SREE VIDYANIKETHAN ENGINEERING COLLEGE
(AUTONOMOUS)
Sree Sainath Nagar, Tirupati

Department of Electronics and Instrumentation Engineering

Supporting Document for 1.1.3

Courses having focus on

Employability/ Entrepreneurship/ skill Development

Program: B.Tech.- Electronics and Instrumentation Engineering

Regulations : SVEC-16

The Courses (with course outcomes) under SVEC-16 Regulations which focus on ***employability/ entrepreneurship/ skill development*** are highlighted with the following colours.

Skill

Employability

Entrepreneurship

I B. Tech. - I Semester

(16BT1BS02) ENGINEERING PHYSICS

(Common to ECE, EEE & EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	*70*	*100*	*3*	*1*	*--*	*3*

PRE-REQUISITES: Intermediate / senior secondary Physics

COURSE DESCRIPTION:

Lasers; optical fibers; principles of quantum mechanics; band theory of solids; semiconductors; dielectric properties of materials; acoustics of buildings; superconductors; crystallography and nanomaterials.

COURSE OUTCOMES:

After completion of the course, a successful student will be able to:

CO1: Acquire basic knowledge of lasers, optical fibers, quantum mechanics, dielectrics, semiconductors, and superconductors, acoustic of buildings, crystallography and nanomaterials.

CO2: Analyze the construction and working of various laser systems, semiconductor devices, various types of optical fibers and its communication system and nano materials properties.

CO3: Gain skills in designing lasers, optical fiber cable, semiconductor devices, acoustically good halls and nanomaterials.

CO4: Develop problem solving skills in engineering context.

CO5: Use relevant techniques for assessing ball milling, pulsed laser deposition, p-n junction and Laser

DETAILED SYLLABUS:

UNIT I - LASERS AND FIBER OPTICS (11periods)

Lasers: Introduction, characteristics of lasers, spontaneous and stimulated emission of radiation, Einstein's coefficients - condition for amplification, population inversion, Nd:YAG laser, Helium-Neon laser, semiconductor laser and applications of lasers.

Fiber optics: Introduction, principle of optical fiber, acceptance angle, acceptance cone and numerical aperture, classification of optical fibers, optical fiber communication system and applications of optical fibers.

UNIT II – PRINCIPLES OF QUANTUM MECHANICS AND BAND THEORY OF SOLIDS (07 p*eriods*)

Principles of Quantum Mechanics: Introduction, de-Broglie's hypothesis, Schrödinger's one dimensional wave equation (time independent), significance of wave function, particle in a one dimensional potential box, Fermi-Dirac distribution and effect of temperature (qualitative treatment).

Band Theory of Solids: Electron in a periodic potential, Kronig-Penney model (qualitative treatment), origin of energy bands formation in solids, distinction between conductors, semiconductors and insulators based on band theory.

UNIT III – SEMICONDUCTORS AND DIELECTRIC PROPERTIES OF MATERIALS (13 periods)

Semiconductors: Introduction, types of semiconductors, intrinsic carrier concentration, electrical conductivity in semiconductors, drift and diffusion currents, Einstein's relation, Hall effect and its applications, direct and indirect band gap semiconductors, p-n junction, energy band diagram of p-n diode, LED, photo diode and Solar cell.

Dielectric Properties of Materials: Introduction, dielectric constant, electronic, ionic and orientation polarizations (qualitative treatment), local field, frequency dependence of polarizability (qualitative treatment), ferroelectricity.

UNIT IV – ACOUSTICS OF BUILDINGS AND SUPERCONDUCTIVITY (07 periods)

Acoustics of Buildings: Introduction, basic requirement of acoustically good hall, reverberation and time of reverberation, Sabine's formula for reverberation time (qualitative treatment), absorption coefficient of sound and its measurement, factors affecting the architectural acoustics and their remedies.

Superconductivity: Introduction, General properties - Meissner effect, penetration depth, Type-I and Type-II superconductors, flux quantization, Josephson effects, BCS theory (qualitative treatment), applications of superconductors.

UNIT V – CRYSTALLOGRAPHY AND NANOMATERIALS (07 p*eriods*)

Crystallography: Introduction, crystal planes, crystal directions and Miller indices, separation between successive (hkl) planes, X-ray diffraction by crystal planes, Bragg's law-powder method.

Nanomaterials: Introduction, principles of nanomaterials, properties of nanomaterials, synthesis of nanomaterials by ball milling and pulsed laser deposition and applications of nanomaterials.

Total Periods: 45

TEXT BOOK:

1. P. K. Palaniswamy, ***Engineering Physics***, Scitech Publications India Private Limited, 2nd Edition, 2009

REFERENCE BOOKS:

1. Dr. S. Mani Naidu, ***Engineering Physics***, Pearson Education, 1st Edition, 2013.
2. M.N. Avadhanulu, P.G.Kshirsagar, ***A textbook of Engineering Physics***, S.Chand & Company Ltd. Revised edition 2014.
3. K. Thyagarajan, ***Engineering Physics-I***, McGraw-Hill Education (India) Pvt. Ltd. 2015.

I B. Tech. – I Semester

(16BT1BS03) MATRICES AND NUMERICAL METHODS

(Common to all Branches)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	*70*	*100*	*3*	*1*	*--*	*3*

PRE-REQUISITES: Intermediate /Senior secondary mathematics

COURSE DESCRIPTION: Fundamentals of matrix theory; numerical solutions of equations, curve fitting; interpolation; numerical differentiation and integration; numerical solutions of ordinary differential equations.

COURSE OUTCOMES: After completion of the course a successful student is able to

CO1: Acquire basic **knowledge** in

(a) Finding the rank of matrices and analyzing them.
(b) Solving algebraic and transcendental equations by various numerical methods.
(c) Fitting of various types of curves to the experimental data.
(d) Estimating the missing data through interpolation methods.
(e) Identification of errors in the experimental data
(f) Finding the values of derivatives and integrals through various numerical methods.
(g) Solving differential equations numerically when analytical methods fail.

CO2: Develop skills in **analyzing** the

(a) methods of interpolating a given data
(b) properties of interpolating polynomials and derive conclusions
(c) properties of curves of best fit to the given data
(d) algebraic and transcendental equations through their solutions
(e) properties of functions through numerical differentiation and integration
(f) properties of numerical solutions of differential equations

CO3: Develop skills in **designing** mathematical models for
- (a) Fitting geometrical curves to the given data
- (b) Solving differential equations
- (c) Constructing polynomials to the given data and drawing inferences.

CO4: Develop numerical skills in **solving the problems** involving
- (a) Systems of linear equations
- (b) Fitting of polynomials and different types of equations to the experimental data
- (c) Derivatives and integrals
- (d) Ordinary differential equations

CO5: Use relevant numerical **techniques** for
- (a) Diagonalising the matrices of quadratic forms
- (b) Interpolation of data and fitting interpolation polynomials
- (c) Fitting of different types of curves to experimental data
- (d) obtaining derivatives of required order for given experimental data
- (e) Expressing the functions as sum of partial fractions

DETAILED SYLLABUS:

UNIT–I : MATRICES (11 periods)

Rank of a matrix, echelon form, normal form, inverse of a matrix by elementary row operations. Solutions of linear system of equations. Eigen values, Eigen vectors and properties (without proof), Diagonalization. Quadratic form (QF), reductions to canonical form using orthogonal transformation and nature of QF.

UNIT-II NUMERICAL SOLUTIONS OF EQUATIONS AND CURVE FITTING (8 periods)

Solutions of Algebraic and Transcendental equations by bisection method, Regula-Falsi method, Newton – Raphson's method. Curve fitting by the principle of least squares, fitting of a straight line, parabola and exponential curves.

UNIT- III INTERPOLATION (8 periods)

Interpolation, difference operators and their relationships, Newton's forward and backward formulae, Lagrange's interpolation formula. Partial fractions using Lagrange's interpolation formula.

UNIT-IV NUMERICAL DIFFERENTIATION AND INTEGRATION (8 periods)

Numerical differentiation using Newton's forward and backward formulae. Numerical integration using Trapezoidal rule, Simpson's $1/3^{rd}$ rule and $3/8^{th}$ rule.

UNIT- V NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS (10 periods)

Numerical solutions of first order Initial value problems using Taylor series method, Euler's method , modified Euler's method, Runge – Kutta method (4 thorder only) and Milne's predictor – corrector method.

Total no. of periods: 45

TEXT BOOK:

1. T.K.V. Iyenger, B. Krishna Gandhi, S.Ranganadham and M.V.S.S.N.Prasad, ***Mathematical Methods***, S.Chand and Company, 8/e, 2013

REFERENCE BOOKS:

1. B.S. Grewal, ***Higher engineering mathematics***, Khanna Publishers, 42nd Edition. 2012
2. S.S.Sastry, ***Introductory methods of Numerical Analysis***, Prentice Hall of India, 5/e, 2013

I B. Tech. - I Semester

(16BT1BS04) MULTI - VARIABLE CALCULUS AND DIFFERENTIAL EQUATIONS

(Common to all Branches)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	*70*	*100*	*3*	*1*	--	*3*

PRE-REQUISITES: Intermediate /Senior secondary mathematics

COURSE DESCRIPTION: First order differential equations; higher order linear differential equations; functions of several variables; applications of integration; multiple integrals; vector calculus.

COURSE OUTCOMES: After completion of the course a successful student is able to

CO1: Acquire knowledge in
- (a) Higher order Differential equations
- (b) Maximum and minimum values for the functions of several variables
- (c) Double and triple integrals
- (d) Differentiation and integration of vector functions.
- (e) Line and surface volume
- (f) transforming integrals from three dimensional surfaces and volumes on to plane surfaces

CO2: Develop skills in analyzing the
- (a) methods for differential equation for obtaining appropriate solutions,
- (b) Properties of oscillatory electrical circuits and heat transfer in engineering systems
- (c) The variations in the properties of functions near their stationary values
- (d) Flow patterns of fluids, electrical and magnetic flux and related aspects

CO3: Develop skills in designing mathematical models for
- (a) R-C and L-R-C oscillatory electrical circuits
- (b) Heat transfer and Newton's law of cooling
- (c) Engineering concepts involving lengths of curves and areas of planes, Flux across surfaces

CO4: Develop analytical skills in solving the problems involving
- (a) Newton's law of cooling
- (b) non homogeneous linear differential equations
- (c) maximum and minimum values for the functions
- (d) lengths of curves, areas of surfaces and volumes of solids in engineering
- (e) transformation of integrals from three dimensional surfaces and volumes on to plane surfaces

CO5: Use relevant mathematical techniques for evaluating
- (a) various types of particular integrals in differential equations
- (b) stationary values for multi variable functions
- (c) multiple integrals in change of variables
- (d) integrations of vector functions.

DETAILED SYLLABUS:

UNIT-I: FIRST ORDER DIFFERENTIAL EQUATIONS (6 periods)

Linear and Bernoulli type, exact equations and reducible to exact. Orthogonal trajectories (Both Cartesian and polar forms). Newton's law of cooling.

UNIT II: HIGHER ORDER LINEAR DIFFERENTIAL EQUATIONS (9 periods)

Method for solution of linear equations- Differential operator *D*, Solution of second order linear homogeneous equations with constant coefficients, Solution of Higher order homogeneous linear equations with constant coefficients, **Solution of Non homogeneous linear equations**-Operator methods for finding particular integrals- for cases – e^{ax}, sin ax, cos ax, x^n, e^{ax} V(x), xV(x). Method of Variation of parameters. Applications to oscillatory electrical circuits.

UNIT-III: FUNCTIONS OF SEVERAL VARIABLES (8 periods)

Functions of Two Variables: Limits, Continuity; **Partial Derivatives**: Total Differential and Derivatives, Jacobian, Functional dependence, Taylor's Theorem, maxima and minima of functions of two variables with and without constraints – Lagrange's method of undetermined multipliers.

UNIT-IV: APPLICATIONS OF INTEGRATION AND MULTIPLE INTEGRALS (10 periods)

Applications of integration to – lengths of curves, areas of surfaces of revolution, Double and Triple integrals – change of

order of integration, change of variables in integrals. Area enclosed by plane curves, volumes of solids.

UNIT-V: VECTOR CALCULUS (12 periods)

Vector differentiation: Gradient of a scalar field and Directional Derivative, Divergence and Curl of a Vector field

Line integrals: Line integrals independent of path – work done.

Surface area and Surface Integrals: Surface Area, Surface Integrals, Flux across a surface.

Green's Theorem: Green's Theorem (without proof)- verification- applications

Gauss Divergence Theorem and Stoke's Theorem: Gauss Divergence theorem (without proof), Stokes's Theorem (without proof) –verifications and applications.

Total no. of periods: 45

TEXT BOOK:

1. T.K.V. Iyengar, B. Krishna Gandhi,S.Ranganatham and M.V.S.S.N. Prasad, ***Engineering Mathematics, Vol-1***, S. Chand &Company, 13/e, 2014

REFERENCE BOOKS:

1. Grewal, B.S., ***Higher engineering mathematics***,Khanna publishers, Delhi, 42/e. 2012.
2. Kreyszig, E., ***Advanced Engineering Mathematics***,John Wiley and Sons, Inc.,9/e.2012.

I B. Tech. - I Semester

(16BT10241) NETWORK ANALYSIS

(Common to ECE & EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	4	1	0	4

PRE-REQUISITES: --

COURSE DESCRIPTION: Basic concepts of electric circuits; Voltage - Current relationship of basic circuit elements; Mesh and Nodal analysis; Network theorems; AC circuits; Two-port network parameters; Transient analysis.

COURSE OUTCOMES: After successful completion of the course, student will be able to

CO1: Demonstrate knowledge in
- voltage and current relationships for various electric elements.
- network reduction techniques.
- concepts of AC fundamentals and single phase circuits.
- concepts of two-port networks.
- various network theorems.
- transient behavior of the circuits.

CO2: Analyze
- a circuit using conventional, mesh and nodal concepts.
- a two-port network for various network parameters.
- various types of two-port networks.
- the transient behavior of the circuits.

CO3: Design circuits to meet the required specifications

CO4: Evaluate
- electrical circuits for voltage, current and power using conventional circuit analysis methods and network theorems.
- transient response.
- two-port networks.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION TO ELECTRICAL CIRCUITS **(12 Periods)**

Concepts of charge, current, voltage, power, circuit elements, Ohm's law, Kirchoff's Laws, Network reduction techniques, voltage and current division rules, Series-Parallel circuits, Star-Delta and Delta-Star transformations, Source transformation, nodal analysis, mesh analysis- Problems.

UNIT-II: SINGLE PHASE AC CIRCUITS (12 Periods)

Introduction to AC quantities and basic definitions: Cycle, Time period, Frequency, Amplitude, determination of Average value, RMS value, Form factor and Peak factor for different alternating waveforms, phasor notation, phase and phase difference, phase relation in R, L, C circuits, series and parallel circuits, impedance and power triangle, power factor. Series and Parallel resonance, Quality factor and bandwidth-Problems.

UNIT-III: NETWORK THEOREMS (10 Periods)

Superposition, Thevenin's, Norton's, Maximum power transfer, Tellegen's, Millman's, Reciprocity, Compensation theorems for D.C. and sinusoidal excitation- Problems.

UNIT-IV: TWO-PORT NETWORKS (10 Periods)

Impedance parameters, admittance parameters, transmission (ABCD) parameters, hybrid parameters, conversion of one parameter to another, conditions for reciprocity and symmetry, interconnection of two-port networks in series, parallel and cascaded configurations - Problems.

UNIT-V: TRANSIENT ANALYSIS (10 Periods)

Transient response of R-L, R-C and R-L-C for DC excitation and Sinusoidal excitation - Solution by using Differential equation and Laplace Transforms method - Problems.

Total Periods: 54

TEXT BOOKS:

1. Sudhakar, S.P.Shyam Mohan, Circuits and Network analysis and synthesis, 5th edition, Tata McGraw Hill publishing company Ltd., New Delhi, 2007.
2. W. H. Hayt, J. E. Kemmerly, S. M. Durbin, Engineering Circuit Analysis, 6th edition, Tata McGraw Hill publishing company Ltd., New Delhi, 2008.

REFERENCE BOOKS:

1. M.E. Van Valkenberg, Network Analysis, Pearson Publications, 3rd edition, New Delhi 2006.
2. A.Chakrabarthi, Circuit Theory (analysis and synthesis), 6th edition, Dhanpat Rai & Co, New Delhi, 2014.

I B. Tech. - I Semester

(16BT10501) PROGRAMMING IN C

(Common to all Branches)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	*70*	*100*	*3*	*1*	*-*	*3*

PRE-REQUISITES: NIL

COURSE DESCRIPTION:

Program design; Operators and Expressions; Data Input and Output; Control Statements; Functions; Arrays; Strings; Pointers; Structures & Unions and File handling Techniques;

COURSE OUTCOMES:

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

CO1: Demonstrate knowledge in:
- o Elements of C Language
- o Selection and Repetition statements.
- o Arrays, Strings and Functional statements.
- o Derived data types, Files and Pointers

CO2: Analyze complex engineering problems to develop suitable solutions

CO3: Design algorithms for specified engineering problems

CO4: Use appropriate 'C' language constructs for solving engineering problems

CO5: Write programs using 'C' language to implement algorithms

DETAILED SYLLABUS:

UNIT I – INTRODUCTION TO C PROGRAMMING, OPERATORS & EXPRESSIONS (08 periods)

Introduction to C Programming: The C Character set, Writing First Program of C, Identifiers and Keywords, Data types, Constants, Variables and Arrays, Declarations, Expressions, Statements and Symbolic Constants.

Operators and Expressions: Arithmetic Operators, Unary Operators, Relational and Logical Operators, Assignment Operators, the Conditional Operators.

UNIT II – DATA INPUT AND OUTPUT & CONTROL STATEMENTS (08 periods)

Data Input and Output: Single Character Input and Output, Input Data & Output data, The gets and puts Function.

Control Statements: Branching: The if-else Statement, Looping: The while Statement, More Looping: The do-while Statement, Still More Looping: The for Statement, Nested Control Statement, The switch Statement, The break & continue Statements, The goto Statement.

UNIT III – FUNCTIONS, PROGRAM STRUCTURES & ARRAYS (11 p*eriods*)

Functions: A Brief Overview, Defining a Function, Accessing a Function, Function Prototypes, Parsing Argument to a Function, Recursion.

Program Structure: Storage Classes, Automatic Variables, External (Global) Variables, Static Variables, Multi file Programs, **Arrays**: Defining an Array, Processing an Array, Processing Array to function, Multidimensional Arrays. Linear search, Binary search, Fibonacci search, Bubble sort and Insertion sort

UNIT IV – STRINGS & POINTERS (09 periods)

Strings: Defining a String, NULL Character, Initialization of Strings, Reading and Writing a String, Processing a Strings, Character Arithmetic, Searching and Sorting of Strings, Library Functions for Strings.

Pointers: Pointer Declaration, Passing Pointers to a Function, Pointers and One-dimensional Arrays, Dynamic Memory Allocation, Operations on Pointers, Pointers and Multidimensional Arrays, Arrays of Pointers.

UNIT V – STRUCTURES AND UNIONS & FILE HANDLING (09 periods)

Structures and Unions: Defining a Structure, Processing a Structure, User-Defined Data types (typedef), Structures and Pointers, Passing Structures to Function, Self –Referential Structures, Unions

File Handling: Files introduction, Opening and Closing a Data File, Reading and Writing a Data File, Processing a Data File, Unformatted Data File, Concept of Binary Files, Accessing the File Randomly.

Total Periods: *45*

TEXT BOOK:

1. Byron Gottfried and Jitender Kumar C "*Programming with C*," Third Edition, McGraw Hill Education (India) Pvt, Ltd, New Delhi, 2016.

REFERENCE BOOKS:

1. PradipDey and Manas Ghosh, *"Programming in C",* Second Edition, Oxford University Press, NewDelhi, 2007.
2. E. Balagurusamy, "*Programming in C",* Seventh Edition, Mc Graw Hill Education (India) Pvt, Ltd, New Delhi, 2014.

I B. Tech. I-Semester

(16BT1BS32) ENGINEERING PHYSICS LAB

(Common to ECE, EEE & EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	0	0	3	2

PRE-REQUISITES: Intermediate / senior secondary Physics.

COURSE DESCRIPTION:

Characteristics of p-n junction diode, Photodiode, LED, and semiconductor laser diode. Experimental determination of carrier concentration and energy gap of a semiconductor material, wave length of a laser source, size of fine particle, numerical aperture and acceptance angle of optical fiber. Determination of frequency of electrically vibrating tuning fork and A.C source using A.C sonometer, magnetic field along axial line of a current carrying coil and rigidity modulus of material of a wire using torsional pendulum.

COURSE OUTCOMES:

After completion of the course, a successful student will be able to:

CO1: Acquire basic knowledge about semiconductor materials, magnetic materials and lasers.

CO2: Acquire analytical skills in the estimation of carrier concentration of semiconductor materials and characterization of p-n junction.

CO3: Develop skills in designing electronic circuits using semiconductor components.

CO4: Acquire skills to use instrumental techniques in A.C sonometer and Melde's experiment.

CO5: Apply diffraction techniques for determination of size of tiny particles and wave length of lasers.

ENGINEERING PHYSICS LAB

Conduct a minimum of any **Ten** of the following experiments.

1. Determination of wavelength of a laser source using Diffraction Grating.
2. Determination of particle size by using a laser source.
3. Determination of Numerical aperture and acceptance angle of an optical fiber.

4. Melde's experiment - transverse & longitudinal modes.
5. Magnetic field along the axis of a current carrying coil- Stewart and Gee's method.
6. Calculation of A.C frequency using sonometer.
7. I-V Characteristics of a p-n Junction diode.
8. Energy gap of a material of a p-n Junction.
9. Characteristics of LED source.
10. Characteristics of Photo diode.
11. Hall Effect.
12. Determination of rigidity modulus of the material of the wire using torsional pendulum.

I B. Tech. - I Semester

(16BT10232) ELECTRICAL AND ELECTRONICS WORKSHOP PRACTICE

(Common to ECE, EEE & EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	0	0	3	2

PRE-REQUISITES: NIL

COURSE DESCRIPTION: Identification and specifications of various Electric and Electronic devices; analysis of various series, parallel and series-parallel electrical circuits; develop various electrical circuits for domestic and industrial applications.

COURSE OUTCOMES: After successful completion of the course, student will be able to

CO1: Demonstrate knowledge on various Electrical and Electronic Devices.
CO2: Analyze various series and parallel electrical circuits.
CO3: Design and develop various electrical circuits for domestic and industrial applications.
CO4: Function effectively as individual and as a member in a team.
CO5: Communicate effectively both oral and written forms

DETAILED SYLLABUS:

PART A: (Demonstration)

1. Identification and Specifications of R, L, C Components (Colour Codes), Potentiometers, Switches (SPST, DPST and DPI), Gang Condensers, Relays, Bread Boards, PCBs, Fuses, MCBs, Earthing and Electrical Wiring accessories.
2. Identification and Specifications of Active Devices: Diodes, BJTs, Low-power JFETs, MOSFETs, Power Transistors, LEDs, LCDs, Optoelectronic Devices, SCR, UJT, DIACs, TRIACs, Linear and Digital ICs.
3. Study the operation of
   - Multimeter (Analog and Digital)
   - Function Generator
   - Regulated Power Supplies
   - CRO.

PART-B:

1. Measurement of Electrical Quantities (AC & DC) using: Voltmeter, Ammeter and Wattmeter.
2. Measurement of Resistivity of a conducting wire.
3. Circuit with one lamp controlled by one switch and provision of 2-pin or 3-pin socket PVC surface conduit system.
4. Circuit with two lamps controlled by two switches with PVC surface conduit system.
5. Circuit for Stair case wiring and Godown wiring.
6. Circuit connection for a Fluorescent tube
7. Solder simple electronic circuits.
8. B-H curve of a Magnetic material
9. I-V and P-V characteristics of a Solar panel
10. Design and Fabrication of a single-phase transformer
11. PCB preparation and design of a circuit on a PCB

I B. Tech. - I Semester

(16BT10251) NETWORK ANALYSIS LAB

(Common to ECE & EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	0	0	3	2

PRE-REQUISITES: NIL

COURSE DESCRIPTION: Verification of KVL, KCL and network theorems; analysis of AC and DC circuits; determination of resonant frequency in series and parallel RLC circuits; evaluation of transients

COURSE OUTCOMES: After successful completion of the course, student will be able to

CO1: Demonstrate knowledge in
- Identification of various circuit elements and their values.
- Concepts of electric circuits and two-port networks.

CO2: Analyze and relate physical observations and measurements in electric circuits to theoretical perception.

CO3: Design circuit parameters to meet the required specifications.

CO4: Demonstrate skills in evaluating and interpret
- Various circuit parameters using conventional and network theorems
- Network parameters

CO5: Function effectively as individual and as a member in a team.

CO6: Communicate effectively in oral format and prepare laboratory reports.

LIST OF EXPERIMENTS:

Any TEN experiments are to be conducted

1. Verification of KVL and KCL.
2. Mesh and Nodal analysis.
3. Series and Parallel resonance.
4. Phasor analysis of RL, RC and RLC circuits.
5. Measurement of active and reactive power in a single phase circuit.
6. Steady state response of series RL and RC circuits.
7. Two-port network parameters.
8. Verification of Superposition and Reciprocity theorems.
9. Verification of Thevenin's and Norton's theorem.
10. Verification of Maximum Power transfer theorem for DC and AC excitations.
11. Verification of Millmann's and compensation theorem.
12. Transient response of RL, RC and RLC circuits.

I B. Tech. - I Semester

(16BT10531) PROGRAMMING IN C LAB

(Common to all Branches)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	0	0	3	2

PRE-REQUISITES:-

A course on "Programming in C"

COURSE DESCRIPTION:

Hands on practice in developing and executing simple programs using C Programming constructs– Conditional statements, Loops, Arrays, Strings, Functions, Structures, Pointers and Functions.

COURSE OUTCOMES:

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

CO1: Demonstrate practical knowledge of using C language constructs:
- Selection and Repetition statements.
- Arrays, Strings and Functional statements.
- Derived data types, Files and Pointers

CO2: Analyze problems to develop suitable algorithmic solutions

CO3: Design Solutions for specified engineering problems

CO4: Use appropriate 'C' language constructs for solving engineering problems

CO5: Implement and execute programs using 'C' language

CO6: Document programs and communicate effectively while conducting Professional transactions.

List of Exercises:

1. a. Let a and b are two integer variables whose values are 10 and 13 respectively. Write a program to evaluate the following arithmetic expressions.
   i) a + b ii) a–b iii) a * b iv) a/b v) a % b
   b. Write a program to evaluate the following algebraic expressions after reading necessary values from keyword.
   i) $(ax + b)/(ax – b)$
   ii) $2.5 \log x + \text{Cos } 32^0 + | x^2 + y^2|$
   iii) $x^5 + 10 x^4 + 8$ and $x^3 + 4 x + 2$
   iv) ae^{kt}

2. a. Mr. Gupta deposited Rs.1000 in a bank. The bank gives simple interest at the rate of 15% per annum. Write a program to determine the amount in Mr. Gupta's account at the end of 5 years. (Use the formula I = P T R / 100)

b. A cashier has currency notes of denominations Rs.10, Rs. 50 and Rs. 100. If the amount to be withdrawn is input in hundreds, find the total number of notes of each denomination the cashier will have to give to the withdrawer.

c. In a town, the percentage of men is 52. The percentage of total literacy is 48.If total percentage of literate men is 35 of the total population; write a program to find the total number of illiterate men and women if the population of the town is 8000.

3. a. Write a program that prints the given 3 integers in ascending order using if - else.

b. Write a program to calculate commission for the input value of sales amount.

Commission is calculated as per the following rules:

i) Commission is NIL for sales amount Rs. 5000.

ii) Commission is 2% for sales when sales amount is >Rs. 5000 and <= Rs. 10000.

iii) Commission is 5% for sales amount >Rs. 10000.

c. A character is entered through keyboard. Write a program to determine whether the character entered is a capital letter, a small case letter, a digit or a special symbol. The following table shows the range of ASCII values for various characters.

	Characters ASCII values
	A - Z 65 - 90
	a - z 97- 122
	0 - 9 48 - 57
Special Symbols	0 - 47, 58 - 64, 91- 96, 123 - 127

4. a. If cost price and selling price of an item is input through the keyboard, write program to determine whether the seller has made profit or incurred loss. Also determine how much profit or loss he incurred in percentage.

b. An insurance company calculates premium as follows:

i. If a person's health is excellent and the person is between 25 and 35 years of age and lives in a city and is a male then premium is Rs.4 per thousand and the policy amount cannot exceed Rs.2 lakhs.

ii. If a person satisfies all the above conditions and is female then the premium is Rs.3 per thousand and the policy amount cannot exceed Rs.1 lakh.

iii. If a person's health is poor and the person is between 25 and 35 years of age and lives in a village and is a male then premium is Rs.6 per thousand and the policy cannot exceed Rs. 10000.

iv. In all other cases the person is not insured.

Write a program to determine whether the person should be insured or not, his/her premium rate and maximum amount for which he/she can be insured.

5. a. Write a program, which takes two integer operands and one operator as input from the user, performs the operation and then prints the result. (Consider the operators +,-,*, /, %. Use switch statement)

b. Write a program to find the grace marks for a student using switch. The user should enter the class obtained by the student and the number of subjects he has failed in. Use the following rules:

i. If the student gets first class and the number of subjects failed is >3, then no grace marks are awarded. If the number of subjects failed is less than or equal to '3' then the grace is 5 marks per subject.

ii. If the student gets second class and the number of subjects failed in is >2, then no grace marks are awarded. If the number of subjects failed in less than or equal to '3' then the grace is 4 marks per subject.

iii. If the student gets third class and the number of subjects failed in is >1, then no grace marks are awarded. If the number of subjects failed in is equal to '1' then the grace is 5 marks per subject.

6. a. Write a program to find the sum of individual digits of a positive integer.

b. A Fibonacci sequence is defined as follows:

The first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a program to generate the first N terms of the sequence.

Write a program to generate all the prime numbers between 1 and N, where N is a value supplied by the user.

7. a. Write a program to find the largest and smallest number in a given list of integers.

b. Write a program to perform the following:

i. Addition of two matrices.

ii. Multiplication of two matrices.

8. a. Write a program that uses functions to perform the following operations:
   i. To insert a sub-string in main string at a specified position.
   ii. To delete N characters from a given string from a specified position.
   b. Write a program to determine whether the given string is palindrome or not.
   c. Write a program to display the position or index in the main string S where the sub string T begins. Display -1 if S does not contain T.
   d. Write a program to count the number of lines, words and characters in a given text.
9. a. Write a program to read list of student names and perform the following operations using functions.
   i. to print list of names
   ii. to sort them in ascending order
   iii. to print the list after sorting.
   b. Write a menu driven program to read list of student names and perform the following operations using array of character pointers.
   i. to insert a student name
   ii. to delete a name
   iii. to print the name
10. Write a program that uses functions to perform the following operations:
   i. Reading a complex number
   ii. Writing a complex number
   iii. Addition of two complex numbers
   iv. Multiplication of two complex numbers
   (**Note:** Represent complex number using a structure.)
11. a. Write a program to accept the elements of the structure as:
   Employee-name,Basic pay
   Display the same structure along with the DA, CCA and Gross salary for 5 employees.
   Note: DA=51% of Basic pay, CCA=Rs.100.consolidated.
   b. Define a structure to store employee's data with the following specifications:
   Employee-Number, Employee-Name, Basic pay, Date of Joining
   i. Write a function to store 10 employee details.
   ii. Write a function to implement the following rules while revising the basic pay.

If Basic pay<=Rs.5000 then increase it by 15%.

If Basic pay> Rs.5000 and <=Rs.25000 then it increase by 10%.

If Basic pay>Rs.25000 then there is no change in basic pay.

Write a function to print the details of employees who have completed 20 years of service from the date of joining.

12. a. Write a program which copies one 'text file' to another 'text file'.

    b. Write a program to reverse the first N characters of a given text file.

Note: The file name and N are specified through command line.

13. Write a program to print the output by giving the Customer_ID as an input.

REFERENCE BOOKS:

1. Byron Gottfried and Jitender Kumar C, "Programming with C," Third Edition, McGraw Hill Education(India) Pvt. ltd, New Delhi, 2016.
2. Pradip Dey and Manas Ghosh, "Programming in C," Second Edition, Oxford University Press, New Delhi, 2007.

I B. Tech. - II Semester

(16BT1HS01) Technical English

(Common to ECE, EEE & EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	--	3

PRE-REQUISITES: English at Intermediate level

COURSE DESCRIPTION: Introduction to Communication; Active Listening; Effective Speaking; Reading; and Writing.

COURSE OUTCOMES:

On successful completion of this course, the students will be able to:

CO1: Demonstrate knowledge in

- ♦ Process of communication
- ♦ Modes of listening
- ♦ Paralinguistic features
- ♦ Skimming and Scanning
- ♦ Elements of style in writing

CO2: Analyze the possibilities and limitations of language for understanding

- ♦ Barriers to Communication
- ♦ Barriers to Effective Listening
- ♦ Barriers to Speaking
- ♦ Formal and metaphorical language

CO3: Design and develop functional skills for professional practice.

CO4: Apply writing skills in preparing and presenting documents

CO5: Function effectively as an individual and as a member in diverse teams.

CO6: Communicate effectively with the engineering community and society in formal and informal situations.

DETAILED SYLLABUS:

UNIT I - INTRODUCTION TO COMMUNICATION: (9 periods)

Introduction -Language as a Tool of Communication - Communicative Skills (Listening, Speaking, Reading and Writing) - Effective Communication - Modes of Communication - Barriers to Communication (classification).

UNIT II - ACTIVE LISTENING: (9 periods)

Introduction - Reasons for poor Listening - Traits of a Good Listener - Listening Modes - Types of Listening - Barriers to Effective Listening - Listening for General Content and Specific Information.

UNIT III - EFFECTIVE SPEAKING: (9 periods)

Introduction - Achieving Confidence, Clarity and Fluency - Paralinguistic Features - Barriers to Speaking - Types of Speaking - Persuasive Speaking.

UNIT IV - READING: (9 periods)

Introduction and Reading Rates - Reading and Interpretation - Intensive and Extensive Reading - Critical Reading - Reading for Different Purposes - SQ3R Reading Technique -Study Skills.

UNIT V - WRITING: (9 periods)

Introduction - Language - Elements of Style - Techniques for Good Technical Writing - Referencing and Styling - Right Words and Phrases - Sentences.

Total Periods: 45

TEXT BOOKS:

1. Meenakshi Raman & Sangeetha Sharma, Technical Communication, Oxford University Press, New Delhi, 2012.

REFERENCE BOOKS:

1. Ashraf Rizvi, Effective Technical Communication, McGraw-Hill Education (India) Pvt.Ltd., New Delhi, 2015.
2. Sanjay Kumar & Pushp Lata, Communication Skills, Oxford University Press, New Delhi, 2013.
3. Teri Kwal Gamble and Michael Gamble, Communication Works, Tata Mc Graw-Hill, New Delhi, 2010.
4. Rajendra Pal and J.S. Korlahalli, Essentials of Business Communication, Sultan Chand and Sons (P) Ltd., New Delhi, 2010.

I B. Tech. - II Semester

(16BT1BS01): ENGINEERING CHEMISTRY

(Common to ECE, EEE & EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	--	3

PRE REQUISITE: Intermediate/Senior Secondary Chemistry

COURSE DESCRIPTION: Water technology, Chemistry of Engineering materials, Nanochemistry, Green Chemistry, Electro chemical cells, Sensors, Corrosion and Lubricants.

COURSE OUTCOMES:

After completion of the course, a successful student is able to:

CO1: Acquire basic knowledge in water technology, engineering plastics, conducting polymers, composites, Electro chemical cells, Nano Chemistry, principles of Green Chemistry, corrosion phenomenon and lubricants.

CO2: Develop analytical skills in:
- a. Determination of hardness of water.
- b. Determination of viscosity, flame and fire points, cloud and pour points.

CO3: Develop designing skills in:
- a. Synthesis of engineering plastics.
- b. Chemical methods for the synthesis of Nano materials.

CO4: Develop skills for providing solutions through:
- a. Mitigation of hardness of water.
- b. Newer Nanomaterials and engineering plastics for specific applications

CO5: Acquire awareness to practice engineering in compliance to modern techniques such as:
- a. Nalgonda technique for defluoridation of water
- b. Electroplating technique for control of corrosion.

CO6: Acquire awareness to societal issues on:
- a. Quality of water.
- b. Bio-diesel
- c. Chemical materials utility and their impact.

DETAILED SYLLABUS:

UNIT–I: WATER TECHNOLOGY (9 periods)

Introduction: Types of water, impurities in water and their consequences, types of hardness of water, units of hardness of water, disadvantages of hardness of water, estimation of hardness of water by EDTA method, Boiler troubles: Scales and Sludges, Caustic embrittlement, Boiler corrosion and Priming and Foaming.

Softening of water: Zeolite process and Ion exchange process, advantages and disadvantages. Desalination of brackish water by Reverse Osmosis, Numerical problems on estimation of hardness of water.

Fluorides in water: Effects on human health, defluoridation method-Nalgonda method; comparison of merits and demerits of various defluoridation methods (Nalgonda, Bone Charcoal, Activated Alumina, Contact precipitation, Brick, Reverse osmosis).

UNIT – II: CHEMISTRY OF ENGINEERING MATERIALS (9 periods)

Engineering Plastics: Definition, general properties, synthesis, properties and applications of PC, PTFE, and PMMA.

Conducting polymers: Definition, types of conducting polymers: Intrinsic and extrinsic conducting polymers with examples, engineering applications of conducting polymers.

Biodegradable polymers: Definition, properties, classification, mechanism of degradation of biodegradable polymers and their applications.

Composites – Introduction, types of composites: fiber reinforced particulate and layered composites with examples, advantages of composites and applications.

UNIT– III: NANOCHEMISTRY AND GREEN CHEMISTRY (9 periods)

Nanochemistry: Introduction, classification, properties and applications of Nano materials (nano particles, nano tubes, nano wires, nano composites, dendrimers); synthesis of Nano materials – Sol-gel process.

Green Chemistry: Introduction, principles of green chemistry, Tools of Green Chemistry with Examples, Applications of Green Chemistry in science and technology.

Biodiesel: Introduction, Synthesis (Trans esterification method),

advantages, disadvantages and applications.

UNIT–IV: ELECTROCHEMICAL CELLS AND SENSORS (9 periods)

Electrochemical cell: Introduction, EMF of an electrochemical cell.

Batteries: Introduction, types of Batteries: primary and secondary batteries with examples, Ni-Cd batteries, Lithium-ion batteries, Lithium- Polymer batteries, Applications of batteries.

Fuel Cells: Definition, examples: $H_2 - O_2$ Fuel cell, solid oxide fuel cell, Bio-fuel cell and applications of fuel cells.

Sensors - Introduction, Types of Sensors, electrochemical sensor: construction and working principle of potentiometric sensor, and applications of electrochemical sensors.

UNIT–V: CORROSION AND LUBRICANTS (9 periods)

Corrosion: Introduction, Definition, types of corrosion (dry and wet corrosion), galvanic corrosion, concentration cell corrosion, Factors influencing corrosion, Corrosion control: cathodic protection; sacrificial anodic protection and impressed current cathodic protection; protective coatings: Galvanizing and Electroplating (Nickel).

Lubricants: Definition, functions of lubricants, mechanism of lubrication, classification of lubricants, properties of lubricants – viscosity, flash and fire points, cloud and pour points, Aniline points, neutralization number and mechanical strength.

Total periods: 45 periods

TEXT BOOKS:

1. P.C.Jain & Monika Jain, **Engineering Chemistry**, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 16th edition, 2013.
2. K.N. Jayaveera, G.V. Subba Reddy & C. Ramachandraiah **Engineering Chemistry**, Mc. Graw-Hill Higher Education, Hyderabad, 1st edition, 2015.

REFERENCE BOOKS:

1. A.K. Bandyopadhyay, **Nano Materials,** New Age international publishers, 2nd edition, 2014.
2. Paul T. Anastas and John C Warner, **Green Chemistry: Theory and practice,** Oxford University Press, 2000.

I B. Tech. - II Semester

(16BT2BS01) TRANSFORMATION TECHNIQUES AND PARTIAL DIFFERENTIAL EQUATIONS

(Common to all Branches)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	*70*	*100*	*3*	*1*	*--*	*3*

PRE REQUISITE: Intermediate /Senior secondary mathematics

COURSE DESCRIPTION: Fourier series; Fourier integrals and transforms; Laplace transforms; z –transforms; partial differential equations.

COURSE OUTCOMES:

After completion of the course a successful student is able to

CO1: Acquire basic knowledge in
- (a) Fourier series and Fourier transforms
- (b) Fourier integrals
- (c) Laplace transforms and their applications
- (d) z- transforms and their applications
- (e) solving partial differential equations

CO2: Develop skills in analyzing the
- (a) Properties of Fourier series for a given function
- (b) Partial differential equations through different evaluation methods
- (c) Difference equations through z – transforms
- (d) Engineering systems and processes involving wave forms and heat transfer

CO3: Develop skills in designing mathematical models for
- (a) Problems involving heat transfer and wave forms
- (b) Engineering concepts involving, Fourier transforms, Fourier integrals, Laplace transforms, z-transforms and difference equations

CO4: Develop analytical skills in solving the problems involving
- (a) Fourier series and Fourier transforms
- (b) Laplace transforms
- (c) Z-transforms and difference equations
- (d) Heat transfer and wave motion

CO5: Use relevant transformation techniques for
- (a) Obtaining Fourier transforms for different types of functions
- (b) Laplace transforms
- (c) Z- transforms
- (d) Partial differential equations

DETAILED SYLLABUS

UNIT- I : FOURIER SERIES (7 periods)

Fourier series: Determination of Fourier coefficients, convergence of Fourier series (Dirichlet's conditions), Fourier series of even and odd functions, Half-range Fourier sine and cosine expansions.

UNIT- II: FOURIER INTEGRALS AND FOURIER TRANSFORMS (8 periods)

Fourier integral theorem (statement only), Fourier sine and cosine integrals, Fourier transform, Fourier sine and cosine transforms –properties, Inverse transform and finite Fourier transforms.

UNIT-III: LAPLACE TRANSFORMS (12 periods)

Laplace transforms of standard functions. Properties of Laplace transforms. First and second shifting Theorems. Laplace transforms of derivatives and integrals. Inverse transforms. Convolution theorem (without proof), inverse Laplace transforms by convolution theorem. Laplace transform of periodic functions, Applications of Laplace transforms to ordinary differential equations of first and second order with constant coefficients.

UNIT-IV: Z- TRANSFORMS (9 periods)

Z – transforms, inverse Z– transforms, damping rule, shifting rule, initial and final value theorems. Convolution theorem (without proof), solution of difference equations by Z– transforms.

UNIT – V: PARTIAL DIFFERENTIAL EQUATIONS (9 periods)

Formation of Partial differential equations – Solutions of first order linear equations by method of grouping. First and second order equations by method of separation of variables – Solutions of one dimensional Wave equation, Heat equation.

Total no. of periods: 45

TEXT BOOKS:

1. T.K.V. Iyengar, B. Krishna Gandhi,S.Ranganadham and M.V.S.S.N. Prasad,***Engineering Mathematics, vol-1***, S. Chand & Company 13/e,2014.
2. T.K.V. Iyenger, B. Krishna Gandhi, S.Ranganadham and M.V.S.S.N.Prasad, ***Mathematical Methods***,S.Chand and Company, 8/e,2013.

REFERENCE BOOKS:

1. Grewal, B.S., ***Higher Engineering Mathematics***,Khanna publishers, Delhi, 42/e,2012.
2. Kreyszig, E., ***Advanced Engineering Mathematics***,John Wiley and Sons, Inc.,9/e,2013.

I B. Tech. - II Semester

(16BT20401) ELECTRONIC DEVICES AND CIRCUITS

(Common to ECE, EEE & EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	--	3

PRE-REQUISITES: A Course on Engineering Physics.

COURSE DESCRIPTION:

Characteristics of general and special purpose electronic devices; Rectifiers; filters and regulators; Biasing and small signal analysis of BJT and FET.

COURSE OUTCOMES:

On successful completion of this course the students will be able to:

CO1: Demonstrate knowledge in

- p-n junction diode and its characteristics
- Zener diode and its characteristics
- Rectifiers, Filters and Regulators
- Characteristics of BJT, FET, MOSFET and special purpose electronic devices.

CO2: Analyze numerical and analytical problems in

- Rectifiers using Filters
- Regulated Power Supplies
- Transistor biasing circuits and stabilization
- Transistor amplifiers
- FET biasing circuits and amplifiers

CO3: Design electronic circuits such as

- Rectifiers with and without filters
- Voltage regulators
- BJT and FET biasing circuits
- BJT and FET amplifiers

CO4: Solve engineering problems and arrive at solutions pertaining to electronic circuits.

CO5: Select appropriate technique for transistor modeling.

DETAILED SYLLABUS:

UNIT-I: P-N JUNCTION DIODE, RECTIFIERS AND REGULATORS (11 Periods)

P-N Junction Diode:

p-n Junction as a diode, *p-n* Junction diode equation, Volt-Ampere (V-I) characteristics, temperature dependence of *p-n* characteristics, diode resistance-static and dynamic resistances, transition and diffusion capacitances, break down mechanisms in semiconductor diodes, Zener diode characteristics.

Rectifiers and Regulators:

Half-Wave rectifier and Full-Wave rectifiers (Qualitative and quantitative analysis), Harmonic components in a rectifier circuit, Inductor filter, Capacitor filter, L - section filter, ð- section filter, comparison of various filter circuits in terms of ripple factors. Simple circuit of a regulator using Zener diode. Problems on rectifier circuits.

UNIT-II- *BIPOLAR JUNCTION TRANSISTOR, BIASING AND STABILIZATION*: (10 Periods)

Transistor construction, BJT Operation, Transistor currents and their relations, Input and Output Characteristics of a Transistor in Common Emitter, Common Base and Common Collector Configurations, BJT specifications, Transistor Operating Point, DC and AC Load Lines, Importance of Biasing, Fixed Bias, Emitter Feedback Bias, Collector to Base Feedback Bias, Voltage Divider Bias, Bias Stability, Transistor as an amplifier, Thermal Runaway, Problems on biasing circuits.

UNIT-III- *SMALL SIGNAL ANALYSIS OF BJT AMPLIFIERS*: (08 Periods)

BJT Modeling, Hybrid Modeling, Determination of h-Parameters from Transistor Characteristics, Measurement of h-Parameters, Miller's Theorem, Analysis of CE, CB and CC configurations using simplified Hybrid Model, Comparison of CB, CE and CC configurations.

UNIT-IV- *FIELD EFFECT TRANSISTORS*: (10 Periods)

Construction, Principle of operation and characteristics of JFET and MOSFET (Enhancement & Depletion), Biasing of FET, Small Signal Model of JFET, Common Source and Common Drain Amplifiers using JFET, Generalized FET Amplifier, FET as Voltage Variable Resistor, Comparison of BJT and FET.

UNIT-V- *SPECIAL PURPOSE ELECTRONIC DEVICES*:

(06 Periods)

Principle of Operation and Characteristics of Tunnel Diode, Uni-Junction Transistor (UJT), Varactor Diode, Silicon Control Rectifier (SCR). Principle of operation of Schottky Barrier Diode.

Total Periods: *45*

TEXT BOOK:

1. J. Millman, Christos C. Halkias and SatyabrataJit, *Electronic Devices and Circuits,* TMH, 3rd Edition, 2010.

REFERENCE BOOKS:

1. R.L. Boylestad and Louis Nashelsky, *Electronic Devices and Circuits,* PHI, 10thEdition, 2009.
2. David A. Bell, *Electronic Devices and Circuits,* Oxford University press, 5thEdition, 2014.
3. S. Salivahanan, N. Suresh Kumar, *Electronic Devices and Circuits*, Mc-Graw Hill, 3rd Edition 2013.
4. Ben G. Streetman, Sanjay Banerjee , Solid State Electronic Devices, Pearson Prentice Hall, 2006.

I B. Tech. - II Semester

(16BT20541) Foundations of Data Structures

(Common to ECE, EEE & EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	*70*	*100*	*3*	*1*	-	*3*

PRE-REQUISITES:

A course on "Programming in C"

COURSE DESCRIPTION:

Concepts of sorting: sorting by exchange, sorting by distribution, sorting by merging and data structures: stacks, queues, linked lists, trees, graphs, and hash table.

COURSE OUTCOMES:

On successful completion of this course the students will be able to:

CO1: Gain knowledge in Sorting techniques, Linear and Non-linear Data Structures.

CO2: Analyze the performance of sorting techniques and their relationship to Data Structures.

CO3: Design appropriate hashing function for a given application and develop programs to implement Linear and Non-Linear data structures

CO4: Apply appropriate data structure to provide solutions for real time problems using C Language.

DETAILED SYLLABUS:

UNIT I – SORTING (9 periods)

SORTING - Sorting by Exchange-Shell Sort, Quick sort. Sorting By Distribution-Counting Sort, Bucket Sort, Radix Sort. Sorting By Merging-Merge Sort.

UNIT II– STACKS AND QUEUES (9 periods)

STACKS - Introduction, Stack Operations, Applications.

QUEUES - Introduction, Operations on Queues, Circular Queues and Applications.

UNIT III –LINKED LISTS (9 periods)

LINKED LISTS – Introduction, Single Linked List, Circular Linked List, Doubly Linked List, Multiply Linked List and Applications.

LINKED STACKS AND LINKED QUEUES - Introduction, Operations on Linked Stack and Linked Queues, Dynamic Memory Management and Linked Stacks.

UNIT IV – TREES AND BINARY TREES (9 periods)

TREES– Introduction, Definition and Basic Terminologies, Representation of Trees.

BINARY TREES – Basic Terminologies and Types, Representation of Binary Trees, Binary Tree Traversals, Binary Search Trees: Definition and Operations and Applications.

UNIT V – Graphs and Hashing (9 periods)

Graphs – Introduction, Definitions and Basic Terminologies, Representation of Graphs, Graph Traversals, Applications.

Hashing – Introduction, Hash Table Structure, Hash Functions, Linear Open Addressing, Chaining and Applications.

Total Periods: *45*

TEXT BOOK:

1. G.A.V. Pai, *"Data Structures and Algorithms",* Tata McGraw Hill, Second Edition, 2009.

REFERENCE BOOK:

1. Debasis Samanta, "Classic Data Structures", PHI Learning, Second Edition, 2009.

I B. Tech. - II Semester

(16BT1HS31) ENGLISH LANGUAGE LAB

(Common to ECE, EEE & EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	0	0	3	2

PRE-REQUISITES: English at intermediate or equivalent level.

COURSE DESCRIPTION: Phonetics; Vocabulary Building; Functional Grammar; Just a Minute; Elocution/Impromptu; Giving Directions/Conversation Starters; Role Play; Public Speaking; Describing People, Places, Objects and Events; Reading Comprehension; Listening Comprehension; Information Transfer.

COURSE OUTCOMES:

On successful completion of this course the students will be able to:

CO1: Demonstrate knowledge in
- Phonetics
- Information Transfer

CO2: Analyze the situations in professional context by using
- Vocabulary
- Grammar

CO3: Design and develop functional skills for professional practice.

CO4: Apply the techniques of Listening and Reading skills to comprehend Listening and Reading comprehension.

CO5: Function effectively as an individual and as a member in diverse teams through
- Extempore talk and
- Role Play

CO6: Communicate effectively in public speaking in formal and informal situations.

CO7: Recognize the need to engage in lifelong learning to upgrade competence of knowledge and communication.

LIST OF EXERCISES:

1. Phonetics
2. Vocabulary Building
3. Functional Grammar
4. Just a Minute
5. Elocution/Impromptu
6. Giving Directions/Conversation Starters
7. Role Play
8. Public Speaking
9. Describing People, Places, Objects and Events.
10. Reading Comprehension

11. Listening Comprehension
12. Information Transfer

Total Lab Slots: 10

TEXT BOOK:

1. Department Lab Manual

REFERENCE BOOKS:

1. D. Sudha Rani, *A Manual for English Language Laboratories*, Pearson Education.
2. D. Sudha Rani, *Advanced Communication Skills Laboratory Manual*, Pearson Education.
3. R. Manivannan and G. Immanuel, *Communication Skills Laboratory*, VK Publications, Sivakasi, 2013
4. Nira Kumar*, English Language Laboratories*, PHI Learning Pvt. Ltd., New Delhi, 2011.

SUGGESTED SOFTWARE: (16BT1HS31)

1. ETNL Language Lab Software Version 4.0
2. GEMS - Globarena E- Mentoring System.
3. Speech Solutions.
4. English Pronunciation Dictionary by Daniel Jones.
5. Learn to Speak English 8.1, The Learning Company - 4 CDs.
6. Mastering English: Grammar, Punctuation and Composition.
7. English in Mind, Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge.
8. Dorling Kindersley Series - Grammar.
9. Language in Use 1, 2 & 3.
10. Cambridge Advanced Learner's Dictionary - 3rd Edition.
11. Centronix - Phonetics.
12. Let's Talk English, Regional Institute of English South India.
13. The Ultimate English Tutor.

I B. Tech. - II Semester

(16BT1BS31): ENGINEERING CHEMISTRY LABORATORY

(Common to ECE, EEE & EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	3	2

PRE REQUISITE: Intermediate/Senior Secondary Chemistry

COURSE DESCRIPTION: Estimation of hardness, alkalinity, dissolved oxygen of water samples and estimation of Iron by volumetric methods, determination of effect of P^H on rate of corrosion, measurement of viscosity of lubricants; Instrumental methods like potentiometer, conductivity meter, P^H meter and colorimeter; synthesis of Polymers and Nano materials.

COURSE OUTCOMES:

After completion of the course, a successful student is able to:

CO1: Acquire basic Knowledge about the volumetric analysis and synthesis of materials used for engineering applications.

CO2: Acquire analytical skills in the estimation of hardness of water, alkalinity of water, dissolved oxygen in water and estimation of Iron through wet laboratory methods.

CO3: Develop designing skills for the synthesis of polymers and Nanomaterials.

CO4: Acquire skills to use instrumental techniques for the determination of Electrical conductance of electrolytes, EMF of a cell, PH of a solution, determination of viscosity of lubricants and estimation of iron in cement.

CO5: Provide solutions for environmental issues through determination of quality of water.

List of Experiments:

A minimum of any **Ten** experiments are to be conducted among the following:.

1. Estimation of Hardness of water by EDTA method.
2. Estimation of alkalinity of Water.
3. Estimation of Dissolved Oxygen in water.
4. Estimation of Ferrous Iron by Dichrometry.
5. Preparation of Novalac Resin.
6. Synthesis of Nano metal-oxide using sol– gel process.
7. Conductometric titration of strong acid Vs strong base
8. Estimation of Ferrous ion by Potentiometry.
9. Determination of amount of corrosion of metals in different medium
10. Measurement of viscosity of lubricants by Ostwald viscometer.
11. Determination of P^H of a given solution by P^H metry.
12. Estimation of Ferric iron in cement by Colorimetric method.

Total Time Slots: 12

I B. Tech. - II Semester

(16BT10331) COMPUTER AIDED ENGINEERING DRAWING

(Common to ECE, EEE & EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	*50*	*100*	*--*	*1*	*6*	*3*

PRE-REQUISITES: *None*

COURSE DESCRIPTION:

Engineering drawing conventions; importance of engineering drawing; fundamental concepts of sketching; computed aided drafting and different types of projections of geometric entities (both 2D and 3D) through computer aided drafting packages.

COURSE OUTCOMES:

After completion of the course, a successful student is able to:

- CO1: Understand, write and read the language of engineering drawing in industry through International System of Standards.
- CO2: Develop the imagination and mental visualization ability for interpreting the geometrical details of engineering objects.
- CO3: Produce different views and projection in drawing.
- CO4: Use modern CAD software for design and drafting of drawings.
- CO5: Create multi-view drawings suitable for presentation to Engineering community.
- CO6: Introduce and communicate universally accepted conventions and symbols for their usage in technical drawing.

DETAILED SYLLABUS:

UNIT : I - BASICS OF ENGINEERING DRAWING PRACTICE, GEOMETRICAL CONSTRUCTIONS, CONICS AND SPECIAL CURVES (18 periods)

Introduction, drawing instruments and its uses, sheet layout, BIS conventions, lines, lettering and dimensioning practices. Geometrical constructions: Construction of regular polygons: Pentagon, Hexagon, Heptagon and Octagon. Conic sections**:** Introduction, construction of ellipse: rectangular method, eccentricity method. Construction of parabola: rectangular method, eccentricity method. Construction of hyperbola: eccentricity method. Special curves*:* cycloid, involute.

UNIT: II – INTRODUCTION TO COMPUTER AIDED SKETCHING (18 periods)

Computer screen, layout of the software, creation of 2D/3D environment, selection of drawing size and scale, Standard tool bar/menus, Coordinate system, description of most commonly used toolbars, navigational tools: commands and creation of lines, Co-ordinate points, axes, poly-lines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints viz. tangency, parallelism, inclination and perpendicularity.

UNIT: III – PROJECTION OF POINTS, STRAIGHT LINES AND PLANES (21 periods)

Introduction, method of projection, planes of projection, reference line and notations. Projection of points: Points in all the four quadrants. Projection of straight lines**:** lines inclined to HP / VP plane, inclined to both HP and VP planes (straight lines are assumed to be in first quadrant only)**.** Projection of planes**:** projection of triangle, square, rectangle, rhombus, pentagon, hexagon and circular plane for the condition inclined to HP / VP by change of position method.

UNIT IV –PROJECTION OF SOLIDS AND SECTION OF SOLIDS (21 Periods)

Projections of Solids: Introduction, projection of solids: prisms, pyramids, cylinders and cones with axis perpendicular to VP/HP and axis inclined to VP/HP only. Sections of solids**:** Introduction, Cutting plane, sectional views of right regular solids resting with base on HP: prisms, pyramids, cylinder and cone and true shapes of the sections.

UNIT V –ORTHOGRAPHIC AND ISOMETRIC PROJECTIONS AND DEVELOPMENT OF SURFACES (22 periods)

Orthographic projection: simple exercises. Isometric projection: Simple exercises.

Development of surfaces: prisms, pyramids, cylinders, cone and miscellaneous surfaces

Total Periods: *100*

Note: *Student shall practice Unit-I using sketch book only and remaining units using sketch book first and later CAD package.*

TEXT BOOKS:

1. D.M.Kulkarni, A.P.Rastogi, A.K.Sarkar, Engineering Graphics with AutoCAD, PHI Learning Private Limited, New Delhi, Revised Edition, 2010.
2. N D Bhat & V M Panchal, Engineering Drawing, Charotar Publishing House, Gujarat, 51st edition, 2013.

REFERENCE BOOKS:

1. Sham Tickoo, AutoCAD 2013 for Engineers and Designers, Dreamtech Press, 2013.
2. M.H.Annaiah & Rajashekar Patil, Computer Aided Engineering Drawing, New Age International Publishers, 4th Edition, 2012.
3. T.Jeyapoovan, Engineering Drawing and Graphics Using AutoCAD, Vikas Publishing House, 3rd Edition, 2010.
4. Jolhe, Engineering Drawing, Tata McGraw Hill Education Private Limited, 1st Edition, 2007.
5. Basant Aggarwal, Engineering Drawing, Tata McGraw Hill Education Private Limited, 1st Edition, 2008.

I B. Tech. - II Semester

(16BT20551) Foundations of Data Structures Lab

(Common to ECE, EEE & EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	*50*	*100*	*0*	*0*	*3*	*2*

PRE-REQUISITES:

A course on "Foundations of Data Structures"

COURSE DESCRIPTION:

Hands on programming to implement data structures - Linked lists, Stacks, Queues, Trees, Search trees, Sorting, and Hashing in C Language.

COURSE OUTCOMES:

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

CO1: Gain practical knowledge on stacks, queues, trees, graphs and Hashing Techniques

CO2: Identify suitable data structure to solve engineering problems.

CO3: Design solutions for complex engineering problems using linear and non-linear data structures.

CO4: Develop algorithms leading to multiple solutions by conducting investigations of complex problems.

CO5: Apply 'C' language as a tool for implementing linear and non linear data structures

CO6: Communicate effectively by writing Programs and document practical work.

LIST OF PRACTICAL EXERCISES:

1. Implement the following sorting techniques
   (a) Quick Sort (b) Radix Sort (c) Merge Sort
2. Implement the following data structures using arrays
   (a)Stack (b) Queue (c) Circular Queue
3. Implement the following operations on a single linked list.
   (a) Creation (b) Insertion (c) Deletion (d) Display
4. Implement the following operations on a double linked list.
   (a) Creation (b) Insertion (c) Deletion (d) Display
5. Implement the following operations on a circular linked list.
   (a) Creation (b) Insertion (c) Deletion (d) Display
6. Implement the following data structures using linked list.
   (a) Stack (b) Queue (c) Circular Queue
7. Implement the following tree traversals on a binary tree
   (a) Preorder (b) Inorder (c) Postorder
8. Implement the following operation on binary search tree
   (a) Creation (b) Insertion (c) Deletion (d) Inorder
9. Implement the following graph traversal techniques
   (a) Breadth First traversal (b) Depth First Traversal
10. Implement the following Hashing Techniques
    (a) Separate Chaining (b) Open addressing methods

Reference Books:

1. G.A.V. Pai, *"Data Structures and Algorithms",* Tata McGraw Hill, Second Edition, 2009.
2. Debasis Samanta, "*Classic Data Structures",* PHI Learning, Second Edition, 2009.

II B. Tech. – I Semester

(16BT3HS01) ENVIRONMENTAL STUDIES

(Common to EEE, ECE and EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

PRE-REQUISITES: A course on Engineering Chemistry

COURSE DESCRIPTION: Multidisciplinary nature of environment; Natural resources; Ecosystems; Biodiversity; Environment pollution and control; Social issues and environment; Human population and environment; Field studies.

COURSE OUTCOMES: On successful completion of the course, students will be able to:

CO1. Acquire knowledge on nature of environment, natural resources, ecosystems, biodiversity, environmental pollution and control, social issues and human population.

CO2. Analyze natural resources, ecosystems, biodiversity, environmental pollution and control, social issues and human population.

CO3. Develop strategies for environmental pollution control and natural resource management.

CO4. Solve environmental problems through proper analysis and interpretation of environmental data.

CO5. Choose appropriate techniques in environmental pollution control and natural resource management.

CO6. Understand the impact of social issues and population on environment.

CO7. Provide solutions to individuals, industries and government for environmental sustainable development.

CO8. Follow environmental protection laws for sustainable development.

CO9. Communicate effectively on environmental issues in the form reports.

DETAILED SYLLABUS:

UNIT - I: MULTIDISCIPLINARY NATURE OF ENVIRONMENT AND NATURAL RESOURCES (11 Periods)

Multidisciplinary Nature of Environment: Multidisciplinary nature of environment, Segments of environment - Lithosphere, Hydrosphere, Atmosphere, Biosphere; Need for public awareness.

Natural Resources: Renewable and non-renewable resources and associated problems - (a) Forest resources: Use and over exploitation, Deforestation-causes, effects and remedies, Case studies, (b) Water resources: Use and over utilization of surface and groundwater, Conflicts over water, Benefits and problems of large dams, Case studies, (c) Mineral resources: Mining, Adverse effects, Case studies, (d) Food resources: World food problems, Changes caused by agriculture and overgrazing, Effects of modern agriculture, Water logging and salinity, Case studies, (e)Energy resources: Growing needs, Renewable energy resources – Solar, Wind, Hydropower, Hydrogen fuel; Non-renewable energy resources - Coal, Natural gas, Nuclear energy, Role of an individual in conservation of natural resource and equitable use of resources for sustainable lifestyles.

UNIT - II: ECOSYSTEMS AND BIODIVERSITY (10 Periods)

Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem - Producers, Consumers, Decomposers; Food chains, Food webs, Ecological pyramids – Types; Characteristic features, Structure and functions of forest ecosystem, Desert ecosystem, Aquatic ecosystem, Energy flow in the ecosystem, Ecological succession.

Biodiversity: Concept and value of biodiversity, Role of biodiversity in addressing new millennium challenges, Hot spots of biodiversity, Threats to biodiversity, Man-wild life conflicts, Endemic, Endangered and extinct species of India, Conservation of biodiversity – In-situ and ex-situ.

UNIT - III: ENVIRONMETAL POLLUTION AND CONTROL (8 Periods)

Causes, Adverse effects and control measures of pollution - Air pollution, Water pollution, Soil pollution, Noise pollution, Thermal pollution, Nuclear pollution; Solid waste management – Causes, Effects and control measures of urban and industrial wastes; Hazards and disaster management – Floods, Earthquakes, Tsunamis, Case studies.

UNIT - IV: SOCIAL ISSUES AND THE ENVIRONMENT

(8 Periods)

Sustainable development, Urban problems related to energy, Environmental ethics –Issues, Solutions; Global warming, Acid rain, Ozone layer depletion, Nuclear accidents and case studies, Wasteland reclamation, Consumerism and waste products, Concept of green technologies, Environment protection act, Air act, Water act, Wildlife protection act, Forest conservation act, Issues involved in enforcement of environmental legislation, Public environmental awareness.

UNIT - V: HUMAN POPULATION AND THE ENVIRONMENT

(8 Periods)

Population growth, Population characteristics and variation among nations, Population explosion, Family welfare programme, Environment and human health, Human rights, Value education, HIV/AIDS, Women and child welfare, Role of information technology in environment and human health, Case studies, **Field Work / Assignment / Seminar:** Environmental assets – Pond/Forest/Grassland/Hill/ Mountain/Environment impact assessment procedures for local environmental issues.

Total Periods: 45

TEXT BOOKS:

1. A. Kaushik and C. P. Kaushik, *Environmental Studies*, New Age International (P) Ltd Publications, 4th Edition, 2014.
2. Erach Barucha, *Environmental Studies*, Orient Blackswan, 2nd Edition, 2013.

REFERENCE BOOKS:

1. R. Rajagopalan, *Environmental Studies*, Oxford University Press, 2nd Edition, 2011.
2. Benny Joseph, *Environmental Studies*, Tata McGraw-Hill, 2nd Edition, 2009.
3. B. S. Chauhan, *Environmental Studies*, University Science Press, 2008.
4. M. Anji Reddy, *Text Book of Environmental Sciences and Technology*, BS Publications, 2007.

II B.Tech. - I semester

(16BT3BS02) SPECIAL FUNCTIONS AND COMPLEX ANALYSIS

(Common to EEE, ECE & EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Intermediate/senior secondary Mathematics

COURSE DESCRIPTION: Beta, Gamma functions and their properties; Limits continuity and analyticity of complex functions; Integration, power series, singularities, residues; conformal mapping.

COURSE OUTCOMES: On successful completion of the course, studentswill be able to:

CO1. Acquire knowledge in

- Beta and Gamma functions
- Expressing complex functions in power series
- Differentiation and integration of complex functions
- Conformal mappings and bilinear transformations
- Expressing complex functions in terms of graphs and power series

CO2. Develop skills in analyzing the

- The properties exhibited by complex functions in Argand plane
- Properties of real integrals through complex variable techniques
- The properties of improper integrals through residue theory
- Conformal transformations of complex valued functions for inferences
- The properties of complex functions by expressing them in power series and graphs

CO3. Develop skills in designing mathematical models involving

- Integrals of complex variable functions
- Improper integrals using beta and gamma functions
- Residue theory of complex functions
- Power series expansions of complex variable functions
- Transformations of complex variable functions
- Fluid flow patterns and flux functions.

CO4. Develop analytical skills in providing solutions for problems involving

- Fluid, Electrical and Magnetic Potential functions
- Integration of complex functions
- Improper real integrals

CO5. Use relevant Complex variable techniques for

- Residues and integrals of complex functions.
- Improper real integrals through complex functions
- Techniques of Beta and Gamma functions to improper integrals

DETAILED SYLLABUS

UNIT-I: SPECIAL FUNCTIONS (9 Periods)

Beta and Gamma functions - Properties - Relationship between Beta and Gamma functions- Evaluation of improper integrals using Beta and Gamma functions. Bessel function -Generating function (without proof) - Recurrence relations.

UNIT-II: ANALYTIC FUNCTIONS (9 Periods)

Function of a Complex Variable - Limits and Continuity of functions, uniform continuity, Differentiability and Analyticity – Cauchy Riemann equations (both Cartesian and polar) - Conjugate and harmonic conjugate functions - Milne Thomson method-Potential functions.

UNIT-III: COMPLEX INTEGRATION AND POWER SERIES (9 Periods)

Line integral - Evaluation of line integrals along curves and closed contours - Cauchy's Integral theorem - Cauchy's integral formula - Generalized integral formula- Evaluation of integrals using integral formula. Taylor's theorem (without proof) - Laurent's theorem (without proof) - Power series expansion of complex functions.

UNIT-IV: RESIDUE THEOREM (9 Periods)

Zeros, Singularities – Types of singularities- poles - Residues – Evaluation of residues at simple poles and poles of order m - Residue theorem - Evaluation of integrals using residue theorem – Evaluation of improper and real integrals of the type:

i) $\int_0^{2\pi} f(\cos\theta, \sin\theta)\,d\theta$ ii) $\int_{-\infty}^{\infty} f(x)\,dx$ iii) $\int_{-\infty}^{\infty} e^{imx} f(x)\,dx$

UNIT-V: CONFORMAL MAPPING (9 Periods)

Conformal mappings, Translation, Rotation, Inversion.Special transformations: $w = z^2, w = e^z, w = \log z, \quad w = \sin z, w = \cos z.$

Bilinear transformation - Properties - Fixed points - Cross ratio - Invariance of circles under bilinear transformation - Determination of bilinear transformation using three given points.

Total Periods: 45

TEXT BOOK:

1. T.K.V. Iyengar, B. Krishna Gandhi S., Ranganatham and M.V.S.S.N. Prasad, *Text book of Engineering Mathematics, Vol-III*, S. Chand & Company, 9th Edition 2012.

REFERENCE BOOKS:

1. Grewal, B.S, *Higher Engineering Mathematics*, Khanna Publishers, Delhi, 42nd Edition 2012.
2. Shahnaz Bathul, *Special Functions and Complex Variables*, PHI Learning, 2nd Edition 2010.

II B. Tech. – I Semester

(16BT31001) ELECTRICAL AND ELECTRONIC MEASUREMENTS

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Courses on Network Analysis, Engineering Physics.

COURSE DESCRIPTION: Construction and principle of operation of Ammeters, Voltmeters, Ohmmeters; Potentiometers; Power meter; Power Factor meter; Energy Meters; Design of Bridges - AC, DC, Frequency and Time measurements.

COURSE OUTCOMES: On successful completion of the course, students will be able to

CO1. Demonstrate knowledge in construction and Principle of operation of different instruments used for measurement of
- Voltage
- Current and Resistance
- Power
- Power factor
- Energy measurement
- Frequency and time

CO2. Analyze the performance characteristics of various measuring instruments.

CO3. Design instruments and circuits for measurement of Power, Energy, Power factor, Voltage, Current, Resistance, Capacitance and Inductance.

CO4. Interpret and synthesize data obtained from measuring systems to provide valid conclusions.

CO5. Select appropriate technique to measure Power, Energy, Power factor, Voltage, Current, Resistance, Capacitance and Inductance.

CO6. Apply contextual knowledge to develop measuring instruments used in domestic and industries.

DETAILED SYLLABUS:

UNIT - I: AMMETERS AND VOLTMETERS (12 Periods)

Classification of analog instruments, Principle of operation of analog instruments, operating forces of electromechanical indicating instruments: deflecting, control and damping; Permanent Magnet Moving Coil (PMMC): Construction, working principle, Expression of torque equation, Errors in PMMC Instruments, Advantage and Disadvantages of PMMC Instruments; Moving Iron Instruments: Classification of Moving Iron Instruments, Construction, working principle and Expression of torque equation; Ammeter: Ammeter shunt, Effect of Temperature Change in Ammeter, Multi-range Ammeters;

Voltmeter: Voltmeter Multipliers, Effect of Temperature Change in Voltmeters, Multi-range Voltmeter, Analog voltmeter: AC voltmeter using rectifiers, true RMS Voltmeter.

UNIT-II: OHMMETERS, POTENTIOMETERS AND ENERGY METER (9 Periods)

Ohmmeters: Series type ohmmeter, shunt type ohmmeter, Multimeter. Potentiometers: Standardization, Compton's Potentiometers, Types of AC Potentiometers: Polar types, Coordinate types. Power in D.C Circuits, Power in A.C Circuits. Electrodynamometer wattmeter: Construction, working principle, Torque equation. Single Phase Induction Type Energy Meter: Construction, Working Principle.

UNIT-III: BRIDGES (9 Periods)

Measurement of Resistance: Medium Resistance Measurement- Wheatstone bridge, Kelvin Bridge; Low Resistance Measurement- Kelvin double bridge; High Resistance Measurement- Direct deflection methods, Meggar.
Measurement of Inductance: Maxwell Bridge, Hay's Bridge and Anderson Bridge.
Measurement of capacitance: De Sauty's Bridge and Schering bridge, Q-meter.

UNIT-IV: FREQUENCY AND TIME MEASUREMENTS (8 Periods)

Digital Frequency Meter - Basic Circuit, Time Base Selector, Start and Stop gate; Circuit for Measurement of Frequency; Simplified Composite Circuit for a Digital Frequency Meter; High Frequency Measurement, Frequency synthesizer; Period Measurement; Ratio and Multiple Ratio Measurements; Time Interval Measurements; Universal Counter Timer.

UNIT - V: ANALYZERS AND RECORDERS (7 Periods)

Introduction, Wave analyzers - Frequency selective wave analyzer, Heterodyne wave analyzer; Harmonic Distortion Analyzers, Total Harmonic Distortion; Spectrum analyzers; Recorders - Strip Chart recorders, x-y recorders, Magnetic tape recorders, CD/DVD Recorders; LCD, Digital Storage Oscilloscopes.

Total Periods: 45

TEXT BOOK:

1. A.K.Sawhney, *A Course in Electrical and Electronics Measurements and Instrumentation*, Dhanpat Rai and Sons, New Delhi, 19th Edition, 2011.

REFERENCE BOOKS:

1. E.W. Golding & F.C. Widdis, *Electrical Measurements and Measuring Instruments*, Wheeler Publishing, 5th Edition, 2011.
2. Doeblin, E.O., *Measurement Systems: Applications and Design*, TMH, 4th Edition, 2003.
3. H.S. Kalsi, *Electronic Instrumentation*, TMH, 2002.

II B. Tech. – I Semester

(16BT31002) SENSORS AND TRANSDUCERS

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: A course on Engineering Physics.

COURSE DESCRIPTION: Units and standards; Static and dynamic characteristics of transducers; Working principle of resistive, inductive, capacitive, self-generating and other sensors; Applications of sensors.

COURSE OUTCOMES: On successful completion of the course, students will be able to

CO1. Demonstrate knowledge on principles of sensors and transducers with their characteristics.
CO2. Apply analytical skills to determine the response of sen sors for change in physical parameters.
CO3. Solve the problems pertaining to RTD, Thermistors, piezoelectric, capacitive and inductive sensors.
CO4. Select an appropriate sensor to measure the physical parameter for specific application.
CO5. Apply the principles of resistive, inductive, capacitive, self-generating and other sensors for measuring real time physical parameters in industries.
CO6. Follow the ethical standards while using measuring in struments.

DETAILED SYLLABUS:

UNIT - I: MEASUREMENTS AND STANDARDS (9 Periods)

Significance of Measurements, Classification of Instruments: Deflection and Null Type instruments, Elements of a Generalized Measurement System, Types of errors: Gross Error, Systematic Error, Random Error, Statistical analysis of measurement data.
Units: Fundamental and Derived Units, CGS System of Unit, Practical Units, M.K.S System, S.I. Units; Standards and their Classification: Electrical Standards, Resistance Standards, Current Standards, Inductance Standards and Capacitance Standards.

UNIT - II: CHARACTERISTICS OF TRANSDUCERS (9 Periods)

Principle of transducer, Classification of transducer, Static Characteristics: Calibration, accuracy, precision, sensitivity, linearity, threshold, resolution, hysteresis, dead space, reproducibility, span. Dynamic characteristics: Dynamic error, Fidelity, Measuring lag,

Speed of response, Numerical problems on static and Dynamic characteristics. Mathematical model of measuring system, Transfer function of Zero order system, First order system and Second order system, Step response of First order and second order system.

UNIT - III: RESISTIVE AND CAPACITIVE SENSORS (9 Periods)

Resistive Sensors: Potentiometers, Metal and Semiconductor Strain gauges, Resistance temperature detectors, Thermistors, Light dependent resistors, Hot-wire resistive transducer.
Capacitive Sensors: Change in overlapping area, dielectric constant and distance between the plates of variable and differential capacitor. Frequency response of capacitive sensors.

UNIT - IV: INDUCTIVE AND SELF-GENERATING SENSORS (9 Periods)

Inductive sensors: Variable reluctance sensors, Eddy current sensors, Linear variable differential transformers, Synchros, Hall Effect sensors.
Self-generating sensors: Piezoelectric sensors: piezoelectric effect, deformation modes, equivalent circuit, materials. Thermoelectric effect, photovoltaic effect and its materials. Electrochemical sensors: Ion selective electrodes, Solid state electrodes.

UNIT – V: DIGITAL AND OTHER SENSORS (9 Periods)

Digital transducers: Incremental encoder, absolute encoder. Photodiode, Phototransistors, Fiber optic sensors: Basics, sensor technology. Ultrasonic sensors: Basics, sensing methods. Biosensors, Basics of SMART sensors, Microsensor Technology: Thick-film, Thin-film, Micromachining.

Total Periods: 45

TEXT BOOKS:

1 Ramon Pallas-Areny and John G. Webster, *Sensors and Signal Conditioning*, John Wiley & Sons, Inc., 2nd edition, 2001.

2 A.K.Sawhney, A Course in Electrical and Electronic Measurements and Instrumentation, Dhanpat Rai & Co., 19th edition, 2013.

REFERENCE BOOKS:

1. D. V. S Murty, *Transducers and Instrumentation*, PHI Learning Private Limited, 2nd edition, 2011.
2. D. Patranabis, *Sensors and Transducers*, PHI Learning Private Limited, 2nd edition, 2003.
3. John P. Bentley, *Principles of Measurement Systems*, Pearson Education, 4th edition, 2005.
4. Doebelin E.O, *Measurement Systems - Application and Design*, Tata McGraw-Hill, 4th edition, 2003.

II B. Tech. – I Semester

(16BT30403) SWITCHING THEORY AND LOGIC DESIGN

(Common to ECE and EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: —

COURSE DESCRIPTION: Number system and Boolean algebra; Minimization; Analysis and synthesis of digital circuits; Asynchronous Sequential Logic & Programmable Memories.

COURSE OUTCOMES: On successful completion of the course, students will be able to

CO1. Demonstrate the knowledge in
- Conversion of number systems, Binary Codes.
- Basic theorems, properties and postulates of Boolean algebra.
- Minimization of switching functions using Map method and Tabular method.
- Combinational and sequential circuits.
- Realization of Boolean functions using PLDs.

CO2. Analyse combinational and sequential circuits.

CO3. Design and develop various combinational, sequential circuits and PLDs.

CO4. Solve problems and arrive at solutions pertaining to Digital Electronics.

CO5. Apply minimization techniques to asynchronous and synchronous designs and suggest appropriate design for engineering solutions.

CO6. Apply appropriate logic functions to obtain optimized designs useful for the society.

DETAILED SYLLABUS:

UNIT -I: NUMBER SYSTEM & BOOLEAN ALGEBRA **(10 Periods)**

Introduction, Binary Numbers, Number base conversions, Complements of numbers, Signed binary numbers, Binary codes, Error detection and correction codes. Boolean Algebra-Basic definition, Basic theorems and properties, Boolean Functions, Canonical & Standard forms, logic operations & Logic gates.

UNIT- II: GATE LEVEL MINIMIZATION (8 Periods)

Introduction, the map method, four variable, Five variable K-map, POS & SOP Simplification, Don't care conditions, NAND & NOR Implementation, Other two level Implementation, Ex-or Function, Quine-McCluskey Technique-simplification of Boolean function using tabulation Method.

UNIT- III: ANALYSIS AND SYNTHESIS OF COMBINATIONAL CIRCUITS (10 Periods)

Combinational circuits, Analysis & Design procedure, Binary Adder-subtractor, Decimal Adder, Binary Multiplier, Magnitude comparator, Decoder, Encoders, Multiplexers, Demultiplexers-1-Line to 4-Line and 1-Line to 8-Line Demultiplexers.

UNIT- IV: ANALYSIS AND SYNTHESIS OF SEQUENTIAL CIRCUITS (10 Periods)

Sequential Circuits, Latches, Flip-Flops, Analysis of Clocked sequential circuits, State Reduction & Assignment, Design procedure, Registers-Shift Registers, Counters- Synchronous counters and Asynchronous counters.

UNIT- V: ASYNCHRONOUS SEQUENTIAL LOGIC & PROGRAMMABLE MEMORIES (7 Periods)

Introduction, Analysis procedure, Design Procedure, Reduction of State and flow tables, Hazards, Programmable Memories-ROM, PLA, PAL.

Total Periods: 45

TEXT BOOK:

1. M. Morris Mano, *Digital Design*, Pearson, 5th Edition, 2013.

REFERENCE BOOKS:

1. A. Anand Kumar, *Switching Theory and Logic Design*, PHI, 2008.
2. ZviKohavi and NirahK.Jha, *Switching Theory and Finite Automata Theory*, Tata McGraw-Hill, 2nd Edition, 1978.
3. Charles H. Roth, *Fundamentals of Logic Design*, Thomson Publications, 5th Edition, 2004.

II B. Tech. – I Semester

(16BT30241) ELECTRICAL TECHNOLOGY

(Common to ECE and EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Courses on Network Analysis, Engineering Physics.

COURSE DESCRIPTION: Analysis of phase & line quantities and measurement of power in three phase system; Constructional details, operation, performance evaluation and applications of DC & AC machines; Testing of DC machines and Transformers; Special machines and single phase transformers.

COURSE OUTCOMES: On successful completion of the course, students will be able to

CO1. Demonstrate knowledge on
- Construction and operation of various electrical machines
- Measurement of power in three-phase system
- Applications of various types of electrical machines

CO2. Analyze
- The operation and performance of various electrical machines
- The polyphase circuit for measurement of power

CO3. Design suitable accessories / controllers for various machines to meet the nominal specifications.

CO4. Solve engineering problems pertaining to various machines and provide feasible solutions.

CO5. Select appropriate control techniques for various electrical machines used in domestic and industrial applications.

CO6. Apply the conceptual knowledge of various electrical machines in relevance to industry and society.

DETAILED SYLLABUS:

UNIT-I: DC MACHINES (13 Periods)

DC Generator: Construction and working principle, types, EMF equation, losses, open circuit and load characteristics, applications.

DC Motor: Working principle, types, torque equation, characteristics and applications. Speed control of DC shunt motor. Necessity of starter, three-point starter. Swinburne's test.

UNIT-II: SINGLE PHASE TRANSFORMER (8 Periods)
Construction and working principle, EMF equation, losses, equivalent circuit, OC and SC tests on single phase transformer, predetermination of efficiency and regulation.

UNIT-III: THREE PHASE SYSTEMS (7 Periods)
Introduction and advantages of polyphase system, generation of three phase voltages, phase sequence, star and delta connections, relationship between phase and line quantities in three phase balanced circuits, power measurement in three phase balanced and unbalanced systems using two wattmeter method.

UNIT-IV: THREE PHASE INDUCTION MOTOR AND ALTERNATOR (9 Periods)
Induction motor: Principle of operation, constructional details, slip, rotor frequency, starting and running torques, torque-slip characteristics.
Alternators: Principle of operation, constructional details, types, interrelation between speed and number of poles and EMF equation.

UNIT-V: SPECIAL MACHINES (7 Periods)
Construction of single phase induction motor, double field revolving theory, resistance start, capacitor start and capacitor start & run split phase induction motors operation and applications, Constructional details, operation and applications of shaded-pole motor, universal motor and stepper motor (VR and PM type only).

Total Periods: 44

TEXT BOOKS:

1. V.K. Mehta, Rohit Mehta, *Principles of Electrical Engineering,* S.Chand& Company Pvt. Ltd, New Delhi, 2016.
2. B.L. Theraja and A.K. Theraja, *AText Book of Electrical Technology in S. I. Units,* Vol.2, S.Chand & Company Ltd, Multicolour illustrative Edition, New Delhi, 2014.

REFERENCE BOOKS:

1. A.Sudhakar and Shyammohan, *Principles of Electrical Engineering*, Tata McGraw Hill Education Private Limited, New Delhi. 2012.
2. M.S. Naidu and S. Kamakshaiah, *Introduction to Electrical Technology*, Tata McGraw Hill publishing company Ltd, New Delhi, 2007.

II B. Tech. – I Semester

(16BT30431) BASIC ELECTRONICS AND DIGITAL DESIGN LAB

(Common to ECE and EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	3	2

PRE-REQUISITES: Courses on Electronic Devices and Circuits, Switching Theory and Logic Design.

COURSE DESCRIPTION: Diode characteristics; Rectifiers; BJT and FET characteristics; UJT and SCR characteristics; BJT Amplifiers; Combinational Circuits; Realization of Flip-flops; Sequential Circuits; Demonstration on VHDL Programme.

COURSE OUTCOMES: On successful completion of the course, students will be able to

CO1. Demonstrate knowledge in different electronic devices, analog and digital circuits.

CO2. Analyze the characteristics of different electronic devices and circuits like
- Diodes-PN Junction Diodes, Zener Diodes, SCR
- Transistors-BJT,FET,UJT
- Combinational Circuits-HA, FA
- Flip Flops-JK FF, D FF
- Sequential Circuits -Counters

CO3. Design electronic circuits like FET Amplifiers, Combinational Circuits and Sequential Circuits.

CO4. Solve engineering problems with better Electronic circuits.

CO5. Work individually and also in a group in the area of Analog and Digital circuits.

CO6. Communicate verbally and in written form in the area of Electronic Devices and circuits.

LIST OF EXPERIMENTS:

PART A

ANALOG DEVICES AND CIRCUITS (Minimum SIX experiments to be conducted)

1. PN Junction and Zener diodes characteristics.
2. Ripple Factor and Load Regulations of Rectifier with and without filters (Full wave or Half wave).
3. Input and Output characteristics of Transistor in CE configuration.

4. Drain and Transfer Characteristics of JFET.
5. Design a Common Source Amplifier Stage and Plot its Frequency response.
6. UJT Characteristics.
7. SCR characteristics.

PART B

DIGITAL CIRCUITS (Minimum FOUR experiments to be conducted)

Design and Realization of

1. Basic gates using universal gates.
2. Half Adder and Full Adder using logic gates.
3. Multiplexer and Demultiplexer using logic gates.
4. Flip Flops using logic gates.
5. Asynchronous Counter using ICs.
6. Synchronous Counter using ICs.

Demonstration of

7. VHDL Programme

II B. Tech. – I Semester

(16BT31031) MEASUREMENTS AND TRANSDUCERS LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	3	2

PRE-REQUISITES: Courses on Sensors and Transducers, Electrical and Electronic Measurements.

COURSE DESCRIPTION: Measurement of parameters like voltage, resistance, inductance, capacitance, displacement, pressure, force, temperature and weight.

COURSE OUTCOMES: On successful completion of the course, students will be able to

CO1. Demonstrate knowledge on
- Measuring instruments
- Principles of Sensors and transducers
- AC and DC bridges

CO2. Analyze the operation and performance of measuring instruments and transducers.

CO3. Design circuits for measurement of Voltage, Current, resistance, capacitance and Inductance.

CO4. Interpret and synthesize the data obtained from mea surements and provide valid conclusions.

CO5. Select and apply appropriate sensor and measuring technique to measure the physical parameter.

CO6. Understand the working of various sensors and transducers and provide engineering solutions for societal use.

CO7. Follow ethical principles in designing circuits for measurement of physical parameters.

CO8. Do experiments related to measurement of electrical and physical parameters effectively as an individual and as a member in a group.

CO9. Communicate verbally and in written form in the area of measurements and instrumentation.

LIST OF EXPERIMENTS:

Minimum of 11 Experiments to be conducted

1. Calibration of D'Arsonval Galvanometers for measurement of Voltage & Current.
2. Calibration of D'Arsonval Galvanometers for measurement of Resistance (shunt &series).
3. Design of Wheatstone bridge and Kelvin Bridge for measurement of Resistance.

4. Design of Schering Bridge and Desauty Bridge for measurement of Capacitance.
5. Design of Maxwell's bridge and Andersons Bridge for measurement of Inductance.
6. Measurement of resistance, inductance, capacitance and quality factor of the coil using Q meter.
7. Calibration and testing of single phase energy meter.
8. Design and Calibration of LVDT for linear displacement measurement.
9. Study and analyze the characteristics of temperature sensors.
10. Study and analyze the characteristics of strain gauge and load cell.
11. Study and analyze the characteristics of proximity sensors.
12. Study and analyze the characteristics of radiation detectors.
13. Determination of time constant of a RC circuit.

II B. Tech. – I Semester

(16BT30251) ELECTRICAL TECHNOLOGY LAB

(Common to ECE and EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	3	2

PRE-REQUISITES: A course on Electrical Technology.

COURSE DESCRIPTION: Construction, operation, types, performance evaluation of DC & AC machines and transformers; Necessity of starter for DC motors; Three phase power measurement.

COURSE OUTCOMES: On successful completion of the course, students will be able to

CO1. Demonstrate knowledge on
- Construction, operation of DC & AC machines and transformers.
- Starting and speed control of DC motors.
- Testing of DC & AC machines and transformers.
- Characteristics of DC & AC machines and transformers.
- Measurement of three phase power.
- Applications of DC & AC machines and transformers.

CO2. Analyze the operation and performance of DC & AC machines, transformers and three phase system for various operating conditions.

CO3. Design the circuit with suitable accessories / controllers for desired operation conditions of DC & AC machines.

CO4. Interpret and synthesize the data obtained from experimentation on DC & AC machines, transformers and three phase system and provide valid conclusions.

CO5. Select and apply appropriate technique for testing and control of DC & AC machines and transformers useful in industry.

CO6. Apply the conceptual knowledge of electrical machines in relevance to industry and society.

CO7. Commit to ethical principles and standards while exercising the practical investigations on electrical machines.

CO8. Work individually or in a group while exercising practical investigationsin the field of electrical machines.

CO9. Communicate effectively in verbal and written form in relevance to electrical machines.

LIST OF EXPERIMENTS:

PART – A

1. Construction of DC machines, transformers, synchronous machines,induction motors and DC motor starters.

PART – B

Any NINE experiments are to be conducted

1. Magnetization characteristics of a DC generator.
2. Load characteristics of DC shunt generator.
3. Swinburne's test on a DC shunt machine.
4. Brake test on a DC shunt motor.
5. Speed control of DC shunt motor by
   a. Field flux control method
   b. Armature voltage control method.
6. OC and SC tests on a single phase transformer.
7. Load test on a single phase transformer.
8. Measurement of power using two wattmeter method
9. Brake test on a three phase induction motor.
10. Regulation of a three phase alternator by synchronous impedance method.
11. Brake test on single phase induction motor.

II B. Tech. – II Semester

(16BT50201) CONTROL SYSTEMS

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Courses on Multivariable Calculus and Differential Equations, Transformation Techniques and Partial Differential Equations.

COURSE DESCRIPTION: Concepts of control system; transfer function of various physical systems; time response analysis; frequency response analysis; controller design; state space analysis.

COURSE OUTCOMES: On successful completion of the course, students will be able to

CO1. Demonstrate knowledge on
- The concepts of open and closed loop control systems.
- Stability analysis in time and frequency domain.
- Controllers and compensators to meet the desired specifications.
- State variable techniques.

CO2. Analyze
- Time and frequency response of second order systems.
- Stability analysis using root-locus, bode and Nyquist plots.
- Controllers and compensators to meet the desired response.
- State space representation from transfer function.

CO3. Design a compensator to meet the design specifications of control system.

CO4. Solve problems pertaining to control systems to provide feasible solutions in real time environment.

CO5. Select appropriate techniques to solve control system problems in relevance to industry.

CO6. Apply the conceptual knowledge of control systems in domestic and industrial applications.

DETAILED SYLLABUS:

UNIT-I: MATHEMATICAL MODELING OF SYSTEMS **(11 Periods)**

Introduction to control systems. Basic elements of control system – open loop and closed loop systems. Effect of feedback.Modeling of physical systems - electrical systems, mechanical systems,

analogous systems, armature control and field control of DC motor, DC servomotor. Transfer function - block diagram reduction techniques, signal flow graph.

UNIT-II: TIME RESPONSE AND STABILITY ANALYSIS (13 Periods)

Various test signals and its importance. Time response of first and second order systems, Time-domain specifications, steady state response, steady state error and error constants, static and generalized error coefficients. Routh-Hurwitz stability criterion, Root locus technique- root locus diagram, rules to construct root loci, effect of pole zero additions on the root loci.

UNIT-III: FREQUENCY DOMAIN ANALYSIS (8 Periods)

Performance specifications in the frequency domain. Stability Analysis - Bode plot, Polar plot and Nyquist plot.

UNIT-IV: CONTROLLERS AND COMPENSATORS (6 Periods)

Introduction to controllers, effect of P, PI and PID controllers. Compensators - lag, lead, lead-lag compensator design using Bode plot.

UNIT-V: STATE SPACE ANALYSIS (7 Periods)

Transfer function Vs state space representation. Concepts of state, state variables and state model. Modeling of physical system in state space. Transfer function to state model and vice-versa. State transition matrix and its properties. Controllability and Observability using Kalman's test.

Total Periods: 45

TEXT BOOKS:

1. A. Anand Kumar, *Control Systems*, PHI learning Pvt Ltd., 2nd Edition, 2014.
2. Katsuhiko Ogata*, Modern Control Engineering,* Pearson Education Publishers, 5th Edition, 2010*.*

REFERENCE BOOKS:

1. Nagrath I.J. and Gopal M, *Control Systems Engineering*, New Age International Publications, 5th edition, 2010*.*
2. Richard C. Dorf and Robert H. Bishop, *Modern Control Systems*, Prentice Hall, 12th Edition, 2010.
3. Benjamin C.Kuo and FaridGolnaraghi, *Automatic Control Systems*, John Wiley & Sons Publications, 8th Edition, 2002.
4. A.Nagoorkani, *Control Systems*, RBA Publications, 2nd Edition, 2006.

II B. Tech. – II Semester

(16BT30401) ELECTRONIC CIRCUIT ANALYSIS AND DESIGN

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: A course on Electronic Devices and Circuits.

COURSE DESCRIPTION: Single Stage Amplifiers; Multi-Stage amplifiers; Frequency Response; Feedback Amplifiers; Oscillators; Large Signal Amplifiers; Tuned Amplifiers.

COURSE OUTCOMES: On successful completion of the course, students will be able to

CO1. Demonstrate knowledge in
- Single Stage Amplifiers
- Multi Stage Amplifiers.
- BJT Frequency Response.
- Feedback Amplifiers.
- Power Amplifiers.
- Tuned Amplifiers.

CO2. Perform analysis of electronic circuits for meeting de fined specifications.

CO3. Design and develop electronic circuits such as Feedback Amplifiers, Oscillators and Poweramplifiers with given specifications.

CO4. Solve problems pertaining to electronic circuit design.

CO5. Select an Amplifier circuit for a specific electronic sub-system.

CO6. Apply course knowledge to assess societal issues and understand the consequent responsibilities relevant to the professional engineering practice using electronic circuits.

DETAILED SYLLABUS:

UNIT-I: BJT AMPLIFIERS (10 Periods)

Single Stage Amplifiers: Introduction, Classification of Amplifiers, Analysis of CE amplifier with an Emitter Resistance.

Multistage Amplifiers: Distortion in amplifiers, Cascading Transistor amplifiers, Methods of inter-stage coupling, RC Coupled Amplifier, Direct and Transformer Coupled Amplifier, Multistage Frequency Effects, Darlington Pair, Bootstrapped Darlington circuit, Cascode amplifier.

UNIT- II: HIGH FREQUENCY RESPONSE (9 Periods)

BJT: Frequency response of BJT amplifier, Analysis at low and high frequencies, Effect of coupling and bypass capacitors, Hybrid-ð Common Emitter transistor model, Hybrid-ð conductance, Hybrid-ð capacitances, validity of Hybrid-ð model, CE short circuit current gain, CE current gain with resistive load, Gain-Bandwidth Product.

FET: Analysis of Common Source and Common Drain Amplifier circuits at High frequencies.

UNIT-III: FEEDBACK AMPLIFIERS (10 Periods)

Negative feedback amplifiers: Feedback Concept, Classification, General characteristics, Effect of feedback on amplifier characteristics, Voltage series, Current series, Current shunt and Voltage shunt feedback configurations.

Oscillators: Conditions for oscillations, types of oscillators, RC-phase shift oscillators with BJT and FET with the relevant analysis, Wein bridge oscillator, Hartley oscillator, Colpitts oscillator, Piezoelectric crystal oscillator, Frequency Stability.

UNIT-IV: POWER AMPLIFIERS (8 Periods)

Classification, Class A large-signal amplifiers- Series Fed and Transformer-coupled Audio power amplifier, Efficiency**;** Second harmonic Distortions, Higher order harmonic Distortion, Class B amplifier-Transformer coupled Push-pull amplifier, Complementary symmetry Push-pull amplifier, Efficiency, MOSFET power amplifier, Thermal stability and Heat sinks.

UNIT-V: BJT TUNED AMPLIFIERS (8 Periods)

Introduction, Q-Factor, Small Signal Tuned Amplifiers, Effect of Cascading Single Tuned Amplifiers on Bandwidth, Double-tuned amplifier, Effect of Cascading Double Tuned Amplifiers on Bandwidth, Stagger Tuned Amplifiers, Stability of Tuned Amplifiers, Class-C Tuned amplifier.

Total Periods: 45

TEXT BOOKS:

1. Jacob Millman and Christos C. Halkias, *Integrated Electronics,* Tata McGraw-Hill, 2nd Edition, 2010.
2. S Salivahanan, N.Suresh Kumar, A. Vallavaraj, Electronic Devices and Circuits, Tata McGraw Hill, 3rd Edition, 2008.

REFERENCE BOOKS:

1. Robert L. Boylestad and Louis Nashelsky, *Electronic Devices and Circuits Theory*, Pearson Education, 10th Edition, 2009.
2. David A. Bell, *Electronic Devices and Circuits,* Oxford University press, 5th Edition, 2014.
3. Donald A. Neamen, *Electronic Circuit Analysis and Design*, Tata McGraw-Hill, 3rd Edition, 2007.

II B. Tech. – II Semester
(16BT41001) INDUSTRIAL INSTRUMENTATION - I

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Courses on Sensors and Transducers, Electrical and Electronic Measurements.

COURSE DESCRIPTION: Measurement of Force, Weight, Torque, Pressure, Velocity, Acceleration, Sound and Temperature.

COURSE OUTCOMES: On successful completion of the course, students will be able to

CO1. Demonstrate knowledge of construction and working principles of different sensors for use in industrial instruments.
CO2. Identify, formulate and analyze different types of sensors for various industrial applications.
CO3. Design suitable sensors for desired parameter measure ment in industry.
CO4. Solve engineering problems pertaining to measurement of Force, Torque, Velocity, Acceleration, Pressure and Temperature to provide feasible solutions.
CO5. Select appropriate sensor and measuring techniques for the measurement of industrial parameters.

DETAILED SYLLABUS:

UNIT - I: FORCE AND TORQUE MEASUREMENT (8 Periods)
Force Measurement: Spring Balance, Load cell types, Hydrostatic, Pneumatic, Magnetoelastic, Piezoelectric, Elastic, Analysis and selection of Force sensors.
Torque Measurement: Load Cell method, Strain gauge method, Weidman Magnetostrictive, Relative angular twist, Analysis and selection of torque sensors.

UNIT - II: VELOCITY AND ACCELERATION MEASUREMENT (9 Periods)
Velocity Measurement: Electromagnetic Type, Revolution counter, Tachometers – Capacitive type, Drag cup type, Tachogenerators - AC, DC, Stroboscope, Analysis and Selection of Velocity sensors.
Acceleration Measurement: Reluctance type, Potentiometric type, Photo cell type, piezoelectric type, Null Balance, Analysis and selection of Acceleration sensors.
Gyroscopes: Principle, Single axis Restrained Gyro and Two axis free Gyro, Three axis Gyro.

UNIT - III: PRESSURE MEASUREMENT (10 Periods)

Dead weight gauges, Manometer and its Types, Elastic transducers – Bourdon tube, Diaphragm, Bellows, Electrical Types, Resistive, Inductive and Capacitive, Force balance & Vibrating Cylinder, High pressure measurement – Very high pressure transducer (Bulk modulus Gage), Low Pressure (Vacuum) measurement – McLeod Gauge, Knudsen Gauge, Momentum transfer gauge, Thermal conductivity gauge, Ionization gauge, Sound level meter, Microphone. Analysis and selection of pressure sensors.

UNIT - IV: TEMPERATURE MEASUREMENT – I (9 Periods)

Definition, Temperature vs Heat, Temperature measurement using change in physical properties – Solid expansion type, Fluid expansion type (Filled-in system), Resistance temperature detector (RTD), principle and types, construction requirements for industry, measuring circuits, 3-Lead Method, 4-Lead arrangement. Thermistors, principle and sensor types, manufacturing techniques, measuring circuits, linearization methods and applications. Thermocouples: thermoelectric effects, Laws, Thermoelectric characteristics of thermocouple, types, Processing and preparation, construction, installation and protection, measuring circuits, Cold junction Compensation, thermocouple burn out detection and high temperature measurement methods, thermopiles.

UNIT – V: TEMPERATURE MEASUREMENT – II (9 Periods)

Calibrators and simulators, Color Indicators, Crayons, Pellets, Fiber optic thermometers, Integrated circuit transistors & diodes; Radiation measurement: Radiation thermometers, introduction, definition of terms, general form of radiation measurement system, radiation thermometer types, Pyrometric cones, Pneumatic and suction pyrometers, Radiation & Infrared Pyrometers; Quartz crystal thermometry, temperature switches and thermostats, ultrasonic thermometers, Miscellaneous temperature sensors: Fluidic sensors, Johnson noise thermometer, liquid crystals, Paramagnetic salts, spectroscopic temperature measurement, Thermography, Analysis and selection of Temperature sensors.

Total Periods: 45

TEXT BOOKS:

1. D. Patranabis, *Principles of Industrial Instrumentation*, TMH, 3rd Edition, 2010.
2. Ramon Pallás Areny, John G. Webster, *Sensors and Signal Conditioning*, John Wiley and Sons, 2nd Edition, 2000.

REFERENCE BOOKS:

1. Bela G Liptak, *Instrument Engineers' Handbook: Process Measurement and Analysis*, CRC Press - Butterworth Heinemann, 4th Edition, 2003.
2. Jon Wilson, *Sensor Technology Handbook*, Newnes, 2004.
3. B. C. Nakra, K. K. Chaudhry, *Instrumentation Measurement And Analysis*, TMH, 2nd Edition, 2003.
4. Ernest Doebelin, Dhanesh Manik, *Measurement Systems*, McGraw Hill International, 6th Edition, 2011.

II B. Tech. – II Semester

(16BT41002) LINEAR AND DIGITAL ICs

(Common to EEE and EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Courses on Electronic Devices and Circuits, Switching Theory and Logic Design.

COURSE DESCRIPTION: Differential Amplifier; Characteristics of Operational Amplifiers; Linear & Non-Linear Applications of Op-Amp; IC 555 timer and phase locked loops; Application of PLL; A-D & D-A Converters; CMOS and Bipolar Logic Interfacing; HDL with combinational and sequential logic design.

COURSE OUTCOMES: On successful completion of the course, students will be able to

CO1. Demonstrate knowledge in
- Op-amp operation and applications.
- Timer & PLL circuits.
- A-D & D-A Converters
- CMOS and Bipolar logic Interfacing.
- HDL design and programming.

CO2. Analyze
- Op-amp based circuits.
- Timers for various circuits.
- Different logic families.

CO3. Design
- Circuits using Op-amps.
- Logic gates using CMOS.
- Combinational and sequential circuits.

CO4. Solve problems in
- Evaluating parameters of Op-amp based circuits.
- Programming of various combinational and sequential logic design.

CO5. Apply appropriate modeling technique to suit IC Design.

CO6. Understand the impact of design and use of Linear and Digital ICs in the development of efficient and cost effective products.

DETAILED SYLLABUS:

UNIT –I: OPERATIONAL AMPLIFIER (11 periods)

Op-amp internal circuit - Differential Amplifier, Transfer Characteristics, Level Translator, Output stage;Basic information of Op-Amp, Ideal & Practical operational Amplifier-Inverting, non-Inverting & Differential Amplifier, Voltage follower, DC Characteristics- Input Bias Current, Input Offset Current, Input Offset Voltage, Total Output Offset Voltage, CMRR, PSRR, Thermal Drift.

AC Characteristics- Frequency Response, Frequency Compensation, Slew Rate, Features and characteristics of 741 Op-Amp.

UNIT – II: LINEAR AND NON LINEAR APPLICATIONS, FILTERS (10 Periods)

Linear Applications - Integrator and differentiator, Instrumentation amplifier, AC amplifier, Non - Linear Applications - Comparators & its applications, Multivibrators: monostable and astable, RC phase shift oscillator, Log and Antilog amplifiers. Filters: First - order LPF, HPF, Butterworth Filters, Second order LPF, HPF.

UNIT – III: IC 555 TIMER, PLL AND CONVERTERS (8 Periods)

Introduction to 555 timer, functional diagram, monostable and astable operations and applications. PLL - Introduction, block schematic, principles and description of individual blocks, Voltage Controlled Oscillator (IC 566).

D-A Converters: R-2R ladder & Inverted R-2R ladder, A-D converters: Sample and hold circuit, Flash type, Successive Approximation type and Dual slope ADC.

UNIT – IV: CMOS LOGIC AND HDL Programming (8 Periods)

CMOS logic, CMOS steady state electrical behavior, CMOS dynamic electrical behavior.

Introduction to Verilog: HDL based design flow, program structure, language elements, operators, User defined primitives, data flow modeling, behavioral modeling, structural modeling.

UNIT–V: MODELING AND DESIGN OF DIGITAL CIRCUITS USING VERILOG (8 Periods)

Introduction to 74x283 adder, 74x151 multiplexer, 74x541, 74x245 three state devices, 74x138 decoder, 74x148 encoder, Flip-flops- SR & JK, 74x163 Counter. Design and programming of Digital IC applications using the above components.

Total Periods: 45

TEXT BOOKS:

1. D. Roy Chowdhury, *Linear Integrated Circuits*, New Age International Pvt. Ltd., 4th Edition, 2010.
2. John F. Wakerly, *Digital Design Principles & Practices*, Pearson Education, 4th Edition, 2009.

REFERENCE BOOKS:

1. Ramakanth A. Gayakwad, *Op-Amps & Linear ICs*, PHI, 3rd Edition, 1987.
2. J. Bhasker, *VERILOG Primer*, BS Publications, 2nd Edi tion, 2001.
3. Stephen Brown, Zvonko Vranesic, *Fundamentals of Digital Logic with VERILOG Design*, TMH, 2nd Edition, 2007.
4. T.R. Padmanabhan, B. Bala Tripura Sundari, *Design through Verilog HDL*, Wiley India, 2004.

II B. Tech. – II Semester

(16BT30402) SIGNALS AND SYSTEMS

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: A course on Transformation Techniques and Partial Differential Equations.

COURSE DESCRIPTION: Analysis of signals and systems; Representation of signals using Fourier series and Fourier transforms; Time-Domain and Frequency-Domain aspects of signals and systems; concept of convolution and correlation; Sampling and types of sampling; Laplace transform of signals; Z-Transform of sequences.

COURSE OUTCOMES: On successful completion of the course, students will be able to

CO1. Demonstrate knowledge in
- Representation of signals and systems.
- Fourier series representation of periodic signals
- Fourier transform of signals
- Convolution and correlation of functions
- Laplace transform
- Sampling Process
- Z-Transform

CO2. Analyze various continuous and discrete time signals and systems in time andf requency domains.

CO3. Develop solutions to stable and causal systems.

CO4. Solve problems pertaining to transforms and signal processing.

CO5. Select and apply appropriate transformation techniques for understanding of the frequency content of signals at the input and output of the systems.

DETAILED SYLLABUS:

UNIT- I: SIGNALS AND SYSTEMS (10 periods)

Elementary signals- Unit Impulse and Unit Step Functions, Exponential and Sinusoidal Signals. Classification of Continuous-Time and Discrete-Time Signals, Basic operations on signals, Classification of Continuous-Time and Discrete-Time Systems, Basic System Properties, Linear Time-Invariant Systems - Discrete-Time LTI Systems- The Convolution Sum, Continuous-Time LTI Systems - The Convolution Integral, Properties of Linear Time-Invariant Systems.

UNIT -II: FOURIER SERIES & FOURIER TRANSFORM (12 periods)

Fourier series: Representation of Fourier series, Continuous

time periodic signals, Dirichlet's conditions, Properties of CT Fourier Series, Trigonometric Fourier Series and Exponential Fourier Series with examples. Complex Fourier spectrum. Fourier series representation of a periodic signals.
Fourier Transforms: Deriving Fourier Transform from Fourier series, Fourier Transform of standard signals, Fourier Transform of Periodic Signals, Properties of CT Fourier Transform, Systems characterized by Linear constant coefficient differential equations. The Magnitude-Phase Representation of the Fourier Transform, The Magnitude-Phase Representation of the Frequency Response of LTI Systems.

UNIT- III: CORRELATION OF SIGNALS (7 periods)
Cross correlation and auto correlation of functions, properties of correlation function, Energy density spectrum, Parseval's theorem, Power density spectrum, Relation between auto correlation function and energy/power spectral density function. Relation between convolution and correlation, Detection of periodic signals in the presence of noise by correlation, Extraction of signal from noise by filtering.

UNIT- IV: LAPLACE TRANSFORMS (7 periods)
The Laplace Transform, The Region of Convergence for Laplace Transforms, The Inverse Laplace Transform, Relationship between Fourier and Laplace Transforms, Properties of the Laplace Transform, Some Laplace Transform Pairs, Analysis and Characterization of LTI Systems Using the Laplace Transform.

UNIT- V: SAMPLING AND Z-TRANSFORMS (9 periods)
Sampling: Representation of a Continuous-Time Signal by its Samples - Sampling Theorem, Reconstruction of a Signal from Its Samples Using Interpolation. Effect of under sampling - Aliasing, Discrete-Time Processing of Continuous-Time Signals.
Z-Transforms: Region of Convergence for the z-Transform, The Inverse z-Transform, Relation between Fourier and Z-Transforms, Properties of the z-Transform, Some Common z-Transform Pairs, Analysis and Characterization of LTI Systems Using z-Transforms.

Total Periods: 45

TEXT BOOK:
1. Alan V. Oppenheim, Alan S. Willsky, & S. Hamid, *Signals and Systems*, Pearson Higher Education, 2nd Edition, 2008.

REFERENCE BOOKS:
1. Simon Haykin and B. Van Veen, *Signals & Systems*, John Wiley, 2nd Edition, 2010.
2. A. Anand Kumar, *Signals & Systems*, PHI, 2011.
3. B.P. Lathi, *Principles of Linear Systems and Signals*, Oxford University Press, 2nd Edition, 2013.

II B. Tech. – II Semester

(16BT40406) PULSE AND DIGITAL CIRCUITS

(Common to ECE and EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Courses on Electronic Devices and Circuits, Network Analysis.

COURSE DESCRIPTION: Linear and non-linear Wave shaping circuits; Switching characteristics of Diode and Transistor; Design of multivibrators; Sweep circuits; Sampling and logic gates.

COURSE OUTCOMES: On successful completion of the course, students will be able to

CO1. Apply the knowledge in
- Responses of High-pass and low-pass RC circuits for different inputs
- Clipping and clamping operations.
- Multivibrators.
- Methods of generating the Time-base waveforms
- Operating Principles of of Sampling gates
- Realization of logic gates using Diodes and Transistors

CO2. Analyze theperformance of Linear and non-linear Wave shaping Circuits.

CO3. Design and develop different Multivibrator Circuits, Sweep circuits, clipper and clamper circuits.

CO4. Solve engineering problems pertaining to pulse and Digital circuits to provide valid conclusions.

CO5. Apply appropriate techniques to obtain optimum solution in the field of pulse and digital circuits.

CO6. Apply contextual knowledge in pulse and digital circuits to assess propagation delay and power dissipation parameters to the Professional engineering practice for societal use.

DETAILED SYLLABUS:

UNIT-I: LINEAR WAVE SHAPING (9 Periods)

High-pass, Low-pass RC circuits, Their response for Sinusoidal, Step, Pulse, Square and Ramp inputs. High pass RC network as a Differentiator and Low pass RC network as an Integrator, Ringing circuit, Attenuators and its application as a CRO probe.

UNIT-II: NONLINEAR WAVE SHAPING (9 Periods)
Diode clippers, Transistor clipper, Clipping at two independent levels, Comparators, Clamping operation, Clamping circuit taking source and Diode resistances into account, Clamping circuit theorem, Practical clamping circuits, Effect of Diode characteristics on Clamping voltage, Synchronized Clamping.

UNIT-III: MULTIVIBRATOR CIRCUITS (9 Periods)
Transistor as a switch, Analysis and Design of Fixed-Bias Bistable, Monostable, Astable Multivibrators (Collector-Coupled), Symmetrical and Asymmetrical triggering, Schmitt trigger Circuit.

UNIT-IV: TIME-BASE GENERATORS (10 Periods)
Voltage Time-Base Generators: General features of a Time-Base signal, Exponential Sweep Circuit, Constant Current Sweep Circuit, UJT Sweep Circuit, Miller and Bootstrap Time-Base generators - basic principles, Transistor Miller Time-Base generator, Transistor Bootstrap Time-Base generator.
Current Time-Base Generators: A Simple Current Sweep, Linearity Correction through Adjustment of Driving Waveform, Transistor Current Time-Base generator.

UNIT-V: SAMPLING GATES AND DIGITAL LOGIC CIRCUITS (8 Periods)
Samplig Gates: Basic operating principles of sampling gates, Unidirectional and Bi-directional sampling gates, Reduction of pedestal in gate circuits, Four Diode Sampling gate, Applications of sampling gates.
Digital Logic Circuits: Realization of Logic gates (OR, AND & NOT) using diodes & transistors, Introduction to DTL, TTL, ECL and CMOS Logic.

Total Periods: 45

TEXT BOOKS:

1. Jacob Millman, Herbert Taub and Suryaprakash Rao Mothiki, *Pulse, Digital and Switching Waveforms*, TMH, 3rd Edition,2011.
2. David A. Bell, *Solid State Pulse Circuits*, PHI, 4th Edition, 2009.

REFERENCE BOOKS:

1. A. Anand Kumar, *Pulse and Digital Circuits*, PHI, 2nd Edition, 2008.
2. R.Venkataraman, *Pulse Digital Circuits and Computer Fundamentals*, Dhanapat Rai Publications, 3rd Edition, 1994.

II B. Tech. – II Semester

(16BT41031) ANALOG ELECTRONICS LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	3	2

PRE-REQUISITES: Courses on Electronic Devices and Circuits, Pulse and Digital Circuits, Electronic Circuit Analysis and Design.

COURSE DESCRIPTION: Diode characteristics; Rectifiers; BJT and FET characteristics; UJT and SCR characteristics; BJT Amplifiers; Non-linear and Linear Wave shaping circuits; Feedback Amplifiers; Design of Multi-vibrator circuits; Power Amplifiers.

COURSE OUTCOMES: On successful completion of the course, students will be able to

CO1. Apply the knowledge in

- Diodes-PN Junction Diodes, Zener Diodes, SCR
- Transistors-BJT,FET,UJT
- Feedback amplifiers and oscillators
- Clipping and Clamping Circuits
- RC High Pass and Low Pass Circuits
- Multi-vibrators

CO2. Analyze different types of amplifier, oscillator and pulse circuits.

CO3. Design different types of Electronic circuits like feedback amplifiers, Oscillators, Multi -vibrators, Schmitt Trigger.

CO4. Provide solutions through the design and conduct of experiments, analysis and synthesis.

CO5. Apply biasing technique for design of amplifiers.

CO6. Function effectively as an individual and as a member in a group in the area of analog electronic circuits.

CO7. Communicate effectively in oral and written form in the area of analog electronic circuits.

LIST OF EXPERIMENTS:
(Minimum of Twelve experiments to be conducted)

Part-I: Design and simulate the following circuits using any simulation

software (Minimum of Six experiments to be conducted)

1. Common Emitter (CE) amplifier.
2. Common Source (CS) amplifier.
3. A two stage RC coupled amplifier.
4. Cascode amplifier.
5. Voltage series feedback amplifier.
6. RC phase shift oscillator using transistors.
7. Class - A power amplifier (transformer less).

Part-II: Implementation of the following circuits through hardware

(Minimum of Six experiments to be conducted)

1. Design and Verify the Linear Wave Shaping circuit - Differentiator and Integrator.
2. Design and Verify the Non Linear Wave Shaping cir cuits-Clippers and Clampers.
3. Implementation of a Transistor as a Switch.
4. Implementation of Schmitt Trigger.
5. Implementation of Bootstrap Sweep Circuit.
6. Implementation of UJT Relaxation Oscillator.
7. Implementation of Astable Multivibrator using Transis tors.

II B. Tech. – II Semester

(16BT41032) CONTROL SYSTEMS DESIGN LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	3	2

PRE-REQUISITES: A Course on Control Systems.

COURSE DESCRIPTION: Open and closed loop systems; DC and AC servo motor; stability analysis electrical systems; P, I, D parameters.

COURSE OUTCOMES: On successful completion of the course, students will be able to

CO1. Demonstrate knowledge on the effect of feedback and different controllers.

CO2. Develop skills to analyze

- The characteristics of servomotors
- The stability of the system using root-locus bode and Nyquist plots
- The time domain and frequency specifications of second order system

CO3. Design a transfer function of given model.

CO4. Develop programming skills to solve open and closed loop control systems.

CO5. Select and apply modern tools for solving complex problems in control systems.

CO6. Function effectively as individual and as member in team.

CO7. Communicate effectively both oral and written in relevance to control systems.

LIST OF EXPERIMENTS:

Conduct any TEN experiments:

1. Transfer function of DC machine.
2. Find Torque transfer function of synchros.
3. Transfer function from the block diagram using MATLAB.
4. Unit step response of given second order transfer function using MATLAB. Determination of peak overshoots, peak time, rise time and delay time.
5. Time response of second order system (hard ware).

6. Stability analysis of a linear time invariant system using Root Locus.
7. Stability analysis of a linear time invariant system using Bode plot and Nyquist plot.
8. Design lead & Lag compensator using Bode plots.
9. Effect of P, PD, PI and PID controllers on a second order system (Hardware/Software).
10. Effect of PID controllers for the given transfer function using MATLAB SIMULINK.
11. Transfer function from state model and Vice-versa.
12. Controllability and observability test using MATLAB.

II B. Tech. – II Semester

(16BT41033) LINEAR AND DIGITAL ICs LAB

(Common to EEE and EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	3	2

PRE-REQUISITES: A course on Linear and Digital ICs.

COURSE DESCRIPTION: Op-Amp characteristics; Applications of Op-Amp; 555 timer; PLL; Digital logic families and interfacing; Digital IC Applications; Programming of digital IC's in HDL.

COURSE OUTCOMES: On successful completion of the course, students will be able to

CO1. Demonstrate knowledge on analog and digital cir cuits.

CO2. Apply analytical skills to determine the op-amp pa rameters.

CO3. Design of analog and digital circuits for Linear & Non linear applications.

CO4. Provide valid conclusions through analysis and synthesis of analog and digital circuits.

CO5. Apply appropriate simulation tools for programming of analog and digital circuits.

CO6. Work individually and also in a group to develop applications using linear and digital ICs.

CO7. Communicate effectively with engineering community to design analog circuits.

DETAILED SYLLABUS:

LIST OF EXPERIMENTS:

(Minimum of Eleven experiments to be conducted)

PART: A (Minimum of THREE experiments to be done using any simulation software)

1. Design and Simulate an Active filter (LPF / HPF) for given cut off frequency.
2. Design and Simulate D-A converter (R-2R ladder) with required voltage levels.
3. Design and Simulate an Instrumentation Amplifier with required gain.

4. Design and Simulate Op-Amp applications – (Integrator /Differentiator) for given cut-off frequency.
5. Design and Simulate applications of 555 timer (Monostable /Astable Multivibrator) with given duty cycle and fre quency.

PART – B: Linear IC's (Minimum of FOUR experiments to be done using hardware)

1. (a) Design and Verify Op-Amp based comparator with given reference voltage.
   (b) Design and Verify Op-Amp based Schmitt Trigger with given Duty cycle and frequency.
2. Design and Verify the Applications of Op-Amp (Integra tor/Differentiator) for given cut-off frequency.
3. Design and Verify the Applications of 555 timer (Monostable /Astable Multivibrator) with given Duty cycle and frequency.
4. Design and Verify and R-2R Ladder DAC circuit using op-amp-741.
5. Design and Verification of active filter (LPF / HPF) for given cut off frequency.
6. Design and Verify an Instrumentation Amplifier with re quired Gain.

PART: C (Minimum of FOUR experiments to be done using Verilog HDL)

1. Simulate the Model of Adder and Subtractor with differ ent flow(Structural, Data and behavioral).
2. Simulate the Model of 3x8 using 2x4 Decoder & 8x3 us ing 4x2Encoder.
3. Simulate the Model of 8x1 using 4x1 using 2x1 Multi plexer.
4. Simulate the Model of J-K, T, D Flip-flops using Logic gates.
5. Simulate the Model of 4-Bit Universal shift register.
6. Simulate the Model of Mod-8 Counter.

III B. Tech. – I Semester

(16BT3HS02) MANAGERIAL ECONOMICS AND PRINCIPLES OF ACCOUNTANCY

(Common to EEE, ECE and EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: —

COURSE DESCRIPTION: Managerial Economics; Demand and Elasticity of Demand; Production Functions; Markets and Pricing Policies; Formation of different types of Business Organizations; Basic concepts of Accounting (Journal, Ledger and Trial balance); Trading Account, Profit and Loss Account and Balance sheet with simple adjustments; Computerized Accounting.

COURSE OUTCOMES: On Successful completion of the course, students will be able to

CO1. Acquire Knowledge in
- Tools and concepts of Micro Economics.
- Basic Principles and concepts of Accountancy.
- Provides life skills for effective utilization of scarce resources.
- Financial Accounting.
- Significance of Economics and Accountancy

CO2. Develop skills in managerial decision making of an organization.

CO3. Apply the Economic theories i.e., Demand, Production, Cost, Markets and Price.

CO4. Develop effective communication in Business and Ac counting transactions.

CO5. Ascertain the profitability and soundness of an organization.

CO6. Practice Financial Accounting.

DETAILED SYLLABUS:

UNIT–I: INTRODUCTION TO MANAGERIAL ECONOMICS, DEMAND ANALYSIS (9 Periods)

Definition, Nature and Scope of Managerial Economics. **Demand:** Determinants of demand – Demand function - Law of demand, assumptions and exceptions - Elasticity of demand – Types of elasticity of demand - Demand forecasting and methods of demand forecasting.

UNIT – II: THEORY OF PRODUCTION AND COST ANALYSIS (9 Periods)

Production Function: Isoquants and Isocosts – Input-output relationship - Law of returns.

Cost Concepts: Total, Average and Marginal Cost **-** Fixed vs. Variable costs – Opportunity Costs Vs Outlay Costs– Separable Costs Vs Joint Costs, Urgent Costs Vs Postponable Costs-Avoidable Costs Vs Unavoidable Costs.
Break Even Analysis (BEA) – Assumptions, Merits and demerits - Determination of Break Even Point (Simple problems).

UNIT – III: INTRODUCTION TO MARKETS AND PRICING (9 Periods)

Market Structure: Types of Markets - Features of perfect competition - Monopoly and monopolistic competition - Price and Output determination in perfect competition, monopoly and monopolistic Markets.
Pricing: Objectives and policies of pricing – Sealed bid pricing - Marginal cost pricing - Cost plus pricing - Going rate pricing – penetration Pricing –skimming Pricing - Block pricing – Peak load pricing - Cross subsidization.

UNIT – IV: INTRODUCTION TO PRINCIPLES OF ACCOUNTING AND CAPITAL (9 Periods)

Accountancy: Introduction – Concepts – Conventions – Double Entry Book Keeping – Journal – Ledger - Trial Balance (Simple problems).
Capital: Significance - Types of capital – Sources of Capital.

UNIT–V: FINAL ACCOUNTS - COMPUTERIZATION OF ACCOUNTING SYSTEM (9 Periods)

Introduction to Final Accounts - Trading account - Profit and Loss account and Balance Sheet with simple adjustments (Simple problems).
Computerization of Accounting System: Manual Accounting *Vs* Computerized Accounting – Advantages and Disadvantages of Computerized Accounting.

Total Periods: 45

TEXT BOOKS:

1. A.R. Aryasri, *Managerial Economics and Financial Analysis*, Tata Mc- Graw Hill, New Delhi, 3rd Edition, 2007.
2. R.Cauvery, U.K. Sudhanayak, M. Girija and R. Meenakshi, *Managerial Economics*, S. Chand and Company, New Delhi, 2nd Edition, 2010.

REFERENCE BOOKS:

1. Varshaney and Maheswari, *Managerial Economics,* Sultan Chand and Sons, New Delhi, 19th Edition, 2005.
2. Ms. Samba Lalita, *Computer Accouting Lab Work*, 1st Edition, Kalyani Publishers, Ludhiana, 2009.
3. S.P. Jain and K.L. Narang, *Financial Accounting*, Kalyani Publishers, Ludhiana, 6th Edition, 2002.

III B. Tech. – I Semester

(16BT51001) BIOMEDICAL INSTRUMENTATION

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: A Course on Electrical and Electronic Measurements.

COURSE DESCRIPTION: Human Anatomy & Physiology; Bio-signals; Cardiovascular and Neuro-muscular Instrumentation; Therapeutic Equipment; Advanced Imaging techniques.

COURSE OUTCOMES: On successful completion of the course, students will be able to

CO1. Demonstrate knowledge on human anatomy and physiology, ECG, EMG and EEG measuring systems, medical imaging and therapeutic equipment.

CO2. Analyze various bio signals like ECG, EMG, EEG.

CO3. Design and develop suitable interfaces for real time applications in the field of biomedical instrumentation.

CO4. Solve problems related to extraction of bio signals.

CO5. Choose appropriate device to solve biomedical engineering problems.

CO6. Apply ethical principles and commit to professional ethics, responsibilities and norms of the biomedical engineering practice.

DETAILED SYLLABUS:

UNIT – I: BIOELECTRIC POTENTIALS AND ELECTRODES (9 Periods)

Block diagram biomedical instrumentation system, Problems encountered in measuring a living system, Structure of cell, Resting and Action Potentials, Propagation of Action Potentials, Propagation of action potentials nerve to neuro-muscular junction, sources of Bioelectric Potentials, Electrode theory: Biopotential electrodes, Biochemical transducers.

UNIT–II: CARDIOVASCULAR INSTRUMENTATION (9 Periods)

Physiology of cardiovascular system, electrical conduction system of the heart, interpretation of ECG waveform, standard 12-lead configurations, Einthoven triangle, specifications of ECG Machine; Blood pressure, blood flow and heart sound measurements; Relation between electrical and mechanical activities of the heart.

UNIT – III: NEURO-MUSCULAR AND RESPIRATORY INSTRUMENTATION (9 Periods)

Physiology of nervous system, electrode placement for EEG and EMG recording, Specification of EEG and EMG machines, Interpretation of EEG and EMG.

Respiratory Instrumentation: Mechanism of respiration, Spirometry, Pneumotachograph Ventilators.

UNIT – IV: THERAPEUTIC EQUIPMENT (10 Periods)

Pacemakers: Need for Cardiac pacemakers, pacing modes, Ventricular asynchronous Pacemaker (Fixed rate Pacemaker), Ventricular inhibited Pacemaker (demand Pacemaker), Atrial Synchronous pacemaker, Comparision between internal & external Pacemakers; Defibrillators: AC Defibrillator, DC Defibrillator, Synchronised DC Defibrillator; Diathermy: Shortwave and microwave, Dialysis: Hemodialysis, Peritonal Dialysis.

UNIT – V: MEDICAL IMAGING SYSTEM (8 Periods)

Ultrasonic Imaging: Doppler principle, Modes of Display: A-Mode, B-Mode and Echocardiography. Computed Tomography: Block diagram of CT scanner, Applications of Computed Tomography. MRI System, Cine angiogram, Endoscope.

Total Periods: 45

TEXT BOOKS:

1. Leslie Cromwell, Fred. J. Weibell and Erich. A. Pfeiffer, *Biomedical Instrumentation and Measurements*, PHI, 2nd Edition, 2003.
2. M. Arumugam, *Biomedical Instrumentation*, Anuradha Publications, 1992.

REFERENCE BOOKS:

1. John G.Webster, *Medical Instrumentation Application and Design*, Wiley India Pvt. Ltd., 3rd Edition, 2004.
2. R.S. Khandpur, *Hand Book of Biomedical Instrumentation*, Tata McGraw Hill, 2nd Edition, 2002.

III B. Tech. – I Semester

(16BT51002) INDUSTRIAL INSTRUMENTATION - II

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: A course on Industrial Instrumentation - I.

COURSE DESCRIPTION: Measurement of Flow, Level, Moisture, Viscosity, Density; Electrical and intrinsic safety; Design of signal conditioning circuits.

COURSE OUTCOMES: On successful completion of the course, students will be able to

CO1. Demonstrate knowledge of construction and working principles of different instruments used in industry.

CO2. Identify, formulate and analyze different types of instruments for various industrial applications.

CO3. Design suitable sensors and signal conditioning circuits for desired parameter measurement in industrial applications.

CO4. Solve engineering problems pertaining to measurement of Density, Viscosity, Moisture, Flow, Level and signal conditioning circuits to provide feasible solutions.

CO5. Select appropriate sensor and measuring technique for the measurement of industrial parameters.

CO6. Apply the knowledge of safety issues while designing measuring instruments used in industries.

DETAILED SYLLABUS:

UNIT - I: DENSITY, VISCOSITY and HUMIDITY MEASUREMENT (11 Periods)

Density: Introduction, Pressure head type, Float type, Displace type, Buoyancy effect densitometer method, Hot wire gas bridge type, Vibration type, Radioactive method. Analysis and selection of density sensors.

Viscosity: Introduction, Friction tube viscometer, Saybolt's viscometer, Rotameter viscometer, Searle's rotating cylinder, Cone and Plate viscometer. Consistency meter – Rotating vane type and Oscillating type. Analysis and selection of viscosity sensors.

Humidity: Psychrometer, hygrometer & Types, Dew point device. Analysis and selection of humidity sensors.

UNIT – II: LEVEL MEASUREMENT (7 Periods)

Introduction, Gauge Glass technique, Float Types – Float–and–tape method, Float–and–shaft method, Magnetic float types. Displacer types, Hydrostatic types – Air-Purge type, Bubbler type. Thermal effect types, Electrical types – Resistance switch type, Inductive and Capacitance type. Ultrasonic method, bellow element type, Fibre - optic type, level transmitters, Analysis and selection of level sensors.

UNIT – III: FLOW MEASUREMENT (10 Periods)

Introduction, Head types – Orifice, Venturi, Flow Nozzle, Dahl Tube, Pitot tube, Area flow meter - Rotameter & types, Mass flow meters – Turbine Mass flow meter, Coriolis flow meter, Gyroscopic flow meter, Liquid bridge mass flow meter, Calorimetric flow meter. Positive displacement type flow meters - Nutating Disc, Rotary Vane, Lobed impeller, Reciprocating Piston type, Fluted Rotor. Electrical type flow meter – Turbo magnetic flow meter, Electromagnetic flow meter, Ultrasonic flow meter, Hotwire anemometer type, Vertex shedding type. Flow transmitters, Analysis and selection of flow sensors.

UNIT - IV: SIGNAL CONDITIONING (9 Periods)

Voltage Dividers: Potentiometers, Application to thermistors, Dynamic measurements, Amplifiers for voltage dividers; Wheatstone Bridge – Compensation & Sensitivity.

Signal conditioning for Self generating sensors: Chopper and low drift amplifiers Composite amplifier, charge amplifier and electrometer amplifier.

Design of I to V, V to I converters, Range conversion of current, voltage, Design of instrumentation amplifier.

UNIT – V: SAFETY INSTRUMENTS (8 Periods)

Proximity Switches - Capacitive, Inductive, Magnetic, Hall-Effect. Limit switches – Mechanical, Optical, Pneumatic, Ultrasonic, Digital outputs & Encoders.

Electrical & Intrinsic Safety: NEMA types, Fuses & Circuit breakers. Explosion hazards & intrinsic safety – Protection methods, Purging, pressurization, ventilation.

Grounding and Shielding: Introduction - concept of earth ground, examples of current return path symbols, shock hazard protection using Earth Ground, grounding considerations, basic grounding practices and examples. Practical guide lines for shielding and examples.

Total Periods: 45

TEXT BOOKS:

1. *D. Patranabis, Principles of Industrial Instrumentation*, 3rd Edition, TMH, 2010.
2. A. K. Sawhney, *A Course in Electrical and Electronics Measurements and Instrumentation,* Dhanpat Rai and Sons, 19th Edition, 2011.

REFERENCE BOOKS:

1. *Bela G Liptak, Instrument Engineers' Handbook: Process Measurement and Analysis, CRC Press - Butterworth Heinemann, 4th Edition, 2003.*
2. M.M.S.Anand., *Electronic Instruments and Instrumentation Technology*, PHI, 2005.
3. *B. C. Nakra, K. K. Chaudhry, Instrumentation Measurement And Analysis,* 2nd Edition, TMH, 2003.
4. Ramon Pallas-Areny and John G. Webster, *Sensors and Signal Conditioning*, John Wiley & Sons, Inc., 2nd Edition, 2001.

III B. Tech. – I Semester

(16BT51003) PRINCIPLES OF COMMUNICATIONS

(Common to EEE and EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: A course on Signals and Systems**.**

COURSE DESCRIPTION: Fundamentals of Communications; Analog and digital communications - modulation and Demodulation Techniques; Information theory and coding.

COURSE OUTCOMES: On successful completion of the course, students will be able to

CO1. Demonstrate fundamental knowledge in

- Elements of communication systems.
- Amplitude, Frequency, and Phase Modulators and Demodulators.
- Data transmission and detection of digital signals.
- Information theory and coding techniques.

CO2. Perform analysis of different modulation techniques and calculate various performance parameters

CO3. Design and develop modulators and demodulators for communication systems.

CO4. Solve engineering problems for feasibility and provide optimal solutions in the area of Analog and Digital Communication Systems.

CO5. Select the appropriate modulation and demodulation techniques for transmission and reception of signals.

CO6. Follow standards while developing the communication systems.

DETAILED SYLLABUS:

UNIT - I: AMPLITUDE MODULATION (10 Periods)

Block diagram of Electrical Communication System, Types of Communications, Need for Modulation, Types of Amplitude Modulation: AM, DSBSC, SSBSC, Power and BW requirements, generation of AM, DSBSC, SSBSC, Demodulation of AM: Diode detector, Product demodulation for DSBSC & SSBSC.

UNIT - II: ANGLE MODULATION (9 Periods)
Frequency & Phase Modulations, Advantages of FM over AM, Bandwidth consideration, Narrowband and Wideband FM, generation and demodulation of FM, Comparison of FM & PM.

UNIT - III: PULSE MODULATION (8 Periods)
Elements & Advantages of Digital communication systems, PAM, Regeneration of Base band Signal, PWM and PPM, Time Division Multiplexing, Frequency Division Multiplexing, Asynchronous Multiplexing.

UNIT - IV: DIGITAL TRANSMISSION (10 Periods)
Pulse Code Modulation: Advantages, Block diagram of PCM, Quantization, effect of Quantization, Quantization error, DM, ADM and Comparison.
Digital Modulation: ASK, FSK, PSK, QPSK, DPSK, Modulation and Demodulation - Coherent and Non-coherent techniques.

UNIT - V: INFORMATION THEORY AND CODING (8 Periods)
Concept of Information, Entropy and Rate of Information, Coding efficiency, Shannon-Fano and Huffman Coding, Error Control Coding, Error Detection and Correction Codes, Block Codes, Convolutional Codes.

Total Periods: 45

TEXT BOOKS:

1. R.P. Singh and S D Sapre, *Communication Systems - Analog and Digital,* TMH, 2nd Edition 2007.
2. Simon Haykin, *Communication Systems,* John Wiley, 2nd Edition 2007.

REFERENCE BOOKS:

1. H. Taub and D. Schilling, *Principles of Communication Systems,* TMH, 2nd Edition, 1991.
2. Sam Shanmugam, *Digital and Analog Communication Systems,* John Wiley, 2006.

III B. Tech. – I Semester

(16BT60402) DIGITAL SIGNAL PROCESSING

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: A course on Signals and Systems.

COURSE DESCRIPTION: Continuous and discrete signals and sequences; systems; DFT and FFT algorithms for the analysis of discrete sequences; design and realization of Digital IIR and FIR filters; DSP processors and architectures.

COURSE OUTCOMES: On successful completion of the course, students will be able to

CO1. Apply the knowledge of fundamentals in
- Frequency analysis of signals and systems.
- DFT and FFT transforms.
- Analog & Digital Filter Design.
- Digital Filter Realization.
- DSP Processors.

CO2. Analyze numerical and analytical problems of discrete time signals and systems in frequency domain using Transforms.

CO3. Design and develop digital filters to optimize system performance and their realization.

CO4. Interpret and synthesize the response of Digital filters to validate their characteristics.

CO5. Apply appropriate techniques and algorithms to design digital signal processing systems with an understanding of limitations.

DETAILED SYLLABUS:

UNIT – I: INTRODUCTION TO DIGITAL SIGNAL PROCESSING (10 Periods)

Discrete-time signals and systems, Linear shift invariant, Stability and Causality, Linear constant coefficient difference equations, solution for difference equations using Z-transforms, Frequency analysis of signals - Fourier series and Fourier transform of Discrete time signals; Frequency domain representation of Discrete Time Systems.

UNIT- II: DISCRETE AND FAST FOURIER TRANSFORMS (9 Periods)

Discrete Fourier Transform, properties of DFT, linear filtering methods based on DFT, Relationship of FT to Z Transform.
Fast Fourier transforms (FFT): Radix-2 Decimation in time (DIT) and Decimation in frequency (DIF) FFT algorithms, Inverse FFT.

UNIT- III: IIR DIGITAL FILTERS (10 Periods)

Design of IIR digital filters from analog filters-IIR filter design by approximation of derivatives, impulse invariance and bilinear transformation. Characteristics of common use analog filters, Frequency transformations. Structural realization of IIR systems-direct, cascade and parallel form structures, Transposed form.

UNIT- IV: FIR DIGITAL FILTERS (9 Periods)

Symmetric and anti-symmetric FIR filters, Design of linear phase FIR digital filters using windowing techniques, Frequency sampling technique, Comparison of IIR and FIR filters. Structural realization of FIR filters-direct, cascade-form structures and linear phase structures.

UNIT –V: INTRODUCTION TO DSP PROCESSORS (8 Periods)

Introduction to programmable DSPs: Multiplier and Multiplier Accumulator (MAC), Modified Bus Structures and Memory Access schemes in P-DSPs, Multiple access memory, multi-ported memory, VLIW Architecture, Pipelining, Special addressing modes, On-Chip Peripherals.

Architecture of TMS 320C6X: Introduction, Features of 'C6X Processors, Internal Architecture, CPU, General-Purpose Register Files, Functional Units and Operation, Data Paths, Control Register File.

Total Periods: 46

TEXT BOOKS:

1. John G. Proakis, Dimitris G. Manolakis, *Digital Signal Processing, Principles, Algorithms and Applications*, Pearson Education/PHI, 4th Edition, 2007.
2. B.Venkataramani, M. Bhaskar, *Digital Signal Processors – Architecture, programming and Applications,*, TATA McGraw Hill, 2nd Edition, 2010

REFERENCE BOOKS:

1. Alan.V. Oppenheim, Ronald.W. Schafer, John R Buck, *Discrete Time Signal Processing*, Prentice Hall, 2nd Edition, 2006.
2. Tarun Kumar Rawat, *Digital Signal Processing*, Oxford University Press, 1st Edition, 2015.

III B. Tech. – I Semester

(16BT51004) COMPUTER ORGANIZATION AND ARCHITECTURE

(Interdisciplinary Elective – 1)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: A course on Switching Theory and Logic Design.

COURSE DESCRIPTION: Basic structure of computers; computer arithmetic operations; register transfer and organization; 8085 architecture, programming and interfacing of 8085 microprocessor; Concepts of micro programmed control, pipelining and memory system.

COURSE OUTCOMES: On successful completion of the course, students will be able to

CO1. Demonstrate knowledge on
- Internal organization of a computer.
- Various memories and hierarchy in a computer.
- Architecture, instruction set and addressing modes of 8085 microprocessor.

CO2. Analyze the performance of a computer.

CO3. Design microprocessor based systems for real time applications.

CO4. Solve engineering problems and arrive at solutions by developing embedded products.

CO5. Choose appropriate hardware, algorithm and program using suitable IDE.

CO6. Practice professional engineering to deliver efficient and cost effective embedded based products for society.

DETAILED SYLLABUS:

UNIT-I: STRUCTURE OF COMPUTERS AND COMPUTER ARITHMETIC (9 Periods)

Structure of Computers: Computer Types, Functional Units, Basic Operational concepts, Bus Structures, Software, Performance, Multiprocessors and Multicomputers, Historical perspective.

Computer Arithmetic: Addition and Subtraction, Multiplication and Division Algorithms.

UNIT-II: REGISTER TRANSFER AND ORGANIZATION
(8 Periods)

Register Transfer, Bus and memory transfers, 4-bit arithmetic circuit, Arithmetic logic shift unit, Instruction codes, Computer registers, Timing and control, Instruction cycle.

UNIT - III: 8085 ARCHITECTURE (10 Periods)

Microprocessor evolution and types, introduction to 8085 architecture, Pin description, Register Organization, Timing Diagram, Instruction Set: Data transfer, arithmetic and logic, branch control, I/O and machine control instructions.

UNIT-IV: 8085 PROGRAMMING & INTERFACING (8 Periods)

Addressing modes, Interrupts of 8085, Simple programs, Interfacing – Memory, I/O devices - memory mapped I/O and I/O mapped I/O.

UNIT-V: MICROPROGRAMMED CONTROL, PIPELINING AND MEMORY SYSTEM (10 periods)

Microprogrammed Control: Control memory; address sequencing, design of control unit.

Pipelining: Basic concepts, Data Hazards, Instruction Hazards, Out of order execution.

Memory System: Semiconductor RAM memories: Internal organization of memory chips, SRAM, DRAM, ROM, cache memory: mapping functions, replacement algorithms, virtual memory.

Total Periods: 45

TEXT BOOKS:

1. M. Moris Mano, *Computer System Architecture*, Pearson/PHI, 3rd Edition, 2008.
2. Ramesh S Gaonkar, *Microprocessor – Architecture, Programming and Applications with the 8085*, Penram International Publishing Private Limited, 5th Edition, 2007.

REFERENCE BOOKS:

1. Carl Hamacher, Zvonks Vranesic, SafeaZaky, *Computer Organization*, McGraw Hill, 5th Edition, 2002.
2. William Stallings, *Computer Organization and Architecture*, Pearson/PHI, 6th Edition, 2003.

III B. Tech. – I Semester

(16BT51031) INDUSTRIAL INSTRUMENTATION LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	3	2

PRE-REQUISITES: A Course on Industrial Instrumentation -II.

COURSE DESCRIPTION: Measurement of Force, Torque, Velocity, Acceleration, Pressure, Temperature, Flow Level, Moisture, Viscosity, Density; Electrical and intrinsic safety.

COURSE OUTCOME: On successful completion of the course, students will be able to

CO1. Demonstrate knowledge for measurement of different industrial process parameters.

CO2. Analyze the functionality of different types of instruments used for various industrial applications.

CO3. Design suitable signal conditioning circuits for measuring instruments.

CO4. Solve engineering problems pertaining to measurement of industrial process parameters to provide feasible solutions.

CO5. Select appropriate sensor and measuring technique for the measurement of industrial parameters.

CO6. Practice professionalism in engineering and deliver efficient & cost effective, maintainable products by understanding the needs of society, safety for sustainable development.

CO7. Follow ethics while developing industrial instruments.

CO8. Function effectively as an individual and work as part of a group in developing industrial instruments.

CO9. Communicate effectively among people about the effects of materials, mechanical design on electrical parameters and vice versa.

LIST OF EXPERIMENTS:

Minimum of Eleven experiments to be conducted.

1. Measurement & Calibration of liquid level & analysis of different techniques.
2. Measurement of speed & analysis of different techniques.
3. Measurement of Viscosity.
4. Measurement of Density.
5. Measurement of Humidity.
6. Measurement of Torque.
7. Design of V to I converter.
8. Design of I to V converter.
9. Design of circuit to measure resistance and calibrate to respective voltage.
10. Measurement of temperature using Thermocouple.
11. Calibration and verification of discharge coefficient of orifice plate.
12. Calibration & measurement of pressure.
13. Basic Programming in LabVIEW.
14. Data Acquisition, calibration and analysis using LabVIEW.
15. Data logging and analysis.

III B. Tech. – I Semester
(16BT51032) SIGNAL PROCESSING LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	3	2

PRE-REQUISITES: A course on Digital Signal Processing.

COURSE DESCRIPTION: Basics of programming using any simulation software; Operations on Signals & sequences; Convolution and correlation; Pole-zero mapping; Power Spectral Density; Filter designing; Study architecture of DSP processor kits and performing basic operations on it; Real-time signal processing like digital filter design (FIR, IIR) and FFT implementation using DSP processor kits.

COURSE OUTCOMES: On successful completion of the course, students will be able to

CO1. Demonstrate fundamental Knowledge in simulation of basic concepts and algorithms such as convolution, Correlation, Digital filters, pole-zero mapping, DFT and FFT in signal processing.

CO2. Analyze signals and Sequences using various processing techniques like Gaussian noise generation, DFT and FFT implementation.

CO3. Design and simulation of IIR and FIR filters.

CO4. Analyze various filter characteristics and interpret data from signal processing systems to provide valid conclusions.

CO5. Use appropriate simulation and hardware tools to solve the complex engineering problems in the domain of signal processing.

CO6. Function effectively as individual and as member in a team to perform operations on signals and design filters.

CO7. Communicate effectively in verbal and written forms while processing signals and designing filters.

LIST OF EXPERIMENTS:

Part – I (Minimum of seven experiments to be conducted)

1. Generation of Various signals and Sequences (Periodic and Aperiodic), Such as Unit Impulse, Unit Step, Square, Saw Tooth, Sinusoidal, Ramp, Sinc function.
2. Operations on Signals and Sequences such as Addition, Multiplication, Scaling, Shifting, Folding.
3. Convolution and correlation of signals and sequences.
4. Locating the zeros and poles and plotting the pole zero maps in s-plane and z-plane for the given transfer function.
5. Generation of Gaussian Noise(real and complex), computation of its mean, M.S. Value and its skew, kurtosis, and PSD, probability distribution function
6. Implement N-point DFT & IDFT
7. Design of FIR filter using windowing method.
8. Design of Butterworth filter.
9. Design of Chebyshev filter.
10. Design of Digital Filter from Analog filters (Bilinear Transformation and Impulse Invariant Transformation).

Part – II (Minimum of four experiments to be conducted))

1. Study of TMS 320C 5X/6X DSP Processor architecture, Study of DSK6713 Hardware and Software API
2. To blink on board LEDs in TMS 320C 5X/6X, to observe the operation of Line-In Line-Out.
3. Sine Wave Generation using Look up Table Method.
4. FFT Implementation of given discrete sequence.
5. FIR Filter Implementation for given specifications.
6. IIR Filter Implementation for given specifications

III B. Tech. – I Semester

(16BT4HS31) SOFT SKILLS LAB

(Common to EEE, ECE and EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	3	2

PRE-REQUISITES: A course on English Language Lab.

COURSE DESCRIPTION: This course covers Body Language; Assertiveness; Goal Setting; Creative Thinking; Interpersonal Skills; Team Work; Conflict Management; Etiquette; Report Writing; Group Discussions; Interviewing Skills.

COURSE OUTCOMES: On successful completion of the course, students will be able to

CO1. Acquire knowledge in
- Goal Setting
- Creative Thinking
- Leadership Skills and
- Team Work

CO2. Analyse the situations and develop skills for
- Body Language
- Personality Development and
- Stress Management

CO3. Apply the techniques of soft skills in a problem situation enhanced through multimedia software.

CO4. Function effectively as an individual and as a member in diverse teams.

CO5. Communicate effectively in public speaking in formal and informal forums.

LIST OF EXERCISES:

1. Body Language
2. Assertiveness
3. Goal Setting
4. Creative Thinking
5. Interpersonal Skills
6. Team Work
7. Conflict Management
8. Etiquette
9. Report Writing
10. Resume Writing
11. Group Discussions
12. Interviewing Skills

Total Lab Slots: 10

REFERENCE BOOKS:

1. R. C. Sharma & Krishna Mohan, *Business Correspondence and Report Writing*, Tata McGraw-Hill Publishing Company Limited, Third Edition, New Delhi, 2012.
2. Gopalswamy Ramesh and Mahadevan Ramesh, *The Ace of Soft Skills*, Pearson, Noida, 2010.
3. Jeff Butterfeild, *Soft Skills for Everyone*, Cengage learning, Delhi, 2011.
4. Barun K. Mitra, *Personality Development and Soft Skills*, Oxford University Press, Noida, 2012.

SUGGESTED SOFTWARE:

1. ETNL Language Lab Software Version 4.0
2. GEMS – Globarena E- Mentoring System
3. Speech Solutions.
4. English Pronunciation Dictionary by Daniel Jones.
5. Learning to Speak English 8.1, The Learning Company – 4 CDs.
6. Mastering English: Grammar, Punctuation and Composition.
7. English in Mind, Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge.
8. Dorling Kindersley Series of Grammar, Punctuation, Composition etc.
9. Language in Use 1, 2 & 3.
10. Cambridge Advanced Learner's Dictionary - 3rd Edition.
11. Centronix – Phonetics.
12. Let's Talk English, Regional Institute of English South India.
13. Ultimate English Tutor.

III B. Tech. – II Semester

(16BT5HS01) MANAGEMENT SCIENCE

(Common to EEE, ECE and EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES:—

COURSE DESCRIPTION: Concepts of Management; Environmental Scanning; Concepts Related to Organization; Operations Management; Work Study; Statistical Quality Control; Inventory Management; Marketing; Human Resource Management; Project Management; Project Crashing; Entrepreneurship; Contemporary Management Practices.

COURSE OUTCOMES:

On successful completion of the course, students will be able to:

CO1. Demonstrate the concepts of operations management, human resources management, project management and contemporary management practices in managerial context.

CO2. Identify and analyse management problems in the business organizations reaching substantiated conclusions using principles of management.

CO3. Design appropriate organization structure for meeting the needs of the organization with consideration of the employees of the organization.

CO4. Competently employ broad based analytical tools for decision making, system design, analysis and performance.

CO5. Provide solution to organizations for sustainable development.

CO6. Apply knowledge of engineering and management principles to manage the projects in multidisciplinary environments.

DETAILED SYLLABUS:

UNIT- I: INTRODUCTION TO MANAGEMENT AND ORGANIZATION (09 Periods)

Concepts of management and Administration, Nature and Importance of management, Evolution of management thought, Functions of management, Contributions of F.W. Taylor and Henry Fayol to the management, Systems approach to management, Managerial skills, Elements of corporate planning process, Environmental scanning, SWOT Analysis, Social responsibilities of management.

Basic concepts related to organization, Objectives and Principles, Types of organizations- Line Organization, Line and Staff

Organization, Functional Organization, Matrix Organization, Network organization.

UNIT- II: OPERATIONS MANAGEMENT (12 Periods)

Plant location- Factors and Principles; Plant Layout- Principles and Types; Methods of production, Work study- Basic procedure involved in method study and work measurement; Statistical Quality Control- Factors affecting quality, Control charts for variables and attributes, Acceptance sampling; Materials management- objectives, Inventory- Types of inventory, Classical EOQ model, ABC analysis; Purchase procedure, Stores management, Marketing- Functions, Channels of distribution.

UNIT-III: HUMAN RESOURCE MANAGEMENT (HRM) (06 Periods)

Nature and scope of HRM, Functions of HRM, Role of HR Manager in an organization, Job evaluation, Merit rating, Maslow's hierarchy of human needs, McGregor's theory X and theory Y, Herzberg's two-factor theory of motivation.

UNIT-IV: PROJECT MANAGEMENT (PERT/CPM) AND ENTREPRENEURSHIP (09 Periods)

Network analysis - Critical path method (CPM), Program evaluation and review technique (PERT); Project cost analysis - Project crashing.

Introduction to Entrepreneurship, Entrepreneurial Traits, Entrepreneur vs. Manager, Role of Entrepreneurship in Economic Development, Women as an Entrepreneur.

UNIT-V: CONTEMPORARY MANAGEMENT PRACTICES (09 Periods)

Basic concepts of Material Requirements Planning, Enterprise resource planning (ERP), Just In Time (JIT) system, Total Quality Management (TQM), Value Chain Analysis, Business Process Outsourcing (BPO), Globalization, Management Challenges, Supply Chain Management (SCM), Role of Information Technology in managerial decision making, Six Sigma Concept, Maintenance Strategies- Preventive, Periodic and Breakdown Maintenance.

Total Periods: 45

TEXT BOOKS:

1. O.P. Khanna, *Industrial Engineering and Management*, Dhanpat Rai and Sons, 2010.
2. Martand T.Telsang, *Industrial Engineering and Production Management*, S. Chand, 2nd Edition, 2006.

REFERENCE BOOKS:

1. Koontz and Weihrich, *Essentials of Management*, TMH, 6th Edition, New Delhi, 2007.
2. N.D. Vohra, *Quantitative Techniques in Management*, TMH, 2nd Edition, New Delhi.

III B. Tech. – II Semester

(16BT61001) ARM PROCESSORS AND PIC MICROCONTROLLERS

(Common to EEE and EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: A course on Switching Theory and Logic Design.

COURSE DESCRIPTION: ARM Processors architecture, Programming, PIC microcontroller architecture, Interrupts and timers of PIC microcontroller, Interfacing.

COURSE OUTCOMES: On successful completion of the course, students will be able to

CO1. Demonstrate knowledge in ARM Processors architecture, PIC architecture, Pin out, Instruction set.
CO2. Analyze various design issues regarding usage of on chip resources and Low power modes.
CO3. Design embedded systems using ARM Processors and PIC microcontrollers to suit market requirements.
CO4. Solve engineering problems and arrive at solutions in designing embedded Systems.
CO5. Use on-chip resources to design embedded systems with an understanding of limitations.
CO6. Practice professional engineering to deliver efficient and cost effective microcontroller based products.

DETAILED SYLLABUS:

UNIT I: PIC MICROCONTROLLER ARCHITECTURE **(10 Periods)**

Microcontrollers vs general purpose microprocessor, Overview of PIC18 family, WREG register in PIC, PIC file register, Default access bank, PIC status register, Data formats and directives, Program counter and program ROM space, Arithmetic, Logic instructions, Branch, call and time delay instructions, I/O port programming, PIC18 pin description, Bit addressability of data RAM, bank switching, Macros and modules.

UNIT- II: TIMERS, SERIAL PORT AND INTERRUPTS
(9 Periods)

Programming timers 0 and 1, Counter programming, Programming timers 2 and 3, Basics of serial communication, PIC18 connection to RS232, Serial port programming in assembly, PIC18 interrupts, Programming timer interrupts, Programming serial interrupts.

UNIT- III: PERIPHERALS AND INTERFACING (7 Periods)

7 segment LED and LCD interfacing, keyboard interfacing, interfacing ADC, DAC, Interfacing stepper motor, DC motor interfacing and PWM.

UNIT- IV: INTRODUCTION TO ARM PROCESSORS (9 Periods)

Introduction to ARM Cortex M3 processor, Background of ARM and ARM architecture, Cortex M3 Processor applications, Cortex M3 fundamentals, registers, Operation modes, Memory system, memory map, Memory system attributes, ARM Pipeline, Exception types.

UNIT -V: ARM PROGRAMMING (10 Periods)

Data transfer instructions, Pseudo Instructions, Data Processing Instructions, Call & unconditional Branch Instructions, Decisions & conditional Branch instructions, Several useful instructions in Cortex M3, ARM Assembly Language Programming, Thumb Instruction Set, ARM Mode & Thumb mode Programming, ARM Programming in C.

Total Periods: 45

TEXT BOOKS:

1. Muhammad Ali Mazidi, Rolin D. McKinlay, Danny causey, *PIC Microcontroller and Embedded Systems: Using C and PIC18*, Pearson Education, 2008.
2. Joseph Yiu, *The Definitive Guide to the ARM Cortex-M3 & M4*, Elsevier, 3rd Edition, 2013.

REFERENCE BOOKS:

1. Andrew Sloss, Dominic Symes, Chris Wright, *ARM System Developer's Guide: Designing and Optimizing System Software (The Morgan Kaufmann Series in Computer Architecture and Design*), 2004.
2. John.B. Peatman, *Design with PIC Microcontroller*, Pearson Education, 1988.

III B. Tech. – II Semester

(16BT61002) PROCESS CONTROL INSTRUMENTATION

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Courses on Control Systems, Sensors and Transducers.

COURSE DESCRIPTION: Mathematical modeling of processes; different types of controllers; characteristics of controllers; design of controllers; tuning of controllers; characteristics of control valves; multi loop controllers.

COURSE OUTCOMES: On successful completion of the course, students will be able to

CO1. Demonstrate knowledge on process control terminology and understand about Single loop and multi loop control systems.

CO2. Analyze the dynamic behavior of a process by developing the mathematical model.

CO3. Design and tune the PID controllers.

CO4. Solve the problems by interpreting the data of a pro cess control system.

CO5. Select and suggest to use appropriate final control elements for different process industries.

CO6. Apply the process control concepts to real time industrial and domestic applications.

DETAILED SYLLABUS:

UNIT - I: PROCESS CHARACTERISTICS (10 Periods)

Elements of process control, Process variables, Degree of freedom, Characteristics of electric system, liquid system, gas system and thermal system, Elements of process dynamics, Mathematical model of liquid process, gas process and thermal processes, Servo operation, Regulatory operation, Self regulation.

UNIT - II: CONTROL SCHEMES AND CONTROLLERS (10 Periods)

Discontinuous controller modes: Two position, Multi-position, Floating control modes; Continuous controller modes: Proportional, Integral, Derivative; Composite controller modes: PI, PD, PID; Electronic controllers: Design of discontinuous, continuous and composite controller modes; Displacement type Pneumatic controllers.

UNIT – III: CONTROLLER TUNING (8 Periods)

One-Quarter decay ratio criteria, Time integral performance criteria, Process loop tuning: open-loop transient response method, Ziegler-Nichol's method, Cohen- Coon method, Direct synthesis method, Frequency response method.

UNIT - IV: FINAL CONTROL ELEMENTS (9 Periods)

Pneumatic actuators: Spring actuator, Hydraulic actuators: Piston actuator, Electrical actuators: Solenoid, Electro-pneumatic actuators, Control valves: Types of control valves and its characteristics, Sliding-stem control valves, Rotating-shaft control valves, Selection of control valves, Pneumatic valve positioner.

UNIT - V: MULTI LOOP CONTROL SCHEMES (8 Periods)

Cascade control, Ratio control, Feed forward control, Over-ride, Split range, Case study on distillation column: principle, control schemes-constant top product, constant bottom product and reflex rate, constant reflex rate and steam rate.

Total Periods: 45

TEXT BOOKS:

1. Donald P.Eckman, *Automatic Process Control*, Wiley In dia Ltd., 2011.
2. Curtis D. Johnson, *Process Control Instrumentation Technology*, Pearson Education, Ltd, 8th Edition, 2014.
3. G. Stephanopoulis, *Chemical Process Control,* PrenticeHall, 1990.

REFERENCE BOOKS:

1. D. Patranabis, *Principles of Process Control*, TMH, 1996.
2. Peter Harriott, *Process Control*, TMH, 1972.

III B. Tech. – II Semester

(16B50308) MECHATRONICS

(Interdisciplinary Elective – 2)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: A course on Industrial Instrumentation – II.

COURSE DESCRIPTION: Mechatronics system; Sensors; Transducers; Actuating systems; DC Motors; Micro controller; Signal Conditioning; Programmable Logic Controllers; Programmable Motion Controllers; Design Approach; Case Studies.

COURSE OUTCOMES: On successful completion of the course, students will be able to

CO1. Demonstrate the knowledge on integrative nature of Mechatronics and different components of mechatronics systems.

CO2. Select the appropriate sensors and actuators required for a system by identifying and analyzing real life engineering problems thoroughly.

CO3. Design signal conditioning circuits for mechatronics systems and establish the controlling methods required for that system to meet the specified needs.

CO4. Select, and apply appropriate programmable motion controller techniques and adaptive controllers to complex mechatronics systems with an understanding of the limitations.

CO5. Exhibit the knowledge on design approach, keeping in view of environmental contexts, to reflect the sustainable development.

CO6. Perform under a standard of professional behavior that requires adherence to the highest principles of ethical conduct.

DETAILED SYLLABUS:

UNIT - I: MECHATRONICS SYSTEM (7 Periods)

Definition, Elements of mechatronics System, Mechatronics design process, System-Measurements system, Control systems; Examples of Automatic control systems, Advantages and Disadvantages.

UNIT - II: SENSORS AND ACTUATORS (11 Periods)

Sensors: Introduction, Types of transducers and sensors, Characteristic Parameters- static and dynamic; Displacement sensors- Potentiometer, Strain gauge, Linear Variable Differential Transformer; Position sensors- Hall effect sensor, Optical Encoder; Proximity- Inductive, Capacitive; Acceleration- Piezoelectric accelerometer; Temperature- Bimetallic strips, Resistance Temperature Detectors (RTD); Light sensors- photo diodes, photo electric transducer; Selection of Sensors.

Actuators: Hydraulic systems, Pneumatic systems, Control valves, Linear and Rotary actuators, Electrical Actuation systems - Switches, Solenoids, Relays, DC motors, AC motors, Stepper motors.

UNIT - III: SIGNAL CONDITIONING (10 Periods)

Signal conditioning: Elements of signal conditioning, Types- Analog,Amplification,Operation Amplifiers; Noise Filters, Bridge circuits, Current-voltage converters, Voltage-frequency converters; Digital signals - Nyquist Sampling theorem, Analog to digital converter, Digital to analog Converter, Data Acquisition System.

UNIT - IV: PROCESS CONTROLLERS (10 Periods)

Programmable Motion Controllers: Controller principles, Two position controller, Proportional (P) controllers, Integral (I) controllers, Derivative (D) controllers; Composite controller Modes – Proportional Integral (PI), Proportional Derivative (PD), Three mode controller (PID); Selection of controllers, Controller tuning, Adaptive controllers.

UNIT - V: DESIGN OF MECHATRONICS SYSTEMS (7 Periods)

Mechatronics approach to design, Case Studies, Future trends, Ethics as design constraint.

Total Periods: 45

TEXT BOOKS:

1. K.P.Ramachandran, *Mechatronics Integrated Mechanical Electronic Systems*, Wiley, 2012.
2. W. Bolton, *Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering,* Pearson, 4th Edition, 2005.

REFERENCE BOOKS:

1. N.P. Mahalik, *Mechatronics Principles Concepts and Applications*, McGraw Hill Education (India) Private Limited, 2012.
2. Devdas Shetty, Richard, *Mechatronic System Design*, Cengage learning, 2nd Edition, 2012.

III B. Tech. – II Semester

(16BT70309) INDUSTRIAL ROBOTICS

(Program Elective-1)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: A Course on Matrices and Numerical Methods.

COURSE DESCRIPTION: Introduction of Robots classifications; Components; Robot drive mechanisms; Mechanical transmission methods aided in functioning of robots; Forward kinematics; inverse kinematics; Manipulator dynamics; Trajectory planning and avoidance of obstacles; Robot programming; Robot Application in Industry; Future Application and Challenges and Case Studies.

COURSE OUTCOMES: On successful completion of the course, students will be able to

CO1. Demonstrate the knowledge on concepts of robot, Kinematics and dynamics, Trajectory planning and programming of robot.
CO2. Identify, analyze and interpret various methods and review the contemporary problems of robotics.
CO3. Optimize various robotic configuration parameters to analyze the reverse and forward kinematics.
CO4. Investigate the performance parameters on the complex robotic designs.
CO5. Apply appropriate functional techniques, resources, and programming tools to robotic engineering activities.
CO6. Consider safety issues in designing robots for societal applications.

DETAILED SYLLABUS:

UNIT - I: INTRODUCTION (9 Periods)

Robot, Brief History, Classifications, Joint notation schemes, Work volume, Degrees of freedom, Components, End effectors - Classification of End effectors, Tools as end effectors; Drive system for grippers - Mechanical, Adhesive, Vacuum, Magnetic; Hooks & scoops, Gripper force analysis and gripper design, Active and Passive grippers.

UNIT - II: ROBOT DRIVES AND POWER TRANSMISSION SYSTEMS (8 Periods)

Robot Drive Mechanisms - Hydraulic, Electric-Servomotor, Stepper Motor; Pneumatic drives, Mechanical transmission method - Gear transmission, Belt drives; Cables, Roller chains, Link Rod systems, Rotary-to-Rotary motion conversion, Rotary-to-Linear motion conversion, Rack and Pinion drives, Lead screws, Ball Bearing screws.

UNIT - III: MANIPULATOR KINEMATICS AND DYNAMICS (10 Periods)

Manipulator kinematics: Mathematical Preliminaries on Vectors & Matrices, Homogeneous transformations as applicable to rotation and translation, (D-H) notation, Forward kinematics, Inverse kinematics, Manipulators with two, Three degrees of freedom.

Manipulator dynamics: Introduction, Inertia of a Link, Lagrangian formulation for a planar 2R manipulator.

UNIT - IV: TRAJECTORY PLANNING AND SENSORS (10 Periods)

Trajectory planning: Trajectory planning and avoidance of obstacles, Path planning, Skew motion, Joint integrated motion, straight line motion.

Sensors: Position sensors, Velocity sensors, Tactile sensors, Proximity sensors, Machine vision sensors, Fail safe hazard sensor systems and Compliance mechanism

UNIT - V: ROBOT PROGRAMMING AND APPLICATIONS (8 Periods)

Robot programming: Types, Features of languages and Software packages.

Robot application: Robot Application in Industry, Task programming, Goals of AI Research, AI Techniques, Robot Intelligence and Task Planning, Modern Robots, Future Application and Challenges, and Case Studies.

Total Periods: 45

TEXT BOOKS:

1. M.P.Groover, *Industrial Robotics: Technology, Programming, and Applications*, Tata McGraw-Hill, 2008.
2. John. J. Craig, *Introduction to Robotics: Mechanics and Control*, Pearson/Prentice Hall, 3rd Edition, 2005.

REFERENCE BOOKS:

1. Richard. D.Klafter, *Robotics Engineering: an integrated approach*, Prentice-Hall publisher, 1st Edition, 1988.
2. K. S. Fu., R. C. Gonzalez, C. S. G. Lee, *Robotics: Control Sensing, Vision and Intelligence,* International Edition, Tata McGraw Hill, 2008.
3. Ashitav Ghosal, Robotics*, Fundamental Concepts and Analysis*, Oxford Press, 2006.
4. Mittal R.K & Nagrath IJ, *Robotics and Control*, Tata McGraw Hill, 6th Edition, 2007.

III B. Tech. – II Semester

(16BT61005) OPTO-ELECTRONICS AND LASER INSTRUMENTATION

(Program Elective-1)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: A course on Industrial Instrumentation-II.

COURSE DESCRIPTION: Optical fiber; components of optical fiber; fiber optic Sensors; Industrial and medical applications of laser.

COURSE OUTCOMES: On successful completion of the course, students will be able to

CO1. Demonstrate knowledge about
- Types of optical fiber, components of optical fiber.
- Measurement of temperature, pressure, strain using fiber optic sensors.
- Operation of laser, Industrial and biomedical applications of laser.
- Holography and optoelectronic modulators.

CO2. Analyze the optical parameters of various types of fibers and their characteristics.

CO3. Design fiber optic sensors for measurement of pressure, temperature, level and velocity.

CO4. Apply different Lasers and optical fibers for real time medical and weather forecasting.

CO5. Use advanced lasers in the field of material processing and biomedical.

CO6. Provides engineering solutions by using lasers and optical fibers to the society.

DETAILED SYLLABUS:

UNIT - I: FIBER OPTICS (9 Periods)

Introduction to optical fibers, Laws of reflection, critical angle, Light guidance, Numerical aperture, Dispersion, Losses, Different types of fibers, Modes of operation and their transmission characteristics.

Components of Optical Fiber: Light Sources for fiber optics, Photo detectors, source coupling, Fiber termination, Splicing and connectors.

UNIT - II: FIBER OPTIC INSTRUMENTATION (9 Periods)

Fiber optic sensors, Fiber optic instrumentation system, Interferometer method of measurement of length, Measurement of pressure, Temperature, Current, Voltage, Liquid level and strain, velocity, acceleration, atmospheric effects and pollutants , fiber optic Gyroscope, fiber grating sensors, acoustic sensors, Polarization maintaining fibers, Applications.

UNIT - III: FUNDAMENTALS OF LASER (9 Periods)

Fundamental characteristics of lasers, Three level and four level lasers, Properties of laser, Laser modes, Resonator configuration, Q-switching and mode locking, Types of lasers: Gas lasers, solid lasers, liquid lasers, semiconductor lasers.

UNIT - IV: INDUSTRIAL AND MEDICAL APPLICATIONS OF LASER (9 periods)

Industrial Applications: Industrial applications of lasers, Laser heating Material processing, laser welding, melting and trimming of material, scribing, trimming material removal and vaporization, calculation of power requirement of laser for material processing, Laser Doppler velocitymeter.

Medical applications: LASERS in medicine, Interaction with tissues, Interaction with bio molecules, laser endoscope, laser instruments for surgery, removal of tumors of vocal chords, Plastic surgery, Oncology.

UNIT - V: HOLOGRAPHY AND OPTOELECTRONIC MODULATORS (9 periods)

Holography: Principle, Methods, Holographic Interferometers, Different types of holographic techniques, Acoustical holography, Character recognitionbyholography, 3-D Cinematography with holographi cscreen.

Opto electronic Modulators: Electro-optic, Magneto-optic and Acousto- optic Modulators.

Total Periods: 45

TEXT BOOKS:

1. Das P., *Lasers and Optical Engineering*, Springers –Verlag New York Inc., Students Edition, 1991.
2. Ghatak A.K. and Thyagarajan K., *Optical Electronics*, Foundation Books, 1991.

REFERENCE BOOKS:

1. Arumugam. M**,** *OpticalFibreCommunicationandSensors***,** Anuradha agencies, 2008**.**
2. Thyagarajan K. and Ghatak A.K., *Lasers: Theory and Applications*, Plenum Press, 1981.
3. Gerd Keiser, *Optical Fiber Communication*, TMH, 3rd Edition, 2000.

III B. Tech. II Semester

(16BT50403) VLSI DESIGN

(Program Elective-2)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Courses on Switching Theory and Logic Design, Linear and Digital ICs.

COURSE DESCRIPTION: CMOS Technology; Stick Diagrams and Layouts; Subsystem design; Programmable Interconnect structures; Synthesis and Test Principles.

COURSE OUTCOMES: On successful completion of the course, students will be able to

CO1. Demonstrate knowledge in

- Understanding the Fabrication Process of MOS Transistors
- Electrical properties of CMOS Circuits
- Designing Static Combinational and Sequential logic at transistor level, including Mask layout.
- Estimating and optimizing combinational RC Circuit delay using RC delay models and logical effort.
- Design methodology and tools.
- Test Principles.

CO2. Analyze characteristics and performance of CMOS circuits.

CO3. Design solutions for subsystems to compensate tradeoff between area, speed and power requirements.

CO4. Synthesize and extract information from designs and layouts for optimum solutions.

CO5. Select and apply appropriate designs to overcome the limitations of CMOS devices for high speed applications.

CO6. Assess test strategies for design and development of Integrated Circuits for societal needs.

DETAILED SYLLABUS:

UNIT-I: FABRICATION AND ELECTRICAL PROPERTIES OF MOS (10 Periods)

Basic Electrical Properties of MOS: Ids – Vds relationships, Threshold Voltage VT, gm, gds and ù0; Pass Transistor, NMOS inverter, Pull up to pull down ratio for an NMOS inverter, CMOS Inverter, Fabrication Process for NMOS and CMOS technology.

UNIT-II: CMOS CIRCUIT DESIGN PROCESS (10 Periods)
VLSI design flow, MOS layers, stick diagrams, NMOS design style, CMOS design style, lambda based design rules, layouts for inverters, sheet resistance, capacitances of layers, Gate delays, Delay estimation, Limitations of Scaling.

UNIT-III: SUBSYSTEM DESIGN - I (8 Periods)
Adders – Transmission based Adder, Carry look-ahead adder, Manchester carry chain adder, Carry Skip Adder, Carry Select Adder; Barrel Shifter, Multipliers – Array Multiplier, Booth Multiplier; ALUs.

UNIT-IV: SUBSYSTEM DESIGN - II (9 Periods)
Counters- Synchronous and Asynchronous Counter; High Density Memory Elements - Design Approach, FPGAs, Programmable Interconnect structures - Fusible links, Antifuse via link, UV Erasable, Electrically Erasable; CPLDs, Cell based Design Methodology.

UNIT-V: LOW POWER DESIGN AND TESTING (8 Periods)
Need for Low Power VLSI Chips, Basic Principles Of Low Power Design, Low Power Techniques for SRAM, CMOS Testing, Need for testing, Test Principles, Design Strategies for test.

Total Periods: 45

TEXT BOOKS:

1. Kamran Eshraghian, Douglas A. Pucknell and Sholeh Eshraghian, *Essentials of VLSI Circuits and Systems*, PHI, 2005.
2. Weste and Eshraghian, *Principles of CMOS VLSI Design*, Pearson Education, 1999.

REFERENCE BOOKS:

1. Gary Yeap, *Practical Low-Power Digital VLSI Design*, Springer Publication, 1998.
2. John M. Rabaey, *Digital Integrated Circuits: A Design Perspective*, PHI, 2nd Edition, 1997.
3. Stephen Brown, Zvonko Vranesic, *Fundamentals of Digital Logic with VHDL Design*, TMH, 2007.

III B. Tech. II Semester

(16BT61006) AIRCRAFT INSTRUMENTATION

(Program Elective-2)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PREREQUISITE: A Course on Industrial Instrumentation-II.

COURSE DESCRIPTION: Aircraft Instruments; Air Data Instruments; Gyroscopic Instruments; Engine Instruments and Electronic Flight Instrumentation System.

COURSE OUTCOMES: On successful completion of the course, students will be able to

CO1. Demonstrate knowledge about

- Aircraft instruments
- Air data instruments
- Gyroscopes
- Engine instruments
- Electronic Flight Instrumentation system

CO2. Analyze the parameters measured in aircraft system.

CO3. Design measurement systems pertaining to various parameters measurement in aircraft.

CO4. Solve Engineering problems pertaining to various parameters measurement in aircraft.

CO5. Select appropriate technique for measurement of parameters in the aircraft.

DETAILED SYLLABUS:

UNIT-I: BASICS OF AIRCRAFT (9 Periods)

Introduction, Control Surfaces, Forces, Moments and Angle of Attack, Modern Aircraft System, Aircraft Instruments and their Layout, Aircraft Display Types:Quantitative Displays, Display Colour and Markings,Instrument Grouping, Glass Cockpits of Modern Aircraft: Attitude Director Indicator, Electronic Attitude Director Indicator, Horizontal Situation Indicator.

UNIT-II: AIR DATA INSTRUMENTS (9 Periods)

Introduction to Air Data Instruments, Types of Air Data Instruments:Air Data Computer, International Standard Atmosphere: Introduction to ISA, Atmospheric Variations with Altitude, Earth's Atmosphere, Air Data Instruments: Combined Pitot and Static Probe, Separate Static Ports, Location of Combined Probe and Static Ports, Pneumatic-Type Air Data Instruments: Pneumatic Air Speed Indicator, Temperature Compensation.

UNIT-III: GYROSCOPIC AND ADVANCED FLIGHT INSTRUMENTS (9 Periods)

Types of Gyro: Conventional Mechanical Gyroscopes, Vibrating Gyros, Ring Laser Gyroscope, Fibre Optic Gyros, Basic Mechanical Gyros and its Properties, Directional Gyro, Gyro Horizon.

UNIT-IV: ENGINE INSTRUMENTS (9 Periods)

Introduction, Engine Speed Measurement: Electrical Tacho Generator / Indicator, Servo- Type RPM Indicators, Non-Contact type Tacho Probe, Optical Tachometer, Hall Effect Sensor, Torque Measurement: Hydro Mechanical Transducer, Electronic Torque Meter, Pressure Measurement.

UNIT –V: ELECTRONIC FLIGHT INSTRUMENTATION SYSTEM (9 Periods)

Engine Fuel Quantity Indicator, Fuel Flow Rate Indicator: Rotating–Vane Flow Meter, Flight Director System, Altitude Director Indicator, Horizontal Situation Indicator, Black Box.

Total Periods: 45

TEXT BOOK:

1. S.Nagabhushana, L.K.Sudha, *Aircraft Instrumentation and Systems*, I K International Publishing House Pvt. Ltd, 2010.

REFERENCE BOOK:

1. Pallett, E.H.J, *Aircraft Instruments and Integrated Systems*, Pearson higher Education, 1992.

III B. Tech. II Semester
(16BT61031) ARM PROCESSORS AND PIC MICROCONTROLLERS LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	3	2

PRE-REQUISITES: A course on ARM Processors and PIC Microcontrollers.

COURSE DESCRIPTION: Assembly language Programming using ARM processors; Interfacing standard peripherals & Programming-DAC, Stepper Motor, ADC, DAC, Keyboard, Seven Segment Display.

COURSE OUTCOMES: On successful completion of the course, students will be able to

CO1. Demonstrate knowledge on instruction set, addressing modes, of ARM processors and PIC microcontrollers.
CO2. Analyze various programming alternatives, interfacing methods & usage of various on-chip resources like Timers, Interrupts, ADC, DAC, and Stepper Motor to build stand alone systems.
CO3. Design and develop microcomputer and microcontroller based system to suit market requirements.
CO4. Solve engineering problems and arrive at solutions in designing embedded Systems.
CO5. Apply resources, and tools for modeling microcomputer and microcontroller based systems with understanding of limitations.
CO6. Follow professional ethics in the design of embedded products.
CO7. Function effectively as an individual, and as a member in developing embedded products.
CO8. Communicate effectively in both written and verbal form in the area of processors and microcontrollers.

LIST OF EXPERIMENTS:

I. Programs using PIC Microcontrollers (Minimum of FIVE experiments)

1. Arithmetic operations.
2. Logical operations.
3. Bit manipulation operations.
4. Macros & Modular programming.
5. Bank Switching.
6. Branch/Time Delay programs.

II. Interfacing with PIC microcontrollers (Minimum of THREE experiments)

1. Interface an LED array, 7-segment display and LCD.
2. Interfacing of PIC18 with Keyboard and logic controllers.
3. Interfacing of PIC18 with ADC and DAC.
4. Interfacing DC Motors and Stepper Motors.

III. Programs using ARM Processors (Minimum of THREE experiments)

1. Arithmetic operations.
2. Logic operations.
3. Branch/Time Delay Programs.
4. Arm Mode & Thumb mode Programming.

III B. Tech. II Semester

(16BT61032) PROCESS CONTROL LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	3	2

PRE-REQUISITES: A course on Process Control Instrumentation.

COURSE DESCRIPTION: Tuning methods, Characteristics of control valve, Response of controllers for different processes like flow, temperature, level etc., Design of controllers.

COURSE OUTCOMES: On successful completion of the course, students will be able to

CO1. Demonstrate knowledge on process equipments.

CO2. Develop the transfer function of the process and analyze the performance of the process in terms of time domain specifications.

CO3. Design electronic PID controller and tune its controller parameters using various tuning methods.

CO4. Give valid conclusions by analyzing the response of flow, temperature, level process.

CO5. Use appropriate hardware/software tools to conduct the process control experiments to measure process parameters.

CO6. Apply concepts of process control for solving real-time issues.

CO7. Execute the experiment individually or in a team in the area of process control.

CO8. Communicate effectively in verbal and written forms in the field of process control.

LIST OF EXPERIMENTS:

PART A: Only for viva-voce examination (2 lab sessions)
Study and demonstration of Piping and Instrumentation diagrams: Symbols, connecting lines, General instruments or functions, Actuator and process elements.

PART B: Minimum of TEN experiments to be conducted

1. Obtain the characteristics of electro-pneumatic converter.
2. Obtain the valve flow-lift characteristics of Linear, Quick Opening and equal percentage control valve.
3. Design Electronic PID controller and verify the output using any simulation software.
4. Determine the PID controller parameters using process reaction curve method for a process.
5. Determine the PID controller parameters using continuous oscillation method for a process.
6. Study the response of ON-OFF controller for temperature process.
7. Obtain the performance for liquid level process with and without controller.
8. Compute the transfer function of a tank for a liquid level process with different flow rates.
9. Measure the flow-rate and to control flow-rate using PID controller for flow process.
10. Analyze the servo and regulatory response for pressure control process.
11. Study the response of ratio controller.
12. Study the closed loop performance of cascade controller.
13. Obtain the transfer function model for Interacting Systems.

III B. Tech. II Semester
(16BT61033) SEMINAR

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
-	100	100	-	-	-	2

PRE-REQUISITES: —

COURSE DESCRIPTION: Identification of topic for the seminar; Literature survey; Performing critical study and analysis of the topic identified; Preparation of report and presentation.

COURSE OUTCOMES: On successful completion of the course, students will be able to

CO1. Demonstrate in-depth knowledge on the seminar topic.

CO2. Analyze critically, the concepts relevant to the seminar topic.

CO3. Undertake investigation of issues related to seminar topic providing valid conclusions.

CO4. Apply techniques to consolidate the solutions relevant to the seminar topic.

CO5. Comprehend societal issues in the context of seminar topic.

CO6. Understand environmental issues in the context of seminar topic.

CO7. Understand ethical issues in the context of seminar topic.

CO8. Function effectively as individual on the chosen seminar topic.

CO9. Develop communication skills, both in oral and written form, for preparing and presenting seminar report.

CO10. Engage in lifelong learning to improve knowledge and competence in the chosen area of seminar.

IV B. Tech. – I Semester

(16BT71001) ANALYTICAL INSTRUMENTATION

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Courses on Engineering Chemistry, Engineering Physics, Sensors and Transducers, Electrical and Electronic Measurements.

COURSE DESCRIPTION: Different types of Liquid and Gas analyzers, Spectroscopic techniques, chromatography, environmental pollution and nuclear radiation detectors.

COURSE OUTCOMES: On successful completion of the course, students will be able to

CO1. Demonstrate knowledge of gas/liquid analyzers, radia tion detectors, different Chromatography Techniques, environmental pollution and nuclear radiation detectors.

CO2. Analyze the sample by using various analytical instru ments.

CO3. Provide valid conclusions by analyzing the different chemical samples using spectrophotometer and chromatography.

CO4. Use appropriate method of analyzer and spectrometer to evaluate the sample.

CO5. Use various analytical instruments like analyzers, spectrophotometer and chromatography to measure the elements of a compound for industrial applications.

CO6. Use environmental pollution monitoring devices to compliance with environmental issues.

DETAILED SYLLABUS:

UNIT - I: LIQUID AND GAS ANALYZERS (10 Periods)

Liquid Analyzers: Electrodes types, Electrochemical Cell; pH measurement, pH meters; Ion-selective electrodes; Conductivity cell, Conductivity meters types; Dissolved oxygen analyzer.

Gas Analyzers: Thermal conductivity**;** Paramagnetic oxygen analyzer, Magnetic wind**;** Hydrogen, Sodium analyzer, Silica analyzer.

UNIT - II: SPECTROSCOPIC TECHNIQUES – I (9 Periods)

Electromagnetic Spectrum, Classification of spectroscopic techniques; Beer - Lamberts law, Source, Detectors, Optical components for photometers; Colorimeter : Single beam and double beam photometer and Colorimeter types; UV – VIS , Infrared Spectroscopy, FTIR spectrophotometer.

UNIT - III: SPECTROSCOPIC TECHNIQUES – II (8 Periods)

Atomic Emission: Types of Excitation: Plasma, Thermal, Arc, Spark, Flame type; Atomic Absorption; Flame photometers: Burners, Flame sources.

Mass spectrometer: Magnetic deflection, Time of Flight, Radio frequency, Quadrupole; NMR spectrometer – Principle and Instrumentation.

UNIT - IV: CHROMATOGRAPHY (9 Periods)

Gas chromatography: Introduction, Principle, Types and Detection systems: Flame ionization detector, Argon ionization detector, Electron capture detector, Photo ionization detector and applications.

Liquid chromatography: Principle, types, detection system: Fluorescence detector, Refractive index detector, thermal detector and applications.

UNIT - V: ENVIRONMENTAL POLLUTION & RADIATION DETECTORS (9 Periods)

Environmental Pollution: COx monitor, NOx analyzer, estimation of H2S, Ammonia, sulphur dioxide, hydrocarbons, Turbidity and Nephelometer.

Nuclear Radiation Detectors: Introduction, Alpha, Beta, Gamma characteristics, Detectors- Gas filled: ionization chamber, proportional counter, GM counters; Liquid/Solid Detectors - Scintillation counter, solid state detector and X-Ray detectors.

Total Periods: 45

TEXT BOOKS:

1. R.S. Khandpur, *Handbook of Analytical Instruments*, TMH, 2nd Edition, 2006.
2. Willard H.H., Merrit L.L., Dean J.A. and Seattle F.L., *Instrumental Methods of Analysis*, CBS Publishing and Distributors, 7th Edition, 1995.

REFERENCE BOOKS:

1. Jain R.K., *Mechanical and Industrial Measurements*, Khanna Publishing, New Delhi, 10th Edition, 1992.
2. Liptak B.G, *Process Measurement and Analysis,* Chilton Book Company, Pennsylvania, 3rd edition, 1995.
3. G.W. Ewing, *Instrumental Methods of Analysis,* McGraw Hill, 2004.
4. Skoog D.A. and Holler.F.J, *Principles of Instrumental Analysis*, Holt Sounder Publication, Philadelphia, 1985.

IV B. Tech. – I Semester

(16BT71002) BIOMEDICAL SIGNAL PROCESSING

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Courses on Digital Signal Processing, Biomedical Instrumentation.

COURSE DESCRIPTION: Analysis of Non Stationary signals, noise & artifact removal, Advanced Signal processing techniques, Event Detection, Spectral Analysis.

COURSE OUTCOMES: On successful completion of the course, students will be able to

CO1. Demonstrate an understanding of biomedical signals and identify the need for Biomedical signal analysis.

CO2. Identify physiological interferences and artifacts affecting the biomedical signals and apply various filtering mechanisms for the enhancement of signals.

CO3. Apply advanced signal processing techniques for the analysis of biomedical signals

CO4. To analyze and detect various events and waveform complexities involved in EEG & ECG signals

CO5. Choose appropriate hardware and IT tools to program the devices to solve Biomedical Engineering Problems.

CO6. Perform the spectral analysis of biomedical signals as per societal needs.

DETAILED SYLLABUS:

UNIT-I: NATURE OF BIOMEDICAL SIGNALS AND ANALYSIS OF NON STATIONARY SIGNALS (9 Periods)

The nature of Biomedical Signals: Need for biomedical signal processing, sources of Biomedical Signals(ECG, EEG, PCG, EMG, Carotid Pulse), objectives of Signal analysis, Difficulties in signal analysis, signal modelling framework, computer aided diagnosis, Heart sounds and murmurs, EEG Rhythms and Waves.

UNIT-II: FILTERING FOR NOISE AND ARTIFACT REMOVAL (9 Periods)

Physiological interference, noise, Data Functions and Transforms, Convolution, Correlation and Covariance, Sampling Theory and Finite Data Considerations, Edge Effects, Illustration of noise removal with case studies, time and frequency domain filtering, homomorphic filtering, Problems.

UNIT – III: ADVANCED SIGNAL PROCESSING TECHNIQUES (9 Periods)

Optimal and Adaptive Filters, Optimal Signal Processing: Wiener Filters, Adaptive Signal Processing, Adaptive Noise Cancellation, Phase Sensitive Detection, Phase Sensitive Detectors, Problems.

UNIT – IV: EVENT DETECTION (9 Periods)

Detection of events & waves-Derivative Based methods for QRS detection, Pan–Tompkins algorithm for QRS detection, Detection of Dicrotic notch, Correlation Analysis of EEG channels, Data Reduction techniques-Turning point algorithm, Huffman Coding, problems.

UNIT – V: SPECTRAL ANALYSIS (9 Periods)

Classical Methods, Review of Fourier series for Periodic and Aperiodic Functions, Frequency Resolution, Truncated Fourier Analysis: Data Windowing, Power Spectrum, Direct FFT and Windowing, The Welch Method for Power Spectral Density Determination, Window Functions, Problems.

Total Periods: 45

TEXT BOOKS:

1. John L Semmlow, *Biosignal & Biomedical Image Processing* – Dekker Media Publishing, 2004.
2. Rangaraj M Rangayyan, *Biomedical Signal Analysis*, IEEE Press, 2001.

REFERENCE BOOK:

1. Willis J Tomkins, *Biomedical Digital Signal Processing,* PHI, 1993.

IV B. Tech. – I Semester

(16BT71003) INDUSTRIAL AUTOMATION

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: A course on Switching Theory and Logical Design.

COURSE DESCRIPTION: Basics of Programmable Logic Controller (PLC); PLC Programming Languages; PLC intermediate Functions ; Concepts of SCADA; Concepts of DCS; Communication networks for DCS; Industrial Data Networks.

COURSE OUTCOMES: On successful completion of the course, students will be able to

CO1. Demonstrate knowledge on Programmable Logic Controller Architecture, DCS and SCADA.

CO2. Analyze various methods of developing algorithms for PLC, SCADA and DCS.

CO3. Design suitable accessories in process automation.

CO4. Analyze the information to provide effective solution for real time problems in automation of process industries.

CO5. Select appropriate techniques/tools for providing Automation.

CO6. To follow ethics while selecting the standards and protocols in industrial automation.

DETAILED SYLLABUS:

UNIT –I: PROGRAMMABLE LOGIC CONTROLLER (8 Periods)

Programmable Logical Controller, Hardware, Architecture of PLC system, Power supplies and Isolators, Selection of PLC Systems- Allen Bradley, Omron, Mitsubishi. IEC Standard, Programming PLC's, Networking of PLC's, Advantages and Disadvantages of PLC.

UNIT –II: PLC INTERMEDIATE FUNCTIONS (10 Periods)

Ladder and functional block programming, Logic functions, Functional blocks, Timer functions, Counter functions, Register basics, Arithmetic functions, Number Comparison Functions, Skip and MCR functions, Sequencer functions, PID functions.

UNIT – III: DISTRIBUTED CONTROL SYSTEM (9 Periods)

Overview of Distributed Control System, DCS Software configuration, DCS Communication, DCS Supervisory Computer tasks, DCS Integration with PLCs and Computers. Communications in Distributed Control Systems – CSMA/CD Protocol, Token ring, Token Bus Communication Topology. Selection of DCS - Mitsubishi, ABB, Emerson Electric.

UNIT – IV: SUPERVISORY CONTROL AND DATA ACQUISITION (8 Periods)

Overview of SCADA, Elements of SCADA system, Remote terminal unit: Communication Interface, Discrete control, Analog control. Master terminal unit, Operator interface. Selection of SCADA Systems- Siemens, Schneider.

UNIT – V: HART AND FIELD DATA NETWORKS (10 Periods)

HART protocol: Introduction, Method of operation, structure, operating conditions, HART communication protocol, communication modes, HART networks, FBIO interface, HART commands, HART field controller implementation, HART OSI model. Field bus: Introduction, General field bus architecture, Basic requirements of field bus standard, Field bus topology, interoperability, interchangeability.

Total Periods: 45

TEXT BOOKS:

1. John W. Webb and Ronald A. Reis, *Programmable Logic Controllers-Principles and Applications*, Pearson Education, 5th Edition, 2002.
2. S.K. Singh, *Computer Aided Process Control*, PHI, 2009.
3. Stuart Boyer A, *Supervisory control and data Acquisition*, ISA, 4th Edition, 2009.

REFERENCE BOOKS:

1. Bolton. W, *Programmable Logic Controllers*, 5th edition, 2009.
2. Romily Bowden, *HART application guide and the OSI communication foundation*, 1999.
3. M. Chidambaram, *Computer Control of Processes*, Narosa Publications, 2nd Edition, 2003.

IV B. Tech. – I Semester

(16BT50501) COMPUTER NETWORKS

(Program Elective-3)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: —

COURSE DESCRIPTION: Introduction to Computer Networks; The Physical Layer; The Data Link Layer; The Medium Access Control Sublayer; The Network Layer; The Transport Layer; The Application Layer.

COURSE OUTCOMES: On successful completion of the course, students will be able to

CO1. Demonstrate knowledge on:
- Functionalities of Various OSI and TCP/IP layers
- 3G Mobile phone networks, 802.11
- TCP,UDP and SMTP

CO2. Analyze the issues related to data link, medium access and transport layers by using channel allocation and connection management schemes.

CO3. Design and compute subnet masks and addresses for networking requirements.

CO4. Solve problems related to Flow control, Error control, congestion control and Network Routing.

CO5. Apply Network Standards - 802.3 and 802.11 for developing computer Networks.

CO6. Assess the impact of wired and wireless Networks in the context of societal applications like VoIP, Multi-user Network Games, Internet of Things.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION AND PHYSICAL LAYER **(9 Periods)**

Introduction: Network hardware, Network software, Reference models - OSI, TCP/IP; Example networks – Internet; Wireless LANs - 802.11.

Physical Layer: Guided transmission media, Wireless transmission.

UNIT-II: DATA LINK LAYER AND MEDIUM ACCESS CONTROL SUBLAYER (10 Periods)

Data Link Layer: Data link layer design issues, Error detection and correction-CRC, Hamming codes, Elementary data link protocols, Sliding window protocols.

Medium Access Control Sublayer: ALOHA, Carrier sense multiple access protocols, Collision-free protocols, Ethernet, Data link layer switching-Repeaters, Hubs, Switches, Routers, and Gateways.

UNIT-III: NETWORK LAYER (10 Periods)

Network layer design issues, Routing algorithms - Shortest path, Flooding, Distance vector, Link state routing, Hierarchical, Broadcast, Multicast, Anycast; Congestion control algorithms, Network layer in the internet - The IP version 4 protocol, IP addresses, IP version 6, Internet control protocols.

UNIT-IV: TRANSPORT LAYER (9 Periods)

UDP – Segment header, Remote procedure call, Real-time transport protocols; TCP **–** service model, Protocol, Segment header, Connection establishment, Connection release, Sliding window, Timer management, Congestion control.

UNIT-V: APPLICATION LAYER (7 Periods)

Domain Name System (DNS)-Name space, Domain resource records, Name servers; Electronic mail-Architecture and services, User agent, Message formats, Message transfer, Final delivery; The World Wide Web- Architectural overview, HTTP.

Total Periods: 45

TEXT BOOK:

1. Andrew S. Tanenbaum and David J. Wetherall, *Computer Networks*, Pearson Education, 5th Edition, 2015.

REFERENCE BOOKS:

1. Behrouz A. Forouzan, *Data Communication and Networking*, Tata McGraw-Hill, 4th Edition, 2010.
2. James F. Kurose and Keith W. Ross, *Computer Networking: A Top-Down Approach Featuring the Internet*, Pearson Education, 2nd Edition, 2012.

IV B. Tech. – I Semester

(16BT71009) POWER PLANT INSTRUMENTATION

(Program Elective-4)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: A Course on Industrial Instrumentation-II.

COURSE DESCRIPTION: Different methods of power generation; Instrumentation and control in water and air-fuel circuit; Turbine monitoring and control; Power plant maintenance.

COURSE OUTCOMES: On successful completion of the course, students will be able to

CO1. Demonstrate knowledge about
- Different methods of power generation.
- Measurement and control in water and air-fuel circuit
- Turbine monitoring and Control
- Power plant management

CO2. Analyze the various parameters like temperature, pressure, level measured in power plant.

CO3. Design measurement system for the measurement of process parameters in power plant.

CO4. Solve Engineering problems pertaining to process parameters measurement and control circuits in power plant to provide valid conclusions.

CO5. Select appropriate technique for the measurement of process parameters in the power plant.

CO6. Apply safety measures during calibration and maintenance of instruments in power plant to meet societal needs.

DETAILED SYLLABUS:

UNIT-I: AN OVERVIEW OF POWER GENERATION (8 periods)

Methods of power generation: Hydro, Nuclear, Solar, Wind, Thermal, Tidal, Geothermal, classification of instruments in a power plant, Objectives of instrumentation and control, Cogeneration.

UNIT-II: INSTRUMENTATION IN WATER CIRCUIT AND AIR-FUEL CIRCUIT (10 periods)

Measurements in water circuit: Water circuit, Water flow measurement, Differential pressure transmitter, Steam flow measurement, Water and Steam pressure measurements,

Water and steam temperature measurements, Drum water level measurement in power plant.

Measurements in Air-fuel circuit: Air-fuel circuit- fuels, Combustion air, Flue gases, Waste gases, Measurement of Flow/ Quantity, Pressure, Temperature, level in power plant.

UNIT –III: CONTROLS IN WATER CIRCUIT AND AIR-FUEL CIRCUIT (10 periods)

Controls in water circuit: Boiler drum level- single element drum level control, Superheated steam temperature control- waterside steam temperature control, Cascade steam temperature control, Feed forward-plus-feedback steam temperature control, Fire side steam temperature control, Steam pressure control.

Controls in Air-fuel circuit: Combustion control, Furnace draft control.

UNIT - IV: TURBINE MONITORING AND CONTROL (9 periods)

Principal parts of steam turbine, Turbine measurements- Process parameters, Mechanical parameters, Electrical parameters,Turbine control system- safety control systems, process control systems, Lubrication system, Controls in lubrication system, Turbo alternator cooling system .

UNIT -V: POWER PLANT MANAGEMENT (8 periods)

Maintenance of measuring instruments- Types of maintenance, Maintenance costs, Life cycle costs,Intrinsic and electrical safety- Intrinsic safety of instruments, Electrical safety, Explosion hazards and intrinsic safety, Interlocks for boiler operation- safety interlocks, start- up and shut down interlocks.

Total Periods: 45

TEXT BOOK:

1. K. Krishnaswamy, M. Ponni Bala, *Power Plant Instru mentation*, PHI, 2010.

REFERENCE BOOKS:

1. Patranabis, *Principles of Industrial Instrumentation*, Mcgraw Hill, 2nd Edition, 2001
2. A.R.Mallick, *Practical boiler operation engineering and power plant*, Denett & Co., 2nd Edition, 2010.

IV B. Tech. – I Semester

(16BT6HS02) BUSINESS COMMUNICATION AND CAREER SKILLS

(Common to EEE, ECE and EIE)

(Open Elective)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: A course on Technical English.

COURSE DESCRIPTION: Nature and Scope of Communication; Corporate Communication; Writing Business Documents; Careers and Resumes; Interviews.

COURSE OUTCOMES: On Successful completion of the course, students will be able to

CO1. Demonstrate knowledge in
- Corporate Communication
- Main Stages of Writing Messages
- Career Building

CO2. Analyze the possibilities and limitations of language in
- Communication Networks
- Crisis Management/Communication

CO3. Design and develop the functional skills for professional practice in
- Business Presentations & Speeches

CO4. Apply written and oral communication techniques in preparing and presenting various documents in technical writing.

CO5. Function effectively as an individual and as a member in diverse teams.

CO6. Communicate effectively with the engineering community and society in formal and informal situations.

DETAILED SYLLABUS:

UNIT -I: NATURE AND SCOPE OF COMMUNICATION **(9 Periods)**

Introduction: Functions of Communication – Roles of a Manager – Communication Basics –Communication Networks – Informal Communication – Interpersonal Communication –Communication Barriers.

UNIT- II: CORPORATE COMMUNICATION (9 Periods)

Introduction: What is Corporate Communication? – Corporate Citizenship and Social Responsibility – Corporate Communication Strategy – Crisis Management/Communication – Cross-Cultural Communication.

UNIT- III: WRITING BUSINESS DOCUMENT (9 Periods)

Introduction: Importance of Written Business Communication, Types of Business Messages – Five Main Stages of Writing Business Messages – Business Letter Writing – Effective Business Correspondence – Common Components of Business Letters – Strategies for Writing the Body of a Letter.

UNIT- IV: CAREERS AND RESUMES (9 Periods)

Introduction – Career Building – Business Presentations and Speeches – Resume Formats – Traditional, Electronic and Video Resumes – Sending Resumes – Follow-up Letters – Online Recruitment Process.

UNIT- V: INTERVIEWS (9 Periods)

Introduction – Fundamental Principles of Interviewing – General Preparation for an Interview – Success in an Interview – Types of Interviewing Questions – Important Non-verbal Aspects – Types of Interviews – Styles of Interviewing.

Total Periods: 45

TEXT BOOK:

1. Meenakshi Raman and Prakash Singh, *Business Communication*, Oxford University Press, New Delhi, 2nd edition, 2012.

REFERENCE BOOKS:

1. Neera Jain and Sharma Mukherji, *Effective Business Communication*, Tata Mc Graw-Hill Education, Pvt. Ltd., New Delhi, 2012.
2. Courtland L.Bovee et al., *Business Communication Today*, Pearson, New Delhi, 2011.
3. Krizan, *Effective Business Communication*, Cengage Learning, New Delhi, 2010.
4. R.K. Madhukar, *Business Communication*, Vikas Publishing House Pvt. Ltd., New Delhi, 2005.

IV B. Tech. – I Semester

(16BT6HS10) INDIAN HISTORY

(Common to EEE, ECE and EIE)

(Open Elective)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: —

COURSE DESCRIPTION: Introduction; Ancient India; Classical and Medieval era; Modern India; India after independence.

COURSE OUTCOMES: On Successful completion of the course, students will be able to

CO1. Gain knowledge on evolution and history of India as a nation.

CO2. Analyze social and political situations of past and current periods.

CO3. Practice in career or at other social institutions morally and ethically.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION (8 Periods)

Elements of Indian History; History Sources: Archaeology, Numismatics, Epigraphy & Archival research; Methods used in History; History & historiography; sociological concepts-structure, system, organization, social institutions, Culture and social stratification (caste, class, gender, power), State& Civil Society.

UNIT-II: ANCIENT INDIA (9 Periods)

Mohenjo-Daro civilization; Harappa civilization; Mauryan Empire.

UNIT -III: CLASSICAL & MEDIEVAL ERA (12 Periods)

Classic Era (200 BC - 1200 AD); Hindu - Islamic Era (1200 - 1800 AD).

UNIT-IV: MODERN INDIA (6 Periods)

Age of Colonialism (17th - 19th centuries); First war of Indian Independence;
Freedom Struggle (1857-1947).

UNIT-V: INDIA AFTER INDEPENDENCE (1947-) (10 Periods)

The Evolution of the Constitution and Main Provisions; Consolidation of India as a Nation; Politics in the States; Indian economy; Modernization and globalization, Secularism and communalism, Nature of development, Processes of social exclusion and inclusion, Changing Nature of work and organization.

Total periods: 45

TEXT BOOK:

1. K. Krishna Reddy, *Indian History*, Tata McGraw-Hill, 21st reprint, 2017.

REFERENCE BOOKS:

1. Guha, Ramachandra, *India after Gandhi*, Pan Macmillan, 2007.
2. Thapar, Romila, *Early India*, Penguin, 2002.

IV B. Tech. – I Semester

(16BT6HS11) PERSONALITY DEVELOPMENT

(Common to EEE, ECE and EIE)

(Open Elective)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: Soft Skills Lab.

COURSE DESCRIPTION: Self-esteem & Self-Management; Developing Positive Attitudes; Self-Motivation & Self-Management; Getting Along with the Supervisor; Workplace Success.

COURSE OUTCOMES: On Successful completion of the course, students will be able to

CO1. Demonstrate knowledge in
- Self-Management
- Planning Career

CO2. Analyze the situations based on
- Attitudes
- Thinking strategies

CO3. Design and develop the functional skills for professional practice in

CO4. Function effectively as an individual and as a member in diverse teams.

CO5. Communicate effectively in public speaking in formal and informal situations.

DETAILED SYLLABUS:

UNIT – I: SELF-ESTEEM & SELF-IMPROVEMENT (9 Periods)

Know Yourself – Accept Yourself; Self-Improvement: Plan to Improve - Actively Working to Improve Yourself.

Case study: 1

UNIT – II: DEVELOPING POSITIVE ATTITUDES (9 Periods)

How Attitudes Develop – Attitudes are Catching – Improve Your Attitudes.

Case study: 2

UNIT – III: SELF-MOTIVATION & SELF-MANAGEMENT **(9 Periods)**

Show Initiative – Be Responsible Self-Management; Efficient Work Habits – Stress Management – Employers Want People Who can Think – Thinking Strategies.

Case study: 3

UNIT – IV: GETTING ALONG WITH THE SUPERVISOR **(9 Periods)**

Know your Supervisor – Communicating with Your Supervisor – Special Communications With Your Supervisor – What Should You Expect of Your Supervisor? – What Your Supervisor Expects of You - Moving Ahead Getting Along with Your Supervisor.

Case study: 4

UNIT - V: WORKPLACE SUCCESS **(9 Periods)**

First Day on the Job – Keeping Your Job – Planning Your Career – Moving ahead.

Case study: 5

Total Periods: 45

TEXT BOOK:

1. Harold R. Wallace and L. Ann Masters, *Personality Development*, Cengage Learning, Delhi, Sixth Indian Reprint 2011.

REFERENCE BOOKS:

1. Barun K. Mitra, *Personality Development and Soft Skills,* Oxford University Press, New Delhi, 2011.
2. Stephen R. Covey, *The 7 Habits of Highly Effective People*, Free Press, New York, 1989.
3. K. Alex, *Soft Skills*, S. Chand & Company Ltd, New Delhi, Second Revised Edition 2011.
4. Stephen P. Robbins and Timothy A. Judge*, Organizational Behaviour*, Prentice Hall, Delhi, 16th Edition 2014.

IV B. Tech. – I Semester

(16BT60118) RURAL TECHNOLOGY

(Common to EEE, ECE and EIE)

(Open Elective)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Rural technology; Non conventional energy; Community development; IT in rural development.

COURSE OUTCOMES: On successful completion of the course, students will be able to

CO1. Demonstrate the knowledge on technologies for rural development.

CO2. Analyze various technologies available which are appropriate for rural development.

CO3. Carryout feasibility study on the public and private partnership for rural development.

CO4. Develop and use latest technologies for rural development.

CO5. Address health and safety issues while choosing technologies for rural development.

CO6. Educate the rural populace on the positive impacts of biofertilisers and usage of agromachinery in agriculture.

DETAILED SYLLABUS:

UNIT – I: RURAL TECHNOLOGY (9 Periods)

India - Technology and rural development, Pre and post independence period, Rural India Life, Indian farmer, Role of science and technology in rural development, Rural technology and poverty eradication, Rural business hubs, Technology in improving rural infrastructure, Various organizations related to innovation, Issues of technology transfer - CAPART, NABARD, CSIR, NIF.

UNIT – II: NON CONVENTIONAL ENERGY (9 Periods)

Definition of energy, Types of alternative sources of energy, Sources of non conventional energy – Solar energy: Solar cooker, Solar heater; Biogas, Recycling and management, Wastes conservation, Assessment and production of biomass products and their utilization.

UNIT – III: TECHNOLOGIES FOR RURAL DEVELOPMENT (9 Periods)

Food and agro based technologies, Tissue culture, Nursery, Building and construction technologies, Cultivation and processing of economic plants, Cottage and social industries.

UNIT – IV: COMMUNITY DEVELOPMENT (9 Periods)

Water conservation, Rain water Harvesting, Drinking water, Environment and Sanitation, Bio fertilizers, Medical and aromatic plants, Employment generating technologies – Apiculture, Pisciculture, Aquaculture.

UNIT – V: IT IN RURAL DEVELOPMENT (9 Periods)

Role of information technology (IT) in rural areas, Impact of IT in rural development, Need and necessity of technology, Corporate social responsibilities, Private sector participation (Activities in different spheres: Employment, Education, Health, Agriculture and service sectors) and Saansad Adarsh Gram Yojana (SAGY), Village adoption schemes.

Total Periods: 45

TEXT BOOKS

1. M. S. Virdi, *Sustainable Rural Technologies*, Daya Publishing House, 2009.
2. S. V. Prabhath and P. Ch. Sita Devi, *Technology and Rural India*, Serials Publications, 2012.

REFERENCE BOOKS

1. R. Chakravarthy and P. R. S. Murthy, *Information Technology and Rural Development,* Pacific Book International, 2012.
2. Shivakanth Singh, *Rural Development Policies and Programmes,* Northern Book Centre, 2002.
3. L. M. Prasad, *Principles and Practice of Management*, S. Chand & Sons, 8th Edition, 2014.
4. Venkata Reddy, K., *Agriculture and Rural Development - Gandhian Perspective*, Himalaya Publishing House, 2001.

LIST OF EXPERIMENTS:

Minimum of TEN experiments to be conducted

1. Calibration and measurement of pH value, Dissolved Oxygen and Thermal Conductivity of a given sample.
2. Measure the absorbance, transmittance and concentration of the sample using UV-VIS Spectrophotometer.
3. Measure the concentration of a sample using Flame Photometer.
4. Characteristics of Geiger Muller Counter.
5. Compound analysis of a sample using Gas/Liquid chromatography.
6. Blood pressure measurement using sphygmomanometer.
7. Analysis of ECG for different lead configurations.
8. Analysis of EEG Signals.
9. Analysis of EMG Signals.
10. Design of Instrumentation Amplifier for bioelectrical Signals.
11. Measurement of Respiration rate, Heart Sounds.

IV B. Tech. – I Semester

(16BT71032) INDUSTRIAL AUTOMATION LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	3	2

PRE-REQUISITES: Courses on Process Control Instrumentation, Industrial Automation.

COURSE DESCRIPTION: Automatic control of motors; liquid level; temperature; pressure; processes using PLC based control systems and SCADA systems. P&I diagram of Feedback Control system, Cascade control system and Ratio control system.

COURSE OUTCOMES: On successful completion of the course, students will be able to

CO1. Demonstrate knowledge on
- P& I diagrams
- PLC and SCADA
- Pneumatic and Hydraulic

CO2. Analyze operation and performance of automation process made for Level Process, Bottle filling sys tem, Temperature and DC motor speed control.

CO3. Design an algorithm to automate Level Process, Bottle filling system, Temperature and DC motor speed control.

CO4. Interpret and synthesis the data obtained from various industrial processes to provide valid conclusions.

CO5. Select and apply appropriate techniques to make industrial process automation.

CO6. Follow professional ethics and practices to provide automation solutions for the society.

CO7. Commit to ethical principle in the design of process and algorithms.

CO8. Function effectively as individual and as member in team in the field of industriala utomation.

CO9. Communicate effectively both oral and written forms in the area of industrial automation.

LIST OF EXPERIMENTS:

Minimum of ELEVEN experiments to be conducted

1. Study of various symbols and abbreviations used in P&I diagram.
2. Draw the P&I diagram of Feedback Control System and Cascade Control System.
3. Implementation of Ladder Diagrams for Logic gates, timer and counters.
4. Programming a PLC to demonstrate control of a level Process.
5. Programming a PLC to demonstrate DC Motor speed control.
6. Programming a PLC to demonstrate Bottle filling system.
7. Programming a PLC to demonstrate Temperature control.
8. Implementation of PLC programming through SCADA.
9. Programming a PLC to demonstrate control of flow process trough SCADA.
10. Study of hydraulic components and hydraulic circuits.
11. Design of pressure and flow control valves using hydraulics.
12. Study of pneumatic components and technology.
13. Design of the interaction between cylinders & valves using pneumatics.

IV B. Tech. – I Semester

(16BT71033) COMPREHENSIVE ASSESSMENT

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
-	100	100	-	-	-	2

PRE-REQUISITES: All the technical courses of the program up to IV B. Tech. – I Semester.

COURSE DESCRIPTION: Assessment of student learning outcomes in the courses of the program.

COURSE OUTCOMES: Comprehensive Assessment enables a successful student to:

CO1. Demonstrate knowledge in the courses of the Electron ics and Instrumentation

CO2. Analyze problems in the courses of the Electronics and Instrumentation.

CO3. Design solutions for the problems in the courses of the Electronics and Instrumentation.

CO4. Solve complex engineering problems in the courses of the Electronics and Instrumentation.

CO5. Apply tools and techniques to complex engineering activities with an understanding of limitations in the courses of the Electronics and Instrumentation.

CO6. Provide solutions as per societal needs with consideration to health, safety, legaland cultural issues in the domain of Electronics and Instrumentation.

CO7. Understand the impact of the professional engineering solutions in environmental context and need for sustainable development in the domain of Electronics and Instrumentation.

CO8. Apply ethics and norms of the engineering practice in the courses of the Electronics and Instrumentation.

CO9. Function effectively as an individual in the domain of Electronics and Instrumentation.

CO10. Present views cogently and precisely in the domain of Electronics and Instrumentation.

CO11. Engage in life-long learning in the domain of Electronics and Instrumentation.

IV B. Tech. – II Semester
(16BT81031) PROJECT WORK

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
100	100	200	-	-	-	12

PRE-REQUISITES: All technical courses of the program up to IV B. Tech. – I Semester.

COURSE DESCRIPTION: Identification of topic for the project work; Literature survey; Collection of preliminary data; Identification of implementation tools and methodologies; Performing critical study and analysis of the topic identified; Time and cost analysis; Implementation of the project work; Preparation of thesis and presentation.

COURSE OUTCOMES: On successful completion of project work, students will be able to

CO1. Demonstrate in-depth knowledge on the project topic.
CO2. Identify, analyze and formulate complex problem chosen for project work to attain substantiated conclusions.
CO3. Design solutions to the chosen project problem.
CO4. Undertake investigation of project problem to provide valid conclusions.
CO5. Use the appropriate techniques, resources and modern engineering tools necessary for project work.
CO6. Understand societal issues in the context of the project work.
CO7. Understand environmental issues while executing the project work.
CO8. Understand professional and ethical responsibilities while executing the project work.
CO9. Function effectively as individual and a member in the project team.
CO10. Develop communication skills, both oral and written form, for preparing and presenting project report.
CO11. Demonstrate knowledge and understanding of cost and time analysis required for carrying out the project.
CO12. Engage in lifelong learning to improve knowledge and competence in the chosen area of the project.