

(COMMON TO ALL BRANCHES)

COURSE OBJECTIVES

To enable the students to

- introduce concepts like dimensioning, conventions and standards related to Engineering drawing and imbibe knowledge on plane curves and projection of points
- impart knowledge on projection of lines and plane surfaces
- develop the visualization skills for understanding the projection of solids
- illustrate on development of surfaces for simple solids
- understand the orthographic projection and isometric view

Concepts and Conventions (Not for Examination)

2

Importance of graphics in engineering applications – Use of drafting instruments – **BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.**

UNIT I PLANE CURVES AND PROJECTION OF POINTS

10

Basic Geometrical constructions, **Curves used in Engineering Practices:** Conics – Construction of Ellipse, Parabola and Hyperbola by eccentricity method – Construction of cycloid – Construction of involutes of square and circle – Drawing of tangents and normal to the above curves. Applications of above cited curves. Orthographic projection – Principles-Principal Planes - **Projection of points in four quadrants.**

UNIT II PROJECTION OF LINES AND PLANES

12

Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by Change of Position method. **Projection of Planes** (Square, Pentagon, Hexagon and Circle) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS

12

Projection of simple solids like Square Prism, Pentagonal Prism, Hexagonal Prism, Triangular Prism. Square Pyramid, Pentagonal Pyramid, Hexagonal Pyramid, **Cylinder and Cone when the axis is inclined to one of the principal planes** (either horizontal or vertical plane).

UNIT IV DEVELOPMENT OF SURFACES

12

Development of lateral surfaces in simple vertical position when the cutting plane is inclined to one of the principal planes and perpendicular to the other – Prisms, pyramids cylinders and cones.

UNIT V ORTHOGRAPHIC AND ISOMETRIC PROJECTIONS

12

Representation of Three-dimensional objects – Introduction of Orthographic projection – Need for importance of multiple views and their placement – First angle projection – layout views – Developing visualization skills through multiple views from pictorial views of objects Principles of isometric projection – isometric scale **– Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones - Conversion of Isometric view to orthographic projection.**

TOTAL PERIODS: 60

COURSE OUTCOMES

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

- perform sketching of basic curves and projection of points in four quadrants
- draw the projections of straight lines and plane surfaces in given quadrant
- comprehend the projection of solids in various positions in first quadrant
- draw the development of surfaces.
- prepare orthographic and isometric projection of simple solids.

TEXT BOOKS

1. Natrajan K.V., “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2009.
2. Prabhakaran. S, Makesh. M, Subburam. V, “Engineering Graphics”, Maruthi Publishers, Chennai, 2016

REFERENCE BOOKS

1. Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
2. Luzzader, Warren.J. and Duff, John M., “Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
3. Shah M.B., and Rana B.C., “Engineering Drawing”, Pearson, 2nd Edition, 2009.
4. Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 2008.
5. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	1	-	-	-	-	1	1	2	1
CO2	3	3	3	3	3	1	-	-	-	-	1	1	2	1
CO3	3	3	3	3	3	1	-	-	-	-	1	1	2	1
CO4	3	3	3	3	3	1	-	-	-	-	1	1	2	1
CO5	3	3	3	3	3	1	-	-	-	-	1	1	2	1



SEMESTER III

MA16301	TRANSFORMS AND BOUNDARY VALUE PROBLEMS	3	2	0	4
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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

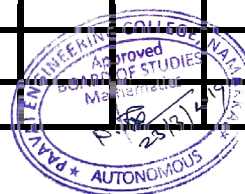
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2. Veerarajan T., “Transforms and Partial Differential Equations”, Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012.

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.

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CO 5	2	1	3	1				2					2	



COURSE OBJECTIVES

To enable the students to

- ✦ learn about biasing of BJT
- ✦ design and construct basic amplifiers
- ✦ construct JFET and MOSFET amplifiers
- ✦ understand the advantages and analysis of feedback amplifiers.
- ✦ learn about the various methods of oscillators

UNIT I BIASING OF DISCRETE BJT **9**

Need for Biasing, operating point, Various biasing methods for BJT, DC and AC Load line –Biasing Design-Stability Factor- **Bias compensation techniques**-Thermal stability.

UNIT II BJT AMPLIFIERS AND LARGE SIGNAL AMPLIFIERS **9**

Small signal Analysis of CE,CB and CC amplifiers - Differential amplifiers- CMRR-Darlington Amplifier
– Cascade amplifier - Cascode Amplifier - Large signal Amplifiers - **Class A , Class B and Class C Power Amplifiers**

UNIT III JFET AND MOSFET AMPLIFIERS **9**

Small signal analysis of JFET amplifiers - Design of biasing for JFET - Common source amplifier, Source follower and Common Gate amplifiers - Voltage swing limitations - Small signal Analysis of MOSFET - **Design of biasing for MOSFET.**

UNIT IV FEEDBACK AMPLIFIERS **9**

Feedback amplifiers - General feedback structure - Properties of negative feedback - Basic feedback topologies - Series - Shunt, Series - Series, Shunt - Shunt and shunt - Series feedback - Determining the Loop Gain.

UNIT V OSCILLATORS **9**

Classification, Barkhausen Criterion - Mechanism for start of oscillation and stabilization of amplitude, **Analysis of RC oscillators – RC Phase shift - Wien bridge - General form of LC oscillator - Hartley, Colpitts and Crystal oscillators.**

TOTAL PERIODS 45

COURSE OUTCOMES

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

- design circuits with transistor biasing.
- know about simple amplifier circuits.
- analyze the performance of JFET and MOSFET amplifiers.
- understand the concepts of feedback amplifiers

- design the simple oscillator circuits.

TEXT BOOKS

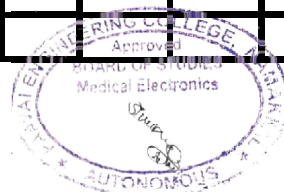
1. Donald .A. Neamen, “Electronic Circuit Analysis and Design” 2nd Edition, Tata Mc Graw Hill, 2009.
2. David A., “Bell Electronic Devices and Circuits”, Oxford Higher Education Press, 5th Edition, 2010

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1. Adel .S. Sedra, Kenneth C. Smith, “Micro Electronic Circuits”, 6th Edition, Oxford University Press, 2010.
2. Millman.J. and Halkias C.C, “Integrated Electronics”, Mc Graw Hill, 2001.
3. D.Schilling and C.Belove, “Electronic Circuits”, 3rd Edition, Mc Graw Hill, 1989.
4. Behzad Razavi, “Design of Analog CMOS Integrated Circuits”, Tata Mc Graw Hill, 2007.
5. Paul Gray, Hurst, Lewis, Meyer “Analysis and Design of Analog Integrated Circuits”, 4 th Edition, John Willey and Sons 2005
6. Robert L. Boylestad and Louis Nasheresky, “Electronic Devices and Circuit Theory”, 10th Edition, Pearson Education / PHI, 2008.

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CO 5	2	1	3	1				2					2	



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

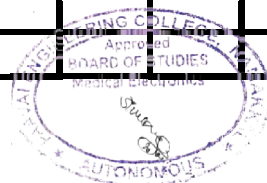
1. M. Morris Mano, "Digital Design", 3.ed., Prentice Hall of India Pvt. Ltd., New Delhi, 2003/Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003 .
2. H. Charles Roth Jr, "Digital System Design using VHDL", Thomson/ Brookscole, 2005.(Unit V)

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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.

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MD16303

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
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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
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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
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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
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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
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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
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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

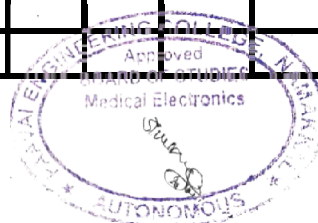
1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, “Signals and Systems”, Pearson, Indian Reprint, 2007.
2. Simon Haykin and Barry Van Veen, —Signals and Systems, John Wiley, 1999.

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:

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CO 4	2	1	2	3									2	
CO 5	2	1		2									2	



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 the 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. Prabhjot Kaur, "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

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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, Mc Graw 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

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COURSE OBJECTIVES

To enable the students to

- learn the basics of Measurement Systems.
- learn the characteristics of various types of measurement systems and errors in measuring instruments.
- know the relevance of digital instruments in measurements and need for data acquisition systems
- understand the importance of Display Devices and Recorders in practical fields
- analyse various concepts of transducers

UNIT I INTRODUCTION**9**

Functional elements of an instrument - Static and dynamic characteristics - Errors in measurement- statistical evaluation of measurement data - Standards and calibration.

UNIT II ELECTRICAL AND ELECTRONICS INSTRUMENTS**9**

Principle and types of analog and digital voltmeters, ammeters, multimeters - Single and three phase watt meters and energy meters - Magnetic measurements - Determination of B-H curve and measurements of iron loss - Instrument transformers - Instruments for measurement of frequency and phase.

UNIT III COMPARISON METHODS OF MEASUREMENTS**9**

Introduction, significance of measurements, methods of measurements, Instruments and measurement systems, Functions of instruments and measurement systems, Applications of measurement systems. D.C and A.C potentiometers, DC Bridges –Wheatstone, Kelvin , AC bridges- Maxwell, Hay, Schering and Wien bridge - Multiple earth and earth loops - Electrostatic and electromagnetic interference - Grounding techniques, Measurement Errors

UNIT IV STORAGE AND DISPLAY DEVICES**9**

Oscilloscopes: Introduction, basic principles, CRT features, Block diagram and working of each block, Typical CRT connections, Dual beam and dual trace CROs, Electronic switch. Magnetic disk and tape – Recorders, digital plotters and printers, LED, LCD and dot matrix display – Data Loggers- X-Y recorder, Magnetic and Digital tape recorders.

UNIT V TRANSDUCERS AND DATA ACQUISITION SYSTEMS**9**

Classification of transducers - Passive and Active - Variable resistive, capacitive and inductive transducers and its applications - Strain gauges, Thermistor, RTD, LVDT, capacitor microphone - Thermocouple - Piezoelectric, Photo electric, transducers - Elements of data acquisition system - Smart sensors.

TOTAL PERIODS**45**

COURSE OUTCOMES

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

- analyze the functions of different electronic instruments
- instrument characteristics, errors and generalized measurement system
- design Data Acquisition system.
- understand and use different display devices and recorders
- select right kind of transducers for specific application

TEXT BOOKS:

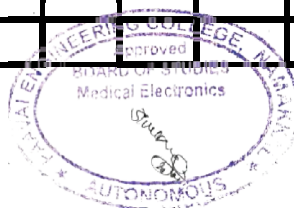
1. E.O. Doebelin, Measurement Systems – Application and Design, Tata McGraw Hill publishing company, 2003.
2. A.K. Sawhney, A Course in Electrical and Electronic Measurements and Instrumentation, Dhanpat Rai and Co, 2004.

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1. A.J. Bouwens, Digital Instrumentation, Tata Mc Graw Hill, 1997.
2. D.V.S. Moorthy, Transducers and Instrumentation, Prentice Hall of India Pvt Ltd, 2007.
3. H.S. Kalsi, Electronic Instrumentation, Tata Mc Graw Hill, II Edition 2004.
4. Martin Reissland, Electrical Measurements, New Age International (P) Ltd., Delhi, 2001.
5. J. B. Gupta, A Course in Electronic and Electrical Measurements, S. K. Kataria and Sons, Delhi, 2003.

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To enable the students to

- study the characteristic of CC and CS Amplifier
- study the Transfer characteristic of differential amplifier
- perform experiment to obtain the max power transfer of power amplifiers
- differentiate feedback amplifiers and oscillators.

LIST OF EXPERIMENTS

1. Frequency Response of fixed bias amplifier
2. Frequency Response of CC / CS amplifier
3. Darlington Amplifier
4. Differential Amplifiers- Transfer characteristic, CMRR Measurement
5. Determination of max power transfer of class A / class B power amplifier
6. Cascode / Cascade amplifier
7. Series and Shunt feedback amplifiers-Frequency response
8. RC Phase shift oscillator / Wien Bridge oscillator
9. Hartley Oscillator / Colpitts Oscillator
10. Simulation of Wien Bridge oscillator
11. Simulation of Colpitts Oscillator

TOTAL PERIODS 60

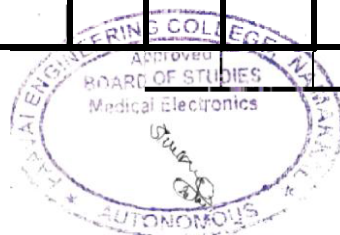
COURSE OUTCOMES:

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

- analyze the max power transfer of power amplifiers
- measure CMRR in differential amplifier
- simulate amplifiers using Multisim
- analyze various types of feedback amplifiers

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									3	
CO 2	2	1		2									3	
CO 3	2	1	2	3									3	
CO 4	2	1	2	3									2	



COURSE OBJECTIVES

To enable the students to

- design and implement Adders and Subtractors design and implement code converters and
- combinational logic circuits like MUX, DEMUX, Encoder, Decoder
- 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 IC 74180.
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 IC 7445 and IC 74147.
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

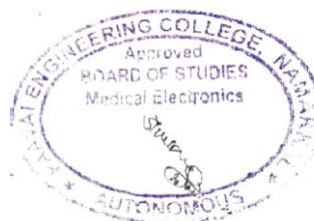
COURSE OUTCOMES:

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
- analyze the combinational logic circuits like MUX, DEMUX, Encoder, Decoder etc.
- simulate 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													
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CO 2	2	1					2	2					3	
CO 3	2	1					2	2					3	
CO 4	2	1					2	2					2	



COURSE OBJECTIVES

To enable the students to

- study the characteristics of Strain Gauges
- study the characteristics of sensors, signal conditioning circuits and their biomedical applications
- study the characteristics of Static and Dynamic characteristics of RTD and lead wire compensations
- study the characteristics of A/D and D/A converter

LIST OF EXPERIMENTS

1. Characteristics of strain gauges.
2. Displacement measurement using LVDT.
3. Characteristics of temperature sensors
4. Wheatstone and Kelvin's bridge for measurement of resistance
5. Characteristics of Light sensors-Photodiode, Photo Transistor
6. Static and Dynamic characteristics of RTD and lead wire compensations
7. Bridge Circuits for Measurement of Resistance, capacitance and inductance
8. Static characteristic of Thermistor and its linearization
9. Calibration of Voltmeter and Ammeter using potentiometer
10. Characteristics of A/D and D/A converter

TOTAL PERIODS 60

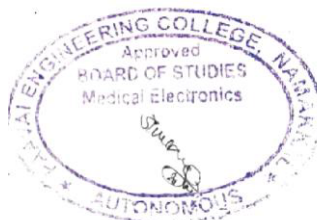
COURSE OUTCOMES:

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

- design measurement system by using LVDT and strain gauges.
- analyze the functions of different electronic instruments
- analyze the various light sensor measurements
- understand the characteristics of Basic Converters

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 3	2	1	3	1	2	2	2	2					3	1
CO 4	2	1	3	1	2	2	2	2					2	1



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 9
OPERATIONAL AMPLIFIER

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 fibre 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

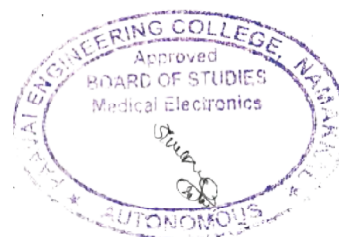
1. D.Roy Choudhry, Shail Jain, "Linear Integrated Circuits", New Age International Pvt. Ltd., Fourth edition 2010.
2. Sergio Franco, "Design with operational amplifiers and analog integrated circuits", McGraw Hill, 3rd edition 2007.

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.

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CO 4	2	1	3	1									2	
CO 5	2	1	3	1				2					2	



COURSE OBJECTIVES

To enable the students to

- gain knowledge on control system modelling
- understand the concept of time domain analysis of control systems
- carryout frequency response analysis using various plots
- study methods to analyze the stability of control systems
- know the concept of state variable analysis in control systems

UNIT I CONTROL SYSTEM MODELING 9

Basic elements of control System - Open loop and Closed loop systems - Differential equation - Transfer function concept - **Modelling of electric systems**, Translational and rotational mechanical systems - Block diagram reduction Techniques - **Signal flow graph** - Mason's gain formula.

UNIT II TIME RESPONSE ANALYSIS 9

Standard test Signals - Time response analysis - First order systems - Impulse and step response analysis of second order systems - Steady state errors - **P, PI, PD and PID Compensation.**

UNIT III FREQUENCY RESPONSE ANALYSIS 9

Frequency response - Bode plot, Polar plot, Nyquist plot - Frequency domain specifications from the plots - Gain margin and phase margin assessment - Series, Parallel, Series - parallel Compensators.

UNIT IV STABILITY ANALYSIS 9

Stability - Location of roots in S plane for **stability - Routh-Hurwitz Criterion** - Root Locus technique, Construction of Root Locus - Nyquist stability criterion.

UNIT V STATE VARIABLE ANALYSIS 9

State space representation of continuous time systems - State equations - Transfer function from state variable representation - Solutions of the state equations - **Concepts of controllability and observability.**

TOTAL PERIODS 45

COURSE OUTCOMES

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

- determine the models of control systems and their representation
- learn time domain techniques to design a control system
- understand the basic frequency response plots
- identify the major causes that affect the stability of a control system
- know the concept of state variable analysis of control systems

TEXT BOOKS

1. J.Nagrath and M.Gopal, "Control System Engineering", New Age International Publishers, 5th Edition, 2007.

REFERENCES

1. Benjamin, C.Kuo, "Automatic control systems", Prentice Hall of India, 7th Edition, 1995.
2. M.Gopal, "Control System – Principles and Design", Tata McGraw Hill, 2nd Edition, 2002.
3. Schaum's Outline Series, "Feedback and Control Systems", Tata McGraw-Hill, 2007.
4. John J.D'azzo and Constantine H.Houpis, "Linear control system analysis and design", Tata McGraw-Hill Inc., 1995.
5. Richard C. Dorf and Robert H. Bishop, "Modern Control Systems", Addison – Wesley, 1999.

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CO 4	2	1	3	1									2	
CO 5	2	1	3	1				2					2	



COURSE OBJECTIVES

To enable the students to

- ♦ understand analog and digital communication techniques.
- ♦ learn data and pulse communication techniques.
- ♦ be familiarized with source and Error control coding.
- ♦ gain knowledge on multi-user radio communication.

UNIT I ANALOG COMMUNICATION 9

Noise: Source of noise - External noise- Internal noise- Noise calculation. Introduction to Communication **Systems:** Modulation Types - Need for modulation. Theory of Amplitude modulation - Evolution and description of **SSB techniques** - Theory of frequency and phase modulation. Comparison of various Analog communication system (AM, FM, PM).

UNIT II DIGITAL COMMUNICATION 9

Amplitude Shift Keying (ASK) - Frequency Shift Keying (FSK) - Minimum Shift Keying (MSK) - Phase Shift Keying (PSK) - BPSK QPSK 8 PSK 16 PSK - Quadrature Amplitude Modulation (QAM) - 8 QAM - 16 QAM - Bandwidth efficiency- Comparison of various digital communication system (ASK - FSK - PSK - QAM).

UNIT III DATA AND PULSE COMMUNICATION 9

Data Communication: History of data Communication - Standards organizations for data communication- Data communication circuits - Data communication codes - Error detection and correction techniques - Data communication hardware - Serial and parallel interfaces. **Pulse Communication:** Pulse Amplitude Modulation (PAM) **Pulse Time Modulation (PTM) Pulse Code Modulation (PCM)** - Comparison of various pulse communication systems (PAM, PTM, PCM).

UNIT IV SOURCE AND ERROR CONTROL CODING 9

Entropy, Source encoding theorem, Shannon-Fano coding, **Huffman coding, Mutual information, Channel capacity, Channel coding theorem, Error control coding, Linear block codes, Cyclic codes, Convolution codes, Viterbi decoding algorithm.**

UNIT V MULTI-USER RADIO COMMUNICATION 9

Advanced Mobile Phone System (AMPS) - Global System for Mobile Communications (GSM) - Code Division Multiple Access (CDMA)-Cellular concept and frequency Reuse - Channel assignment and Hand - Overview of Multiple Access Schemes - Satellite communication - Bluetooth.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- apply analog and digital communication techniques.
- use data and pulse communication techniques.
- analyze Source and Error control coding.
- utilize multi-user radio communication.

TEXT BOOKS

1. Simon Haykin, "Communication Systems", 4th Edition, John Wiley and Sons, 2004
2. Wayne Tomasi, "Advanced Electronic Communication Systems", 6th Edition, Pearson Education, 2009.

REFERENCES

1. B. P.Lathi, "Modern Analog and Digital Communication Systems", 3rd Edition, Oxford University Press, 2007.
2. H.Taub, D L Schilling and G Saha, "Principles of Communication", 3rd Edition, Pearson Education, 2007.
3. Martin S.Roden, "Analog and Digital Communication System", 3rd Edition, Prentice Hall of India, 2002.
4. Blake, "Electronic Communication Systems", Thomson Delmar Publications, 2002.
5. B.Sklar, "Digital Communication Fundamentals and Applications" 2nd Edition Pearson Education 2007.
6. Rappaport T.S, "Wireless Communications: Principles and Practice", 2nd Edition, Pearson Education, 2007

CO-PO Mapping:

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CO 4	2	1	3	1									2	



COURSE OBJECTIVES

To enable the students to

- gain knowledge on basic concepts of medical instrumentation.
- explain the function of bio amplifiers.
- know the basic measurements of physiological parameters
- have basic knowledge on Clinical Laboratory instruments
- know about medical equipment design and developments.

UNIT I BASIC CONCEPTS OF MEDICAL INSTRUMENTATION AND BIO SENSORS 9

Terminology of medicine and medical devices, generalized medical instrumentation system, alternative operational modes, medical measurement constraints - classification of biomedical instruments - biostatistics - regulations of medical devices. Bio potential and bio sensors: Origin of bio potential and its propagation. Electrode - skin interface, half-cell potential. Types of electrodes and its application. Recording problems - measurement with two electrodes. Biosensor: Need of sensors, working principle of biosensor, various types of biosensors and its applications, bio transducers, bio interface.

UNIT II ELECTRODE CONFIGURATIONS and BIO AMPLIFIER 9

Bio signal characteristics - frequency and amplitude ranges. ECG - Einthoven's triangle, standard 12 lead system. EEG - 10-20 electrode system, unipolar, bipolar and average mode. EMG - unipolar and bipolar mode. Bioamplifier: Basic Amplifier configurations, Need for bio-amplifier - single ended bio-amplifier, differential bio-amplifier, isolation amplifiers - transformer and optical isolation - isolated DC amplifier and AC carrier amplifier. Chopper amplifier.

UNIT III MEASUREMENTS OF BLOOD PRESSURE, BLOOD VOLUME AND CARDIAC OUTPUT 9

Blood pressure: Direct and Indirect measurements - Harmonic analysis of blood pressure waveforms - Heart sounds - Phonocardiography - Temperature, Respiration rate and pulse rate measurement, Blood volume Electromagnetic flow meters - Ultrasonic flow meters - chamber plethysmography - photo plethysmography. CARDIAC OUTPUT MEASUREMENTS: Indicator dilution, thermal dilution and dye dilution method, Electromagnetic and ultrasound blood flow measurement.

UNIT IV CLINICAL LABORATORY INSTRUMENTS 9

Blood gas and acid base Physiology - Electro chemical sensor chromatography - Electrophoresis - Blood cell counter, Auto analyzer, Centrifuge, Blood gas analyzers, colorimeter, flame photometer, spectrophotometer.

UNIT V DESIGN AND DEVELOPMENT OF BIOMEDICAL DEVICES AND SYSTEMS

9

The essentials of design - Overview - Biomedical engineering design in Industrial context - Fundamental design Tools - Product definition- Product development- Hardware development methods and tools - Software development methods and tools- Biomaterials and material testing- Biological engineering designs Developing Biomedical Devices- Emerging Issues in Healthcare- Innovation and Rights- Industrial designs- Patent classification- Examples of Industrial design requirements evaluations

TOTAL PERIODS: 45

COURSE OUTCOMES

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

- explain the basic concepts of Medical Instrumentation
- perform Electrical and non-electrical physiological measurements
- explain the function of bio amplifiers.
- explain the functions of laboratory and radiological equipments
- explain about medical equipment designing procedure

TEXT BOOKS:

1. Medical Instrumentation: Application and Design- by John G. Webster-john wiley and sons-inc,2009-fourth edition
2. Design of Biomedical Devices and Systems, Third Edition- Paul H. King, Richard C. Fries, Arthur T. Johnson- CRC Press-2014

REFERENCES:

1. R. S. Khandpur, "Handbook of Biomedical Instrumentation " 2nd Edition, Tata McGraw Hill, 2003
2. Medical Instruments and Devices: Principles and Practices by Steven Schreiner, Joseph D. Bronzino, Donald R. Peterson- CRC Press -first edition -2017

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 5	2	1	3	1				2					2	

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
- 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 templates.

UNIT V EXCEPTION HANDLING 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

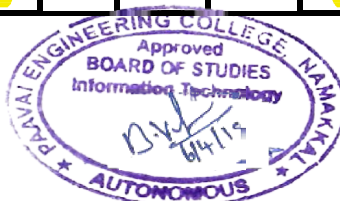
1. E.Balagurusamy, “Object Oriented Programming with C++”, Tata McGraw Hill, Sixth Edition, 2013.

REFERENCES

1. Ira Pohl, “Object Oriented Programming using C++”, Pearson Education, Second Edition Reprint 2004.
2. B. Lippman, Josee Lajoie, 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:

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CO 5	3	1	2	3	2	-	-	1	-	-	-	3	2	1



COURSE OBJECTIVES

To enable the students to

- fundamental knowledge of object oriented programming.
- 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: 60 PERIODS

COURSE OUTCOMES

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

- design an object oriented program using classes and objects.
- apply inheritance to reuse the C++ code.
- apply polymorphism to extend the code and reduce the complexity of the program.
- implement files 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:

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CO4	2					2	2	2					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
- analyze the working of power supply

CO-PO Mapping:

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COURSE OBJECTIVES

To enable the students to

- provide hands on training on Measurement of physiological parameters, biochemical parameters measurement and bio signal analysis.
- measure PH and conductivity
- design and analyze biological pre amplifiers
- study the characteristics of Optical Isolation amplifier

LIST OF EXPERIMENTS

1. Design and analysis of biological pre amplifiers
2. Blood pressure measurement
3. Experiment of Photoplethysmography
4. Recording of ECG signal and analysis
5. Recording of EMG-Signal
6. Recording of various physiological parameters using patient monitoring system and telemetry units.
7. Measurement of respiration rate.
8. Measurement and recording of peripheral blood flow
9. Study of characteristics of optical Isolation amplifier
10. Measurement of PH and Conductivity

TOTAL PERIODS 60

OUTCOMES:

At the end of the laboratory student is able to:

- design the amplifier for Bio signal measurements
- recording and analysis of bio signals
- Study the characteristics of optical Isolation amplifier
- Measure various rate parameters.

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	

