SEMESTER III

S.No	Category	Course Code	Course Title	L	T	P	C
Theory							
1	BS	MA16301	Transforms and Boundry Value Problems	3	2	0	4
2	ES	BM16301	Electron Devices and Circuits	3	0	0	3
3	PC	BM16302	Signals and Systems	3	2	0	4
4	PC	BM16303	Digital Electronics	3	0	0	3
5	PC	BM16304	Anatomy and Human Physiology	3	0	0	3
6	PC	BM16305	Biosensors and Measurement Devices	3	0	0	3
Practical							
7	PC	BM16306	Biosensors and Measurement Devices Laboratory	0	0	4	2
8	PC	BM16307	Digital Electronics Laboratory	0	0	4	2
9	ES	BM16308	Electronic Devices and Circuits Laboratory	0	0	4	2
			TOTAL	**18**	**4**	**12**	**26**
			Cumulative Total				**74**

SEMESTER IV

S.No	Category	Course Code	Course Title	L	T	P	C
Theory							
1	BS	MA16402	Probability and Random Process	3	2	0	4
2	ES	BM16401	Linear Integrated Circuits	3	0	0	3
3	PC	BM16402	Medical Instrumentation - I	3	0	0	3
4	PC	BM16403	Pathology and Microbiology	3	0	0	3
5	ES	IT16407	Object Oriented Programming with C++	3	0	0	3
6	HS	CH16401	Environmental Science and Engineering	3	0	0	3
Practical							
7	ES	BM16404	Linear Integrated Circuits Laboratory	0	0	4	2
8	PC	BM16405	Pathology and Microbiology Laboratory	0	0	4	2
9	ES	IT16408	Object Oriented Programming with C++ Laboratory	0	0	4	2
10	HS	EN16402	Business English Course Laboratory	0	0	2	1
			TOTAL	**18**	**2**	**8**	**26**
			Cumulative Total				**100**

SEMESTER III

MA16301 TRANSFORMS AND BOUNDARY VALUE PROBLEMS 3 2 0 4

COURSE OBJECTIVES

To enable the students to

- introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems
- acquaint the student with Fourier transform techniques used in wide variety of situations.
- introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes
- develop Z transform techniques for discrete time systems.
- learn about applications of Partial Differential Equations.

UNIT I FOURIER SERIES 15

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

UNIT II FOURIER TRANSFORMS 15

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

UNIT III PARTIAL DIFFERENTIAL EQUATIONS 15

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

UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 15

Solutions of one dimensional wave equation - One dimensional equation of heat conduction - Steady state solution of two-dimensional equation of heat conduction.

UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS 15

Z-transforms - Elementary properties - Inverse Z-transform - Convolution theorem - Formation of difference equations - Solution of difference equations using Z-transform.

TOTAL PERIODS: 75

COURSE OUTCOMES

Upon the completion of the course, the students will be able to

- gain a well-founded knowledge of Fourier series, their different possible forms and the frequently needed practical harmonic analysis that an engineer may have to make from discrete data.
- grasp the concept of expression of a function, under certain conditions, as a double integral leading to identification of transform pair and specialization on Fourier transform pair, their properties.

- obtain capacity to formulate and identify certain boundary value problems encountered in engineering practices, decide on applicability of the Fourier series method of solution, solve them and interpret the results.
- capable of mathematically formulating certain practical problems in terms of partial differential equations, solve them and physically interpret the results.
- learn the basics of Z – transform in its applicability to discretely varying functions, gained the skill to formulate certain problems in terms of difference equations and solve them using the Z – transform technique bringing out the elegance of the procedure involved.

TEXT BOOKS

1. Narayanan S., Manickavasagam Pillai.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students" ,Vol. II and III, S.Viswanathan Publishers Pvt Ltd. 1998
2. Veerarajan T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012.

REFERENCES

1. Larry C. Andrews, Bhimsen K. Shivamoggi, "Integral Transforms for Engineers", SPIE Optical Engineering press, Washington USA (1999).
2. Ramana.B.V., "Higher Engineering Mathematics", Tata McGraw-Hill Publishing Company limited, New Delhi (2010).
3. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education (2007).
4. Erwin Kreyszig., "Advanced Engineering Mathematics" 10th Edition, Wiley Publications
5. Ray Wylie C and Barrett.L.C, "Advanced Engineering Mathematics", Tata McGraw Hill Education Pvt Ltd, Sixth Edition, New Delhi, 2012.

CO-PO Mapping:

Course Outcomes (CO's)	Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak													
	Programme Outcomes (PO's)												Programme Specific Outcomes (PSO's)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	1	3	1				2					3	
CO 2	2	1	3	1									3	
CO 3	2	1	3	1									3	
CO 4	2	1	3	1									2	
CO 5	2	1	3	1				2					2	

BM16301 ELECTRON DEVICES AND CIRCUITS 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- understand the structure of basic electronic devices.
- be exposed to active and passive circuit elements.
- familiarize the operation and applications of transistor like BJT and FET.
- explore the characteristics of amplifier gain and frequency response.
- learn the required functionality of positive and negative feedback systems.

UNIT I PN JUNCTION DEVICES 9

PN junction diode - structure, operation and V - I characteristics, diffusion and transition capacitance - Rectifiers - Half Wave and Full Wave Rectifier - Zener diode characteristics - Zener diode as regulator - Display devices - LED, Laser diodes.

UNIT II TRANSISTORS AND SCR CHARACTERISTICS 9

BJT - structure, operation, characteristics and biasing, JFET and MOSFET biasing, UJT and SCR - structure and characteristics.

UNIT III BJT AND FET AMPLIFIERS 9

BJT small signal model - analysis of CE, CB and CC amplifiers - gain and frequency response - JFET small signal model - analysis of CS and Source follower - gain and frequency response.

UNIT IV MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER 9

Different Coupling Schemes used in Amplifiers, Two Stage RC Coupled Amplifier, Cascode Amplifier Differential amplifier - Configuration - Modes of operation - Methods of improving CMRR.

UNIT V FEEDBACK AMPLIFIERSAND OSCILLATORS 9

Feedback amplifiers - definition, block diagram - properties of negative feedback - feedback topologies - oscillators, concept of positive feedback - condition for oscillations, RC oscillators - RC phase shift - Wien bridge. LC oscillators Hartley, Colpitts and Crystal oscillators.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of the course, the students will be able to

- explain the structure and working operation of basic electronic devices.
- able to identify and differentiate both active and passive elements
- analyze the characteristics of different electronic devices such as diodes and transistors
- choose and adapt the required components to construct an amplifier circuit.
- employ the acquired knowledge in design and analysis of oscillators

TEXT BOOKS

1. David A.Bell, circuits, Oxford University higher education,5th edition, 2008
2. Sedraandsmith,–Microelectroniccircuits‖,7th Ed., Oxford University Press.

REFERENCES

1. BalbirKumar,Shail.B.Jain,–Electronic devices and circuits‖ PHI learning private limited, 2nd edition 2014.
2. Thomas L.Floyd,–Electronic devices‖ Conventional current version, Pearson prentice hall, 10th Edition,2017.
3. Donald A Neamen,–Electronic Circuit Analysis and DesignTata McGrawHill,3rdEdition, 2003.
4. RobertL.Boylestad,–Electronic Devices and Circuit Theory, 2002.
5. Robert B.Northrop, –Analysis and Application of Analog Electronic Circuits to Biomedical Instrumentation, CRC Press, 2004.

Co – Po Mapping:

Course Outcomes (CO's)	Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak													
	Programme Outcomes (PO's)												Programme Specific Outcomes (PSO's)	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO 1	3	3	3	3		2					2	3	3	3
CO 2	3	3	3					2			3	3	3	3
CO 3		3	3	3	3			2		3		3	3	3
CO 4		3	3	3	3		2			3		3	3	3
CO 5	3	3			3		2			3	3	3	3	3

BM16302 SIGNALS AND SYSTEMS 3 2 0 4

COURSE OBJECTIVES

To enable the students to

- introduce the basic concepts of continuous time and discrete time signals and systems
- analyze signals and systems using different transforms
- acquire the basic knowledge in Sampling and Z transform
- know about the analysis and realization of LTI - Continuous Time systems
- know about the analysis and realization of LTI - Discrete Time systems

UNIT I CLASSIFICATION OF SIGNALS AND SYSTEMS 15

Continuous time signals (CT signals) - Discrete time signals (DT signals) - Step, Ramp, Pulse, Impulse, Exponential, basic operation on signals, classification of CT and DT signals - periodic and aperiodic signals, Energy and Power signals - CT systems and DT systems - Properties - LTI system - Properties, Discrete time - Convolution sum, Continuous time - convolution integral.

UNIT II ANALYSIS OF CONTINUOUS TIME SIGNALS 15

Fourier series - definition, properties and analysis - Fourier transform - definition, properties and analysis - Laplace Transform - definition, ROC, properties and signal Analysis - Unilateral Laplace Transform.

UNIT III SAMPLING THEOREM AND Z - TRANSFORM 15

Sampling Theorem - Reconstruction - Aliasing - DTFT and properties - Z - transform - Region of Convergence - Properties of ROC - Properties of z - transform - Inverse Z - transform using Partial fraction expansion.

UNIT IV LINEAR TIME INVARIANT - CONTINUOUS TIME SYSTEMS 15

Differential Equation - impulse response, Step response and output response - Fourier and Laplace transforms in analysis of continuous time (CT) systems - Block diagram representation for causal LTI System.

UNIT V DISCRETE TIME SYSTEMS 15

Difference Equations using Z transform - Impulse response - Analysis of Discrete time systems using DTFT and z - Transform - Direct Form I - Direct Form II - Cascade and Parallel Realization.

TOTAL PERIODS 75

COURSE OUTCOMES

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

- analyze the basic concepts of solving problems in signals and systems.
- demonstrate critical thinking and problem solving capabilities
- solve problems and solutions relating to LTI - continuous time systems
- demonstrate the basic knowledge and competence in the analysis of continuous time systems
- have an in - depth knowledge about LTI - discrete time systems

TEXT BOOK

1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, "Signals and Systems", Pearson, Indian Reprint, 2007.
2. Simon Haykin and Barry Van Veen, —Signals and Systems, John Wiley, 1999.

REFERENCES

1. John G.Proakis and Dimitris G.Manolakis, - Digital Signal Processing, Principles, Algorithms and Applications, PHI, 3rd Edition. 2000.
2. M.J.Roberts, - Signals and Systems Analysis using Transform method and MATLAB, TMH, 2003
3. K.Lindner, - Signals and Systems, McGraw Hill International, 1999.
4. Moman H. Hays, - Digital Signal Processing, Schaum's outlines, Tata McGraw - Hill., 2004.

Co – Po Mapping:

Course Outcomes (CO's)	Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak													
	Programme Outcomes (PO's)												Programme Specific Outcomes (PSO's)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	3	2	3	3	3		3	2	3	3	3	3
CO 2									2		3		3	3
CO 3	3	3	3	2	3	3	3				3		3	3
CO 4									2	2	2	3	3	3
CO 5	3	3	3	3	3	3	3		3	2	3		3	3

BM16303 DIGITAL ELECTRONICS 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- understand the fundamentals and simplification of digital logic
- design the various combinational circuits
- study and design synchronous sequential circuits
- design and implement asynchronous sequential circuits
- acquire basic knowledge about memory devices and HDL programming

UNIT I BOOLEAN ALGEBRA AND LOGIC GATES 9

Boolean postulates and laws - De - Morgan's Theorem - Principle of Duality - Boolean functions - Minimization of Boolean functions - Karnaugh map Minimization - Tabulation Method - Don't care Conditions. Logic Gates - Implementations of Logic Functions using gates - NAND - NOR implementations - TTL - CMOS - NAND, NOR, NOT - Tristate gates

UNIT II COMBINATIONAL CIRCUITS 9

Design procedure of Combinational circuits: Adders - Subtractors - Parallel and serial adder/ Subtractor - Carry look ahead adder - BCD adder - 2 bit Magnitude Comparator - Multiplexer, Demultiplexer - Encoder, Decoder - Parity generator and checker - Code converters.

UNIT III SEQUENTIAL CIRCUITS 9

Flip flops - Triggering - Realization of flip flop using other flip flops - Asynchronous and Synchronous counters - Classification of sequential circuits - Moore and Mealy - Design of Synchronous counters - Modulo - n counter - Ring counters - Shift registers.

UNIT IV ASYNCHRONOUS SEQUENTIAL CIRCUITS 9

Design of fundamental mode and pulse mode circuits - primitive state / flow table - Minimization of primitive state table - state assignment - Excitation table - cycles - Race Free State assignment - ASM Chart - Hazards: Static - Dynamic - Essential - Hazards elimination.

UNIT V MEMORY DEVICES AND INTRODUCTION TO HDL 9

Classification of memories - ROM - ROM organization - PROM - EPROM - EEPROM - EAPROM, RAM - RAM organization - Write operation - Read operation - Memory decoding - memory expansion - Static RAM Cell - Bipolar RAM cell - Dynamic RAM cell. Programmable Logic Devices - PLA - PAL - FPGA - Introduction to HDL - Simple programs Using Verilog HDL.

TOTAL PERIODS 45

COURSE OUTCOMES

Upon completion of the course, the students will be able to

- understand the realization of Boolean functions using various techniques
- design and implement combinational circuits
- design and implement synchronous sequential circuits
- design and study the effect of hazards in asynchronous sequential circuits
- know the concept of Memories and HDL.

TEXT BOOKS

1. M. Morris Mano, "Digital Design", 3.ed., Prentice Hall of India Pvt. Ltd., New Delhi, 2003/PearsonEducation (Singapore) Pvt. Ltd., New Delhi, 2003.
2. H. Charles Roth Jr, "Digital System Design using VHDL", Thomson/ Brookscole, 2005.(Unit V)

REFERENCES

1. S. Salivahanan and S. Arivazhagan, "Digital Circuits and Design", 3rd Edition, Vikas Publishing House Pvt.Ltd, New Delhi, 2007.
2. John .M Yarbrough, "Digital Logic Applications and Design", Thomson Publications, New Delhi, 2007.
3. Charles H.Roth, "Fundamentals of Logic Design", Thomson Publication Company, 2003.
4. Donald P.Leach and Albert Paul Malvino, "Digital Principles and Applications", 5th edition, Tata Mc - Graw Hill Publishing Company Limited, New Delhi, 2003.

CO-PO Mapping:

Course Outcomes (CO's)	Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak													
	Programme Outcomes (PO's)												Programme Specific Outcomes (PSO's)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12	PS O1	PSO2
CO 1	3	3	3	3	2					3	2	3	3	3
CO 2	3	3	3	3		2	2			3	3	3	3	3
CO 3	3	3	3	3		2				3		3	2	3
CO 4	3	3	3	3	3		2			3	2	3	3	3
CO 5	3	3	3	3	3	2	2			3	2	3	3	3

BM16304 ANATOMY AND HUMAN PHYSIOLOGY 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- identify all the organelles of an animal cell and their function.
- understand structure and functions of the various types of systems of human body.
- provide the knowledge of structure and functioning of nervous system, cardiovascular system, respiratory system, digestive system and musculoskeletal system
- provide the knowledge of physiological parameters of normal health and factors affecting various physiological processes in the body.
- Locate and have idea while dealing with images.

UNIT I CELL AND TISSUE STRUCTURE 9

Structure of cell - structure and functions of sub organelles - Cell membrane - Transport of across Cell Membrane - Action potential - Cell to Cell Signaling - Cell Division. Types of Specialized tissues - Functions Terms and terminologies, Tissues: Epithelial tissue - definition, Function classification with examples, modifications: Skin, Connective tissue definition, components, function classification with examples. Lymphoid tissue, Cartilage - Hyaline cartilage, Fibro cartilage, Elastic cartilage.

UNIT II SKELETAL, MUSCULAR AND RESPIRATORY SYSTEMS 9

Skeletal::Types of Bone and function - Physiology of Bone formation - Division of Skeleton - Types of joints and function - Types of cartilage and function. Vertebral column - parts, function, curvatures, vertebrae. Thoracic cage - ribs, sternum. Muscular: Parts of Muscle - Movements. Respiratory: Parts of Respiratory Systems - Types of respiration - Mechanisms of Breathing - Regulation of Respiration

UNIT III CARDIOVASCULAR AND LYMPHATIC SYSTEMS 9

Cardiovascular: Components of Blood and functions - Blood Groups and importance - Structure of heart - Conducting system of heart - Properties of cardiac muscle - Cardiac cycle - Heart beat - Types of Blood vessel - Regulation of heart rate and blood pressure. Cardiac action potential, Principles of ECG measurement. Lymphatic: Parts and functions of Lymphatic systems - Types of Lymphatic organs and vessels

UNIT IV NERVOUS AND ENDOCRINE SYSTEMS AND SENSE ORGANS 9

Nervous: Functional components of nervous system - Cells of nervous systems - Types of neuron and synapses - Mechanisms of nerve impulse - Brain: Parts of brain - Spinal cord - Tract and pathways of spines - Reflex mechanism - Classification of nerves - Autonomic nervous systems and its functions. Endocrine - Pituitary and thyroid gland, Sense organs: Eye and Ear.

UNIT V DIGESTIVE AND URINARY SYSTEMS **9**

Digestive: Introduction - organs of Digestive system - Digestion and absorption. Electrogastrogram, Bilirubin measurement - Pancreas and Liver. Urinary: Structure of kidney and nephron - Mechanisms of urine formation - Regulation of blood pressure by urinary system - Urinary reflex - Dialysis .

TOTAL PERIODS **45**

COURSE OUTCOMES

Upon completion of the course, the students will be able to

- students would be able to explain basic structure and functions of cell
- students would be learnt about anatomy and physiology of various systems of human body
- students would be able to locate and have idea while dealing with images
- to analyze and interpret physiological data to design of medical instruments used for diagnosis
- students would be able to explain interconnect of various systems

TEXT BOOKS:

1. PrabhjotKaur, "Anatomy and Physiology", Lotus Publishers. 2014
2. Elaine.N. Marieb , ―Essential of Human Anatomy and Physiology‖, Eight Edition, Pearson Education, New Delhi, 2007
3. Ross andWilson's,"Anatomy and Physiology in Health and Illness", Anne Waugh and Allison Grant, 9thEdition, Churchill Livingstone Publications.2006

REFERENCES:

1. Frederic H. Martini, Judi L. Nath, Edwin F. Bartholomew, Fundamentals of Anatomy and Physiology. Pearson Publishers, 2014
2. Gillian Pocock, Christopher D. Richards, The Human Body - An introduction for Biomedical and Health Sciences, Oxford University Press, USA, 2013
3. William F.Ganong, ―Review of Medical Physiology‖, 22nd Edition, McGraw Hill, New Delhi, 2010
4. Guyton and Hall, ―Medical Physiology‖, 13th Edition, Elsevier Saunders, 2015
5. Eldra Pearl Solomon, ―Introduction to Human Anatomy and Physiology‖, W.B. Saunders Company, 2015

Co – Po Mapping:

Course Outcomes (CO's)	Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak													
	Programme Outcomes (PO's)												Programme Specific Outcomes (PSO's)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	3	3	2	2					2	3	3	2
CO 2	3	3	3			3				3	3	3	3	3
CO 3	3	3	3	3		3	3			2	2	3	3	2
CO 4	3	3	3	3								3		
CO 5	3	3	3	3							2	3	2	2

BM16305 BIOSENSORS AND MEASUREMENT DEVICES 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- get the basic idea of measurements and the errors associated with measurement.
- know about the various types of transducers.
- understand the function of signal generators and analyzers.
- gain knowledge on functioning of the various measuring instruments, display devices and application on the biomedical devices.
- gain knowledge in biosensor and its application

UNIT I MEASUREMENT SYSTEM AND BASICS OF TRANSDUCER 9

Measurements and generalized measurement system: Static characteristics, accuracy, precision, linearity, hysteresis, threshold, Dynamic Characteristics - calibration, standards and errors in measurement, Transducer: Basics, Classification, Characteristics and Choice.

UNIT II TRANSDUCERS FOR BIO - MEDICAL INSTRUMENTATION 9

LVDT, Strain gauges, Transducer: Resistance, RTD, Capacitive, Inductive, Electrochemical, Piezo - electric, Hall effect, Opto - electronic Digital encoding/digital, Thermistor, Thermocouple, photo optic transducers, POT.

UNIT III SIGNAL GENERATORS AND SIGNAL ANALYZER 9

Signal generator: AF, Pulse, AM, FM, Function, and Sweep frequency generator, Signal analyzer Wave, Spectrum, Logic, and Distortion analyzer, Heterodyne wave analyzer.

UNIT IV DIGITAL DATA DISPLAY AND RECORDING SYSTEM 9

DVM and Multimeter, Frequency, Period measurement, Time interval and pulse width measurement, Graphic recorders - strip chart, X - Y recorder, Magnetic tape recorder, CRO basics: CRT, General purpose oscilloscope, Dual trace, Dual beam, Sampling oscilloscope, Digital storage oscilloscope, LCD monitor.

UNIT V BIOSENSORS AND ITS APPLICATIONS 9

Gas sensor, Microbial sensor, electro analytical sensor, Enzyme based sensor - Glucose sensor, electronic nose - halitosis, Advances in sensor technology: Lab - on - a - chip, Smart sensor, MEMS and Nano sensor.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of the course, the students will be able to

- get the basic idea of measurements and the errors associated with measurement.
- known about the various types of transducers.
- understand the function of signal generators and analyzers.
- have knowledge in biosensors and its application.
- have knowledge on functioning of various measuring instruments, display devices etc.

TEXT BOOKS

1. Sawhney A.K, "A course in electrical and electronic measurements andinstrumentation", DhanpatRaiand Co (P) Ltd, Educational and TechnicalPublishers, 1996.
2. Cooper, "Electronic Instrumentation and Measurement techniques" PrenticeHall of India, 1998

REFERENCES

1. Renganathan S, "Transducer engineering", Allied Publishers Limited, 2003
2. Murty DVS, "Transducer and instrumentation", PHI, second edition, 2008.
3. Manoj Kumar Ram, Venkat R. Bhethanabolta, "Sensors for chemical andbiological applications", CRC press, 2010
4. Patranabis D, "Sensors and transducers", PHI, Second Edition, 2004.
5. Jacob Fraden, "Handbook of Modern Sensors: Physics, Designs andapplications", Third edition, Springer International, 2010.
6. Doeblin, "Measurements Systems: Application and Design", Tata McGraw - Hill,2003
7. Neubert HKP, "Instrument Transducers", Oxford University Press, 1999
8. Bakshi U.A, Bakshi A.V, "Measurement and Instrumentation" TechnicalPublication, 2nd Edition 2011.

Co – Po Mapping:

Course Outcomes (CO's)	Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak													
	Programme Outcomes (PO's)												Programme Specific Outcomes (PSO's)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2				3		2				3		2
CO 2	3	3	3	3	3	2	3	3		3	2	3		
CO 3	3	3	3	3			3	3		3	2	3		
CO 4	3	3	3	3	3	3	2				3	3	3	3
CO 5	3	3	3	3	3		3	3		3	2	3	2	2

BM16306 BIOSENSORS AND MEASUREMENT DEVICES LABORATORY 0 0 4 2

COURSE OBJECTIVES

To provide practice to

- study and analyze the theory and practical characteristics of the various transducers for the measurement of the vital physiological signals.
- get familiar with the various types of transducers and to study the compatibility for any clinical measurements
- study the characteristics of optical teransducer
- study the amperometric sensor for blood glucose measurement

LIST OF EXPERIMENTS

1. Characteristics of pressure transducer
2. Measurement of displacement capacitive transducer, LVDT and Inductive transducer
3. Characteristics of optical transducer for SpO2 measurement
4. Measurement of skin temperature by both contact and non - contact method
5. Study of the characteristics of capacitor level sensor for saline level measurement in a I - V set.
6. Data acquisition of physiological signals
7. Study of hot - wire anemometry
8. Study of amperometric sensor for blood glucose measurement
9. Electronic weighing machine for the measurement of chemical compounds
10. Non - invasive gas analyzer as an electronic nose

TOTAL PERIODS: 60

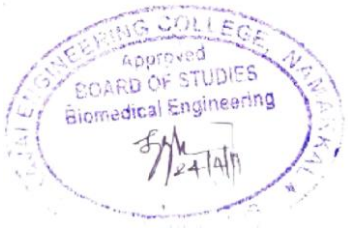
COURSE OUTCOMES

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

- analyze the characteristics of transducers
- understand the physiological signals
- measure the chemical compounds and non - invasive method of gas analyser
- study the characteristics of optical transducer

CO-PO Mapping

Course Outcomes (CO's)	Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak													
	Programme Outcomes (PO's)												Programme Specific Outcomes (PSO's)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	1	3	1	2	2	2	2					3	2
CO 2	2	1	3	1	2	2	2	2					3	2
CO 3	2	1	3	1	2	2	2	2					3	2
CO 4	2	1	3	1	2	2	2	2					2	2



BM16307 DIGITAL ELECTRONICS LABORATORY 0 0 4 2

COURSE OBJECTIVES

To enable the students to

- design and implement Adders and Subtractors and
- implement code converters and combinational logic circuit
- know about the design and implementation of counters and shift registers
- acquire the knowledge about simulation of digital circuits with Verilog HDL

List of Experiments

1. Design and implementation of Full and Half Adders and Full and Half Subtractors using logic gates.
2. Design and implementation of code converters using logic gates

   i. BCD to excess - 3 code convertors and vice versa.

   ii. Binary to gray code convertors and vice - versa.
3. Design and implementation of 4 bit binary Adder/ Subtractor and BCD adder using IC 7483.
4. Design and implementation of 2 Bit Magnitude Comparator using logic gates
5. Design and implementation of 16 bit odd/even parity checker generator using IC74180.
6. Design and implementation of Multiplexer and De - multiplexer using basic logic gates and study of IC 74160 and IC 74164.
7. Design and implementation of encoder and decoder using logic gates and study of IC7445 and IC74147.
8. Construction and verification of 4 bit ripple counter and Mod - n Ripple counters.
9. Design and implementation of 3 - bit synchronous up (or) down counter.
10. Implementation of 3 - bit shift registers using Flip flops
11. Design and Simulation of Full and Half Adders, Full and Half Subtractors, Multiplexer and De - multiplexer, Encoder and Decoder, 4 bit Ripple Counter using Verilog HDL.

TOTAL PERIODS 60

COURSE OUTCOMES

Upon the completion of the course, the students will be able to

- design Adders and Subtractors using basic logic gates and karnaugh map
- create code converters using basic logic gates combinational logic circuits like MUX,DEMUX, Encoder, Decoder etc.
- know about the design and implementation of counters and shift registers
- acquire the knowledge about simulation of digital circuits with Verilog HDL

CO-PO Mapping:

Course Outcomes (CO's)	Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak													
	Programme Outcomes (PO's)												Programme Specific Outcomes (PSO's)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	3	3	2					3	2	3	3	3
CO 2	3	3	3	3		2	2			3	3	3	3	3
CO 3	3	3	3	3		2				3		3	2	3
CO 4	3	3	3	3	3		2			3	2	3	3	3

BM16308 ELECTRONIC DEVICES AND CIRCUITS LABORATORY 0 0 4 2

COURSE OBJECTIVES

To provide practice on:

- learn the characteristics of basic electronic devices such as Diode.
- understand the working of Transistors.
- analyze the concept of feedback amplifiers and oscillators.
- understand the character of UJT and SCR

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. Common Emitter input - output Characteristics
5. Common Source input - output Characteristics
6. Characteristics of UJT
7. Characteristics of SCR
8. Differential Amplifiers - CMRR Measurement
9. Series and Shunt feedback amplifiers - Frequency response
10. RC Phase shift oscillator / Wien Bridge oscillator
11. Hartley Oscillator / Colpitts Oscillator

TOTAL PERIODS: 60

COURSE OUTCOMES

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

- analyze the characteristics of PN diodes and Zener diodes
- understand the characteristics of Transistors and SCR
- design the feedback amplifiers and Oscillators
- understand the character of UJT and SCR

CO-PO Mapping:

Course Outcomes (CO's)	Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak													
	Programme Outcomes (PO's)												Programme Specific Outcomes (PSO's)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	3	3	3				3			3		2
CO 2	3		3		3						3	3	2	
CO 3	3	3			3						2	3	3	3
CO 4	3	3	3	3	3				3		3	3	3	2

SEMESTER IV

MA16402 PROBABILITY AND RANDOM PROCESS 3 2 0 4

COURSE OBJECTIVES

To enable the students to

- acquire knowledge of the random variable and manipulate.
- understand the concepts of some standard distributions.
- analysis the relationship between the two random variables.
- provide necessary basic concepts in probability and random processes for applications such as random signals, linear systems etc in communication engineering.
- enable students to understand the topics such as signals and systems, pattern recognition, voice and image processing and filtering theory.

UNIT I RANDOM VARIABLES 15

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

UNIT II STANDARD DISTRIBUTION 15

Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions and their properties - Functions of a random variable.

UNIT III TWO DIMENSIONAL RANDOM VARIABLES 15

Joint distributions - Marginal and conditional distributions - Covariance - Correlation and Linear regression - Transformation of random variables.

UNIT IV RANDOM PROCESS AND MARKOV CHAIN 15

Classification - Stationary process - Poisson process - Markov Chain - Transition probabilities - Limiting Distributions.

UNIT V CORRELATION AND SPECTRAL DENSITIES 15

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 75

COURSE OUTCOMES

Upon the completion of the course, the students will be able to

- have a fundamental knowledge of the basic probability concepts.
- have a well - founded knowledge of standard distributions which can describe real life phenomena.
- acquire skills in handling situations involving more than one random variable and functions of random variables.
- understand and characterize phenomena which evolve with respect to time in a probabilistic manner.
- be able to analyze the response of random inputs to linear time invariant systems.

TEXT BOOKS

1. T. Veerarajan. "Probability, Statistics and Random Processes", 2nd ed., Tata McGraw - Hill, New Delhi, 2008.
2. Ibe.O.C., "Fundamentals of Applied Probability and Random Processes", Elsevier,2nd Indian Reprint, 2010.
3. Peebles. P.Z., "Probability, Random Variables and Random Signal Principles", Tata McGraw Hill, 4th Edition, New Delhi, 2008.

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.
5. Venkatachalam G," Probability and Random Process", Hitech Publishing Company Pvt.Ltd.,Chennai,3rd Edition, 2012.

Course Outcomes (CO's)	Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak													
	Programme Outcomes (PO's)												Programme Specific Outcomes (PSO's)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	1	3	1				2					3	
CO 2	2	1	3	1									3	
CO 3	2	1	3	1									3	
CO 4	2	1	3	1									2	
CO 5	2	1	3	1				2					2	

IT16407 OBJECT ORIENTED PROGRAMMING WITH C++ 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- learn the basic concepts of Object Oriented Programming.
- learn the basics of C++ language.
- development of object oriented C++ programs.
- object oriented concepts in generic programming
- to know about master of OOP using C++.

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 reference - Return 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 - Friendly 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 - 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, Function templates, user defined template arguments, class template.

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

TOTAL PERIODS 45

COURSE OUTCOMES

Upon the completion of the course, the students will be able to

- identify and apply object oriented concepts like abstraction, encapsulation, modularity, hierarchy, typing, concurrency and persistence.
- estimate various metrics specific to object oriented development.
- apply arrays, pointers and functions to write a C++ program.
- create and use data type, expression and functions in C++.
- use inheritance and templates in C++ program.

TEXT BOOKS

1. E.Balagurusamy, "Object Oriented Programming with C++", Tata McGraw Hill, Sixth Edition, 2013.

REFERENCES

1. Ira Pohl, "Object Oriented Programming using C++", Pearson Education, Second Edition Reprint 2004.
2. S. B. Lippman, JoseeLajoie, Barbara E. Moo, "C++ Primer", Fourth Edition, Pearson Education, 2005.
3. B. Stroustrup, "The C++ Programming language", Third edition, Pearson Education, 2004.

CO-PO Mapping:

Course Outcomes (CO's)	Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak													
	Programme Outcomes (PO's)												Programme Specific Outcomes (PSO's)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2
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CO 2	3	2	1	2	3	-	-	-	-	-	-	2	-	2
CO 3	2	2	3	2	3	-	-	-	-		2	3	3	2
CO 4	2	2	3	2	2	-	-	2	-	-	-	3	-	2
CO 5	3	1	2	3	2	-	-	1	-	-	-	3	2	1

BM16401 LINEAR INTEGRATED CIRCUITS 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- introduce the basic of operational amplifier
- learn linear and nonlinear applications of operational amplifier
- study the applications of analog multiplier and PLL
- introduce theory of analog and digital conversion
- acquire the basic knowledge of special function IC's

UNIT I INTEGRATED CIRCUIT FABRICATION AND BASICS OF OPERATIONAL AMPLIFIER **9**

Integrated Circuit classification, Fundamentals of Monolithic IC Technology, Basic Fabrication process Fabrication of a typical circuit - Active and passive components of ICs - Operational amplifier - Basic information of Op - Amps - Ideal Op - Amp - operational amplifier Internal circuit - Examples of IC Op - Amps - DC, AC Characteristics of Op - Amp - virtual ground, frequency compensation techniques - slew rate.

UNIT II APPLICATIONS OF OPERATIONAL AMPLIFIERS **9**

Basic Op - Amp applications (sign changer, scale changer, voltage follower, adder and subtractor) - Instrumentation amplifier - Voltage - to - Current and Current - to - Voltage converter - Logarithmic amplifier - Anti - logarithmic amplifiers - Differentiator - Integrator - Comparator - Schmitt trigger - Active filters - Design of Low pass, high pass and band pass filters - Precision rectifiers.

UNIT III ANALOG MULTIPLIER AND PLL **9**

Analog multiplier IC - applications - Analysis of four quadrant and variable Trans - conductance multipliers - PLL: Basic principles - Phase Detector/Comparator - Voltage controlled Oscillator - Monolithic PLL - PLL applications - Frequency multiplier - AM, FM and FSK demodulators - Frequency synthesizers - Frequency translation.

UNIT IV ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTORS **9**

Introduction - basic DAC techniques: Binary weighted resistor type - R - 2R ladder type - sample and hold circuits - Analog - to - Digital converters: Flash type ADC - Counter type ADC - Successive approximation register type ADC - Dual slope ADC - DAC / ADC Specifications.

UNIT V SPECIAL FUNCTION ICS **9**

Waveform generators - Basic principles of sine wave oscillators - Astable and monostable multivibrators using Op - Amp - ICL8038 Function Generator - 555 timer: description of functional diagram - Astable, monostable operation - IC 723 general purpose voltage regulator - switching regulator - Switched capacitor filter - LM380 audio amplifier - Opto - couplers and fiber optic ICs.

TOTAL PERIODS 45

COURSE OUTCOMES

Upon the completion of the course, the students will be able to

- learn the Basic Concepts of operational amplifier
- understand the working and applications of operational amplifier
- learn about PLL applications in modulator circuits
- study about working of analog and digital communication circuits
- know the basic function of special function IC's

TEXT BOOKS

1. D.RoyChoudhry, Shail Jain, "Linear Integrated Circuits", New Age International Pvt. Ltd., Fourth edition 2010.
2. Sergio Franco, "Design with operational amplifiers and analog integrated circuits", McGraw Hill, 3rd edition 2007.

REFERENCES

1. William D.Stanely, "Operational Amplifiers with Linear Integrated Circuits", Pearson Education, 2004.
2. David L.Terrell, "Op Amps - Design, Application, and Troubleshooting", Elsevier publications 2005.
3. Ramakant A. Gayakwad, "OP - AMP and Linear IC's", Prentice Hall, 1994.
4. Botkar K.R., "Integrated Circuits", Khanna Publishers, 1996.
5. Taub and Schilling, "Digital Integrated Electronics", McGraw Hill, 1977.
6. Caughlier and Driscoll, "Operational amplifiers and Linear Integrated circuits", PHI, 1989.
7. Michael Jacob J., "Applications and Design with Analog Integrated Circuits", PHI, 1996.

CO-PO Mapping:

Course Outcomes (CO's)	Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak													
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CO 2	3	3	3	3		2	2			3	3	3	3	3
CO 3	3	3	3	3		2				3		3	2	3
CO 4	3	3	3	3	3		2			3	2	3	3	3
CO 5	3	3	3	3	3	2	2			3	2	3	3	3

CH16401 ENVIRONMENTAL SCIENCE AND ENGINEERING 3 0 0 3

COURSE OBJECTIVES

At the end of this course the student is expected to

- know the constituents of the environment and the precious resources in the environment.
- conserve all biological resources.
- understand the role of human being in maintaining a clean environment and useful environment for the future generations
- maintain the ecological balance and preserve bio - diversity.
- the role of government and non - government organizations in environment management.

UNIT I INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES 9

Environment: Definition - scope - importance - need for public awareness. Forest resources: Use - over exploitation - deforestation - case studies - mining - effects on forests and tribal people. Water resources: Use - over utilization of surface and ground water - floods - drought - conflicts over water. Mineral resources Use - exploitation - environmental effects of extracting and using mineral resources - case studies. Food resources: World food problems - changes caused by agriculture and overgrazing - effects of modern agriculture - fertilizer - pesticide problems - water logging - salinity - case studies. Energy resources Growing energy needs - renewable and non renewable energy sources. Land resources: Land as resource - land degradation - soil erosion. Role of an individual in conservation of natural resources.

UNIT II ECOSYSTEMS AND BIODIVERSITY 9

Concept of an ecosystem: Structure and function of an ecosystem - producers - consumers - decomposers - energy flow in the ecosystem - ecological succession - food chains - food webs and ecological pyramids. Types of ecosystem: Introduction - characteristic features - forest ecosystem - grassland ecosystem - desert ecosystem - aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).Biodiversity: Introduction - definition (genetic - species - ecosystem) diversity. Value of biodiversity: Consumptive use - productive use - social values - ethical values - aesthetic values. Biodiversity level: Global - national - local levels - India as a mega diversity nation - hotspots of biodiversity. Threats to biodiversity Habitat loss - poaching of wildlife - man wildlife conflicts - endangered and endemic species of India Conservation of biodiversity: In - situ and ex - situ conservation of biodiversity - field study.

UNIT III POLLUTION 9

Pollution: Définition - air pollution - water pollution - soil pollution - marine pollution - noise pollution - thermal pollution - nuclear hazards. Solid waste management: Causes - effects - control measures of urban and industrial wastes. Role of an individual in prevention of pollution - pollution case studies. Disaster management: Floods - earthquake - cyclone - landslides. Electronic waste - Sources - Causes and

its effects.

UNIT IV SOCIAL ISSUES AND ENVIRONMENT 9

Sustainable development: Unsustainable to sustainable development - urban problems related to energy. Water Conservation - rain water harvesting - watershed management. Resettlement and rehabilitation of people. Environmental ethics: Issues - possible solutions - climate change - global warming and its effects on flora andfauna - acid rain - ozone layer depletion - nuclear accidents - nuclear holocaust - wasteland reclamation. Consumerism and waste products. Environment protection act: Air (Prevention and Control of Pollution) act - water (Prevention and control of Pollution) act - wildlife protection act - forest conservation act - issues involved in enforcement of environmental legislation.

UNIT V HUMAN POPULATION AND ENVIRONMENT 9

Human population: Population growth - variation among nations - population explosion - family welfare programme and family planning - environment and human health - Human rights - value education - HIV/ AIDS Swine flu - women and child welfare. Role of information technology in environment and human health.

TOTAL PERIODS 45

COURSE OUTCOMES

Upon the completion of the course, the students will be able to

- know the relationship between the human population and environment.
- understand the basic concepts of environment studies and natural resources.
- gaining the knowledge about ecosystem and biodiversity.
- have knowledge about causes, effects and control measures of various types of pollution.
- understand the social issues and various environmental acts.

TEXT BOOKS

1. Raman Sivakumar, Introduction to Environmental Science and Engineering, 2nd Edn, TataMcGraw Hill
   Education Private Limited, New Delhi,(2010).
2. Benny Joseph, "Environmental Science and Engineering", Tata McGraw Hill, (2010).

REFERENCES

1. BharuchaErach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad India,2010.
2. S. Divan, Environmental Law and Policy in India, Oxford University Press, New Delhi, 2001.
3. K.D. Wager, Environmental Management, W.B. Saunders Co., Philadelphia, USA, 1998.
4. W.P. Cunningham, Environmental Encyclopedia, JaicoPublising House, Mumbai, 2004.

Course Outcomes (CO's)	Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak													
	Programme Outcomes (PO's)												Programme Specific Outcomes (PSO's)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2
CO 1	2	2	3	2	2	-	-	-	-	-	-	2	2	2
CO 2	3	2	1	2	3	-	-	-	-	-	-	2	-	2
CO 3	2	2	3	2	3	-	-	-	-		2	3	3	2
CO 4	2	2	3	2	2	-	-	2	-	-	-	3	-	2
CO 5	3	1	2	3	2	-	-	1	-	-	-	3	2	1

BM16402 MEDICAL INSTRUMENTATION I 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- understand origin of bio - potential.
- study different types of electrodes used in bio - potential recording.
- understand the characteristics of bio - amplifiers and different types of recorders.
- understand how to measure various physiological parameters and helps to design simple biomedical sensors
- study the instrumentation concerned with measuring various parameters and the principle of working and gain knowledge on usage of instruments in hospitals and servicing.

UNIT I BIOELECTRODES AND BIOCHEMICAL SENSORS 10

Components of Medical Instrumentation - System Origin of Bio potential: Action Potential, Nernst Equation, Goldman equation, Hodgkin - Huxley model - Electrode electrolyte interface, Half - cell potential, Polarisable and Non - polarisable electrodes - Skin electrode interface - Bio - electrodes: Surface - , Micro - . Needle - electrodes - Equivalent circuits of electrodes - Biochemical - , and Transcutaneous - electrodes: pH, pO2, pCO2 - Ion sensitive Field effect Transistors.

UNIT II BIOPOTENTIAL MEASUREMENTS 8

Bioamplifiers - Carrier Amplifier, - Isolation Amplifier - Differential amplifier - Chopper Amplifier - Instrumentation Amplifier - Bioelectric signals (ECG, EMG, EEG, EOG and ERG) and their characteristics - Electrodes for ECG, EEG and EMG - Einthoven triangle, Standard 12 - lead configurations - ECG Machine - EMG machine - 10 - 20 electrodes placement system for EEG - EEG machine - Heart sound and characteristics, PCG

UNIT III PATIENT MONITORING SYSTEMS AND BIOTELEMETRY 8

Measurement of Blood pressure - Direct Methods and Indirect Methods - Temperature - Respiration rate - Heart rate measurement - Oximetry - Pulse oximeter, Ear oximeter - Computerized patient monitoring system - Bedside, Central Monitoring system - Biotelemetry: Basics components, and its different types.

UNIT IV CARDIAC MEASUREMENTS AND ASSIST DEVICES 10

Cardiac output Measuring techniques - Dye Dilution method, Thermo dilution method, BP method - Blood Flow measuring Techniques: Electromagnetic Type - Ultrasound Blood Flow meter, Laser Doppler Blood Flow meter - Cardiac Arrhythmias - Plethysmography - Cardiac Pacemakers - Defibrillator: AC - , and DC - types - Heart - Lung Machine (HLM) - Oxygenators

UNIT V CLINICAL INSTRUMENTATION 9

Chemical Fibro sensors, Fluorescence sensors - Blood cell counters - Coulter counter, Electrical Impedance Method , Optical Method - Colorimeter, Spectro photometer, Flame photometer - Chromatography - Mass Spectrometer - Biochemical and Bioanalytical equipments Electrical hazard - Micro - and Macroshock - Patient safety procedures

TOTAL PERIODS 45

COURSE OUTCOMES

Upon the completion of the course, the students will be able to

- examine the various concepts of biochemical sensors.
- evaluate the different models in biomedical systems.
- synthesize the behavior of assist devices.
- compare different patient monitoring and application of biotelemetry systems.
- understand the analytical equipment of bioengineering systems.

TEXT BOOKS

1. Geoddes L.A and Baker L.E, "Principles of Applied Biomedical Instrumentation", John Wiley, 3rd Edition, 1975, Reprint 1989.
2. Khandpur R.S, "Hand - book of Biomedical Instrumentation", Tata McGraw Hill, 2nd Edition, 2003.
3. Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, "Biomedical Instrumentation and Measurements", Prentice - Hall India, 2nd Edition, 1997

REFERENCES

1. R. Stuart MacKay, "Bio - Medical Telemetry: Sensing and Transmitting Biological Information from Animals and Man", Wiley - IEEE Press, 2nd Edition, 1968.
2. John G. Webster, "Medical Instrumentation application and design", John Wiley, 3rd Edition, 1997.
3. Carr, Joseph J, Brown, John M., "Introduction to Biomedical equipment technology", JohnWiley and sons, New York, 4th Edition, 1997.
4. Geddes L.A and Baker L.E, "Principles of Applied Biomedical Instrumentation", John Wiley - Inter Science, 3rd Edition, 1989.
5. C.Rajarao and S.K. Guha, "Principles of Medical Electronics and Bio - medical Instrumentation", Universities press (India) Ltd, First Edition, Orient Longman Ltd, 2001.

Course Outcomes (CO's)	Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak													
	Programme Outcomes (PO's)												Programme Specific Outcomes (PSO's)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3			3	2			2				2	2	
CO 2			2										2	2
CO 3	2			3						3			3	3
CO 4		2			3		2						3	
CO 5		3	2							3			1	

BM16403 PATHOLOGY AND MICROBIOLOGY 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- gain a knowledge on the structural and functional aspects of living organisms.
- know the etiology and remedy in treating the pathological diseases.
- empower the importance of public health.
- understand the structure and function of organs and its synthesize.
- understand the structure and function of human body

UNIT I CELL DEGENERATION, REPAIR AND NEOPLASIA 9

Cell injury - Reversible cell injury and Irreversible cell injury and Necrosis, Apoptosis, Intracellular accumulations, Pathological calcification - Dystrophic and Metastatic .cellular adaptations of growth and differentiation, Inflammation and Repair including fracture healing, Neoplasia, Classification, Benign and Malignant tumours, carcinogenesis, spread of tumours Autopsy and biopsy.

UNIT II FLUID AND HEMODYNAMIC DERANGEMENTS 9

Edema, Hyperemia/Ischemia, normal hemostasis, thrombosis, disseminated intravascular coagulation, embolism, infarction, shock, Chronic venous congestion. Hematological disorders - Bleeding disorders, Leukaemias, Lymphomas Haemorrhage.

UNIT III MICROBIOLOGY 9

Structure of Bacteria and Virus. Routes of infection and spread; endogenous and exogenous infections, Morphological features and structural organization of bacteria and virus, growth curve, identification of bacteria , culture media and its types , culture techniques and observation of culture. Disease caused by bacteria, fungi, protozoal, virus and helminthes.

UNIT IV MICROSCOPES 9

Light microscope - bright field, dark field, phase contrast, fluorescence, Electron microscope (TEM and SEM). Preparation of samples for electron microscope. Staining methods - simple, gram staining and AFB staining.

UNIT V IMMUNOPATHOLOGY 9

Natural and artificial immunity, types of Hypersensitivity, antibody and cell mediated tissue injury: opsonization, phagocytosis, inflammation, Secondary immunodeficiency including HIV infection. Auto - immune disorders: Basic concepts and classification, SLE.Antibodies and its types, antigen and antibody reactions, immunological techniques: immune diffusion, immunoelectrophoresis, RIA and ELISA, monoclonal antibodies.

TOTAL PERIODS 45

COURSE OUTCOMES

Upon the completion of the course, the students will be able to

- analyze structural and functional aspects of living organisms.
- explain the function of microscope
- discuss the importance of public health.
- describe methods involved in treating the pathological diseases.
- understand the analytical equipment of bioengineering systems.

TEXT BOOKS

1. RamziSCotran,VinayKumar andStanley LRobbins,-Pathologic Basis of Diseases,7th edition,WB Saunders Co. 2005 (Units I andII).
2. Ananthanarayanan and Panicker, -Microbiology Orient blackswan, 2017 10th edition. (Units III,IV and V).

REFERENCES

1. Underwood JCE: General and Systematic Pathology Churchill Livingstone, 3rd edition, 2000.
2. Dubey RC and MaheswariDK.-ATextBookofMicrobiology|ChandandCompanyLtd,2007
3. Prescott,Harleyand Klein,-Microbiology|,10thedition,McGrawHill,2017

CO-PO Mapping:

COs	Programme Outcomes (PO's)												Programme Specific Outcomes (PSO's)	
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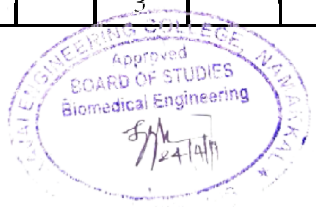
CO 1	3			3	2			2				2	2	
CO 2			2										2	2
CO 3	2			3						3			3	3
CO 4		2			3		2						3	
CO 5		3	2							3			1	



BM16404 LINEAR INTEGRATED CIRCUITS LABORATORY 0 0 4 2

COURSE OBJECTIVES

To enable the students to

- study the application of operational amplifier
- know the design of multivibrators using operational amplifier and 555 timer
- design oscillators and active filters in various applications.
- simulate the Op - Amp application circuits using PSPICE software

LIST OF EXPERIMENTS

Design and testing of

1. Inverting, Non inverting amplifier and differential amplifier
2. Instrumentation amplifier
3. Integrator and Differentiator
4. Active low pass, High pass and band pass filters.
5. Astable, Monostable Multivibrators and Schmitt trigger (using IC 741)
6. Phase shift Oscillator and Wien bridge oscillators (using IC 741)
7. Astable and monostable Multivibrators using NE555 Timer
8. Frequency multiplier using PLL IC
9. Voltage regulation using LM317 and LM723

Simulation Experiments

10. Simulation of (i) Instrumentation amplifier,(ii) Integrator and Differentiator,(iii) Active low pass, High pass and band pass filters, (iv) Astable, Monostable Multivibrators and Schmitt trigger (using IC 741), (v) Phase shift Oscillator and Wien bridge oscillators (using IC 741).

TOTAL PERIODS 60

COURSE OUTCOMES

Upon the completion of the course, the students will be able to

- design and test the Op - amp applications
- understand the working and applications of filters
- design oscillators and multivibrators for various applications
- analyse the working of power supply

CO-PO Mapping:

COs	Programme Ou												Programme Specific Outcomes (PSO's)	
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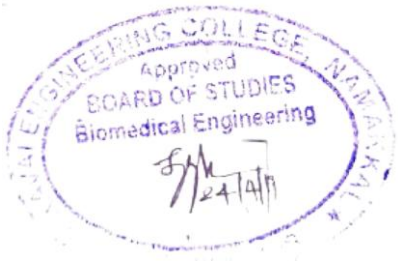
CO 1	3			3	2			2				2	2	
CO 2			2										2	2
CO 3	2			3						3			3	3
CO 4		2			3		2						3	



IT16408 OBJECT ORIENTED PROGRAMMING WITH C++ LABORATORY 0 0 4 2

COURSE OBJECTIVES

To enable the students to

- know the fundamental knowledge of object oriented programming.
- understand the skills required to become a proficient C++ programmer.
- transforming the physical problem domain into a hierarchy of objects.
- using OOP to solve simple engineering problems.

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 operator overloading.
4. Develop C++ Programs using constructor, destructor, and copy constructor.
5. Develop C++ Programs overload the new and delete operators.
6. Develop C++ Programs using Inheritance, Polymorphism and its types.
7. Develop C++ Programs using Arrays and Pointers.
8. Develop C++ Programs using Dynamic memory allocation.
9. Develop C++ Programs using Function Templates.
10. Develop C++ Programs using Exceptions Handling.

TOTAL PERIODS 60

COURSE OUTCOMES

At the end of the course, the student should be able to

- design an object oriented program using classes and objects.
- applyinheritance to reuse the C++ code.
- apply polymorphism to extend the code and reduce the complexity of the program.
- implementfiles and streams in C++ programs.

RECOMMENDED SYSTEM/SOFTWARE REQUIREMENTS

Software: Turbo C++.

Hardware: Flavor of any WINDOWS or LINUX and Standalone desktops 30 Nos.

CO-PO Mapping:

Course Outcomes (CO's)	Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak													
	Programme Outcomes (PO's)												Programme Specific Outcomes (PSO's)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2					2	2	2					3	3
CO 2	2					2	2	2					3	3
CO 3	2					2	2	2					3	3
CO 4	2					2	2	2					2	3

BM16405 PATHOLOGY AND MICROBIOLOGY LABORATORY 0 0 4 2

COURSE OBJECTIVES

To enable the students to

- study the parts of compound microscope.
- demonstrate the manual tissue processing.
- know the simple, gram and AFB stain.
- study the bleeding and clotting time.

LIST OF EXPERIMENTS

1. Urine physical and chemical examination (protein, reducing substances, ketones,bilirubin and blood)
2. Hematoxylin and eosin staining.
3. Study of parts of compound microscope
4. Histopathological slides of benign and malignant tumours.
5. Manual tissue processing and section cutting (demonstration)
6. Simple stain.
7. Gram stain.
8. AFB stain.
9. Slides of malarial parasites, micro filarial and leis mania donovani.
10. Haematology slides of anemia and leukemia.
11. Bleeding time and clotting time.
12. Study of bone marrow charts.

TOTAL PERIODS 60

COURSE OUTCOMES

Upon the completion of the course, the students will be able to

- design and test the urine physical and chemical examination.
- know the parts of compound microscope.
- understand the manual tissue processing
- analyze the haematology slides of anemia and leukemia.

CO-PO Mapping:

Course Outcomes (CO's)	Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak													
	Programme Outcomes (PO's)												Programme Specific Outcomes (PSO's)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3			3	2			2				2	2	
CO 2			2										2	2
CO 3	2			3						3			3	3
CO 4		2			3		2						3	

EN16402 BUSINESS ENGLISH COURSE LABORATORY **0 0 2 1**

COURSE OBJECTIVES

To enable the students to

- develop the reading skills of the students and to familiarize them in skimming and scanning.
- instill the communication concepts and enhance the students' conversational skills through various practice sessions.
- familiarize them with a variety of business correspondence.
- develop the receptive skills such as listening and reading and to make the students well versed in the productive skills (writing and speaking)

UNIT I READING AND VOCABULARY **8**

Understanding short, notices, messages - detailed comprehension of factual material - skimming and scanning skills - interpreting visual information - reading for gist and specific information - reading for grammatical accuracy and understanding of text structure - reading and information transfer.

UNIT II WRITING **7**

Fixing appointments - asking for permission - giving instructions - apologizing and offering compensation - making or altering reservations - dealing with requests - giving information about a product.

UNIT III LISTENING **8**

Listening to short telephonic conversation - Listening to short conversation or monologue - Listening to specific information - Listening to recorded interview, discussion.

UNIT IV SPEAKING **7**

Conversation between the interlocutor and the candidate - general interaction and social language - A mini presentation by each candidate on a business theme - organising a larger unit of discourse - giving information and expressing opinions - to way conversation between candidates followed by further prompting from the interlocutor Expressing opinions - agreeing and disagreeing.

TOTAL PERIODS 30

LIST OF EXPERIMENTS

1. Reading
2. Writing
3. Listening
4. Speaking

COURSE OUTCOMES

Upon the completion of the course, the students will be able to

- enrich the business vocabulary through reading.
- develop their pronunciation skills.
- speak effectively in English in various occasions.
- speak and write in English effectively.

TEXT BOOKS

1. Cambridge BEC Preliminary, Self Study Edition, Cambridge University Press, New York, 2012
2. Whitby, Norman. Business Benchmark, Pre - intermediate to intermediate, Business Preliminary,ShreeMaitreyPrintech Pvt. Ltd., Noida, 2014.

REFERENCES

1. Raman, MeenakshiandSangeetha Sharma. Technical Communication: Principles and Practice Oxford University Press, New Delhi. 2011.
2. Rizvi, Ashraf. M. Effective Technical Communication. Tata McGraw - Hill, New Delhi.2005.
3. Rutherford, Andrea. J Basic Communication Skills for Technology. Pearson, New Delhi.

CO-PO Mapping:

Course Outcomes (CO's)	Mapping of course objectives with PO's and PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak													
	Programme Outcomes (PO's)												Programme Specific Outcomes (PSO's)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2
CO 1	2	1	3	1				2					3	
CO 2	2	1	3	1									3	
CO 3	2	1	3	1									3	
CO 4	2	1	3	1									2