



RAJIV GANDHI COLLEGE OF ENGINEERING AND TECHNOLOGY
Pondy Cuddalore Main Road, Kirumampakkam, Puducherry – 607 403.
Affiliated to Pondicherry University and Approved by AICTE, New Delhi

DEPARTMENT OF BIOMEDICAL ENGINEERING

SEMESTER III



RAJIV GANDHI COLLEGE OF ENGINEERING AND TECHNOLOGY
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DEPARTMENT OF BIOMEDICAL ENGINEERING

ACADEMIC YEAR 2023 - 2024

COURSE DETAILS

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
II / III	MAT31	MATHEMATICS III	

Course Prerequisite: Basic knowledge for formulas differential and integration.

Course Objectives

- To provide the concepts of functions of a complex variable, conformal mapping, complex integration, series expansion of complex functions, Harmonic analysis and Fourier series.
- To make the students understand and work out problems of constructing analytic functions, conformal mapping, bilinear transformation, contour integration and expanding functions into Fourier series including Harmonic analysis.

Course Outcomes

COS	Upon successful completion of this course, students should be able to:	RBT
CO1	To understand the concepts of function of a complex variable and complex integration.	L2
CO2	To apply these ideas to solve problems occurring in the area of Engineering and Technology.	L3
CO3	Expand functions into Fourier series which are very much essential for in Engineering and Technology.	L3
CO4	To apply these ideas to solve problems occurring in the area of Engineering and Technology.	L3
CO5	Obtain Fourier transform for the functions which are needed for solving application problems.	L4

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
PSO 2	Use various tools to provide diagnosis and therapeutic applications
PSO 3	Design and develop healthcare information system



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DEPARTMENT OF BIOMEDICAL ENGINEERING

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3	–	–	2	–	3	–	–	2	2	3	2
CO2	3	3	2	3	–	–	2	–	2	–	–	2	3	3	2
CO3	3	3	3	3	1	–	2	3	3	–	–	3	3	3	2
CO4	3	3	3	1	–	–	2	–	2	–	–	1	3	2	1
CO5	3	3	3	3	1	1	2	3	3	–	–	3	3	3	1
Average	3	3	2.6	2.6	1	0	2	1.2	2.6	0	0	2.2	2.8	2.8	1.6



Head of the Department

Head of the Department
 Department of Biomedical Engineering
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DEPARTMENT OF BIOMEDICAL ENGINEERING

ACADEMIC YEAR 2023 - 2024

COURSE DETAILS

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
II / III	BMT32	ELECTRIC CIRCUIT ANALYSIS	43

Course Prerequisite: Engg Mathematics I and Basic Electrical circuits

COURSE OBJECTIVES

- To analyze electrical circuits using KCL and KVL
- To learn network theorems and apply them for circuit analysis
- To study resonance and coupled circuits
- To study two port parameters
- To study transient analysis of RC, RL, RLC circuits
- Integration and expanding functions into Fourier series including Harmonic analysis.

COURSE OUTCOMES

COS	Upon successful completion of this course, students should be able to:	RBT
CO1	Ability to analyze AC & DC Circuits and gain Knowledge about power factor	(L3)
CO2	Apply the knowledge of network analysis techniques in DC and AC circuits.	(L4)
CO3	To design resonant and tuned circuits	(L6)
CO4	Ability to find the transient response of RC, RL and RLC circuits	(L5)
CO5	Ability to evaluate the two port parameters of the circuits	(L5)

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
PSO 2	Use various tools to provide diagnosis and therapeutic applications
PSO 3	Design and develop healthcare information system

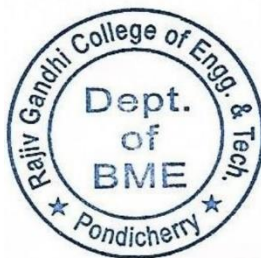


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MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	-	-	-	-	-	-	-	3	2	1	-
CO2	3	3	2	1	-	-	-	-	-	-	-	3	2	1	-
CO3	3	3	2	1	-	-	-	-	-	-	-	3	2	1	-
CO4	3	3	2	1	-	-	-	-	-	-	-	3	2	1	-
CO5	3	3	2	1	-	-	-	-	-	-	-	3	2	1	-
Average	3	3	2	1	0	-	0	-	0	0	0	3	2	1	0



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DEPARTMENT OF BIOMEDICAL ENGINEERING

ACADEMIC YEAR 2023 - 2024

COURSE DETAILS

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
II / III	BMT33	ELECTRONIC DEVICES AND CIRCUITS	43

Course Prerequisite: Basic Electric and Electronics

COURSE OBJECTIVES

- To introduce basic semiconductor devices, their characteristics and application
- To understand analysis and design of simple diode circuit
- To learn to analyze the PN junction behavior at the circuit level and its role in the operation of diodes and active device

COURSE OUTCOMES

COS	Upon successful completion of this course, students should be able to:	RBT
CO1	Analyze the function of various semiconductor devices.	(L3)
CO2	Analyze and design amplifier circuits, oscillators and filter circuits employing BJT, FET devices.	(L3)
CO3	Design resonant and tuned circuits	(L6)
CO4	To find the transient response of RC, RL and RLC circuits	(L5)
CO5	To evaluate the two port parameters of the circuits	(L5)

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
PSO 2	Use various tools to provide diagnosis and therapeutic applications
PSO 3	Design and develop healthcare information system

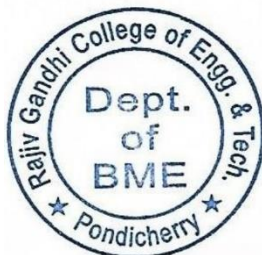


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MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO 12	PSO1	PSO2	PSO3
CO1	3	3	2	-	-	-	-	-	-	-	-	3	2	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	3	2	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	3	2	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	3	2	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	3	2	-	-
Average	3	3	2	0	0	0	0	0	0	0	0	3	2	0	0



[Signature]
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43COURSE DETAILS

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
II / III	BMT34	HUMAN ANATOMY & PHYSIOLOGY	43

Course Prerequisite: Basic knowledge in biology

COURSE OBJECTIVES

- Qualitatively and quantitatively describe each system of the human body covered in this course: integumentary, skeletal, muscular, nervous, sensory, and endocrine.
- Qualitatively and quantitatively describe the normal function of the components of these systems on the organ and cellular level.
- Integrate a basic knowledge of chemistry and biochemistry with human physiology.
- Describe and explain the correlation of the systems covered with each other and their contributions to homeostasis.

COURSE OUTCOMES

COS	Upon successful completion of this course, students should be able to:	RBT
CO1	Explain the function of different types of cells and tissues	(L2)
CO2	Explain the physiological process involved in cardiovascular system and nervous system	(L2)
CO3	Explain the structure and functioning of muscular system and respiratory system	(L2)
CO4	Illustrate the process involved in gastro urinal system	(L2)
CO5	Explain how sense organs contribute the overall functioning of human body	(L2)

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
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PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
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PSO 3	Design and develop healthcare information system



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MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO 12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	3	3	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	3	3	-	-
CO3	3	-	-	-	-	-	-	-	-	-	-	3	3	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-	3	3	-	-
CO5	3	-	-	-	-	-	-	-	-	-	-	3	3	-	-
Average	3	0	0	0	0	0	0	0	0	0	0	3	3	0	0



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COURSE DETAILS

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
II / III	BMT35	DATA STRUCTURES AND OBJECT-ORIENTED PROGRAMMING	43

Course Prerequisite: Basic knowledge in computer

COURSE OBJECTIVES

- To acquaint students with data structures used when programming for the storage and manipulation of data.
- The concept of data abstraction and the problem of building implementations of abstract data types are emphasized.
- To understand the concepts of object-oriented programming
- To expertise the programming skills through C++ language

COURSE OUTCOMES

COS	Upon successful completion of this course, students should be able to:	RBT
CO1	Select of relevant data structures and combinations of relevant data structures for the given problems in terms of memory and run time efficiency.	(L2)
CO2	Apply data abstraction in solving programming problems.	(L4)
CO3	An ability to conceptualize the problem in terms of object-oriented features	(L4)
CO4	An ability to use the OO programming techniques (C++) in developing applications.	(L4)
CO5	An ability to design and develop a complete object-oriented application	(L4)

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
PSO 2	Use various tools to provide diagnosis and therapeutic applications
PSO 3	Design and develop healthcare information system

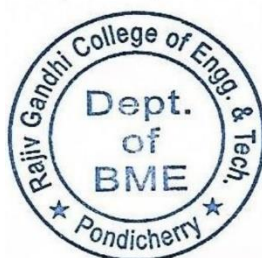


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MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO 12	PSO1	PSO2	PSO3
CO1	3	3	2	-	-	-	-	-	-	-	-	3	-	1	-
CO2	3	3	2	-	-	-	-	-	-	-	-	3	-	1	-
CO3	3	3	2	-	-	-	-	-	-	-	-	3	-	1	-
CO4	3	3	2	-	-	-	-	-	-	-	-	3	-	1	-
CO5	3	3	2	-	-	-	-	-	-	-	-	3	-	1	-
Average	3	3	2	0	0	0	0	0	0	0	0	3	0	1	0



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ACADEMIC YEAR 2023 - 2024

COURSE DETAILS

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
II / III	BMT36	BIOCHEMISTRY	43

Course Prerequisite: Basic knowledge about organic chemistry and biology

COURSE OBJECTIVES

- To describe the molecular & functional organization of a cell & list its sub-cellular & components.
- Delineate structure, function & interrelationship of various biomolecules & consequences of deviation from normal.
- Summarize the fundamental aspects of enzymology & clinical applications wherein regulation of enzymatic activity is altered.

COURSE OUTCOMES

COS	Upon successful completion of this course, students should be able to:	RBT
CO1	Demonstrate an in-depth knowledge of the molecular function of cell and genes.	(L2)
CO2	Summarize the fundamental aspects of enzymology and clinical application wherein regulation of enzymatic activity is altered.	(L2)
CO3	Define and explain the Biomolecules and its classification.	(L2)
CO4	Illustrate the biochemistry of human functions and test.	(L2)
CO5	Explain the principle and application of human compounds measuring instruments.	(L2)

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
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PO8	Ethics
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PO11	Project management and finance
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PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
PSO 2	Use various tools to provide diagnosis and therapeutic applications
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MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO 12	PSO1	PSO2	PSO3
CO1	2	-	-	-	3	-	-	-	2	-	-	-	3	-	-
CO2	2	-	-	-	3	-	-	-	2	-	-	-	3	-	-
CO3	2	-	-	-	3	-	-	-	2	-	-	-	3	-	-
CO4	2	-	-	-	3	-	-	-	2	-	-	-	3	-	-
CO5	2	-	-	-	3	2	-	3	2	-	-	-	3	-	-
Average	2	0	0	0	3	0.4	0	0.6	2	0	0	0	3	0	0



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ACADEMIC YEAR 2023 - 2024

COURSE DETAILS

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
II / III	BMP31	ELECTRONIC DEVICES AND CIRCUITS LAB	43

Course Prerequisite: Basic Electric and Electronics laboratory

COURSE OBJECTIVES

- Be familiar with the structure of basic electronic devices.
- Be exposed to the operation and applications of electronic devices

COURSE OUTCOMES

COS	Upon successful completion of this course, students should be able to:	RBT
CO1	Acknowledge diode and transistor characteristics to apply on real time Transducers	(L4)
CO2	Derive the formulation and miscellaneous functions of the Base, Emitter, Collector Transceivers.	(L4)
CO3	Gain Knowledge on working of Amplifiers and its functional defects and defaults.	(L4)
CO4	Design Oscillators and its derivative V-1characteristic	(L4)
CO5	Deliver the Rectifier's phase shift and functional applications of Clipper and Clamper over a built on transducers.	(L4)

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
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PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
PSO 2	Use various tools to provide diagnosis and therapeutic applications
PSO 3	Design and develop healthcare information system

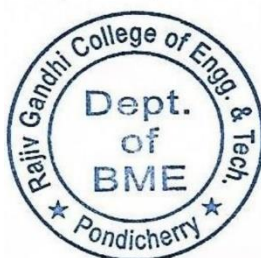


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MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO 12	PSO1	PSO2	PSO3
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CO2	3	3	2	-	-	-	-	-	-	-	-	3	3	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	3	3	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	3	3	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	3	3	-	-
Average	3	2.5	2	0	0	0	0	0	0	0	0	3	3	0	0



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ACADEMIC YEAR 2023 - 2024

COURSE DETAILS

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
II / III	BMP32	BIOCHEMISTRY AND HUMAN PHYSIOLOGY LAB	43

Course Prerequisite: Basic knowledge about biochemistry and physiology

COURSE OBJECTIVES

- To describe the molecular & functional organization of a cell & list its sub-cellular & components.
- Delineate structure, function & interrelationship of various biomolecules & consequences of deviation from normal.
- Summarize the fundamental aspects of enzymology & clinical applications wherein regulation of enzymatic activity is altered.

COURSE OUTCOMES

COS	Upon successful completion of this course, students should be able to:	RBT
CO1	Classify the general test for carbohydrate, protein and lipids	(L2)
CO2	Experiment with estimation of glucose, urea and creatinine.	(L4)
CO3	Evaluate the blood grouping and hemoglobin estimation	(L4)
CO4	Explain the data security and standards.	(L4)
CO5	Ability to interpretate the various levels of biochemical parameters	(L4)

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
PSO 2	Use various tools to provide diagnosis and therapeutic applications
PSO 3	Design and develop healthcare information system

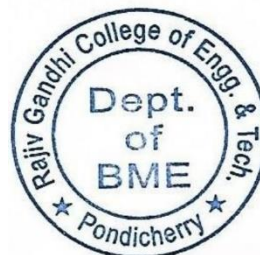


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DEPARTMENT OF BIOMEDICAL ENGINEERING

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO 12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	3	-	-	1	3	-	-
CO2	2	2	-	-	2	-	-	-	2	-	-	-	3	-	-
CO3	-	2	-	-	2	-	-	-	3	-	-	2	3	-	-
CO4	2	2	-	-	2	-	-	-	-	-	-	3	3	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	3	2	-	-
Average	1	1.5	0	0	1.5	0	0	0	2	0	0	1.8	3	0	0



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DEPARTMENT OF BIOMEDICAL ENGINEERING

ACADEMIC YEAR 2023 - 2024

COURSE DETAILS

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
II / III	BMP33	DATA STRUCTURES AND OBJECT-ORIENTED PROGRAMMING LAB	43

Course Prerequisite: Basic knowledge about computer

COURSE OBJECTIVES

- To learn various object-oriented concepts through simple programs.
- To understand the concepts of searching and sorting algorithms

COURSE OUTCOMES

COS	Upon successful completion of this course, students should be able to:	RBT
CO1	Differentiate static and dynamic memory allocation technic	(L4)
CO2	Implement various operations on linear and non-linear data structures	(L6)
CO3	Analyze and implement different searching and sorting techniques	(L4)
CO4	Identity the appropriate data structure to solve a given problem	(L4)
CO5	To create Compute time complexities of different algorithms	(L6)

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
PSO 2	Use various tools to provide diagnosis and therapeutic applications
PSO 3	Design and develop healthcare information system

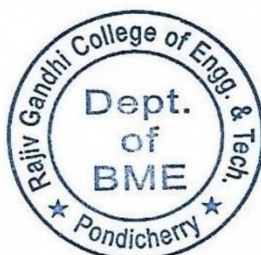


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DEPARTMENT OF BIOMEDICAL ENGINEERING

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO 12	PSO1	PSO2	PSO3
CO1	3	3	2	-	-	-	-	-	-	-	-	3	2	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	3	2	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	3	2	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	3	2	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	3	2	-	-
Average	3	3	2	0	0	0	0	0	0	0	0	3	2	0	0



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DEPARTMENT OF BIOMEDICAL ENGINEERING

SEMESTER V



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DEPARTMENT OF BIOMEDICAL ENGINEERING

ACADEMIC YEAR 2023 - 2024

Course Details

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
III / V	BMT51	PROBABILITY AND RANDOM PROCESSES	37

Course Prerequisites:

Course Objectives

- This course aims at providing the necessary basic concepts in random processes.
- Knowledge of fundamentals and applications of random phenomena will greatly help in the understanding of topics such as signals & systems, pattern recognition, voice and image processing and filtering theory

Course Outcomes

COS	Upon successful completion of this course, students should be able to:	RBT
CO1	To understand the fundamental knowledge of the basic probability concepts.	(L2)
CO2	Able to apply well-founded knowledge of standard distributions in real life phenomena.	(L3)
CO3	To Acquire skills in handling situations involving more than one random variable and functions of random variables.	(L4)
CO4	To Understand and characterize phenomena which evolve with respect to time in probabilistic manner.	(L2)
CO5	Able to analyze the response of random inputs to linear time invariant systems.	(L4)

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
PSO 2	Use various tools to provide diagnosis and therapeutic applications
PSO 3	Design and develop healthcare information system

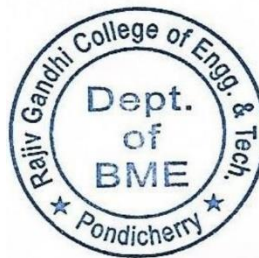


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MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	-	-	-	-	-	-	-	-	3	2	1	-
CO2	3	3	2	-	-	-	-	-	-	-	-	3	2	1	-
CO3	3	3	2	-	-	-	-	-	-	-	-	3	2	1	-
CO4	3	3	2	-	-	-	-	-	-	-	-	3	2	1	-
CO5	3	3	2	-	-	-	-	-	-	-	-	3	2	1	-
Average	3	3	2	0	0	0	0	0	0	0	0	3	2	1	0



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ACADEMIC YEAR 2023 - 2024

Course Details

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
III / V	BMT52	BIO CONTROL SYSTEMS	37

Course Prerequisite: Knowledge of Electrical and Electronics Circuits. and Electrical Instruments.

Course Objective:

- To familiarize the student with the analysis and design of industrial process control.
- To learn the Object-Oriented analysis and design for real-time systems.
- Understand the concept of Stability of various domains.
- Apply mathematical modeling principles in understanding the various fundamental biological systems.

Course Outcomes

COS	Upon successful completion of this course, students should be able to:	LEVEL
CO1	Interpret the need for mathematical modeling of various system, representation of systems in block diagram and signal flow graphs and introduced to biological systems.	L2
CO2	Determine the time response of various systems.	L2
CO3	To Discuss the concept of system stability	L2
CO4	Development of advanced object-oriented software solutions for real-time system.	L5
CO5	Appraise the concepts of modeling basic physiological systems.	L2

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
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PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
PSO 2	Use various tools to provide diagnosis and therapeutic applications
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MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	-	-	-	-	-	-	-	-	2	1	-
CO2	3	2	2	2	-	-	-	-	-	-	-	-	2	1	-
CO3	3	2	2	2	-	-	-	-	-	-	-	-	2	1	-
CO4	3	2	2	2	1	-	-	-	-	-	1	-	2	1	-
CO5	3	2	2	2	1	-	-	-	3	-	1	-	2	1	-
Average	3	2	2	2	1		-	0	3	0	1	2	2	1	-



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DEPARTMENT OF BIOMEDICAL ENGINEERING

ACADEMIC YEAR 2023 - 2024

Course Details

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
III / V	BMT53	PATHOLOGY AND MICROBIOLOGY	37

Course Prerequisites: knowledge in microbiology and pathology

Course Objectives

- To study Cell-structure and function (ultrastructural and molecular aspects), intercellular junctions, cell cycle and division, cell cycle regulators, cell - cell and cell - extra cellular matrix interactions.
- Detailed molecular aspects of DNA, RNA, and intracellular organelles, transcription and translation and molecular biology techniques.

COURSE OUTCOMES

COS	Upon successful completion of this course, students should be able to:	RBT
CO1	Understand and explain factors, about the causation of disease.	(L2)
CO2	Understand processes involved in the gross and microscopic changes of organs and tissues and explain these changes.	(L2)
CO3	Understand and explain the basis of evolution of clinical signs and symptoms.	(L2)
CO4	To Understand about the Genetic disorders	(L2)
CO5	Ability to identify the disease causing Micro organism	(L3)

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
PSO 2	Use various tools to provide diagnosis and therapeutic applications
PSO 3	Design and develop healthcare information system




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DEPARTMENT OF BIOMEDICAL ENGINEERING

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	2	1	-	1	-	-	-	3	2	-	-
CO2	3	-	-	-	2	1	-	1	-	-	-	3	2	-	-
CO3	3	-	-	-	2	1	-	1	-	-	-	3	2	-	-
CO4	3	-	-	-	2	1	-	1	-	-	-	3	2	-	-
CO5	3	-	-	-	2	1	-	1	-	-	-	3	2	-	-
Average	3	0	0	0	2	1	0	1	0	0	0	3	2	0	0



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DEPARTMENT OF BIOMEDICAL ENGINEERING

ACADEMIC YEAR 2023 - 2024

COURSE DETAILS

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
III / V	BMT54	MICROPROCESSORS & ITS APPLICATIONS	37

Course Prerequisites: Knowledge of electronic

Course Objectives

- To study 8085 programming
- To study interfacing devices like 8255, 8253, 8259 and 8251
- To study 8086 and programming
- To study the applications of 8085

Course Outcomes

COS	Upon successful completion of this course, students should be able to:	RBT
CO1	Ability to design a simple assembly language program in 8085	(L4)
CO2	Develop interface any i/o device and communicate using 8085	(L6)
CO3	Ability to design a simple assembly language program in 8086	(L4)
CO4	Design a microprocessor based system for any application	(L4)
CO5	To create applications of microprocessor	(L6)

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
PSO 2	Use various tools to provide diagnosis and therapeutic applications
PSO 3	Design and develop healthcare information system



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MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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CO3	3	3	2	-	-	1	-	-	-	-	-	3	2	-	1
CO4	3	3	2	-	-	1	-	-	-	-	-	3	2	-	1
CO5	3	3	2	-	-	1	-	-	-	-	-	3	2	-	1
Average	3	3	2	0	0	1	0	0	0	0	0	3	2	0	1



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DEPARTMENT OF BIOMEDICAL ENGINEERING

ACADEMIC YEAR 2023 - 2024

Course Details

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
III / V	BMT55	MEDICAL INSTRUMENTATION	37

Course Prerequisites: knowledge about electronics and physiological signals

Course Objectives

- To learn the physiology of the human body and the Instrumentation related to Biomedical Systems.
- To understand the concepts of various anatomy of the human body and related to that, the designing of fundamental instrumentation circuits using appropriate sensors.
- This subject will help to learn the concepts of the various bio-potentials related to the human body which can help them to make real-time healthcare applications

Course OUTCOMES

COS	Upon successful completion of this course, students should be able to:	RBT
CO1	Introduce the concepts of physiology and the Electrical Components of a Biomedical system	L2
CO2	Discuss and analyse the measurement of physiological parameters	L2
CO3	To Understand the concepts of Medical Imaging System.	L2
CO4	To Understand Bio-Telemetry and the various Therapeutics Equipment's used in Medicine	L6
CO5	To study the Electrical safety of Bio-Medical Instruments.	L2

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
PSO 2	Use various tools to provide diagnosis and therapeutic applications
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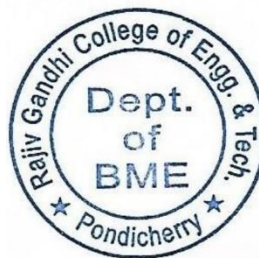


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MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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CO3	3	2	1	1	-	-	-	-	-	-	-	-	2	1	-
CO4	3	2	1	1	-	-	-	-	-	-	1	-	2	1	-
CO5	3	2	1	2	-	-	-	-	3	-	1	-	2	1	-
Average	3	2	1	1.2	-	-	-	0	3	0	1	2	2	1	-



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ACADEMIC YEAR 2023 - 2024

COURSE DETAILS

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
III / V	BME52	ELEMENTS OF BIOTECHNOLOGY	37

Course Prerequisites: knowledge of biochemistry

Course Objectives

- To develop skills of the students in the field of environmental biotechnology and its applications.

Course Outcomes

COS	Upon successful completion of this course, students should be able to:	RBT
CO1	Ability to solve social issues of pollution, waste water management, biodiversity and conservation etc.	(L3)
CO2	Able to create bioremediation and biodegradation technologies for wastes management.	(L6)
CO3	Able to develop formulations of medicine especially vaccines	(L6)
CO4	To understand genetic engineering	(L2)
CO5	Design and develop new bio products.	(L5)

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
PSO 2	Use various tools to provide diagnosis and therapeutic applications
PSO 3	Design and develop healthcare information system

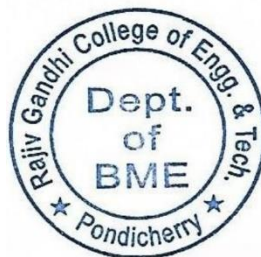


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MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	2	1	-	-	3	1	-	-	-	3	2	-	1
CO2	3	-	2	1	-	-	3	1	-	-	-	3	2	-	1
CO3	3	-	2	1	-	-	3	1	-	-	-	3	2	-	1
CO4	3	-	2	1	-	-	3	1	-	-	-	3	2	-	1
CO5	3	-	2	1	-	-	3	1	-	-	-	3	2	-	1
Average	3	0	2	1	0	0	3	1	0	0	0	3	2	0	1



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DEPARTMENT OF BIOMEDICAL ENGINEERING

ACADEMIC YEAR 2023 - 2024

COURSE DETAILS

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
III / V	BMP51	MEDICAL INSTRUMENTATION LAB	37

Course prerequisites: knowledge about medical instrumentation and biological signals

Course Objectives

- To provide the concepts of acquire and analyze the physiological signals.

Course Outcomes

COS	Upon successful completion of this course, students should be able to:	RBT
CO1	To acquire and analyze Biosignals like ECG, EEG &EMG etc.	(L4)
CO2	Able to handle physiological monitoring system and analyze bio parameters.	(L4)
CO3	Ability to measure and recording peripheral blood flow	(L4)
CO4	To study of characteristics of optical Isolation amplifier	(L2)
CO5	Create ability measurement of visually evoked potential.	(L4)

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
PSO 2	Use various tools to provide diagnosis and therapeutic applications
PSO 3	Design and develop healthcare information system

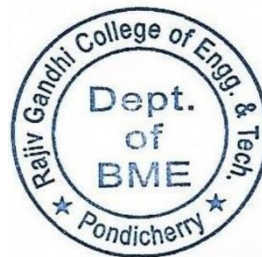


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DEPARTMENT OF BIOMEDICAL ENGINEERING

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	-	3	2	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	3	2	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	3	2	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	3	2	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	3	2	-	-
Average	3	3	0	0	0	0	0	0	0	0	0	3	2	0	0



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DEPARTMENT OF BIOMEDICAL ENGINEERING

ACADEMIC YEAR 2023 - 2024

COURSE DETAILS

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
III / V	BMP52	PATHOLOGY AND MICROBIOLOGY LAB	37

Course Prerequisites: knowledge about microorganism.

COURSE OBJECTIVES

- Able to create analyse the microbes and diagnose microbial infections

Course Outcomes

COS	Upon successful completion of this course, students should be able to:	RBT
CO1	To understand microscope	(L2)
CO2	To develop histopathological slides for tumors	(L6)
CO3	Able to perform various staining process	(L3)
CO4	To study about bone marrow charts	(L2)
CO5	Analyze and interpret the bleeding and prothrombin times	(L3)

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
PSO 2	Use various tools to provide diagnosis and therapeutic applications
PSO 3	Design and develop healthcare information system



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DEPARTMENT OF BIOMEDICAL ENGINEERING

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	3	-	-	1	-	-	1	-	-	-	-	2	-	-
CO2	-	3	-	-	1	-	-	1	-	-	-	-	2	-	-
CO3	-	3	-	-	1	-	-	1	-	-	-	-	2	-	-
CO4	-	3	-	-	1	-	-	1	-	-	-	-	2	-	-
CO5	-	3	-	-	1	-	-	1	-	-	-	-	2	-	-
Average	0	3	0	0	1	0	0	1	0	0	0	0	2	0	0



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DEPARTMENT OF BIOMEDICAL ENGINEERING

ACADEMIC YEAR 2023 - 2024

Course Details

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
III / V	BMP53	MICROPROCESSORS AND ITS APPLICATIONS LAB	37

Course Prerequisites: knowledge about various processor

Course Objectives

- To provide the concepts various microprocessor
- Ability to develop programme for 8085 & 8086

Course Outcomes

COS	Upon successful completion of this course, students should be able to:	RBT
CO1	Develop programming for 8085 microprocessor	(L5)
CO2	Develop programming for 8086 microprocessor	(L5)
CO3	Create Interfacing programme for interrupt controller	(L6)
CO4	Interfacing of various devices like display devices & D/A and A/D converters	(L3)
CO5	To study Stepper motor control using microprocessor	(L2)

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
PSO 2	Use various tools to provide diagnosis and therapeutic applications
PSO 3	Design and develop healthcare information system

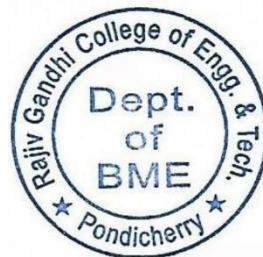


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DEPARTMENT OF BIOMEDICAL ENGINEERING

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	-	3	-	-	-	-	-	-	3	2	-	-
CO2	3	3	2	-	3	-	-	-	-	-	-	3	2	-	-
CO3	3	3	2	-	3	-	-	-	-	-	-	3	2	-	-
CO4	3	3	2	-	3	-	-	-	-	-	-	3	2	-	-
CO5	3	3	2	-	3	-	-	-	-	-	-	3	2	-	-
Average	3	3	2	0	3	0	0	0	0	0	0	3	2	0	0



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DEPARTMENT OF BIOMEDICAL ENGINEERING

ACADEMIC YEAR 2023 - 2024

Course Details

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
III / V	BMP54	GENERAL PROFICIENCY-I	37

Course Prerequisites: Basic knowledge of English grammar.

Course Objectives

- To create good communication.
- Able to develop personality.

COURSE OUTCOMES

COS	Upon successful completion of this course, students should be able to:	RBT
CO1	To develop Body Language	(L5)
CO2	To enhance the Self-Confidence and leadership	(L5)
CO3	Develop writing skills	(L5)
CO4	To develop fluency in speaking	(L5)
CO5	To solve verbal and nonverbal problems	(L4)

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
PSO 2	Use various tools to provide diagnosis and therapeutic applications
PSO 3	Design and develop healthcare information system



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MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	2	-	-	3	-	1	-	3	-	3	-	-	-
CO2	-	-	2	-	-	3	-	1	-	3	-	3	-	-	-
CO3	-	-	2	-	-	3	-	1	-	3	-	3	-	-	-
CO4	-	-	2	-	-	3	-	1	-	3	-	3	-	-	-
CO5	-	-	2	-	-	3	-	1	-	3	-	3	-	-	-
Average	0	0	2	0	0	3	0	1	0	3	0	3	0	0	0



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DEPARTMENT OF BIOMEDICAL ENGINEERING

SEMESTER VII



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DEPARTMENT OF BIOMEDICAL ENGINEERING

ACADEMIC YEAR 2023 - 2024

COURSE DETAILS

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
IV / VII	BMT71	BIOMATERIALS AND ARTIFICIAL ORGANS	55

Course Prerequisites: knowledge about material science and biology

Course Objectives

- To study the characteristics and classification of Biomaterials
- To study about the different metals and ceramics used as biomaterials
- To learn about polymeric materials and combinations that could be used as a tissue replacement implants
- To study the artificial organ developed using these materials

Course Outcomes

COS	Upon successful completion of this course, students should be able to:	RBT
CO1	To Understand classification of Biomaterials with composition, properties, and applications.	(L2)
CO2	CO 2: Analyze Mechanical Properties for combinations of materials (alloy materials) that could be used as a tissue replacement implant.	(L3)
CO3	CO 3: Develop a polymeric materials and combinations for implanting materials	(L5)
CO4	CO 4: Formulate the concepts and designs of various implants to replace soft and hard tissue	(L5)
CO5	CO 5: Apply the knowledge of biomaterials to analyze and design artificial organs.	(L3)

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
PSO 2	Use various tools to provide diagnosis and therapeutic applications
PSO 3	Design and develop healthcare information system

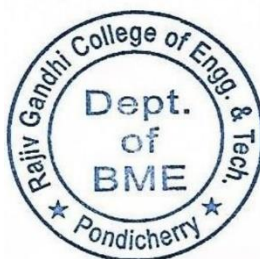


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DEPARTMENT OF BIOMEDICAL ENGINEERING

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3													1	
CO2		3			3	2							3		
CO3		3				2							3		
CO4					3				2						2
CO5			3		2										2
Average	3	3	2.8	2								2	2.75	2.3	1.25



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ACADEMIC YEAR 2023 - 2024

COURSE DETAILS

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
IV / VII	BMT72	DIGITAL IMAGE PROCESSING	55

Course Prerequisites: knowledge about biosignals processing

Course Objectives

- This course gives the knowledge of effectively storing images, extracting interesting patterns from an image, discriminate between different classes of images, and mathematical fundamentals for image processing.
- This may lead to the confidence in developing image-processing applications.

Course Outcomes

COS	Upon successful completion of this course, students should be able to:	RBT
CO1	Review the fundamental concepts of a digital image processing system	(L2)
CO2	Analyze images in the frequency domain using various transforms	(L2)
CO3	Evaluate the techniques for image enhancement and image restoration.	(L2)
CO4	categorize various techniques for image discontinuity and segmentation detection	(L2)
CO5	interpret compression standards and categorize various compression techniques	(L2)

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
PSO 2	Use various tools to provide diagnosis and therapeutic applications
PSO 3	Design and develop healthcare information system



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MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	-	2	-	-	-	-	-	-	-	3	-	-
CO2	3	3	3	3	-	-	-	-	-	-	-	-	-	-	3
CO3	3	3	3	3	-	-	2	2	-	-	-	2	-	-	-
CO4	3	3	3	3	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	3	3	3	-	-	-	-	2	2	-	-	-	-
Average	3	3	3	2.4	1	-	0.4	0.4	-	0.4	0.4	0.4	0.6	0.6	0.6



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ACADEMIC YEAR 2023 - 2024

COURSE DETAILS

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
IV / VII	BME75	RADIOLOGICAL EQUIPMENTS	55

Course Prerequisites: knowledge about medical imaging.

Course Objectives

- Students should gain an in-depth understanding of various types of radiological equipment, including X-ray machines, computed tomography (CT) scanners, magnetic resonance imaging (MRI) machines, ultrasound devices, and nuclear medicine equipment.
- Students should learn the basic principles behind each type of radiological equipment, including the physics of radiation and imaging techniques.

COURSE OUTCOMES

COS	Upon successful completion of this course, students should be able to:	RBT
CO1	Explain and understanding of medical XRAY equipment and the appropriate performance	(L2)
CO2	Explain and understanding of medical CT device and the appropriate performance	(L2)
CO3	To demonstrate an understanding of magnetic resonance imaging device and its performance.	(L2)
CO4	Explain the nuclear medicine system principle, working and operation.	(L2)
CO5	Illustrate and study the radiation therapy and radiation safety.	(L2)

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
PSO 2	Use various tools to provide diagnosis and therapeutic applications
PSO 3	Design and develop healthcare information system



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MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	3	-	-	2	-	-	-	3	-	-
CO2	2	-	-	-	-	3	-	-	2	-	-	-	3	-	-
CO3	2	-	-	-	-	3	-	-	2	-	-	-	3	-	-
CO4	2	-	-	-	-	-	-	-	2	-	-	-	3	-	-
CO5	2	-	-	-	-	-	3	-	2	-	-	-	3	-	-
Average	2	0	0	0	-	1.8	0.6	0	2	0	0	0	3	0	0



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ACADEMIC YEAR 2023 - 2024

COURSE DETAILS

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
IV / VII	BME76	MEDICAL OPTICS	55

Course Prerequisite: Knowledge of maximum utilization of light or laser in Medical field.

Course Objective:

- To provide a sound basic knowledge and understanding of the optical properties of tissues
- To impart knowledge on applications of microscopy techniques including optical coherence tomography and fluorescence microscopy.
- To impart knowledge in laser physics and the principles of the thermal, photochemical and photomechanical effects that light can have on biological tissue.

Course Outcome:

COS	Upon successful completion of this course, students should be able to:	LEVEL
CO1	To provide a sound basic knowledge and understanding of optical properties of tissues.	L4
CO2	To impart knowledge of the fundamentals of optics and applications of basic principles to design and optimize optical instruments used in medical diagnosis	L2
CO3	Knowledge on applications of microscopy techniques including optical coherence tomography and fluorescence microscopy	L1
CO4	Designing geometrical optics and its role in the design of microscopy instruments.	L5
CO5	Knowledge in laser physics and the principles of thermal photochemical and photomechanical effects that light can have on biological tissue.	L2

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
PSO 2	Use various tools to provide diagnosis and therapeutic applications
PSO 3	Design and develop healthcare information system



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DEPARTMENT OF BIOMEDICAL ENGINEERING

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	–	3	1	–	3	3	–	–	–	3	3	2	2	2
CO2	3	–	3	1	–	–	–	3	–	–	–	3	2	2	3
CO3	3	–	–	1	3	–	–	–	–	3	–	3	2	2	3
CO4	3	–	–	1	3	2	3	3	2	2	3	3	2	2	–
CO5	3	3	3	1	3	3	–	2	1	–	–	3	2	2	3
Average	3	0.6	1.8	1	1.8	1	1.2	1.6	1.2	1	1.2	3	2	2.2	1.2



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DEPARTMENT OF BIOMEDICAL ENGINEERING

ACADEMIC YEAR 2023 - 2024

COURSE DETAILS

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
IV / VII	BMP71	MEDICAL IMAGE PROCESSING LAB	55

Course Prerequisites: knowledge about digital image processing

COURSE OBJECTIVES

- Students should gain a fundamental understanding of digital image representation, including pixels, color models (e.g., RGB, grayscale), and image formats.
- Learn Basic Image Processing Techniques: Students should become familiar with basic image processing techniques, including image enhancement, filtering, and transformations.

COURSE OUTCOMES

COS	Upon successful completion of this course, students should be able to:	RBT
CO1	Students should be able to apply image enhancement techniques to improve image quality, including contrast stretching, histogram equalization, and noise reduction.	(L2)
CO2	Ability to Analysis of spatial and intensity resolution of images.	(L2)
CO3	Analyze images using DFT	(L2)
CO4	Ability to use various image enhancement techniques.	(L2)
CO5	Analyze texture of image using statistical properties	(L2)

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
PSO 2	Use various tools to provide diagnosis and therapeutic applications
PSO 3	Design and develop healthcare information system

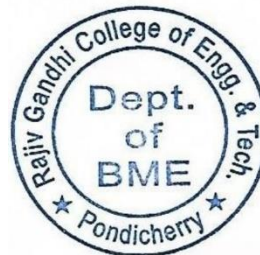


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MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOM

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	-	-	-	-	-	-	-	-	3	2	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	3	2	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	3	2	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	3	2	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	3	2	-	-
Average	3	3	2	0	0	0	0	0	0	0	0	3	2	0	0



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ACADEMIC YEAR 2023 - 2024

COURSE DETAILS

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
IV / VII	BMP72	SEMINAR	55

Course Prerequisites: Spoken English, concern Subject knowledge.

COURSE OBJECTIVES

- To provide confidence to communicate their thoughts.
- To make the ability to presentation of subjects
- To enhance the demonstration of their projects.

COURSE OUTCOMES

COS	Upon successful completion of this course, students should be able to:	RBT
CO1	To improve the communication.	(L2)
CO2	To develop the personality	(L2)
CO3	To create the knowledge shringing	(L2)
CO4	To enhance the confidence	(L2)

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
PSO 2	Use various tools to provide diagnosis and therapeutic applications
PSO 3	Design and develop healthcare information system



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MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	2	-	3	-	-	1	-	3	-	3	-	-	-
CO2	-	-	2	-	3	-	-	1	-	3	-	3	-	-	-
CO3	-	-	2	-	3	-	-	1	-	3	-	3	-	-	-
CO4	-	-	2	-	3	-	-	1	-	3	-	3	-	-	-
Average	0	0	2	0	3	0	0	1	0	3	0	3	0	0	0



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ACADEMIC YEAR 2023 - 2024

COURSE DETAILS

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
IV / VII	BMP73	INDUSTRIAL VISIT	55

Course Prerequisites: Internship

Course Objectives

- To provide the concepts coordination and cooperation for team work
- To provide real time operations of all medical equipment's.

Course Outcomes

COS	Upon successful completion of this course, students should be able to:	RBT
CO1	Ability to handle the medical equipment's.	(L3)
CO2	To develop team coordination.	(L5)
CO3	To develop organizational quality by organizing industrial visit	(L5)

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
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PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
PSO 2	Use various tools to provide diagnosis and therapeutic applications
PSO 3	Design and develop healthcare information system

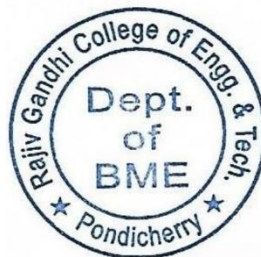


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MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	2	1	-	1	-	1	-	-	1	-	2	-	-
CO2	-	-	2	1	-	1	-	1	-	-	1	-	2	-	-
CO3	-	-	2	1	-	1	-	1	-	-	1	-	2	-	-
CO4	-	-	2	1	-	1	-	1	-	-	1	-	2	-	-
CO5	-	-	2	1	-	1	-	1	-	-	1	-	2	-	-
Average	0	0	2	0	0	1	0	1	0	0	0	0	2	0	0



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DEPARTMENT OF BIOMEDICAL ENGINEERING

ACADEMIC YEAR 2023 - 2024

COURSE DETAILS

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
IV / VII	BMPW7	PROJECT WORK PHASE 1	55

Course Prerequisites: Internship / In-plant training

COURSE OBJECTIVES

- To provide the innovative ideas to solves the problems in healthcare sector.
- To provide depth knowledge in biomedical engineering.

COURSE OUTCOMES

COS	Upon successful completion of this course, students should be able to:	RBT
CO1	To create a new innovative idea	(L6)
CO2	To develop depth knowledge in medical instrumentation	(L5)
CO3	To create research environments	(L6)
CO4	To understand the research methodology.	(L2)

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
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MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	-	-	1	-	1	-	-	-	3	2	-	-
CO2	3	3	2	-	-	1	-	1	-	-	-	3	2	-	-
CO3	3	3	2	-	-	1	-	1	-	-	-	3	2	-	-
CO4	3	3	2	-	-	1	-	1	-	-	-	3	2	-	-
CO5	3	3	2	-	-	1	-	1	-	-	-	3	2	-	-
Average	3	3	2	0	0	1	0	1	0	0	0	3	2	0	0



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SEMESTER IV



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DEPARTMENT OF BIOMEDICAL ENGINEERING

ACADEMIC YEAR 2023 - 2024

COURSE DETAILS

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
II / IV	MAT41	MATHEMATICS IV	43

Course Prerequisite: Basic knowledge for formulas partial differential equation and statistical methods.

COURSE OBJECTIVES

- Importance of problems in Partial Differential Equations
- Problem solving techniques of PDE
- To make the students knowledgeable in the areas of Boundary Value Problems like vibrating string (wave equation), heat equation in one and two dimensions.
- To acquaint the students with the concepts of Theory of sampling.

COURSE OUTCOMES

COS	Upon successful completion of this course, students should be able to:	RBT
CO1	Understand the different types of PDE and will be able to solve problems occurring in the area of engineering and technology.	L2
CO2	Know sampling theory and apply to solve practical problems in engineering and technology.	L2
CO3	Gain the knowledgeable in the areas of boundary value problems like vibrating string (wave equation), heat equation in one and two dimensions.	L2
CO4	understand and implement the concepts of theory sampling.	L6
CO5	Use statistics for inferential decision making with confidence intervals and hypothesis tests under different statistical methods.	L2

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
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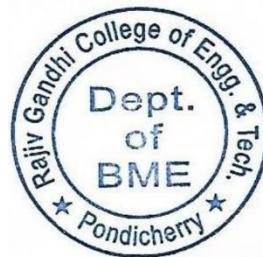


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MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	1	1	-	2	-	3	-	-	2	2	3
CO2	3	3	3	2	3	-	-	2	-	2	-	-	3	3	3
CO3	2	3	2	3	3	1	-	1	3	3	-	-	3	3	3
CO4	3	3	3	3	1	-	-	2	-	2	-	-	1	3	1
CO5	3	3	3	3	3	1	1	2	3	3	-	-	3	3	3
Average	2.8	3	2.8	2.6	2.2	1	0	1.8	1.2	2.6	0	0	2.4	2.8	2.6



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ACADEMIC YEAR 2023 - 2024

COURSE DETAILS

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
II / IV	BMT42	MEDICAL PHYSICS	43

Course Prerequisite: Basic knowledge about Engineering physics

COURSE OBJECTIVES

- To develop basic understanding of medical physics concepts,
- Develop problem-solving and critical-thinking skills,
- Learn to integrate and apply various physics concepts to a single problem,
- Develop scientific communication skills.

COURSE OUTCOMES

COS	Upon successful completion of this course, students should be able to:	RBT
CO1	Describe an imaging system and break it down into its components and physical principles, for each of the imaging modalities covered (x-ray, CT, NM, US, MRI).	(L2)
CO2	Identify the key factors that affect image quality and address these factors for the different imaging modalities.	(L2)
CO3	Learn to communicate the physical principles behind medical technology, radiation safety, and relevant applications.	(L2)
CO4	Apply expert theoretical knowledge and an integrated understanding across all areas of medical physics.	(L2)
CO5	Utilize advanced problem-solving skills to analyze outputs and applying medical physics knowledge into clinical practice.	(L2)

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
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MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	2	-	-	-	-	-	-	-	-	3	2	-	-
CO2	3	-	2	-	-	-	-	-	-	-	-	3	2	-	-
CO3	3	-	2	-	-	-	-	-	-	-	-	3	2	-	-
CO4	3	-	2	-	-	-	-	-	-	-	-	3	2	-	-
CO5	3	-	2	-	-	-	-	-	-	-	-	3	2	-	-
Average	3	0	2	0	0	0	0	0	0	0	0	3	2	0	0



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ACADEMIC YEAR 2023 - 2024

COURSE DETAILS

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
II / IV	BMT43	DIGITAL LOGIC THEORY AND DESIGN	43

Course Prerequisite: Basic knowledge about logic gate.

COURSE OBJECTIVES

- To introduce basic postulates of Boolean algebra and shows the correlation between Boolean expressions
- To introduce the methods for simplifying Boolean expressions
- To outline the formal procedures for the analysis and design of combinational circuits and sequential circuits
- To introduce the concept of memories and programmable logic devices.
- To illustrate the concept of synchronous and asynchronous sequential circuits

COURSE OUTCOMES

COS	Upon successful completion of this course, students should be able to:	RBT
CO1	The students will be able to understand and design of digital circuit and its principle	(L2)
CO2	The students will be able to explain the working of various sequential circuits	(L3)
CO3	Understand the digital Logic families and relevant ICs and its usages	(L2)
CO4	The student will understand algorithmic state machines and threshold logic and its usages	(L2)
CO5	Ability to classify various memory gates	(L3)

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
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PO8	Ethics
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PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
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MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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CO2	3	3	2	-	-	-	-	-	-	-	-	3	2	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	3	2	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	3	2	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	3	2	-	-
Average	3	3	2	0	0	0	0	0	0	0	0	3	2	0	0



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ACADEMIC YEAR 2023 - 2024

COURSE DETAILS

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
II / IV	BMT44	ELECTRICAL AND ELECTRONIC INSTRUMENTS	43

Course Prerequisite: basic knowledge about Electrical and Electronics

COURSE OBJECTIVES

- To have an adequate knowledge in the measurement techniques for current, voltage, power and energy.
- Elaborate discussion about potentiometer & instrument transformers.
- Detailed study of resistance and impedance measuring methods.
- An exposure is given to the student about signal generation and analysis.
- In-depth knowledge is given to the student about cathode ray oscilloscope.
- Emphasis is laid on display and recording devices

COURSE OUTCOMES

COS	Upon successful completion of this course, students should be able to:	RBT
CO1	The students will be able to understand and design of digital circuit and its principle	(L2)
CO2	The students will be able to explain the working of various sequential circuits	(L3)
CO3	Understand the digital Logic families and relevant ICs and its usages	(L2)
CO4	The student will understand algorithmic state machines and threshold logic and its usages	(L2)
CO5	Ability to identify the CRT	(L3)

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
PSO 2	Use various tools to provide diagnosis and therapeutic applications
PSO 3	Design and develop healthcare information system



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DEPARTMENT OF BIOMEDICAL ENGINEERING

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	2	-	-	-	-	-	2	-	-	-	3	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	3	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-	3	-	-
Average	3	3	2	0	0	1	0	1	0	0	0	3	2	0	0



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DEPARTMENT OF BIOMEDICAL ENGINEERING

ACADEMIC YEAR 2023 - 2024

COURSE DETAILS

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
II / IV	BMT45	LINEAR INTEGRATED CIRCUITS	43

Course Prerequisite: Knowledge of Electrical and Electronics Circuits

Course Objective:

- To introduce the basic building blocks of linear integrated circuits.
- To study the linear and non-linear applications of operational amplifiers.
- Understand the concept of analog multipliers and PLL.
- To study the theory of ADC and DAC.
- To introduce the concepts of waveform generation and introduce some special function ICs.

COS	Upon successful completion of this course, students should be able to:	LEVEL
CO1	Design simple circuits like amplifiers using operational amplifiers (OP-amp)	L2
CO2	Design waveform generating circuits.	L2
CO3	Design simple filters circuits for particular application	L2
CO4	Gain knowledge in designing stable voltage regulators	L5
CO5	Design simple Analog to Digital Converter (ADC) and DAC.	L2

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
PSO 2	Use various tools to provide diagnosis and therapeutic applications
PSO 3	Design and develop healthcare information system

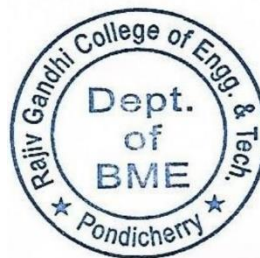


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DEPARTMENT OF BIOMEDICAL ENGINEERING

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	-	-	-	-	-	-	-	-	2	1	-
CO2	3	3	2	2	-	-	-	-	-	-	-	-	2	1	-
CO3	3	3	2	2	-	-	-	-	-	-	-	-	2	1	-
CO4	3	3	2	2		-	-	-	-	-	1	-	2	1	-
CO5	3	3	2	2		-	-	-	3	-	1	-	2	1	-
Average	3	3	2	2			-	0	3	0	1	2	2	1	-



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DEPARTMENT OF BIOMEDICAL ENGINEERING

ACADEMIC YEAR 2023 - 2024

COURSE DETAILS

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
II / IV	BMT46	BIOMEDICAL SENSORS AND TRANSDUCERS	43

Course Prerequisite: Basic knowledge about electrical and electronics

Course Objective:

- To provide the basic principles and design issues of biomedical sensors and instrumentation,
- To gain knowledge on applications of the physical principles of biomedical sensors
- To impart knowledge in analysis of biomedical instrumentation systems.
- To understand the application-specific biomedical sensor and instrumentation design.

COS	Upon successful completion of this course, students should be able to:	LEVEL
CO1	Classify systems modeling biomedical sensors and instrumentation	L2
CO2	Calculate the static and dynamic characteristics of bio instrumentation system	L3
CO3	Analyze fluid mechanics models currently used for clinical research problems	L3
CO4	Designing application-specific biomedical sensor and instrumentation design.	L4
CO5	Knowledge analysis of biomedical instrumentation system.	L6

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
PSO 2	Use various tools to provide diagnosis and therapeutic applications
PSO 3	Design and develop healthcare information system

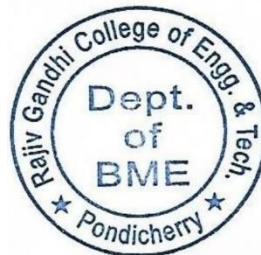


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DEPARTMENT OF BIOMEDICAL ENGINEERING

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	1	–	3	3	–	–	–	3	3	2	2	2
CO2	3	–	3	1	–	–	–	3	–	–	–	3	2	2	3
CO3	3	–	–	1	3	–	–	–	–	3	–	3	2	2	3
CO4	3	–	–	1	3	2	3	3	2	2	3	3	2	2	-
CO5	3	3	3	1	3	3	–	2	1	–	–	3	2	2	3
Average	3	1	1.8	1	1.8	1	1.2	1.6	1.2	1	1.2	3	2	2.2	2



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ACADEMIC YEAR 2023 - 2024

COURSE DETAILS

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
II / IV	BMP41	LINEAR AND DIGITAL INTEGRATED CIRCUITS LAB	43

Course Prerequisites: Basic knowledge about Linear, analog and Digital ICs

COURSE OBJECTIVES

- To understand the basics of linear and digital ICs .
- To study the AC and DC characteristics of operational amplifiers.

COURSE OUTCOMES

COS	Upon successful completion of this course, students should be able to:	RBT
CO1	To selection of linear and digital ICs for various applications	(L3)
CO2	Design various electronics systems such as amplifiers, oscillators and	(L5)
CO3	To create combinational and sequential circuits	(L6)
CO4	Able to analyze the ICs 565 - PLL	(L4)
CO5	To analyze the performance of 4-bit DAC and ADC	(L4)

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
PSO 2	Use various tools to provide diagnosis and therapeutic applications
PSO 3	Design and develop healthcare information system

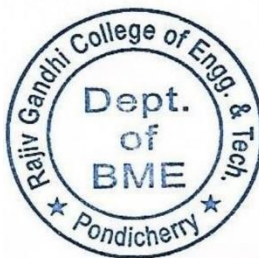


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MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	-	-	-	-	-	-	-	-	-	2	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	2	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-	2	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	2	2	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	2	2	-	-
Average	3	3	2	0	0	0	0	0	0	0	0	2	2	0	0



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ACADEMIC YEAR 2023 - 2024

COURSE DETAILS

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
II / IV	BMP42	BIOMEDICAL SENSORS AND TRANSDUCERS LAB	43

Course Prerequisites: Basic knowledge about electrical and electronic circuits

Course Objectives

- Learn the basic principles of biosensors, including how they detect biological interactions through a transducer.
- Understand different types of transducers (e.g., electrochemical, piezoelectric) and their roles in converting biological signals into measurable data.

Course Outcomes

COS	Upon successful completion of this course, students should be able to:	RBT
CO1	To apply temperature transducers for biological signals	(L3)
CO2	To analyze the pressure and temperature using ICs LM 335, and AD 590 in biological systems	(L3)
CO3	To Determination characteristics of (i) DC Amplifier (ii) Instrumentation Amplifier.	((L3)
CO4	Able to analyze the Characteristics of Ultrasound Transducer and Phono Transducer.	(L3)
CO5	To determination characteristics of Polarized Electrodes, Non-polarized Electrodes, Multi Point Electrodes.	(L3)

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
PSO 2	Use various tools to provide diagnosis and therapeutic applications
PSO 3	Design and develop healthcare information system



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MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	3	2	-	2
CO2	3	2	-	-	-	-	-	-	-	-	-	3	2	-	2
CO3	3	2	-	-	-	-	-	-	-	-	-	3	2	-	2
CO4	3	2	-	-	-	-	-	-	-	-	-	3	2	-	2
Average	3	2	0	0	0	0	0	0	0	0	0	3	2	0	2



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DEPARTMENT OF BIOMEDICAL ENGINEERING

ACADEMIC YEAR 2023 - 2024

COURSE DETAILS

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
II / IV	BMP43	SIMULATION LAB	43

Course Prerequisites: Knowledge about electronic circuits

Course Objectives

- Develop a foundational understanding of the principles and theories behind simulation, including different types of simulations.
- Learn about the various applications of simulation in different fields, such as engineering, business, healthcare, and social sciences.

Course Outcomes

COS	Upon successful completion of this course, students should be able to:	RBT
CO1	Construct the electronic circuit and obtain the result	L4
CO2	Calculate voltage and current value using different theorem	L3
CO3	Analyze the filters and amplifiers	L3
CO4	Build the CMOS circuit and analyze it in various modes	L3

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
PSO 2	Use various tools to provide diagnosis and therapeutic applications
PSO 3	Design and develop healthcare information system



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MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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CO2	3	3	3	3	3	-	-	-	-	-	-	-	-	-	3
CO3	3	3	3	3	3	-	-	-	3	-	-	-	-	-	3
CO4	3	3	3	3	3	-	-	-	-	-	-	-	-	-	3
Average	3	3	3	3	3	0	0	0	1.5	0	0	0	0	0	3



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ACADEMIC YEAR 2023 - 2024

COURSE DETAILS

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
II / IV	BMP44	PHYSICAL EDUCATION	43

COURSE OBJECTIVES

- Develop an understanding of the principles of physical fitness, including cardiovascular endurance, muscular strength, flexibility, and body composition.
- Health Benefits: Recognize the health benefits of regular physical activity and how it contributes to overall well-being.

COURSE OUTCOMES

COS	Upon successful completion of this course, students should be able to:	RBT
CO1	To Create ability to actively participate games and sports.	(L2)
CO2	To Demonstrate improved physical fitness, including cardiovascular endurance, muscular strength, flexibility, and overall body composition.	(L2)
CO3	To create and implement a personalized fitness plan that reflects an understanding of fitness principles and goals.	(L2)

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
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PSO 3	Design and develop healthcare information system

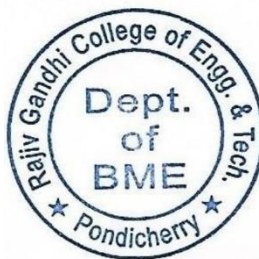


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MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	1	1	2	1	3	-	-	3	1	-	-
CO2	-	-	-	-	1	1	2	1	3	-	-	3	1	-	-
CO3	-	-	-	-	1	1	2	1	3	-	-	3	1	-	-
Average	0	0	0	0	1	1	2	1	3	0	0	3	1	0	0



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DEPARTMENT OF BIOMEDICAL ENGINEERING

SEMESTER VI



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DEPARTMENT OF BIOMEDICAL ENGINEERING

ACADEMIC YEAR 2023 - 2024

COURSE DETAILS

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
III / VI	BMT61	DIAGNOSTIC AND THERAPEUTIC EQUIPMENTS	37

Course Prerequisite: Knowledge Use different medical devices applied in measurement of parameters related to its continuous monitoring and transmission.

Course Objective:

1. Understand the medical devices applied in measurement of parameters related to cardiology,
2. Learn some of the cardiac assist devices
3. Learn to measure the signals generated by muscles
4. Understand the need and use of some of the extracorporeal devices

COS	Upon successful completion of this course, students should be able to:	LEVEL
CO1	Understand the medical devices applied in measurement of parameters related to cardiology, Neurology and the methods of continuous monitoring and transmitting them.	L3
CO2	Measure signals generated by muscles	L1
CO3	Knowledge on applications of microscopy techniques including optical coherence tomography and fluorescence microscopy	L4
CO4	Use different medical devices applied in measurement of parameters related to cardiology, neurology	L6
CO5	Explain about cardiac assist devices, its continuous monitoring and transmission.	L2

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
PSO 2	Use various tools to provide diagnosis and therapeutic applications
PSO 3	Design and develop healthcare information system



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MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3	–	3	2	–	3	–	3	3	3	3	3
CO2	3	2	2	2	3	–	–	3	3	–	2	2	3	3	3
CO3	3	3	3	2	–	–	2	–	3	–	2	2	3	3	3
CO4	3	3	1	2	–	–	–	–	2	–	3	2	3	3	3
CO5	3	1	1	3	3	2	–	2	2	–	2	3	2	3	3
Average	3	2.4	1.8	2.4	1.2	1	0.8	1	2.6	0	2.4	2.4	2.8	3	3



Head of the Department

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DEPARTMENT OF BIOMEDICAL ENGINEERING

ACADEMIC YEAR 2023 - 2024

COURSE DETAILS

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
III / VI	BMT62	TELEMEDICINE	37

Course Prerequisites:

Course Objectives

- To Understand the basic requirement for the delivery of telemedicine services,
- To differentiate and apply telemedicine technology and practices in a variety of health care environments..

Course Outcomes

COS	Upon successful completion of this course, students should be able to:	RBT
CO1	To understand the concept of telemedicine and its system	(L2)
CO2	To understand the basic requirement for the delivery of telemedicine services.	(L2)
CO3	Explain the data exchanges in telemedicine.	(L2)
CO4	Explain the data security and standards.	(L2)
CO5	To differentiate and apply telemedicine technology and practices in a variety of health care environments	(L3)

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
PSO 2	Use various tools to provide diagnosis and therapeutic applications
PSO 3	Design and develop healthcare information system



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DEPARTMENT OF BIOMEDICAL ENGINEERING

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	2	-	-	2	3	-	-
CO2	3	-	-	-	-	-	-	-	2	-	-	2	3	-	-
CO3	3	-	-	-	-	-	-	-	3	-	-	3	3	-	-
CO4	3	-	-	-	-	-	-	-	2	-	-	3	3	-	-
CO5	3	-	-	-	-	3	-	-	2	-	-	3	3	-	-
Average	3	0	0	0	0	0.6	0	0.6	2.2	0	0	2.6	3	0	0



Handwritten signature of the Head of the Department.

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DEPARTMENT OF BIOMEDICAL ENGINEERING

ACADEMIC YEAR 2023 - 2024

COURSE DETAILS

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
III / VI	BMT63	BIOMEDICAL SIGNAL PROCESSING	37

Course Prerequisites: knowledge about signals, Fourier transforms and various filters

Course Objectives

- It provides a solid foundation in advanced biomedical signaling and imaging systems including up-to-date coverage of commercially relevant topics.
- It focuses on biomedical signals, processing the signals, and validate the methods and results for optimization of clinical applications

Course Outcomes

COS	Upon successful completion of this course, students should be able to:	RBT
CO1	Select the function of Signals and system and Compare with relevant Theorem & problems.	(L2,L3)
CO2	Contrast and Identify the function of Discrete time Fourier series , Z – transform ,IIR & FIR filters	(L2,L3)
CO3	Solve the functions of DFT and FFT.	(L2,L3)
CO4	Design of digital filters –FIR & IIR filters.	(L6)
CO5	Analyze how the biomedical Applications are used in all the Signals, System & Fourier series in DFT, FFT with IIR &FIR filters .	(L4)

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
PSO 2	Use various tools to provide diagnosis and therapeutic applications
PSO 3	Design and develop healthcare information system




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MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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CO2	3	3	2	3	3	1	-	-	-	-	-	3	3	2	-
CO3	3	3	2	3	3	1	-	-	-	-	-	3	3	2	-
CO4	3	3	2	3	3	1	-	-	-	-	-	3	2	2	3
CO5	3	3	2	3	3	1	-	-	-	-	-	3	2	2	3
Average	3	3	2	3	3	1	0	0	0	0	0	3	2.6	2	1.2



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DEPARTMENT OF BIOMEDICAL ENGINEERING

ACADEMIC YEAR 2023 - 2024

COURSE DETAILS

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
III / VI	BMT64	EMBEDDED SYSTEM DESIGN	37

Course Prerequisites: knowledge about microprocessor programming

Course Objectives

- To introduce system design concepts to students using microcontrollers with foundational concepts of microcontroller architecture and programming.
- To introduce hardware and software integration for real time systems using microcontrollers and thereby imparting real time system design knowledge to students.

Course Outcomes

COS	Upon successful completion of this course, students should be able to:	RBT
CO1	Foundational knowledge in activating and using a generic microcontroller. Preliminary design considerations for system level implementation.	(L2)
CO2	Knowledge of 8051 Microcontroller hardware features and internal peripherals. Programming knowledge of 8051 microcontrollers	(L2)
CO3	Knowledge of ARM Processor hardware features and internal peripherals. Programming knowledge of ARM Processors.	(L2)
CO4	Software design techniques to be followed for embedded system designing.	(L2)
CO5	Using real time operating systems for embedded systems.	(L2)

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
PSO 2	Use various tools to provide diagnosis and therapeutic applications
PSO 3	Design and develop healthcare information system

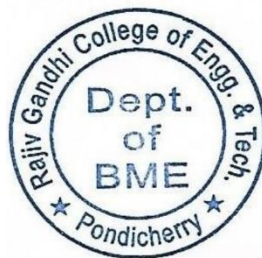


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MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	-	3	-	-	-	-	-	-	3	3	-	3
CO2	3	3	2	-	3	-	-	-	-	-	-	3	3	-	3
CO3	3	3	2	-	3	-	-	-	-	-	-	3	3	-	3
CO4	3	3	2	-	3	-	-	-	-	-	-	3	3	-	3
CO5	3	3	2	-	3	-	-	-	-	-	-	3	3	-	3
Average	3	3	2	0	3	0	0	0	0	0	0	3	3	0	3



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ACADEMIC YEAR 2023 - 2024

COURSE DETAILS

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
III / VI	BMT65	MEDICAL INFORMATICS AND EXPERT SYSTEM	37

Course Prerequisites: knowledge about informatics

Course Objectives

- Medical informatics is the intersection of information science, computer science, and health care.
- It deals with the resources, devices, and methods required to optimize the acquisition, storage, retrieval, and use of information in health and biomedicine.
- Health informatics tools include not only computers but also clinical guidelines, formal medical terminologies, and information and communication systems.

COURSE OUTCOMES

COS	Upon successful completion of this course, students should be able to:	RBT
CO1	To understand usage of computers in healthcare	(L2)
CO2	To understand generation of electronic patient record.	(L2)
CO3	Able to analyze clinical laboratory and medical imaging data.	(L3)
CO4	To create medical decision-making using expert system.	(L6)
CO5	To understand the concept virtual reality in medicine.	(L2)

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
PSO 2	Use various tools to provide diagnosis and therapeutic applications
PSO 3	Design and develop healthcare information system



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MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	-	-	-	-	-	-	-	-	3	2	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	3	2	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	3	2	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	3	2	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	3	2	-	-
Average	3	3	2	0	0	0	0	0	0	0	0	3	2	0	0



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DEPARTMENT OF BIOMEDICAL ENGINEERING

ACADEMIC YEAR 2023 - 2024

COURSE DETAILS

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
III / VI	BME63	MEDICAL IMAGING TECHNIQUE	37

Course Prerequisite: Knowledge of Medical Instrumentation

Course Objective:

- To study the quality assurance test for radiography, method of recording sectional images
- To study the functioning of radio-isotopic imaging equipments.
- Understand the concept of MRI, image acquisition and reconstruction.
- To study the 3-D image display techniques.

COS	Upon successful completion of this course, students should be able to:	LEVEL
CO1	Explain and apply the fundamental concepts of image processing techniques for the analysis of medical images.	L2
CO2	To study the Computer Tomography (CT)images	L2
CO3	To study and Identify the Ultrasound images	L3
CO4	To study and Identify the Radio Nuclide images	L3
CO5	To study the Magnetic Resonance Imaging.	L2

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
PSO 2	Use various tools to provide diagnosis and therapeutic applications
PSO 3	Design and develop healthcare information system

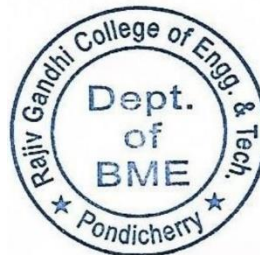


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MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1	-	-	-	-	-	-	-	-	2	1	-
CO2	3	3	1	1	-	-	-	-	-	-	-	-	2	1	-
CO3	3	3	1	1	-	-	-	-	-	-	-	-	2	1	-
CO4	3	3	1	1		-	-	-	-	-	1	-	2	1	-
CO5	3	3	1	1		-	-	-	2	-	1	-	2	1	-
Average	3	3	1	1				0	2	0	1		2	1	-



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DEPARTMENT OF BIOMEDICAL ENGINEERING

ACADEMIC YEAR 2023 - 2024

COURSE DETAILS

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
III / VI	BMP61	DIAGNOSTIC AND THERAPEUTIC EQUIPMENTS LAB	37

Course Prerequisites: knowledge of diagnostic and therapeutic equipment's

Course Objectives

- Students should gain a comprehensive understanding of various diagnostic and therapeutic laboratory techniques, including their principles and applications.
- Students should be able to identify and describe the function of key laboratory equipment and tools used in diagnostics and therapeutics.

Course Outcomes

COS	Upon successful completion of this course, students should be able to:	RBT
CO1	Ability to analyze ECG and Peripheral pulse rate	(L3)
CO2	Able to perform demonstration of short wave / ultrasound diathermy unit	(L4)
CO3	To evaluate the pulmonary function using spirometer.	(L4)
CO4	To perform Pacemaker & Defibrillator analysis	(L4)
CO5	Students able to apply the Audiometry to assay patient audibility	(L3)

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
PSO 2	Use various tools to provide diagnosis and therapeutic applications
PSO 3	Design and develop healthcare information system

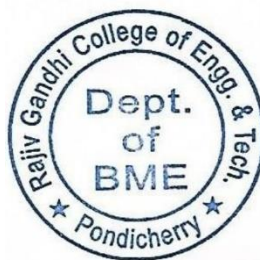


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MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	-	3	2	-	-
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CO3	3	3	-	-	-	-	-	-	-	-	-	3	2	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	3	2	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	3	2	-	-
Average	3	3	0	0	0	0	0	0	0	0	0	3	2	0	0



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DEPARTMENT OF BIOMEDICAL ENGINEERING

ACADEMIC YEAR 2023 - 2024

COURSE DETAILS

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
III / VI	BMP62	BIOMEDICAL SIGNAL PROCESSING LAB	37

Course Prerequisite: knowledge of biosignals and biosignals processing.

Course Objectives

- Students should gain a thorough understanding of the types, characteristics, and sources of biomedical signals, such as ECG, EEG, EMG, and other physiological signals.
- Students should be familiar with key signal processing techniques and algorithms relevant to biomedical signal analysis, including filtering, transformation, and feature extraction.

COURSE OUTCOMES

COS	Upon successful completion of this course, students should be able to:	RBT
CO1	Able to estimate the generation of functional & random sequences and correlate	(L4)
CO2	Ability to Spectrum Analysis using DFT	(L3)
CO3	Students able to generate and analyze ECG & Arrhythmia signal	(L3)
CO4	To measure of hearing threshold using audiometer.	(L2)
CO5	Ability to classify PCG	(L2)

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
PSO 2	Use various tools to provide diagnosis and therapeutic applications
PSO 3	Design and develop healthcare information system



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MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
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CO3	3	3	2	-	-	-	-	-	-	-	-	3	2	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	3	2	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	3	2	-	-
Average	3	3	2	0	0	0	0	0	0	0	0	3	2	0	0



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DEPARTMENT OF BIOMEDICAL ENGINEERING

ACADEMIC YEAR 2023 - 2024

COURSE DETAILS

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
III / VI	BMP63	SYSTEM DESIGN USING MICROCONTROLLERS LAB	37

Course Prerequisite: knowledge about digital logic circuits

Course Objectives

- Students should gain a comprehensive understanding of microcontroller architectures, including CPU, memory, and peripheral components.
- Students should be familiar with programming concepts relevant to microcontrollers, such as interrupts, timers, and I/O operations.

Course Outcomes

COS	Upon successful completion of this course, students should be able to:	RBT
CO1	Ability to acquire data transfer for Block move, Exchange, Sorting, Finding largest element in an array.	(L2)
CO2	Ability to develop arithmetic instructions for 16 b Arithmetic operations – bit addressable.	(L2)
CO3	Able to perform Boolean & Logical Instructions	(L2)
CO4	To develop external ADC and temperature control interface to 8051.	(L2)
CO5	Ability to interface Stepper and DC motor control to 8051.	(L2)

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
PSO 2	Use various tools to provide diagnosis and therapeutic applications
PSO 3	Design and develop healthcare information system



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DEPARTMENT OF BIOMEDICAL ENGINEERING

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	2	-	-	-	-	-	-	-	-	3	2	-	-
CO2	3	-	2	-	-	-	-	-	-	-	-	3	2	-	-
CO3	3	-	2	-	-	-	-	-	-	-	-	3	2	-	-
CO4	3	-	2	-	-	-	-	-	-	-	-	3	2	-	-
CO5	3	-	2	-	-	-	-	-	-	-	-	3	2	-	-
Average	3	0	2	0	0	0	0	0	0	0	0	3	2	0	0



Head of the Department

Head of the Department
 Department of Biomedical Engineering
 Rajiv Gandhi College of Engineering & Technology
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DEPARTMENT OF BIOMEDICAL ENGINEERING

ACADEMIC YEAR 2023 - 2024

COURSE DETAILS

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
III / VI	BMP64	GENERAL PROFICIENCY – II	37

Course Prerequisites: knowledge about English grammar

COURSE OBJECTIVES

- To provide the concepts of functions of a complex variable, conformal mapping, complex integration, series expansion of complex functions, Harmonic analysis and Fourier series.
- To make the students understand and work out problems of constructing analytic functions, conformal mapping, bilinear transformation, contour integration and expanding functions into Fourier series including Harmonic analysis.

COURSE OUTCOMES

COS	Upon successful completion of this course, students should be able to:	RBT
CO1	To ability construct the technical and non-technical passage	(L5)
CO2	Ability to create Job Application Letter Writing & Resume Writing	(L6)
CO3	Students able to perform Group Discussion	(L2)
CO4	To make the students to be adaptation of corporate life	(L3)
CO5	Students' ability to solve Verbal and numerical aptitude	(L3)

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
PSO 2	Use various tools to provide diagnosis and therapeutic applications
PSO 3	Design and develop healthcare information system



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DEPARTMENT OF BIOMEDICAL ENGINEERING

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	2	-	-	1	-	1	-	-	-	1	2	-	-
CO2	-	-	2	-	-	1	-	1	-	-	-	1	2	-	-
CO3	-	-	2	-	-	1	-	1	-	-	-	1	2	-	-
CO4	-	-	2	-	-	1	-	1	-	-	-	1	2	-	-
CO5	-	-	2	-	-	1	-	1	-	-	-	1	2	-	-
Average	0	0	2	0	0	1	0	1	0	0	0	1	2	0	0



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DEPARTMENT OF BIOMEDICAL ENGINEERING

SEMESTER VIII



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DEPARTMENT OF BIOMEDICAL ENGINEERING

ACADEMIC YEAR 2023 - 2024

COURSE DETAILS

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
IV / VIII	BMT81	PROFESSIONAL ETHICS	55

COURSE OBJECTIVES

- To provide the concepts of functions of a complex variable, conformal mapping, complex integration, series expansion of complex functions, Harmonic analysis and Fourier series.
- To make the students understand and work out problems of constructing analytic functions, conformal mapping, bilinear transformation, contour integration and expanding functions into Fourier series including Harmonic analysis.

COURSE OUTCOMES

COS	Upon successful completion of this course, students should be able to:	RBT
CO1	To understand the Engineering Ethics – Moral issues, Ethical theories and their uses	(L2)
CO2	To understand the Engineering as Experimentation – Code of Ethics	(L2)
CO3	To understand Engineer’s responsibility for safety	(L2)
CO4	To understand the Responsibilities and rights	(L2)
CO5	To understand the Global issues of engineering ethics	(L2)

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
PSO 2	Use various tools to provide diagnosis and therapeutic applications
PSO 3	Design and develop healthcare information system

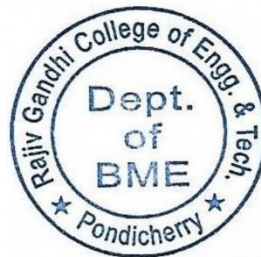


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DEPARTMENT OF BIOMEDICAL ENGINEERING

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	1	-	3	-	-	-	-	-	-	-
CO2	-	-	-	-	-	1	-	3	-	-	-	-	-	-	-
CO3	-	-	-	-	-	1	-	3	-	-	-	-	-	-	-
CO4	-	-	-	-	-	1	-	3	-	-	-	-	-	-	-
CO5	-	-	-	-	-	1	-	3	-	-	-	-	-	-	-
Average	0	0	0	0	0	1	0	3	0	0	0	0	0	0	0



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DEPARTMENT OF BIOMEDICAL ENGINEERING

ACADEMIC YEAR 2023 - 2024

COURSE DETAILS

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
IV / VIII	BMT82	HOSPITAL SAFETY MAHAGEMENT	55

Course Prerequisites: Handling and safety of medical instrumentations

Course Objectives

This course is designed to provide health policy, health organization, health financing system, Safety and Security, Hazardous materials, Emergency management, Fire safety medical equipment, Utility systems

Course Outcomes

COS	Upon successful completion of this course, students should be able to:	RBT
CO1	Ability to analyze and control hazards and risks	(L4)
CO2	Ability to predict and prevent accidents or injuries	(L4)
CO3	To develop safe conditions in the hospitals	(L5)
CO4	To create health financing system	(L6)
CO5	To respond the Emergency management in hospitals.	(L5)

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
PSO 2	Use various tools to provide diagnosis and therapeutic applications
PSO 3	Design and develop healthcare information system

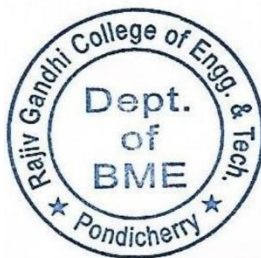


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DEPARTMENT OF BIOMEDICAL ENGINEERING

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	1	-	-	-	3	2	-	2
CO2	3	3	-	-	-	-	-	1	-	-	-	3	2	-	2
CO3	3	3	-	-	-	-	-	1	-	-	-	3	2	-	2
CO4	3	3	-	-	-	-	-	1	-	-	-	3	2	-	2
CO5	3	3	-	-	-	-	-	1	-	-	-	3	2	-	2
Average	3	3	0	0	0	0	0	1	0	0	0	3	2	0	2



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DEPARTMENT OF BIOMEDICAL ENGINEERING

ACADEMIC YEAR 2023 - 2024

COURSE DETAILS

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
IV / VIII	BMT83	BIOMECHANICS	55

Course Prerequisites: Anatomy and Physiology of Human body

COURSE OBJECTIVES

- Course provides the mechanical properties and structural behavior of biological tissues, and biodynamics.
- Specific course topics will include structure and function relationships in tissues and organs; application of stress and strain analysis to biological tissues.

COURSE OUTCOMES

COS	Upon successful completion of this course, students should be able to:	RBT
CO1	Identify a given bone, ligament or muscle by name, anatomic location, or function.	(L4)
CO2	Recall the general characteristics, material properties, appropriate constitutive model, and adaptation potential for tissue and organs studied.	(L2)
CO3	Identify relationships between structure and function in tissues and the implications/importance of these relationships.	(L4)
CO4	Analyze the forces at a skeletal joint for various static and dynamic human activities.	(L4)
CO5	To understand and solve problems in human locomotion	(L2&L4)

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
PSO 2	Use various tools to provide diagnosis and therapeutic applications
PSO 3	Design and develop healthcare information system



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DEPARTMENT OF BIOMEDICAL ENGINEERING

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	-	-	-	-	-	-	-	-	3	3	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	3	3	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	3	3	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	3	3	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	3	3	-	-
Average	3	3	2	0	0	0	0	0	0	0	0	3	3	0	0



Head of the Department

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DEPARTMENT OF BIOMEDICAL ENGINEERING

ACADEMIC YEAR 2023 - 2024

COURSE DETAILS

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
IV / VIII	BME87	REHABILITATION ENGINEERING	55

Course Prerequisites: Bone mechanics and Physiology of human locomotion

Course Objectives

- Study the principles of rehabilitation.
- Know new rehabilitation concepts for future development and applications.
- Learn therapeutic Exercise Techniques.
- Understand orthopedic prosthetics and orthotics in rehabilitation.

Course Outcomes

COS	Upon successful completion of this course, students should be able to:	RBT
CO1	Ability of Rehabilitation Team analyze to provide physical and mental solutions for disabled one	(L4)
CO2	To Study the Principle of Rehabilitation Engineering	(L2)
CO3	To develop therapeutic exercise techniques solution for disabled persons	(L5)
CO4	To understand and explain the principles in management of communication.	(L2)
CO5	Understand The Orthopedic and Prosthetics in Rehabilitation	(L2)

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
PSO 2	Use various tools to provide diagnosis and therapeutic applications
PSO 3	Design and develop healthcare information system



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DEPARTMENT OF BIOMEDICAL ENGINEERING

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	3	2	-	2	-	-	-	3	-	-
CO2	3	-	-	-	-	3	-	-	2	-	-	-	3	-	-
CO3	3	-	-	-	-	3	2	-	3	-	-	-	3	-	-
CO4	3	-	-	-	-	3	-	-	2	-	-	3	3	-	-
CO5	3	-	2	-	-	-	-	-	2	-	-	-	3	-	-
Average	3	0	0.4	0	0	2.4	0.8	0	2.2	0	0	0.6	3	0	0



[Signature]
 Head of the Department

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DEPARTMENT OF BIOMEDICAL ENGINEERING

ACADEMIC YEAR 2023 - 2024

COURSE DETAILS

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
IV / VIII	BMP81	COMPREHENSIVE VIVA VOCE	55

Course Prerequisites: Knowledge about communication and all subjects

Course Objectives

- To analyze the understanding of all Programme core & elective subjects.

Course Outcomes

COS	Upon successful completion of this course, students should be able to:	RBT
CO1	Ability to remember the subjects	(L2)
CO2	Ability defends the subjects	(L2)
CO3	Ability to identify the problems in biomedical engineering concepts	(L2)
CO4	Able to provide the solution for healthcare sector	(L2)
CO5	Ability to share the biomedical engineering thoughts	(L2)

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
PSO 2	Use various tools to provide diagnosis and therapeutic applications
PSO 3	Design and develop healthcare information system



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DEPARTMENT OF BIOMEDICAL ENGINEERING

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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	3	3	-	-	-	-	-	-	-	-	-	3	2	-	2
Average	3	3	0	0	0	0	0	0	0	0	0	3	2	0	2



Head of the Department

Head of the Department

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DEPARTMENT OF BIOMEDICAL ENGINEERING

ACADEMIC YEAR 2023 - 2024

COURSE DETAILS

YEAR / SEM	CODE	SUBJECT NAME	No. of Students Registered
IV / VIII	BMPW8	PROJECT PHASE II	55

Course Prerequisites: Knowledge of designing biomedical projects, preparation of reports

COURSE OBJECTIVES

- To provide analyze the biomedical problems.
- To develop solution for issues in healthcare sectors.

COURSE OUTCOMES

COS	Upon successful completion of this course, students should be able to:	RBT
CO1	Ability to identify the problems in healthcare sector	(L4)
CO2	Ability to design research protocol	(L4)
CO3	Ability to carry out the projects in healthcare sector	(L4)
CO4	Ability to provide solution for healthcare problems	(L5)
CO5	Ability prepares the research report	(L4)

PO AND PSO OVERVIEW

PROGRAM OUTCOMES	
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

PROGRAMME SPECIFIC OUTCOMES	
PSO 1	Addressing the problems associated living systems and non-living systems.
PSO 2	Use various tools to provide diagnosis and therapeutic applications
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MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOME

	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.	Addressing the problems associated living systems and non-living systems.
CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	-	-	1	-	1	-	2	-	3	2	2	2
CO2	3	3	2	-	-	1	-	1	-	2	-	3	2	2	2
CO3	3	3	2	-	-	1	-	1	-	2	-	3	2	2	2
CO4	3	3	2	-	-	1	-	1	-	2	-	3	2	2	2
CO5	3	3	2	-	-	1	-	1	-	2	-	3	2	2	2
Average	3	3	2	0	0	1	0	1	0	2	0	3	2	2	2



Head of the Department

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