understanding to build a comprehensive foundation for later higher-level courses such as Biomedical Signal Processing, Control Systems & Medical Image Image Processing
5. Construct meaning from oral, written and graphical plotting through the experiments.

Lab Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	-	-	-	1	-	-	-	1	-	-	1
2	1	-	-	-	1	-	-	-	1	-	-	1
3	1	1	-	-	1	-	-	-	1	-	-	1

4	1	-	-	-	1	-	-	-	1	-	1	3
5	-	-	-	-	1	-	-	2	-	3	-	1
Average	1	1	-	-	1	-	-	2	1	3	1	1.4

BM-39013: Biomedical Instrumentation I

Course Outcomes: -

At the end of this course students will be able to:

1. Describe origin of various bioelectric signals and technical specifications of various bioelectric electrodes required for their analysis. Outline basic functional components of medical Instrumentation systems.
2. Explain the fundamental concepts of Biomedical recorders and be able to select the bio-amplifiers based on application.
3. Identify and describe various techniques/Instruments for measuring physiological parameters.
4. To be able to compare and distinguish between cardiac output measurement techniques.
5. Analyse, classify and select various analytical techniques and Instruments as per requirement of biomedical applications.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	3	-	1	-	1	-	-	-	2
CO2	3	2	3	3	-	1	-	1	-	-	-	2
CO3	3	1	3	1	-	-	-	1	-	-	-	2
CO4	3	1	-	-	-	1	-	1	-	-	-	2
CO5	3	3	3	3	3	1	-	1	2	-	1	2
Average	3	1.8	3	2.5	3	1	-	1	2	-	1	2

LABORATORY OUTCOMES

1. Measure and analyse the output of signal processing block of biomedical instruments
2. trainer kits.
3. Identify bio electrodes for different medical recorders, demonstrate correct placement of electrodes on body surface and detect errors and suggest corrective measures
4. related electrode placements.
5. Perform experimental setup, record and interpret the results of monitoring and analytical tools.
6. Operate CRO, DSO and other software interfaces of real time biomedical recorders Construct meaning from oral, written and graphical plotting through the experiments.

Lab Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	3	-	-	-	-	-	-	-	3	-	-
2	2	3	-	-	3	-	-	2	-	3	-	-
3	3	3	-	1	-	-	-	-	-	3	-	-
4	-	-	-	-	3		-	2	-	-	-	1
5	-	-	-	-	-	-	-		2	3	-	1
Average	2.7	3.0	-	1.0	3.0	-	-	2.0	2.0	3.0	-	1.0

IP-39021: Industrial Engineering and Management

Course Outcomes:-

At the end of this course students will be able to:

CO1: Learn workplace design, work measurement tests & technology.

CO2: Understand concept of operations & organization management.

CO3: Learn operational research, linear programming, transportation models and its applications.

CO4: Apply and learn quality control & its economics.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	-	-	-	-	-	-	-	-
CO2	3	3	2	2	-	-	-	-	-	-	-	-
CO3	3	3	2	2	-	-	-	-	-	-	-	-
CO4	3	-	2	2	-	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-
Average	3	3	2	2	-	-	-	-	-	-	-	-

BM-xxxxx : Artificial Intelligence and Machine Learning for Medical Applications

Course Outcomes: -

At the end of this course students will be able to:

CO1: To understand the applications of AI, namely game playing, theorem proving, and machine learning

CO2: To comprehend different knowledge representation techniques.

CO3: To apply different reasoning to ML problems.

CO4: To apply clustering algorithms as per problems needed.

CO5: To categorize neural networks for specific application.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	3	-	1	-	1	-	-	-	2
CO2	3	2	3	3	-	1	-	1	-	-	-	2
CO3	3	1	3	1	-	-	-	1	-	-	-	2
CO4	3	1	-	-	-	1	-	1	-	-	-	2
CO5	3	3	3	3	3	1	-	1	2	-	1	2
Average	3	1.8	3	2.5	3	1	-	1	2	-	1	2

LABORATORY OUTCOMES

1. Understand the implementation procedures for the machine learning algorithms
2. Design Java/Python programs for various Learning algorithms.
3. Apply appropriate data sets to the Machine Learning algorithms
4. Identify and apply Machine Learning algorithms to solve real world problems

Lab Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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1	3	2	3	-	2	-	-	-	-	-	-	2
2	3	3	3	-	2	-	-	-	-	-	-	2
3	3	3	3	-	2	-	-	-	-	-	-	2
4	3	2	2	-	2	-	-	-	-	-	-	2
5	3	3	3	-	3	-	-	-	-	-	-	2
Average	3	2.6	2.8	-	2.25	-	-	-	-	-	-	2

BM-XXXXX: Microprocessor & Microcontroller

Course Outcomes:-

After completion of course, students will be able to:

CO1: Describe & understand the fundamental concepts of microprocessors.

CO2: Illustrate the advanced microprocessor of 16 & 32 bit.

CO3: Demonstrate the memory interfacing and peripherals.

CO4: Explain & learn the programming of 8051 microcontrollers.

CO5: Apply the fundamentals of on-board & external communication interface

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	1	2	1	-	-	-	1	-	-
CO2	3	2	2	1	2	1	-	-	-	1	-	1
CO3	3	1	2	2	1	1	-	-	-	1	-	-
CO4	3	1	2	2	2	1	-	-	-	1	-	1
CO5	2	2	1	1	1	1	-	1	-	1	-	-
Average	2.6	1.4	1.6	1.4	1.6	1	-	1	-	1	-	1

LABORATORY OUTCOME

1. Use the Keil software for development purposes.
2. Identify the functionality of development boards to implement embedded applications.
3. Compile bug-free assembly or c-language programs.
4. Design an electronic circuit for diverse I/O devices used in real time embedded applications.
5. Communicate effectively in oral and written form in the field of embedded systems.

Lab Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	-	3	-	1	-	-	-	-	-	-	-
2	2	-	2	-	3	-	-	-	-	-	-	-
3	2	-	2	-	1	-	-	-	-	-	-	-
4	2	-	3	-	3	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	3	-	-
Average	2.25	-	2.5	-	2	-	-	-	-	3	-	-

BM-49004: Biomechanics

Course Outcomes:-

At the end of this course students will be able to:

1. Apply the knowledge of joint mechanics to day to day human movement.
2. Examine the principles of bio-fluid dynamics.
3. Explain the fundamentals of bio solid mechanics.
4. To visualize the biomechanics principles and gait analysis of human locomotion
5. Derive the joint force and muscle force for various biomechanical systems in human

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	3	1	-	-	-	1	2	-	1
CO2	3	2	2	3	1	-	-	-	1	1	-	1
CO3	3	2	2	3	2	-	-	-	1	1	-	1
CO4	3	2	2	3	2	-	-	-	1	2	-	1
CO5	3	2	2	3	2	-	-	-	1	2	-	1
Average	3	2	2	3	1.6	-	-	-	1	1.6	-	1

LABORATORY OUTCOMES

1. Define key biomechanical measurement terms and state how each relates to the structure of biomechanics study.
2. Gain Proficiency in modern biomechanics tools such as force plate, opensim
3. Ability to interpret the results and draw meaningful conclusions
4. Ability to work as a member of a team while carrying out experiments.

Lab Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	2	2	2	2	-	-	-	1	-	-	-
2	3	2	2	2	2	-	-	-	1	-	-	-
3	3	2	2	2	2	-	-	-	1	-	-	-
4	3	2	2	2	2	-	-	-	1	-	-	-
5	2	2	2	2	2	-	-	-	1	-	-	-
Average	3	3	3	2	2	-	-	-	1	-	-	-

BM- 49003/BM-49305: Medical Imaging Systems

Course Outcomes: -

At the end of this course students will be able to:

- CO1: To learn principles of sectional imaging in X-Ray, CT scanner configuration and 2D image reconstruction techniques.
- CO2: Recognize basic physics of MRI, its instrumentation and areas of application.
- CO3: Interpret basic physics of ultrasound, the instrumentation involved and modes of operation.
- CO4: To classify Emission Computed Tomography with emphasis on SPECT and PET imaging.
- CO5: To explain basic knowledge of IR imaging, its advantages and application.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	2	3	3	3	1	1	3	2
CO2	3	3	3	3	3	1	3	-	-	-	3	3
CO3	3	3	3	2	3	1	2	1	3	2	3	3
CO4	3	3	3	2	3	1	2	1	3	2	3	3
CO5	3	2	2	3	1	2	1	1	2	1	3	2
Average	3	2.6	2.6	2.2	2.4	1.6	2.2	1.5	2.25	1.5	3	2.6

BM-49005: Biological Control Systems

Course Outcomes:-

At the end of this course students will be able to:

- CO1: Interpreting physiological systems in terms of control systems and summarizing their properties.
 CO2: Developing a simple respiratory model.
 CO3: Developing a simple cardiovascular model.
 CO4: Summarizing various physiological models.
 CO5: Interpreting different system identification techniques.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	-	-	-	-	-	-	-	-	2
CO2	-	3	-	2	1	1	-	-	1	-	-	2
CO3	1	3	2	2	1	1	-	-	1	-	-	2
CO4	-	3	-	2	-	1	-	-	-	-	-	2
CO5	-	3	-	2	2	-	-	-	-	2	-	2
Average	1.5	2.8	2.5	2	1.3	1	-	-	1	2	-	2

BM-XXXXX: Data Science

Course Outcomes: -

1. To provide a strong foundation for data science and application areas related to it and understand the underlying core concepts and emerging technologies in data science.
2. Understand and apply EDA using Python programming
3. Analyze and apply Feature Selection Techniques using Python programming
4. Understand, Apply and Demonstrate different tools for Data Visualization
5. Learn to think through the ethics surrounding privacy, data sharing and algorithmic decision-making

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	3	-	1	-	1	-	-	-	2
CO2	3	2	3	3	-	1	-	1	-	-	-	2
CO3	3	1	3	1	-	-	-	1	-	-	-	2
CO4	3	1	-	-	-	1	-	1	-	-	-	2
CO5	3	3	3	3	3	1	-	1	2	-	1	2
Average	3	1.8	3	2.5	3	1	-	1	2	-	1	2

LABORATORY OUTCOMES

1. Develop relevant programming abilities, proficiency with statistical analysis of data, ability to build and assess data-based models.
2. Students will execute data analysis with professional software.
3. Students will apply data science concepts and methods to solve problems in real-world contexts and will communicate these solutions effectively
4. Apply professional quality textual and graphical tools to sketch and computing results, incorporating accepted data analysis and synthesis methods, mathematical software, and word-processing tools.
5. Group activities in terms of mini projects to demonstrate the creativity and ability to interact effectively on a social and interpersonal level, divide up and share task responsibilities to complete assignments.

Lab Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	2	3	3	3	3	-	3	3	2	-	3
2	3	-	3	3	3	3	-	3	3	2	-	3
3	3	2	-	3	3	3	-	3	3	-	-	-
4	3	2	3	3	3	3	-	3	3	2	-	3
5	3	-	-	3	3	3	-	3	3	-	-	3
Average	3	2	3	3	3	3	-	3	3	3	-	3

BM-XXXXX: Power Electronics

Course Outcomes:

- EE47002 (T). CO1: Acquire knowledge about fundamental concepts and switches used in power electronics.
- EE47002 (T). CO2: Ability to analyze various single phase and three phase line commutated power converter circuits and understand their applications.
- EE47002 (T). CO3: Nurture the ability to identify basic requirements for line commutated converter based design application.
- EE47002 (T). CO4: To develop skills to build, and troubleshoot power electronics circuits.
- EE47002 (T). CO5: Understand the firing circuit design for line commutated converters.
- EE47002 (T). CO6: Foster ability to understand the use of line commutated converters in professional engineering.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	1	-	-	-	-	-	-	-
CO2	-	3	3	1	1	-	-	-	-	-	-	-
CO3	3	3	-	-	1	-	-	-	-	-	-	-
CO4	3	3	3	1	1	-	-	-	-	-	-	-
CO5	3	3	3	-	1	-	-	-	-	-	-	-
Average	3	3	3	1	1	-	-	-	-	-	-	-

LABORATORY OUTCOMES

1. Recognize the functions of CRO, identify and select proper instruments to observe and record performance on different experimental set ups of power electronics
2. Establish wiring and device connections to assemble experiments of static switches, line commutated converters and record their performances.
3. Analyze and compare the performance of various firing pulse generation circuits for triggering of SCR.
4. Apply professional quality textual and graphical tools to sketch and computing results, incorporating accepted data analysis and synthesis methods, mathematical software, and word-processing tools.
5. Group activities in terms of mini projects to demonstrate the creativity and ability to interact effectively on a social and interpersonal level, divide up and share task responsibilities to complete assignments.

Lab Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	2	3	3	3	3	-	3	3	2	-	3
2	3	-	3	3	3	3	-	3	3	2	-	3
3	3	2	-	3	3	3	-	3	3	-	-	-
4	3	2	3	3	3	3	-	3	3	2	-	3
5	3	-	-	3	3	3	-	3	3	-	-	3
Average	3	2	3	3	3	3	-	3	3	3	-	3

BM-49261: Hospital Management and Information Systems

Course Outcomes:

At the end of this course students will be able to:

1. To write algorithms for linear data structures & their application.
2. To develop algorithms for nonlinear data structure-trees & graphs.
3. Learn basic concepts, components & applications of database system as well as ER
4. model to use efficiently to improve performance of hospital databases.
5. Write SQL queries for solving problems related to current scenarios in hospital database.
6. Design of HIS and its integration in a networked hospital scenario.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	1	-	-	-	-	-	-	-
CO2	-	3	3	1	1	-	-	-	-	-	-	-
CO3	3	3	-	-	1	-	-	-	-	-	-	-

CO4	3	3	3	1	1	-	-	-	-	-	-	-
CO5	3	3	3	-	1	-	-	-	-	-	-	-
Average	3	3	3	1	1	-	-	-	-	-	-	-

LABORATORY OUTCOMES

1. Ability to implement linear and non-linear data structure operations using C programs
2. Ability to solve problems implementing appropriate data structures
3. Ability to implement sorting and searching algorithms using relevant data structures
4. Ability to formulate queries using SQL DML/DDL/DCL commands
5. Ability to design and implement a database schema for a given problem.

Lab Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	2	1	2	3	1	-	1	2	2	-	1
2	2	2	2	2	3	1	-	1	2	3	-	2
3	3	3	1	2	2	1	-	1	2	3	-	1
4	3	2	1	3	2	2	-	1	3	2	-	1
5	3	3	1	3	2	1	-	1	2	2	-	1
Average	2.8	2.4	1.2	2.4	2.4	1.2	-	1	2.2	2.4	-	1.2

BM-49204 : Internet of Things for Medical Applications

Course Outcomes: -

At the end of this course students will be able to:

CO1: To understand the fundamentals of Internet of Things

CO2: To learn about the basics of IoT protocols

CO3: To build a small low cost embedded system using Raspberry Pi.

CO4: To learn various designing components of IoT

CO5: To apply the concept of Internet of Things in smart healthcare.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	1	1	-	-	2	2
CO2	3	-	-	-	-	-	1	1	-	2	2	2
CO3	3	-	-	-	-	-	-	1	-	2	2	2
CO4	3	-	-	-	-	-	1	1	-	-	2	2
CO5	3	3	2	-	1	-	2	2	-	2	2	2
Average	3	3	2	-	1	-	1	1.2	-	2	2	2

LABORATORY OUTCOMES

1. Implement interfacing of various sensors with Arduino/Raspberry Pi.
2. Demonstrate the ability to transmit data wirelessly between different devices.
3. Show an ability to upload/download sensor data on cloud and server.
4. Apply professional quality textual and graphical tools to sketch and computing results, incorporating accepted data analysis and synthesis methods, mathematical software, and word-processing tools.

- Group activities in terms of mini projects to demonstrate the creativity and ability to interact effectively on a social and interpersonal level, divide up and share task responsibilities to complete assignments.

Lab Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	-	-	-	3	-	-	-	-	-	-	3
2	3	-	-	-	3	-	-	-	-	-	1	3
3	3	3	3	3	3	2	-	-	3	3	1	3
4	3	2	3	3	3	3	-	3	3	2	-	3
5	3	-	-	3	3	3	-	3	3	-	-	3
Average	3	2.5	3	3	3	2.6	-	3	3	2.5	1	3

BM-49612: Rehabilitation Engineering

Course Outcomes:-

At the end of this course students will be able to:

- Understand the need and concepts of rehabilitation engineering in general.
- Understand the concept of mobility and functioning of sensory augmentation.
- Identify the key components and design of universal accessibility.
- Analyse the design of orthotics and prosthetics of upper and lower extremities.
- Design manual and power wheelchair.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	-	-	2	-	2	1	2	-	1
CO2	3	2	3	2	3	3	-	1	2	1	-	
CO3	2	3	2	2	1	1	1	2	1	2	-	1
CO4	2	2	3	1	1	2	-	1	2	2	-	
CO5	2	2	3	2	3	3	1	2	1	3	-	1
Average	2	2.2	2.4	1.75	2	2.2	1	1.6	1.4	2	-	1

BM-49611: Hospital Technology Systems

Course Outcomes:-

At the end of this course students will be able to:

- To classify hospital's & understand the architecture of various departments.
- Understand the requirement of electrical power systems in hospitals.
- Design of Air-conditioning and gas supply system, its criticality
- Analyse and implement maintenance protocols of hospital equipment.
- Identify the need and application of hospital information systems.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	2	1	2	3	3	3	1	1	3	1
CO2	2	3	3	3	3	1	3	-	-	-	1	-

CO3	2	3	3	2	3	1	2	1	3	2	1	1
CO4	2	3	3	2	3	1	2	1	3	2	1	1
CO5	3	2	2	3	1	2	1	1	2	1	2	1
Average	2.25	2.75	2.6	2.2	2.4	1.6	2.2	1.5	2.25	1.5	1.6	1

BM-XXXXX: Medical Image Processing

Course Outcomes: -

At the end of this course students will be able to:

1. Understand the concept of 2D signal and apply it on image
2. Evaluate the techniques for image enhancement.
3. Analyze images in the frequency domain using various transforms.
4. Apply and compare various image segmentation techniques on images.
5. Interpret Image the output of morphological operations on images.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	-	-	-	-	-	-	-	-	-	-
CO2	2	2	1	2	2	-	-	-	-	-	-	-
CO3	3	1	1	2	2	-	-	-	-	-	-	-
CO4	2	2	3	2	2	-	-	-	-	1	-	1
CO5	1	3	3	2	2	-	-	-	-	1	-	1
Average	2.2	1.8	2	2	2	-	-	-	-	1	-	1

BM-XXXXX-Design and Manufacturing of Medical Devices

Course Outcomes: -

At the end of this course students will be able to:

- CO1: Provides an overview of design and manufacturing techniques for medical devices development.
- CO2: Able to understand the technical and business aspects of the medical device development process.
- CO3: Apply creative process techniques in synthesizing information, problem-solving and critical thinking.
- CO4: Strategically apply technical skill, knowledge and craftsmanship to prove feasibility of their concepts.
- CO5: Build confidence in students to create a new health care product and enhanced team working skills.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	-	-	-	-	-	-	-	-	-	-
CO2	2	2	1	2	2	-	-	-	-	-	-	-
CO3	3	1	1	2	2	-	-	-	-	-	-	-
CO4	2	2	3	2	2	-	-	-	-	1	-	1
CO5	1	3	3	2	2	-	-	-	-	1	-	1
Average	2.2	1.8	2	2	2	-	-	-	-	1	-	1

BM-XXXXX-Biomaterials

Course Outcomes:-

At the end of this course students will be able to:

1. Illustrate the fundamental concepts of biomaterials, its classification and detailed understanding of different implant materials.
2. Demonstrate and test the bulk and surface properties of biomaterials.
3. Describe the biological testing of biomaterials & fundamentals of tissue engineering
4. Explain detailed understanding of practical applications of biomaterials in medicine and dentistry.
5. Identify and predict the host reaction on application of biomaterials.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	-	-	2	-	2	1	2	-	1
CO2	3	2	3	2	3	3	-	1	2	1	-	
CO3	2	3	2	2	1	1	1	2	1	2	-	1
CO4	2	2	3	1	1	2	-	1	2	2	-	
CO5	2	2	3	2	3	3	1	2	1	3	-	1
Average	2	2.2	2.4	1.75	2	2.2	1	1.6	1.4	2	-	1

BM-XXXXX-Telemedicine

Course Outcomes:-

At the end of this course students will be able to:

CO1: Demonstrate the basic knowledge of telemedicine and telehealth

CO2: Understand the technology of Telemedicine Systems.

CO3: Interpret the clinical applications, standards, and guidelines in telemedicine

CO4: Design of integrated telemedicine architecture with sub systems

CO5: Describe the often complex legal, ethical, regulations and laws in telemedicine.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	3	2	2	2	-	1	-	2	1	1
CO2	-	-	-	3	3	1	2	2	1	3	3	2
CO3	-	-	3	3	-	2	1	-	-	1	3	1
CO4	-	-	2	1	2	3	-	-	2	-	2	-
CO5	-	-	-	1	-	3	-	3	1	-	1	-
Average	2	-	3	2	2	2	2	2	1	2	2	1

BM-XXXXX-Nanosensors

Course Outcomes: -

At the end of this course students will be able to:

CO1: To understand the basics concepts of nanotechnology

CO2: To compare different materials used in the field of nanotechnology

CO3: To analyse and categorize the nanosensors

CO4: To apply the knowledge of nanomaterials in the development of nanosensors

CO5: To analyse and evaluate the performance of different nanosensors

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	-	-	2	-	-	-	-	-	2
CO2	3	3	3	-	-	2	-	-	-	-	-	2
CO3	3	3	3	-	-	2	-	-	-	-	-	2
CO4	3	3	3	-	-	2	-	-	-	-	-	2
CO5	2	-	3	-	-	3	3	-	3	-	-	2
Average	2.8	3	3	-	-	2.1	3	-	-	-	-	2

BM-XXXXX-Medical Ethics and Juriprudence

Course Outcomes: -

At the end of this course students will be able to:

CO1: Understand the significance of medical jurisprudence

CO2: Understand the laws and acts of medical aspects

CO3: Plan the process of a medico legal investigation

CO4: Determine and decide the specimen handling procedure

CO5: Assess the need for liaising and licensing

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	3	-	1	-	3	2	2	1	1
CO2	-	-	-	3	-	1	-	3	2	2	1	1
CO3	-	-	-	3	-	1	-	3	3	2	1	1
CO4	-	-	-	3	-	1	-	3	3	2	2	1
CO5	-	-	-	3	-	1	-	3	3	2	2	1
Average	-	-	-	3	-	1	-	3	2.6	2	1.4	1