PAAVAI ENGINEERING COLLEGE
(AUTONOMOUS)
REGULATIONS 2023
CHOICE BASED CREDIT SYSTEM
B.E.–BIOMEDICAL ENGINEERING
CURRICULUM
(Applicable to the candidates admitted during the academic year 2023-2024 onwards)

SEMESTER III

S.No	Category	Course Code	Course Title	L	T	P	C
Theory							
1	BS	MA23301	Transforms Techniques and Partial Differential Equations	3	1	0	4
2	PC	BM23301	Electron Devices and Circuits	3	0	0	3
3	PC	BM23302	Sensors and Measurements	3	0	0	3
4	PC	BM23303	Anatomy and Human Physiology	3	0	0	3
5	MC	MC23301	Environmental Sciences and Sustainability	2	0	0	0
Integrated Theory							
6	ES	IT23306	Object Oriented Programming with C++	3	0	2	4
Practical							
7	PC	BM23304	Electron Devices and Circuits Laboratory	0	0	4	2
8	PC	BM23305	Sensors and Measurements Laboratory	0	0	4	2
9	EE	GE23301	Professional Development I	0	0	2	1
			Total	**17**	**1**	**12**	**22**

SEMESTER IV

S.No	Category	Course Code	Course Title	L	T	P	C
Theory							
1	BS	MA23402	Probability and Random Processes	3	1	0	4
2	PC	BM23401	Pathology and Microbiology	3	0	0	3
3	PC	BM23402	Biomedical Instrumentation	3	0	0	3
4	PC	BM23403	Microprocessor and Microcontroller	3	0	0	3
5	MC	MC23402	Human Values and Gender Equality	2	0	0	0
Integrated Theory							
6	PC	BM23404	Analog and Digital Integrated Circuits	3	0	2	4
Practical							
7	PC	BM23405	Biomedical Instrumentation Laboratory	0	0	4	2
8	PC	BM23406	Microprocessor and Microcontroller Laboratory	0	0	4	2
9	EE	GE23401	Professional Development II	0	0	2	1
			Total	**17**	**1**	**12**	**22**

MA23301	TRANSFORM TECHNIQUES AND PARTIAL DIFFERENTIAL EQUATIONS	3	1	0	4

(Common to Aero, Agri, BME, Biotech, Civil, Chemical, EEE, Food, Pharma, Mech, MCT, R&A)

COURSE OBJECTIVES

To enable the students to

1	develop the knowledge of periodic and non-periodic functions and their representations using fourier series.
2	acquaint the student with Fourier transform techniques used in wide variety of situations.
3	introduce the basic concepts of PDE for solving standard partial differential equations.
4	acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
5	develop Z transform techniques for discrete time systems.

UNIT I	FOURIER SERIES	12

Dirichlet's conditions; General Fourier series; Odd and even functions; Half range series; Statement of Complex form of Fourier Series; Parseval's identity; Harmonic Analysis.

UNIT II	FOURIER TRANSFORMS	12

Fourier integral theorem (without proof); Fourier transform pair; Sine and Cosine transform - Properties; Transforms of elementary functions; Convolution theorem; Parseval's identity.

UNIT III	PARTIAL DIFFERENTIAL EQUATIONS	12

Formation of partial differential equations; Lagrange's linear equation; Solutions of four standard types of first order partial differential equations; Linear partial differential equations of second order with constant coefficients.

UNIT IV	FOURIER SERIES SOLUTION TO PARTIAL DIFFERENTIAL EQUATIONS	12

Solutions of One-dimensional wave and heat equation; Steady state two-dimensional heat equation.

UNIT V	Z -TRANSFORMS AND DIFFERENCE EQUATIONS	12

Z-transforms - Elementary properties; Inverse Z-transform; Method of partial fraction ; Residue method; Convolution theorem; Solution of difference equations by Z-transform.

	TOTAL PERIODS	60

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	classify the properties of periodic and non-periodic vibrations with the help of Fourier series.	Applying (K3)
CO2	apply the Fourier transform to convert the function from frequency	Applying (K3)

	domain to time domain.	
CO3	demonstrate partial differential equations that occur in many engineering applications.	Applying (K3)
CO4	apply Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.	Applying (K3)
CO5	apply knowledge of Z transform to analyse linear time invariant systems.	Applying (K3)

TEXT BOOKS

1. Veerarajan T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012.
2. Grewal. B.S, "Higher Engineering Mathematics", 44th Edition, Khanna Publications, New Delhi, 2018.

REFERENCES

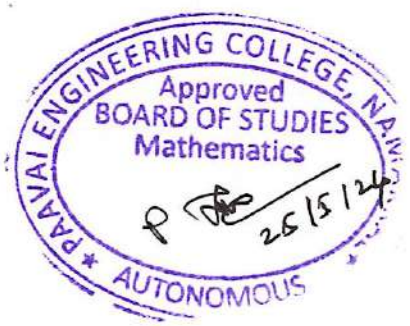
1. Erwin Kreyszig , "Advanced Engineering Mathematics ", 10th Edition, Wiley Publications, New Delhi, India, 2016.
2. Ramana. B.V., "Higher Engineering Mathematics", Tata Mc-Graw Hill Publishing Company limited, New Delhi, 2010.
3. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2007.
4. Wylie. R.C. and Barrett. L.C., "Advanced Engineering Mathematics", Tata Mc-Graw Hill Publishing Company limited, 6th Edition, New Delhi, 2012.

CO-PO MAPPING :

Mapping of Course Outcomes (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes (PSO's)

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

	PO's												PSO's	
CO's	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	2	2	-	-	-	-	-	-	-	3	1	1
CO2	2	3	3	2	-	-	-	-	-	-	-	3	1	1
CO3	3	3	3	2	-	-	-	-	-	-	-	2	2	1
CO4	3	3	3	2	-	-	-	-	-	-	-	2	-	-
CO5	2	3	2	2	-	-	-	-	-	-	-	2	-	-



BM23301	ELECTRON DEVICES AND CIRCUITS	3	0	0	3

COURSE OBJECTIVES	
To enable the students to	
1	understand the concept of diodes and Rectifiers.
2	understand the character of UJT and SCR..
3	impart the knowledge of various configurations, characteristics, applications.
4	categorize the Feedback amplifiers and Oscillators
5	handle display and power devices

UNIT I	PN JUNCTION DIODE	9

PN junction diode - Operation and V-I characteristics-Diffusion and Transition capacitance; Rectifiers- Half wave rectifier, Full wave rectifier, Bridge rectifier; Zener diode –characteristics, Zener diode as regulator; CRO operation.

UNIT II	BIPOLAR JUNCTION TRANSISTOR	9

BJT- NPN-PNP – Operations – Input and Output characteristics of Common Emitter, Common Base, Common Collectror; UJT-Operation and characteristics, SCR -Operation and Characteristics.

UNIT III	FIELD EFFECT TRANSISTOR	9

MOSFET– D-MOSFET and E-MOSFET- Drain and Transfer characteristics, Pinch off voltage and its significance- Threshold voltage; JFET-operation and VI Characteristics.

UNIT IV	FEEDBACK AMPLIFIERS AND OSCILLATORS	9

Voltage / Current, Series , Shunt feedback Amplifiers – positive feedback–Condition for oscillations, RC phase shift – Wien bridge, Hartley, Colpitts and Crystal oscillators; Power amplifiers- class A, class B amplifier.

UNIT V	SPECIAL DEVICES	9

Operation and characteristics of TRIAC, DIAC, Tunnel diode, Photo diode, Photo Transistor-LCD,LED, Laser Diode, LDR.

	TOTAL PERIODS	45

COURSE OUTCOMES		
At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	explain PN junction diode operation, characteristics, and rectifier circuits	Understanding (K2)
CO2	analyze BJT operation in various configurations.	Analyzing (K4)
CO3	explain MOSFET and JFET characteristics and their operation.	Understanding (K2)

CO4	describe feedback amplifier principles, oscillator types, and power amplifier classes.	Understanding (K2)
CO5	discuss special devices, their operation, and characteristics.	Understanding (K2)

TEXT BOOKS

1. David A. Bell, Electric Circuits and Electronic Devices circuits, Oxford University Press, 2010.
2. Sedra and Smith, Micro electronic circuits ,7thEd., Oxford University Press, 27 Jan 2020

REFERENCES

1. Dr.R.SSedha, "A Textbook of Applied Electronics", S CHAND Publication, 2022.
2. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", McGraw-Hill, 6th Edition, 2020.
3. Boylestad & Nashlesky, "Electronic Devices & Circuit Theory", PHI, 10th Edition.
4. Millman & Halkias, "Integrated Electronics", McGraw Hill Publications

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	1	2	-	-	-	-	-	-	-	2	1	-
CO2	2	2	1	2	-	-	-	-	-	-	-	2	1	-
CO3	3	2	1	2	1	-	-	-	-	-	-	2	1	-
CO4	2	2	1	2	1	-	-	-	-	-	-	2	1	-
CO5	3	2	1	2	1	-	-	-	-	-	-	2	1	-

BM23302	SENSORS AND MEASUREMENTS	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1	explain the purpose of measurement, the methods of measurements, errors associated with measurements.
2	understand the principle of transduction, classifications of different transducers.
3	analyze the characteristics of different transducers and its applications.
4	describe the need and function of various signal conditioning circuits.
5	conclude the different display and recording devices.

UNIT I	INTRODUCTION TO MEASUREMENT	9

Measurement System - classification, applications; Elements of a generalized measurement system; Static and dynamic characteristics; Errors in measurement; Statistical evaluation of measurement data; Primary and Secondary Standards.

UNIT II	TRANSDUCERS FOR MEASUREMENT OF NON- ELECTRICAL PARAMETERS	9

Classification of transducers - Measurement of pressure - temperature - displacement - flow; Capacitive Transducers - Resistive Transducers, Strain Gauge-Gauge factor, Thermistor characteristics, Thermocouple; RTD - Smart Sensors - Hall effect Sensors.

UNIT III	PHOTOELECTRIC AND PIEZOELECTRIC SENSORS	9

Phototube - Scintillation counter – Photo Multiplier Tube (PMT) – Photovoltaic - Photo conductive cells - Photo diodes - Phototransistor, Applications of photo electric transducers; Piezoelectric active transducer.

UNIT IV	BRIDGES AND SIGNAL ANALYZER	9

AC and DC Bridges - Wheat stone bridge, Kelvin bridge, Maxwell bridge, Hay bridge, Schering bridge; Distortion analyzer, Heterodyne wave analyzer, spectrum analyzer.

UNIT V	BIOSENSORS	9

Types of modern sensors – Biocatalyst, Enzymes, Isolation of Microorganism, Biosensors, Glucose Electrode; Nanosensors- Measurement of Nanostructure, Generation of Nanostructure, Nanoscale sensors.

	TOTAL PERIODS	45

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	classify the purpose and methods of measurements	Understanding (K2)

CO2	explain the principle of different sensors and its applications	Analyzing (K4)
CO3	describe the characteristics of different transducers.	Understanding (K2)
CO4	illustrate the need and function of various bridges and signal conditioning circuits.	Understanding (K2)
CO5	analyze different biosensors for various applications.	Understanding (K2)

TEXT BOOKS

1. H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw-Hill, New Delhi, 2010
2. L.A.Geddes and L.E.Baker, "Principles of Applied Biomedical Instrumentation", John Wiley and sons, 3rd Edition, Reprint 2008.

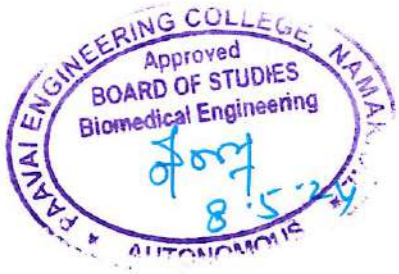
REFERENCES

1. A.K. Sawhney, Puneet Sawhney "A Course in Electrical & Electronic Measurements & Instrumentation", Dhanpat Rai and Co, New Delhi, Edition 2011.
2. M.M.S. Anand, 'Electronics Instruments and Instrumentation Technology', Prentice Hall India, New Delhi, 2009
3. Leslie Cromwell, Fred J. Weibell, Erich A. Preiffer, "Biomedical Instrumentation and Measurements" Prentice Hall India Pvt. Ltd, New Delhi, 2nd Edition, Reprint, 2013.
4. R. K. Rajput, "Electrical and Electronics Measurements and Instrumentation", Chand Pub, 2016.

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

	PO's												PSO's	
CO's	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	1	2	-	-	-	-	-	-	-	2	1	-
CO2	2	2	1	2	-	-	-	-	-	-	-	2	1	-
CO3	3	2	1	2	1	-	-	-	-	-	-	2	1	-
CO4	2	2	1	2	1	-	-	-	-	-	-	2	1	-
CO5	3	2	1	2	1	-	-	-	-	-	-	2	1	-



BM23303	ANATOMY AND HUMAN PHYSIOLOGY	3	0	0	3

COURSE OBJECTIVES	
To enable the students to	
1	be acquainted with basic structural and functional elements of human body..
2	comprehend structure and functions of the various types of systems of human body..
3	provide the knowledge of structure and functioning of nervous system, cardiovascular system, respiratory system, digestive system and musculoskeletal system
4	impart the knowledge of physiological parameters of normal health and factors affecting various physiological processes in the body
5	gain knowledge of organs and structures involving in system formation and functions.

UNIT I	CELL AND TISSUE STRUCTURE	9

Cell; Structure and Organelles - Functions of each component in the cell; Cell membrane Transport across membrane, Origin of cell membrane potential, Action potential. Homeostasis; Tissue: Types Specialized tissues Functions; Basics of organ systems.

UNIT II	RESPIRATORY SYSTEM AND URINARY SYSTEM	9

Respiratory System; Components of respiratory system; Respiratory Mechanism; Types of respiration - Oxygen and carbon dioxide transport and acid base regulation; Urinary system- Structure of Kidney and Nephron; Mechanism of Urine formation, Urinary reflex Homeostasis and blood pressure regulation by urinary system.

UNIT III	CARDIOVASCULAR SYSTEM AND GASTROINTESTINAL SYSTEM	9

Blood composition - Functions of blood, Blood groups, Blood vessels; Structure of heart, Properties of Cardiac muscle, Conducting system of heart, Cardiac cycle, Heart sound; Gastrointestinal system- Introduction - Organs of Digestive system, Digestion and Absorption; Sensory Organs – Eye and Ear.

UNIT IV	SKELETAL AND SPECIAL SENSORY SYSTEM	9

Skeletal system: Bone types and functions Axial Skeleton and Appendicular Skeleton. Joint; Types of Joint Cartilage structure, Types and Functions; Structure of a Neuron Types of Neurons; Neuroglial Cells - Synapses and Types; Brain Divisions of brain lobes; Spinal cord Tracts of spinal cord , Spinal Nerve, Reflex mechanism.

UNIT V	ENDOCRINE AND REPRODUCTIVE SYSTEM	9

Physiology of Pituitary, Thyroid, Parathyroid, Adrenal and Pancreatic hormones and disorders of these glands, Endocrine control of growth and metabolism; Pineal, Thymus, Testes, Ovaries, Physiology of

Reproductive systems, Sex hormones, Physiology of Fertilization, Menstruation, Menopause, Spermatogenesis and Oogenesis, Pregnancy and Parturition and its Clinical disorders.

		TOTAL PERIODS	45

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	reveal basic structural and functional elements of human body.	Understanding (K2)
CO2	enlighten gaseous exchange and fluid maintenance in the human body.	Understanding (K2)
CO3	enlighten organs and structures involving in system formation and functions.	Understanding (K2)
CO4	identify all systems in the human body.	Understanding (K2)
CO5	elucidate special senses in the human body.	Understanding (K2)

TEXT BOOKS

1. Elaine.N. Marieb,"Essential of Human Anatomy and Physiology", 8th Edition, Pearson Education, New Delhi, 2007.
2. Gillian Pocock, Christopher D. Richards, "The Human Body An introduction for Biomedical and Health Sciences", Oxford University Press, USA, 2009.

REFERENCES

1. William F. Ganong – Review of Medical Physiology, 22nd Edition, McGraw Hill, New Delhi, 2010
2. Arthur C. Guyton, "Textbook of Medical Physiology", Elsevier Saunders, 11th Edition, 2006.
3. Eldra Pearl Solomon, - Introduction to Human Anatomy and Physiology, W.B. Saunders Company, 2015.

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1	1	1	-	-	-	-	-	-	-	1	3	3
CO2	2	1	1	1	-	-	-	-	-	-	-	1	3	3
CO3	3	2	1	1	-	2	-	-	-	-	-	1	3	1
CO4	2	2	1	1	-	-	-	-	-	-	-	1	3	1
CO5	3	2	1	1	-	2	-	-	-	-	-	1	3	2

MC23301	ENVIRONMENTAL SCIENCES AND SUSTAINABILITY	2	0	0	0

COURSE OBJECTIVES	
To enable the students to	
1	establish the knowledge of precious resources of the environment and their various impacts.
2	create awareness on ecosystem and biodiversity preserve.
3	learn scientific and technological solutions to current day pollution issues.
4	analyze climate changes, concept of carbon credit and the challenges of environmental management.
5	understand green materials, energy cycles and the role of sustainable urbanization.

UNIT I	ENVIRONMENT AND NATURAL RESOURCES	6

Definition, scope and importance of Environment. Forest resources: Use and over-exploitation, deforestation, - mining, dams and their effects on forests and tribal people. Water resources: Use and over-utilization of surface and ground water, dams-benefits and problems. Food resources: effects of modern agriculture, fertilizer-pesticide problems. Role of an individual in conservation of natural resources.

UNIT II	ECOSYSTEMS AND BIODIVERSITY	6

Concept of an ecosystem: Structure and function of an ecosystem - ecological succession - food chains and food webs. Ecosystems- Types of ecosystem: Introduction - forest ecosystem and lake ecosystems. Biodiversity: Introduction - definition (genetic - species - ecosystem). Diversity - Value of biodiversity - Hotspots of biodiversity - Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

UNIT III	ENVIRONMENTAL POLLUTION	6

Pollution: Définition - air pollution - water pollution - marine pollution - noise pollution. Solid waste management: Causes - effects - control measures of urban and industrial wastes. Role of an individual in prevention of pollution - Electronic waste -Sources-Causes and its effects- Pollution case studies-Field study of local polluted site – Industrial/Agricultural

UNIT IV	SUSTAINABILITY AND ENVIRONMENT	6

Sustainability - from unsustainability to sustainability-millennium development goals, and protocols. Sustainable development goals-targets, indicators and intervention areas. Climate change— acid rain - ozone layer depletion. Regional and local environmental issues and possible solutions-case studies. Concept of carbon credit, carbon footprint. Environmental management in industry-A case study.

UNIT V	SUSTAINABILITY PRACTICES	6

Zero waste and R concept, Circular economy, ISO 14000 Series, Environmental Impact Assessment - Sustainable energy: Non-conventional Sources, Green materials, Energy Cycles - carbon cycle, emission and sequestration, Green Engineering: Sustainable urbanization- Socio economical and technological change.

	TOTAL PERIODS	30

COURSE OUTCOMES		
At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	find the method of conservation of natural resources	Understanding (K2)
CO2	understand ecosystem and the conservation of biodiversity.	Understanding (K2)
CO3	aware of environmental pollution and interpret its effects.	Understanding (K2)
CO4	apply sustainable development for technological advancement and societal development.	Applying (K3)
CO5	measure the sustainability practices for green energy cycles.	Analyzing (K4)

TEXT BOOKS

1. Benny Joseph, "Environmental Science and Engineering", Tata McGraw Hill, 1st edition, 2017.
2. Gilbert M. Masters, Wendell P. Ela " Introduction to Environmental Engineering and Science", 3rd edition, Pearson, 2022.

REFERENCES

1. William P. Cunningham and Mary Ann Cunningham, "Environmental Science: A Global Concern", McGraw Hill, 16th edition, 2023.
2. C. S. Rao, Environmental Pollution and Control engineering, New Age International (P) ltd Publication, New Delhi, 4th edition, 2021.
3. Erach Bharucha, "Textbook of Environmental Studies", Universities Press Pvt. Ltd., edition, 2020.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 4th Edition, 2015.

CO-PO MAPPING :

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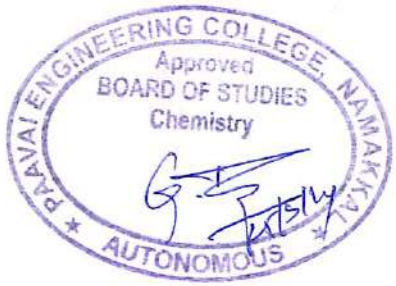
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

	PO's												PSO's	
CO's	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	-	1	-	-	-	2	-	-	1	1	-	-	2	1
CO2	-	2	-	-	1	1	-	1	-	-	-	-	1	1
CO3	2	-	1	1	-	-	-	2	-	-	-	2	1	1
CO4	-	2	-	-	1	-	3	1	1	-	1	1	1	1
CO5	2	2	-	1	-	-	2	1	-	-	-	1	1	1



IT23306	OBJECT ORIENTED PROGRAMMING WITH C++ (Common to EEE and BME)	3	0	2	4

COURSE OBJECTIVES

To enable the students to

1	introduction to C++ and its variables, data type, operators
2	acquire the knowledge about Object Oriented Programming (OOP).
3	study about operator overloading and inheritance in C++.
4	understand the concepts of polymorphism and templates.
5	familiarize the students with templates and generic programming.

UNIT I	INTRODUCTION TO C++	9

Object oriented programming concepts - Introduction to C++, Tokens, Keywords, Identifiers and constants; Basic data types - User defined data types, Derived data types,Symbolic constants; Declaration of variables - Dynamic initialization of variables, Reference variables; Operators in C++ - Scope resolution operator - Manipulators - Expressions and their types - Control structures - The main function – Function prototyping - Call by value - Call by reference - Inline functions -Default arguments - Function overloading

UNIT II	CLASSES AND OBJECTS	9

Specifying a class – Defining member functions, Private member functions, Arrays within a class, Memory allocation for objects, Static data members, Static member functions, Arrays of objects, Objects as function arguments, Friend functions, Returning objects; Constructors - Parameterized constructors, Multiple constructors in a class, Constructors with default arguments, Dynamic initialization of objects, Copy constructor, Dynamic constructors, Destructors.

UNIT III	OPERATOR OVERLOADING AND INHERITANCE	9

Defining operator overloading - Overloading unary, binary operators; Manipulation of strings using operators–Rules for overloading operators– Type Conversions– Inheritance - Defining derived classes, Single inheritance, Multilevel Inheritance, Multiple inheritance, Hierarchical inheritance, Hybrid inheritance; Virtual base classes – Abstract classes.

UNIT IV	POLYMORPHISM AND TEMPLATES	9

Introduction to pointers to objects - This pointer, Pointers to derived classes, Virtual functions, Pure virtual functions; Templates - Function templates, user defined template arguments, class templates.

UNIT V	EXCEPTION HANDING AND GENERIC PROGRAMMING	9

Exception Handling - Exception handling mechanism, multiple catch, nested try, rethrowing the exception – Namespaces – std namespace- Standard Template Library.

LIST OF EXPERIMENTS

1. Write C++ Programs using Classes and Objects.

2.	Design C++ Classes with static members, methods with default arguments, friend functions.
3.	Develop C++ Programs using constructor, destructor, and copy constructor.
4.	Develop C++ Programs Operator Overloading and Inheritance
5.	Develop C++ Programs using Virtual Function and Templates
6.	Develop C++ Programs using Exceptions Handling.
	TOTAL PERIODS **75**

COURSE OUTCOMES		
At the end of this course, students will be able to		**BT Mapped (Highest Level)**
CO1	describe the basic concepts of object-oriented programming with C++.	Understanding (K2)
CO2	analyze a problem and identify classes, objects and the relationships among them.	Analyzing (K4)
CO3	make use of overloading and inheritance concepts to solve real world problems	Applying (K3)
CO4	develop application using polymorphism and templates.	Applying (K3)
CO5	apply the features of exception handling and generic programming.	Applying (K3)

TEXT BOOKS

1. E.Balagurusamy, "Object Oriented Programming with C++", Tata McGraw Hill, Eighth Edition, 2020
2. Herbert Schildt "C++: The Complete Reference", Tata McGraw Hill, 4th Edition, 2017
3. M. M. Mano, "Digital Logic and Computer Design", Pearson Education India, Fourth Edition, Reprint 2019.

REFERENCES

1. Ira Pohl, "Object Oriented Programming using C++", Pearson Education, Second Edition Reprint 2009.
2. S. B. Lippman, JoseeLajoie, Barbara E. Moo, "C++ Primer", Fifth Edition, Pearson Education, 2013.
3. B. Stroustrup, "The C++ Programming language", Third edition, Pearson Education, 2010.
4. Paul Deitel, Harvey Deitel, "C++ How to Program", Tenth Edition, Pearson Education, 2017.

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Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

	Programme Outcomes PO's												**PSO's**	
CO's	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	2	3	2	-	-	-	-	2	-	-	2	2	1
CO2	3	3	3	2	-	-	-	-	2	-	-	2	2	1
CO3	3	3	3	2	-	-	-	-	2	-	-	2	2	1
CO4	3	3	3	2	-	-	-	-	2	-	-	2	2	1
CO5	3	3	3	2	-	-	-	-	2	-	-	2	2	1

BM23304	ELECTRON DEVICES AND CIRCUITS LABORATORY	0	0	4	2

COURSE OBJECTIVES

To enable the students to

1	show the characteristics of basic electronic devices such as Diode.
2	understand the working of Transistors and analyze the concept of feedback amplifiers and oscillators
3	understand the character of UJT and SCR.
4	categorize the Hartley Oscillator / Colpitts Oscillator analyzer

LIST OF EXPERIMENTS

1. Characteristics of PN Junction Diode.
2. Characteristics of Zener diode.
3. Calculate the efficiency and ripple factor for HWR & FWR.
4. Input and Output characteristics of CB,CE,CC Configurations.
5. Characteristics of FET.
6. Characteristics of UJT.
7. Characteristics of SCR.
8. Hartley Oscillator / Colpitts Oscillator.
9. RC phase shift oscillator.
10. Study of CRO.

TOTAL PERIODS	**60**

COURSE OUTCOMES

At the end of this course, students will be able to		**BT Mapped (Highest Level)**
CO1	analyze the characteristics of PN diodes and Zener diodes.	Understanding (K2)
CO2	demonstrate the characteristics of Transistors and SCR.	Applying (K3)
CO3	design the feedback amplifiers and Oscillators and classify the character of UJT and SCR.	Applying (K3)
CO4	categorize the Hartley Oscillator / Colpitts Oscillator analyzer.	Applying (K3)

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2	2	-	1	-	-	-	2	1	2	3	3
CO2	3	2	2	2	-	1	-	-	-	2	1	2	3	3
CO3	3	2	2	2	-	1	-	-	-	2	1	2	3	3
CO4	3	2	2	2	-	2	-	-	-	2	1	2	3	3

BM23305	SENSORS AND MEASUREMENTS LABORATORY	0	0	4	2

COURSE OBJECTIVES

To enable the students to

1	describe the characteristics of various transducers
2	develop temperature sensors.
3	demonstrate light sensors.
4	construct a measurement system for various applications.

LIST OF EXPERIMENTS

1. Characteristics of strain gauges.
2. Displacement measurement using LVDT.
3. Characteristics of temperature sensor-thermistor
4. Characteristics of temperature sensor-RTD.
5. Characteristics of thermocouple.
6. Characteristics of Light sensors-LDR, Photo Diode, Photo Transistor
7. Characteristics of Piezoelectric Transducer
8. Study of Multimeter and Medical Oscilloscope
9. Study of Input / Output characteristics using X Y oscilloscope
10. Force measurement using force sensor and calibration.

TOTAL PERIODS	**60**

COURSE OUTCOMES

At the end of this course, students will be able to		**BT Mapped (Highest Level)**
CO1	design and understand the characteristics and calibration of various transducers	Understanding (K2)
CO2	implement the operations of temperature sensors.	Analyzing (K4)
CO3	design and analyze characteristics of light sensors	Analyzing (K4)
CO4	explain a measurement system for various applications	Analyzing (K4)

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2	2	-	1	-	-	-	2	1	2	1	1
CO2	3	2	2	2	-	1	-	-	-	2	1	2	1	1
CO3	3	2	2	2	-	1	-	-	-	2	1	2	1	1
CO4	3	2	2	2	-	2	-	-	-	2	1	2	1	1

GE23301	PROFESSIONAL DEVELOPMENT I	0	0	2	1

COURSE OBJECTIVES

To enable the students to

1	enhance and evaluate the student's professional skills and introduce the function of corporate world.
2	enhance and develop the students behavioral, speaking and listening skills to face the interview.
3	solve advance level verbal aptitude tests to get placed in Tier I companies.
4	improve their reasoning skills to get placed in reputed companies.

UNIT I	SELF - UNDERSTANDING AND PERSONALITY ENHANCEMENT SKILLS	7

Introduction self-exploration; SWOT analysis - Types and barriers; Effective communication in workplace; Leadership skills; Decision making - Problem solving; Goal setting - Critical, strategic and lateral thinking; JAM level- I; Basic resume building level- I.

UNIT II	BEHAVIOURAL SKILLS, LISTENING AND SPEAKING SKILLS	7

Behaviouralskills; Time management; Emotional intelligence; Analytical thinking- Listening; Listening and hearing; Self-introduction; Group discussion - Types and importance, evaluation criteria, do's and don'ts of GD; GD Level-1.

UNIT III	QUANTITATIVE APTITUDE	8

Number System; LCM and HCF; Simple interest and compound interest; Average; Pipes and cisterns; Area; Profit and loss.

UNIT IV	LOGICAL REASONING	8

Logical sequence; Analogy; Classification; Causes and effect; Making judgment; Directions.

	TOTAL PERIODS	30

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	define and analyze soft skills to improve the leadership skills.	Analyzing (K4)
CO2	demonstrate the behavioral skills through various activities.	Applying (K3)
CO3	develop the problem solving skills through quantitative aptitude.	Applying (K3)
CO4	illustrate the logical reasoning Skills to solve real world problems.	Analyzing (K4)

TEXT BOOKS

1. Agarwal, R.S. "Objective General English", S.Chand & Co.2021.
2. Agarwal, R.S. "Quantitative Aptitude", S.Chand & Co.2021.

REFERENCES

1. Abhijit Guha, "Quantitative Aptitude ", Tata-Mcgraw Hill, 2023.
2. Agarwal, R.S." a modern approach to Verbal & Non Verbal Reasoning", S.Chand & Co Ltd,

New Delhi.2021.

3. Word Power Made Easy By Norman Lewis, Wr.Goyal Publications, 2021.

CO-PO MAPPING :

Mapping of Course Outcomes (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes (PSO's)

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

	PO's												PSO's	
CO's	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	-	-	-	-	-	-	3	3	2	3	-	3	1	1
CO2	-	-	-	-	-	-	2	3	2	3	-	3	1	1
CO3	3	2	2	2	-	1	-	-	-	-	2	-	2	2
CO4	2	1	3	2	-	3	3	1	-	1	2	-	2	2

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English
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AUTONOMOUS

MA23402	PROBABILITY AND RANDOM PROCESSES	3	1	0	4

COURSE OBJECTIVES

To enable the students to

1	analyse the concept of probability
2	understand the concepts of standard distribution methods.
3	differentiate the discrete and continuous two dimensional random variables.
4	provide insight into the classification of random process and Markov process
5	learn applications of microprocessor and microcontroller in biomedical domain.

UNIT I	RANDOM VARIABLES	12

Axioms of probability, Conditional probability, Total probability, Baye's theorem; Random variables - Probability mass functions, Probability density function, Properties; Moments, Moment generating functions and their properties.

UNIT II	STANDARD DISTRIBUTION	12

Binomial, Poisson, Geometric, Uniform, Exponential and Normal distribution and their properties..

UNIT III	TWO DIMENSIONAL RANDOM VARIABLES	12

Functions of random variable; Joint distributions - Marginal and conditional distributions; Covariance, Correlation and Linear regression; Transformation of random variables.

UNIT IV	RANDOM PROCESS AND MARKOV PROCESS	12

Classification - Stationary process (WSS, SSS); Poisson process; Markov Process - Transition probabilities, Markov Chains; Limiting Distributions.

UNIT V	CORRELATION AND SPECTRAL DENSITIES	12

Auto correlation functions, Cross correlation functions, Properties; Power spectral density, Cross spectral density, Properties; Linear time invariant system; System transfer function, Linear systems with random inputs; Autocorrelation and Cross correlation functions of input and output.

	TOTAL PERIODS	60

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	apply the basic probability axioms and concept in the core areas of random phenomena	Applying (K3)
CO2	assign suitable probability distributions in engineering problems.	Applying (K3)
CO3	apply the concept of discrete and continuous two dimensional random variables.	Applying (K3)
CO4	acquire random process techniques in solving real life engineering	Applying (K3)

	problems.	
CO5	analyse the response of random inputs to linear time invariant systems.	Analysing (K3)

TEXT BOOKS

1. T. Veerarajan, "Probability, Statistics and Random Processes", 2nd edition, Tata McGraw- Hill, New Delhi, 2008.
2. Ibe. O.C., "Fundamentals of Applied Probability and Random Processes", Elsevier, 2ndIndian reprint, 2010.

REFERENCES

1. Yates. R.D. and Goodman. D.J., —Probability and Stochastic Processes, 2nd Edition, Wiley India Pvt. Ltd., Bangalore, 2012.
2. Cooper. G.R., McGillem. C.D., —Probabilistic Methods of Signal and System Analysis, 3rd Indian Edition, Oxford University Press, New Delhi, 2012.
3. Hsu and Hwei, —Schaum's Outline of Theory and Problems of Probability, Random variables and Random Processes, Tata McGraw – Hill, New Delhi, 2008.
4. Leon-Garcia, Albert, —Probability and Random Processes for Electrical Engineering, 2nd ed., Pearson Education, 2008.

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	2	3	-	-	-	-	-	-	-	3	1	1
CO2	3	3	3	2	-	-	-	-	-	-	-	2	1	1
CO3	3	2	3	2	-	-	-	-	-	-	-	3	1	-
CO4	3	3	2	3	-	-	-	-	-	-	-	2	1	-
CO5	3	3	2	2	-	-	-	-	-	-	-	3	1	-

BM23401	PATHOLOGY AND MICROBIOLOGY	3	0	0	3

COURSE OBJECTIVES	
To enable the students to	
1	achieve a knowledge on the structural and functional aspects of living organisms
2	be acquainted with the etiology and remedy in treating the pathological diseases.
3	practice on chemical and structural examinations, histopathological examinations etc.
4	empathize the structure and function of human body
5	empathize the structure and function of organs and its synthesize.

UNIT I	CELL DEGENERATION, REPAIR AND NEOPLASIA	9

Cell injury and Necrosis, Apoptosis, Intracellular accumulations, Cellular adaptations of growth and differentiation; Inflammation and Repair including Fracture healing, Neoplasia, Benign and Malignant tumors, Spread of tumors and biopsy; Visualization of histopathological slides of benign and malignant tumors.

UNIT II	FLUID AND HEMODYNAMIC DERANGEMENTS	9

Edema, Normal hemostasis, Thrombosis, Disseminated intravascular coagulation, Embolism, Infarction, shock; Hematological disorders-Bleeding disorders, L Lymphomas; Visualization of hematology Slides of Anemia and Leukemia (acute and chronic); Bleeding time and Clotting time

UNIT III	MICROSCOPES	9

Microscope - Light, Bright field, Dark field, Phase contrast, Fluorescence, Electron microscope –TEM & SEM, Preparation of samples for electron microscope; Staining methods - Simple staining, Gram's staining and AFB staining; Staining techniques Hematoxylin and Eosin staining..

UNIT IV	MICROBIAL CULTURES	9

Morphological features and Structural organization of bacteria, Bacterial growth curve; Sterilization techniques - Physical and Chemical methods, Identification of bacteria; Media - Culture media and its types, Culture techniques and observation of culture; Demonstration on sterilization techniques.

UNIT V	IMMUNOLOGY	9

Natural and artificial immunity, Phagocytosis, Inflammation, Antibodies, Antigen and Antibody reactions, Hypersensitivity; Immunological techniques- Immune diffusion, Immuno electrophoresis, Radioimmuno assay and Enzyme linked Immuno Sorbent Assay, Monoclonal antibodies; Disease caused by bacteria; Visualization of slides of Malarial parasites, Microfilaria and Leishmaniadonovani.

	TOTAL PERIODS	45

COURSE OUTCOMES		
At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	understand structural and functional aspects of living organisms	Understanding (K2)
CO2	recall the function of microscope	Understanding (K2)
CO3	confer the importance of public health.	Applying (K3)
CO4	analyze treatment methods involved in curing the pathological diseases	Understanding (K2)
CO5	perform practical experiments on tissue processing, sterilization techniques and staining processes.	Applying (K3)

TEXT BOOKS

1. Ramzi S. Cotran, Vinay Kumar and StanleyL Robbins, Pathologic Basis of Diseases,7th edition, WB Saunders Co. 2005 (Units I and II).
2. Harsh Mohan "Text book of Pathology", Jaypee brothers Medical publishers private limited, 7th edition 2014.

REFERENCES

1. Underwood JCE: General and Systematic Pathology Churchill Livingstone, 3rd edition, 2000.
2. Anantha Narayanan, "Microbiology, panikkar University press,9th edition 2013.
3. Dubey RC and Maheswari DK. A Text Book of Microbiology, Chand and Company Ltd,2007.
4. Prescott ,Harley and Klein, Microbiology ,10thedition,McGrawHill,2017

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1	1	1	-	-	-	-	-	-	-	1	3	3
CO2	2	1	1	1	-	-	-	-	-	-	-	1	3	3
CO3	3	2	1	1	-	2	-	-	-	-	-	1	3	1
CO4	2	2	1	1	-	-	-	-	-	-	-	1	3	1
CO5	3	2	1	1	-	2	-	-	-	-	-	1	3	2

BM23402	BIOMEDICAL INSTRUMENTATION	3	0	0	3

COURSE OBJECTIVES	
To enable the students to	
1	explain the basic theory of Bio potential Electrodes.
2	illustrate the concept of Bio potential measurement.
3	design Bio potential amplifiers for acquisition of bio signals.
4	study the various non-electrical physiological parameter measurement.
5	outline the biochemical measurements.

UNIT I	BIOPOTENTIAL ELECTRODES CONFIGURATIONS	9

Origin of Bio potential and its Propagation Frequency and amplitude ranges; Electrode-electrolyte interface, Electrode skin interface, Half-cellpotential, Impedance; Polarization effects of electrode and Non-Polarizable electrodes; Types of electrodes - Surface electrode, needle electrode and Micro electrodes and their equivalent circuits; Measurement with two electrodes.

UNIT II	BIOSIGNAL CHARACTERISTICS	9

Biosignal characteristics, Frequency and Amplitude ranges; ECG- Einthoven's triangle Standard 12 lead system,Block diagram; Measurements of heart sounds PCG; EEG 10-20 electrode system, Unipolar, Bipolar and Average mode, Functional block diagram; EMG - Unipolar and Bipolar mode, Block diagram; EOG and ERG.

UNIT III	SIGNAL CONDITIONING CIRCUITS BIOPOTENTIAL AMPLIFIER	9

Need for Bio-amplifier - Single ended bio-amplifier, Differential bio-amplifier,Right leg driven ECG amplifier,Band pass filtering, Isolation amplifiers, Transformer and Optical isolation, Isolated DC amplifier and AC carrier amplifier; Artifacts and removal.

UNIT IV	NON-ELECTRICAL PHYSIOLOGICAL PARAMETER MEASUREMENT	9

Temperature, Respiration rate and Pulse rate measurements, Plethysmography, Pulse oximetry; Blood Pressure; Direct methods - Basic principle of Sphygmomanometer; Pressureamplifiers, Systolic, Diastolic, Mean detector circuit; Indirect methods – Auscultatory method, Oscillo metric method, Ultrasonic method; Blood flow - Electromagnetic and Ultrasound blood flow measurement;Cardiac output measurement- Indicator dilution, Dye dilution and Thermodilution method.

UNIT V	HAEMOTOLOGICAL INSTRUMENTS AND ANALYSIS TECHNIQUES	9

Clinical Laboratory instruments- Medical Diagnosis with chemical tests; Biochemical sensors - pH, pO2 and pCO2, Ion Selective Field Effect Transistor (ISFET), Immunologically Sensitive FET (IMFET);

Blood glucose sensors - Blood gas analysers, colorimeter, Flame photometer, Spectrophotometer, Blood cell counter, Auto analyser.

		TOTAL PERIODS	45
COURSE OUTCOMES			
At the end of this course, students will be able to		**BT Mapped (Highest Level)**	
CO1	understand the electrode behavior and circuit models.	Understanding (K2)	
CO2	describe the fundamentals of Bio potential recording.	Understanding (K2)	
CO3	design various bio amplifiers.	Applying (K3)	
CO4	measure various nonelectrical physiological parameters.	Understanding (K2)	
CO5	measure various biochemical parameters.	Applying (K3)	

TEXT BOOKS

1. Joseph J. Carr and John Brown, "Introduction to Biomedical Equipment Technology", Pearson Education, 4th Edition, 2014
2. John G Webster, "Medical Instrumentation Application and Design", John Wiley and Sons, New York, 4th Edition, 2009.

REFERENCES

1. Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw Hill, New Delhi, 3rd Edition, 2014.
2. Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, Biomedical Instrumentation and Measurements, Pearson Education India, 2nd Edition, 2015.

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1	1	1	-	-	-	-	-	-	-	1	3	3
CO2	2	1	1	1	-	-	-	-	-	-	-	1	3	3
CO3	3	2	1	1	-	2	-	-	-	-	-	1	3	1
CO4	2	2	1	1	-	-	-	-	-	-	-	1	3	1
CO5	3	2	1	1	-	2	-	-	-	-	-	1	3	2

BM23403	MICROPROCESSOR AND MICROCONTROLLER	3	0	0	3

COURSE OBJECTIVES	
To enable the students to	
1	explain the architecture of 8086 microprocessor.
2	describe the architecture of 8051 microprocessor.
3	interface microprocessors with supporting chips.
4	familiarize about ARM microcontroller.
5	learn applications of microprocessor and microcontroller in biomedical domain.

UNIT I	8086 MICROPROCESSOR	9

Introduction To 8086- Microprocessor, Architecture, Minimum and Maximum Mode, Interrupts of 8086, Operand Types, Addressing Modes, Instruction Set and Assembler Directives, Byte and String Manipulation; Assembly Language Programming, Arithmetic Operation- addition, subtraction, division, multiplication of 8 bit and 16 bit; logical operation- AND, OR, NOT, XOR.

UNIT II	8051 MICROCONTROLLER	9

Introduction To 8 Bit Microcontroller; Signal Descriptions of 8051, Architecture of 8051, Special Function Register; Addressing Mode, Instruction Set; Assembly Language Programming, Arithmetic Operation - addition, subtraction, division, multiplication; logical operation- AND, OR, NOT, XOR.

UNIT III	I/O INTERFACE AND 8051 INTERFACING WITH MEMORY DEVICES	9

8255 Programmable Peripheral Interface; Timer, Serial Communication; 8051 Interfacing to External Memory; Interfacing 8051 to ADC, Liquid Crystal Display (LCD), Keyboard and Stepper Motor.

UNIT IV	ARM MICROCONTROLLER	9

Fundamentals-registers, Current Program Status Register, Pipeline, Exceptions, Barrel Shifter, Interrupts and Vector Table, ARM Architecture, ARM Instruction Set, Thumb Instruction Set.

UNIT V	APPLICATIONS IN MEDICINE	9

Mobile Phone Based Bio Signal Recording; Design of Pulse Oximeter Circuit Using ARM Microcontroller; Design of EOG Based Home Appliances Using ARM Microcontroller; Design of Heart Rate Monitoring Circuit Using ARM Microcontroller.

	TOTAL PERIODS	45

COURSE OUTCOMES		
At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	recognize any architecture and assembly language for a processor.	Understanding (K2)
CO2	understand the architectural and pipelining concepts for	Understanding (K2)

	Microprocessors.	
CO3	design and deploy the Interfacing peripherals in real time scenario	Applying (K3)
CO4	design, develop and trouble shoot microcontroller-based system.	Understanding (K2)
CO5	implement microcontroller –based systems in biomedical domain.	Applying (K3)

TEXT BOOKS

1. Yu-Cheng Liu, Glenn A. Gibson, "Microcomputer Systems: The 8086/8088 Family-Architecture ,Programming and Design", Second Edition ,Prentice Hall o India,2007
2. Douglas V.Hall , "Microprocessor and Interfacing .Programming and Hardware", Glencoe, 2nd Edition,2010

REFERENCES

1. Krishna Kant, Microprocessor and Microcontroller Architecture and programming and System Design using 8085,8086,8051 and 8096,PHI,2007,Seventh Reprint,2011
2. Andrew N.Sloss, Donimic Symes, Chris Wright, "ARM System Developer's Guide", Elsevier, 1st Edition,2009
3. Muhammad Ali Mazidi, Janice Gillisple Mazidi "Microprocessor and Microcontroller and Embedded System "Pearson Education",2nd Edition Indian reprint,2014

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1	1	1	-	-	-	-	-	-	-	1	3	3
CO2	2	1	1	1	-	-	-	-	-	-	-	1	3	3
CO3	3	2	1	1	-	2	-	-	-	-	-	1	3	1
CO4	2	2	1	1	-	-	-	-	-	-	-	1	3	1
CO5	3	2	1	1	-	2	-	-	-	-	-	1	3	2

MC23402	HUMAN VALUES AND GENDER EQUALITY	2	0	0	0

COURSE OBJECTIVES

To enable the students to

1	define different types of human values and their impact on individual behaviour and societal norms.
2	apply principles of personal development such as self-confidence, self-discipline, and resilience to navigate modern challenges effectively.
3	evaluate the role of values in shaping professional ethics, civic sense and global citizenship.
4	examine the socio-economic factors influencing gender inequality and explore avenues for empowerment and advocacy.
5	critically analyze prevalent issues and challenges faced by women, including gender-based violence, discrimination, and cultural biases, and propose measures for their eradication.

UNIT I	HUMAN VALUES	6

Value Education - Definition, Types of values; Human values - Acceptance, Consideration. Appreciation, Listening. Empathy, Sympathy, Honesty, Integrity, Wisdom, Decision making, Self-actualization, Character formation towards positive personality, Contentment; - Religious Values - Humility, Compassion, Gratitude, Peace, Justice, Freedom, Equality.

UNIT II	PERSONALITY DEVELOPMENT	6

Personal Development - Introspection, Self-confidence, Self-discipline; Flexibility -Peer pressure - Sensitization towards Gender Equality; Reliability; Unity; Modern Challenges of Adolescent Emotions and behavior - Comparison and Competition, Positive and Negative attitudes; Family values; Self- improvement - Physical exercises, Meditation ,Yoga.

UNIT III	VALUE EDUCATION TOWARDS NATIONAL AND GLOBAL DEVELOPMENT	6

Professional Values -. Integrity, Responsibility, Punctuality, Dedication - Perseverance - Competence; Civic sense and Responsibility; Global Values - Computer Ethics, Moral Leadership, Code of Conduct; Corporate Social Responsibility; Aesthetic values; National Integration and International understanding of Religious Values – Spirituality, thought process.

UNIT IV	GENDER EQUALITY	6

Gender Equality - Definition, Empowerment, Economic Equality; Condition of Women in India-Education, Healthcare, Political Representation, Gender-based Violence; Challenging Stereotypes: Parental and Caregiving Responsibilities; Legal and Policy Reform; Cultural Shifts; Global Perspective; Male Chauvinism; Sustainable Development..

UNIT V	WOMEN ISSUES AND CHALLENGES	6

Women Issues and Challenges - female feticide, violence against women; Domestic violence- dowry

related abuse and deaths, Physical violence, Emotional abuse; Sexual assault; Honour killing; Eve-teasing- Stalking, e-stalking (cyber-crime).	
	TOTAL PERIODS **30**

COURSE OUTCOMES		
At the end of this course, students will be able to		**BT Mapped (Highest Level)**
CO1	discuss the concept of human values and their significance in personal and societal development.	Understanding (K2)
CO2	demonstrate introspective skills to enhance personal growth and self-awareness.	Applying (K3)
CO3	recognize the importance of gender equality in promoting a just and equitable society.	Understanding (K2)
CO4	cultivate a sense of social responsibility and ethical conduct towards achieving national and global development.	Analyzing(K4)
CO5	analyse the challenges faced by women in various spheres and identify strategies for addressing them.	Analyzing(K4)

TEXT BOOKS

1. A Foundation Course in Human Values and Professional Ethics: Presenting a Universal Approach to Value Education - Through Self-exploration. New Delhi, 2016.
2. Aurther, John. Personality Development. Lotus Press, 2018.

REFERENCES

1. Joshi, Dhananjay. Value Education in Global Perspective. Lotus Press, 2014.
2. Mahrotra, Mamta. Gender Inequality in India: Challenging Social Norms. Prabhat Books, 2015.

CO-PO MAPPING:

Mapping of Course Outcomes (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes (PSO's)

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

	PO's												**PSO's**	
CO's	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	-	1	-	1	1	1	2	3	2	1	1	3	-	-
CO2	-	1	-	1	1	1	3	3	2	2	1	1	-	-
CO3	-	1	-	1	1	1	2	3	1	1	1	3	-	-
CO4	-	1	-	1	1	1	2	3	2	2	1	2	-	-
CO5	-	1	-	1	1	1	1	3	2	2	1	3	-	-

BM23404	ANALOG AND DIGITAL INTRGRATED CIRCUITS	3	0	2	4

COURSE OBJECTIVES

To enable the students to

1	study the circuit configuration and introduces practical application of linear circuits.
2	understand the concept of application of ADC and DAC in real time systems.
3	learn Boolean algebra and apply it to digital systems.
4	design various combinational digital circuits using logic gates.
5	analyze the design procedures for sequential circuits.

UNIT I	INTRODUCTIONTO OPERATIONAL AMPLIFIER	9

Operational amplifier; Applications of OpAmp-Voltage follower, Inverting amplifier, Non-inverting amplifier, Differentiator, Integrator, Instrumentation amplifier; First order filters- low pass, high pass; Comparator, Multivibrator, Schmitt Trigger, Triangular wave generator.

UNIT II	DIGITAL TO ANALOG AND ANALOG TO DIGITAL CONVERTERS	9

D/A converters- weighted resistor, R-2R ladder and inverted; D/A accuracy and resolution; A/D converter- flash, dual slope, successive approximation, A/D accuracy and resolution; Voltage controlled oscillator; Voltage to frequency converter; PLL and its applications.

UNIT III	NUMBER SYSTEMS AND LOGIC CIRCUITS	9

Number systems- decimal, binary, octal, hexadecimal, 1's and 2's complement; Boolean theorems- De Morgan's theorem, Logic gates; Universal gates; Sum of products, product of sums; Simplifying expressions using Karnaugh map.

UNIT IV	CODE CONVERTERS AND COMBINATIONAL CIRCUITS	9

Code converters - binary to gray, gray to binary, BCD to excess-3, excess-3 to BCD; Design of combinational circuits - Half adder, full adder, carry look ahead adder, BCD adder, magnitude comparator; Encoder, Decoder, Mux/Demux; PLA,PAL

UNIT V	SEQUENTIAL LOGIC CIRCUITS	9

Flip flops- SR, JK,T,D, master/slave FF; Analysis and design of clocked sequential circuits- state minimization, state assignment, circuit implementation; Counters- mod-n counter, ripple counter, ring counter; Shift Registers- serial in serial out, serial in parallel out, parallel in parallel out, parallel in serial out.

LIST OF EXPERIMENTS

1. Inverting and non-inverting amplifier.
2. Integrator and Differentiator
3. Instrumentation Amplifier using operational amplifier.
4. Design and implementation of Adder and Subtractor using logic gates.

5. Implementation of 4x1 multiplexer and 1x4 demultiplexer using logic gates.		
6. Realization and verification of encoder and decoder using logic gates.		
7. Design and Implementation of 2-bit Magnitude comparator		
	TOTAL PERIODS	**75**

COURSE OUTCOMES		
At the end of this course, students will be able to		**BT Mapped (Highest Level)**
CO1	identify analog linear circuits and develop linear IC based systems.	Understanding (K2)
CO2	understand the concept of application of ADC and DAC in real time systems.	Analyzing (K4)
CO3	apply boolean algebra and apply it to digital systems.	Applying (K3)
CO4	design various combinational digital circuits using logic gates.	Applying (K3)
CO5	analyze and design the sequential circuits	Applying (K3)

TEXT BOOKS

1. Serigo Franco, "Design with operational amplifiers and analog integrated circuits", McGraw Hill Eduction, 3rd Edition, 2017.
2. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, Fourth Edition, 2016.
3. M. M. Mano, "Digital Logic and Computer Design", Pearson Education India, Fourth Edition, Reprint 2019.

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1. Gray and Meyer, "Analysis and Design of Analog integrated circuits", Wiely International, 2009.
2. Michel Jacob J, "Applications and design with Analog Integrated Circuits", Prentice Hall of India, 2nd Edition, 2008.
3. Ramkant A. Gayakwad, "OP-AMP and linear IC's", Prentice Hall, 2012.
4. John. F. Wakerly, "Digital design principles and practices", Pearson Education, 5th Edition, 2018.

CO-PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

	Programme Outcomes PO's												**PSO's**	
CO's	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	-	-	-	-	-	-	2	-	-	1	3	3
CO2	3	2	2	1	-	-	-	-	2	-	-	1	3	3
CO3	3	2	2	1	-	-	-	-	2	-	-	1	3	3
CO4	3	2	2	1	-	-	-	-	2	-	-	2	3	3
CO5	3	1	1	-	-	-	-	-	2	-	-	2	3	3

BM23405	BIOMEDICAL INSTRUMENTATION LABORATORY	0	0	4	2

COURSE OBJECTIVES

To enable the students to

1	design and study about bioamplifiers
2	provide hands on training on measurement of heart sounds, pulse rate.
3	demonstrate the measurements of physiological parameters.
4	find various vital parameters using patient monitoring system.

LIST OF EXPERIMENTS

1. Design of low noise pre-amplifier.
2. Design of ECG amplifier and Measurement of heart rate.
3. Design of EMG amplifier.
4. Measurement of heart sounds using PCG.
5. Measurement of pulse-rate using Photo Transducer.
6. Measurement of Respiration rate.
7. Measurement of P_h and Conductivity.
8. Measure Earth resistance using Resistance meter and find leakage current.
9. Characteristics of Optical Isolation amplifiers.
10. Measurement of vital parameters using Patient Monitoring System.
11. Study of Biotelemetry.
12. Calibration of Medical Equipment.

TOTAL PERIODS	**60**

COURSE OUTCOMES

At the end of this course, students will be able to		**BT Mapped (Highest Level)**
CO1	to design the amplifier for bio signal.	Understanding (K2)
CO2	measure heart rate and heart sounds.	Applying (K3)
CO3	record and analyze pulse rate and respiration rate.	Applying (K3)
CO4	measure blood pressure and blood flow.	Applying (K3)

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

	PO's												PSO's	
CO's	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	2	2	-	1	-	-	-	2	1	2	3	3
CO2	3	2	2	2	-	1	-	-	-	2	1	2	3	3
CO3	3	2	2	2	-	1	-	-	-	2	1	2	3	3
CO4	3	2	2	2	-	2	-	-	-	2	1	2	3	3

BM23406	MICROPROCESSOR AND MICROCONTROLLER LABORATORY	0	0	4	2

COURSE OBJECTIVES	
To enable the students to	
1	implement the assembly language programming of 8086 and 8051
2	experiment the interface concept of various peripheral devices with the processor
3	understanding the basic idea about the data transfer schemes and its applications
4	experiment the interface concept of various peripheral devices with the controller

LIST OF EXPERIMENTS

Assembly Language Programming using 8086 Microprocessor

1. Arithmetic and Logical operation.
2. Move a data block without overlapping.
3. String manipulation.
4. Sorting and Searching.

Interfacing with 8086 Microprocessor

5. Stepper motor control.
6. Key board and Display.
7. Serial Interface.
8. Parallel Interface.

Assembly Language Programming using 8051 Microcontroller

1. Basic arithmetic and logical operations.
2. ADC and DAC interface.
3. Traffic Light controller.

	TOTAL PERIODS	60

COURSE OUTCOMES		
At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	write program for various applications using16-bit Processor	Understanding (K2)
CO2	write assembly language programs for 8051	Applying (K3)
CO3	microprocessor and microcontrollers interface various peripherals	Applying (K3)
CO4	simulate programs for specific applications	Applying (K3)

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2	2	-	1	-	-	-	2	1	2	3	3
CO2	3	2	2	2	-	1	-	-	-	2	1	2	3	3
CO3	3	2	2	2	-	1	-	-	-	2	1	2	3	3
CO4	3	2	2	2	-	2	-	-	-	2	1	2	3	3

GE23401	PROFESSIONAL DEVELOPMENT II	0	0	2	1

COURSE OBJECTIVES

To enable the students to

1	enhance their own behavioural skills to survive in corporate world.
2	evaluate their listening and speaking skills to face the interviews in a successful way.
3	solve advance level verbal aptitude tests to get placed in Tier I companies.
4	improve their reasoning skills to get placed in reputed companies.

UNIT I	WRITING SKILLS	7

Email writing; Fixing and cancelling appointments; Paper submission for seminars and conferences; Business communication; Stress management; Body language; Dress code; Self-introduction II; Update resume building II; JAM level -3.

UNIT II	PRESENTATION SKILLS	7

Presentation skills - Types and methods of delivering presentation, ways and methods to improve presentation skills; Mini presentation in smaller groups; Situational role play; Face to face interview; Group discussion level IL; JAM Level-4.

UNIT III	QUANTITATIVE APTITUDE - I	8

Simplification; Time, speed and distance; Trains; Boats and streams; Ratio and proportion; Partnership; Percentage.

UNIT IV	LOGICAL REASONING	8

Seating arrangement; Arithmetic reasoning; Character puzzle; Syllogisms; Matching definitions; Statements and arguments.

	TOTAL PERIODS	30

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	interpret the personality development through various activities.	Understanding (K2)
CO2	examine speaking and listening skills to excel in their jobs.	Analyzing (K4)
CO3	develop the quantitative skills and analytical skills to face the interview.	Applying (K3)
CO4	extend the reasoning abilities by scoring exceeded percentage to get placed in reputed companies.	Understanding (K2)

TEXT BOOKS

1. Agarwal, R.S. "Objective General English", S.Chand & Co., 2021.
2. Agarwal, R.S. "Quantitative Aptitude", S.Chand & Co., 2021.

REFERENCES

1. Abhijit Guha, "Quantitative Aptitude ", Tata-Mcgraw Hill, 2023.

2. Agarwal, R.S." a modern approach to Verbal & Non Verbal Reasoning", S.Chand & Co Ltd, New Delhi., 2021.

3. Word Power Made Easy By Norman Lewis, Wr.Goyal Publications, 2021.

CO-PO MAPPING :

Mapping of Course Outcomes (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes (PSO's)

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

	PO's												PSO's	
CO's	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	-	-	-	-	-	-	3	3	2	3	-	3	1	2
CO2	-	-	-	-	-	-	2	3	2	3	-	3	1	2
CO3	3	2	2	-	-	1	-	-	-	-	2	-	2	2
CO4	2	3	3	2	-	3	3	1	-	1	2	-	2	2

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