BUNDELKHAND UNIVERSITY

(2011-2012)

SYLLABUS

INSTITUTE OF ENGINEERING & TECHNOLOGY

COURSE OF STUDY AND SCHEME OF B.TECH. EXAMINATION FOR INSTRUMENTATION ENGINEERING

(IVth Year Revised & Modified as per UPTU)

YEAR II, SEMESTER III

(Effective from the session 2009-10)

S.NO	COURSE CODE	SUBJECT	PERIODS PER WEEK			DISTRIBUTION OF MARKS				SUBJECT TOTAL
						INTERNAL ASSESMENT			EXAM	
			L	T	P	CT	TA	TOTAL		
THEORY SUBJECTS										
1	IC-301	Mathematics III	3	1	0	30	20	50	100	150
2	IC-302	Fundamentals of Electronics Devices	3	1	0	30	20	50	100	150
3	IC-303	Digital Electronics	3	1	0	30	20	50	100	150
4	IC-304	Electromagnetic Field Theory	3	1	0	30	20	50	100	150
5	IC-305	Fundamentals of Network Analysis & Synthesis	3	1	0	30	20	50	100	150
PRATICAL/DESIGN/DRAWING										
6	IC-351	Electronics Engineering Lab-I	0	0	2	-	20	20	30	50
7	IC-352	Digital Electronics Lab-I	0	0	2	-	20	20	30	50
8	IC-353	PCB & Electronics Workshop	0	0	3	-	50	50	50	100
9	GP-301	General Proficiency	-	-	-	-	-	-	-	50
		TOTAL								1000

YEAR II, SEMESTER IV

(Effective from the session 2009-10)

S.NO	COURSE CODE	SUBJECT	PERIODS PER WEEK			DISTRIBUTION OF MARKS				SUBJECT TOTAL
						INTERNAL ASSESMENT			EXAM	
			L	T	P	CT	TA	TOTAL		
THEORY SUBJECTS										
1	OE-04**	Science based open elective**	3	1	0	30	20	50	100	150
2	IC-401	Electronics Circuits	3	1	0	30	20	50	100	150
3	IC-402	Electronics Instrumentation and Measurements	3	1	0	30	20	50	100	150
4	IC-403	Signals and Systems	3	1	0	30	20	50	100	150
5	IC-404	Transducer and Sensors	3	1	0	30	20	50	100	150
PRATICAL/DESIGN/DRAWING										
6	IC-451	Electronics Engineering Lab-II	0	0	2	-	20	20	30	50
7	IC-452	Transducer Lab	0	0	3	-	50	50	50	100
8	IC-453	Measurement Lab	0	0	2	-	20	20	30	50
9	GP-401	General Proficiency	-	-	-	-	-	50	-	50
		TOTAL								1000

**Science based open Elective

OE-040 Introduction to soft computing (Neural networks, Fuzzy Logic and Genetic algorithm)
OE-041 Nano Sciences
OE-042 Laser systems and applications
OE-043 Space sciences
OE-044 Polymer science& Technology
OE-045 Nuclear Science
OE-046 Material Science
OE-047 Discrete Mathematics

YEAR III, SEMESTER V

(Effective from the session 2010-11)

S.No.	COURSE CODE	SUBJECT	PERIODS PER WEEK			DISTRIBUTION OF MARKS				SUBJECT TOTAL
			L	T	P	INTERNAL ASSESMENT			EXAM	
						CT	TA	TOTAL		
THEORY SUBJECTS										
1	IC-501	Fluid Mechanics	3	1	0	30	20	50	100	150
2	IC-502	Integrated Circuits	3	1	0	30	20	50	100	150
3	IC-503	Control Systems-I	3	1	0	30	20	50	100	150
4	IC-504	Industrial Instrumentation	3	1	0	30	20	50	100	150
5	IC-505	Microprocessors	3	1	0	30	20	50	100	150
PRACTICAL/DESIGN/DRAWING										
6	IC-551	Integrated circuits Lab	0	0	2	-	20	20	30	50
7	IC-552	Control System-I Lab	0	0	2	-	20	20	30	50
8	IC-553	Instrumentation Lab	0	0	2	-	20	20	30	50
9	IC-554	Microprocessor Lab	0	0	2	-	20	20	30	50
10	GP-501	General Proficiency	-	-	-	-	-	50	-	50
		TOTAL								1000

YEAR III, SEMESTER VI

(Effective from session 2010-11)

S.No.	COURSE CODE	SUBJECT	PERIODS PER WEEK			DISTRIBUTION OF MARKS				SUBJECT TOTAL
			L	T	P	INTERNAL ASSESMENT			EXAM	
						CT	TA	TOTAL		
THEORY SUBJECTS										
1	IC-06*	Departmental Elective-I*	3	1	0	30	20	50	100	150
2	IC-601	Electrical Machines	3	1	0	30	20	50	100	150
3	IC-602	Microcontroller	3	1	0	30	20	50	100	150
4	IC-603	Communication Engineering	3	1	0	30	20	50	100	150
5	IC-604	Digital Signal Processing	3	1	0	30	20	50	100	150
PRACTICAL/DESIGN/DRAWING										
6	IC-651	Seminar	0	0	2	-	50	50	-	50
7	IC-652	Communication Lab	0	0	2	-	20	20	30	50
8	IC-653	Microcontroller Lab	0	0	2	-	20	20	30	50
9	IC-654	DSP Lab	0	0	2	-	20	20	30	50
10	GP-601	General Proficiency	-	-	-	-	-	50	-	50
		TOTAL								1000

DEPARTMENTAL ELECTIVES-I*

1. IC-060 Optoelectronics
2. IC-061 Data Structure
3. IC-062 Intelligent Instrumentation
4. IC-063 Microwave Engineering

YEAR IV, SEMESTER VII

(Effective from the session 2011-12)

S.NO	COURSE CODE	SUBJECT	PERIODS PER WEEK			DISTRIBUTION OF MARKS				SUBJECT TOTAL
						INTERNAL ASSESMENT			EXAM	
			L	T	P	CT	TA	TOTAL		
THEORY SUBJECTS										
1	OE-07*	Open Elective-I*	3	1	0	30	20	50	100	150
2	IC-07*	Departmental Elective-II	3	1	0	30	20	50	100	150
3	IC-701	Control System -II	3	1	0	30	20	50	100	150
4	IC-702	Telemetry Principles	3	1	0	30	20	50	100	150
5	IC-703	Digital Measurement Techniques	3	1	0	30	20	50	100	150
PRATICAL/DESIGN/DRAWING										
6	IC-751	Control System Lab-II	0	0	3	-	20	20	30	50
7	IC-752	Telemetry Lab	0	0	2	-	20	20	30	50
8	IC-753	Industrial Training Viva Voce	0	0	2	-	20	20	30	50
9	IC-754	Project	0	0	2	-	50	50	-	50
10	GP-701	General Proficiency	-	-	-	-	-	50	-	50
		TOTAL								1000

Note: 4 to 6 week industrial training after VI semester exam to be evaluated in VII semester.

** **OPEN ELECTIVE-I**

1. OE-070Entrepreneurship Development
2. OE-071Quality Management
3. OE-072Operation Research
4. OE-073Introduction to Biotechnology

YEAR IV, SEMESTER VIII

(Effective from the session 2011-12)

S.NO	COURSE CODE	SUBJECT	PERIODS PER WEEK			DISTRIBUTION OF MARKS				SUBJECT TOTAL
						INTERNAL ASSESMENT			EXAM	
			L	T	P	CT	TA	TOTAL		
THEORY SUBJECTS										
1	OE-08*	Open Elective-II*	3	1	0	30	20	50	100	150
2	IC-08*	Departmental Elective-III	3	1	0	30	20	50	100	150
3	IC-801	Optimal control Systems	3	1	0	30	20	50	100	150
4	IC-802	Biomedical Instrumentation	3	1	0	30	20	50	100	150
PRATICAL/DESIGN/DRAWING										
6	IC-851	Project**	0	0	12	-	100	100	250	350
7	GP-801	General Proficiency	-	-	-	-	-	50	-	50
		TOTAL	12	4	12	120	180	350	650	1000

**Out of 12 periods, 2 periods per week should be allotted for interaction of group with project guide and 10 periods per week should be allotted for self studies and project work.

***OPEN ELECTIVES-II**

1. OE-080 Non Conventional Energy Resources
2. OE-081 Nonlinear Dynamic Systems
3. OE-082 Product Development
4. OE-083 Automation & Robotics

DEPARTMENTAL ELECTIVES

Elective – II

1. IC-070Optical Instrumentation
2. IC-071Power Plant Instrumentation
3. IC-072 ANN
4. IC-073Filter Design

Elective – III

1. IC-080Computerized Process Control
2. IC-081Bio-medical Signal Processing
3. IC-082Analytical Instrumentation
4. IC-083Micro and Smart Systems
5. IC-084Digital System Design using VHDL

Syllabus III semester:

THEORY SUBJECTS

MATHEMATICS-III (IC-301)

Unit-I: Integral Transforms: Fourier integral, Fourier complex transform, Fourier sine and cosine transform and applications to simple heat transfer equations. Z- transform and its application to solve difference equations

Unit-II: Functions of a Complex Variable: Analytic function, C-R equation and harmonic functions, Line integral in the complex plan, Cauchy's integral formula for analytic functions, Liouvilles theorem. Taylor's and Laurent's series, Singularities, zeroes and poles, Residue theorem, evaluation of real integrals of type ⌡f(cos⌡, sin⌡) d⌡ and ⌡f(x) dx, Conformal mapping and bilinear transformations.

Unit-III: Statistics and Probability: Mean, Median, Mode, Standard deviation, Moments, Moment generating function, Skewness , Kurtosis, Correlation and Regression, Binomial distribution, Poisson distribution.

Unit-IV: Curve Fitting and Solution of Equations: Method of least square and curve fitting of straight line and parabola, Solution of cubic and bi- quadratic equations.

Unit-V: Numerical Method: Difference operator, interpolation, numerical integration by using Trapezoidal rule, Sampson's method, Waddles rule solution of ordinary differential equation by Eulers method, Runga kutta method. Solution of non linear algebraic equations.

FUNDAMENTALS OF ELECTRONICS DEVICES (IC-302)

Unit-I: Crystal Properties and charge Carriers in Semiconductors: Elemental and compound carriers in semiconductors, carrier concentrations, drift of carriers in electric and magnetic fields.

Unit-II: Excess Carriers in Semiconductors: Optical absorption, luminescence, carrier life time and photo conductivity, diffusion of carriers.

Unit-III: Junction Properties: Equilibrium conditions, biased junctions, steady state conditions, reverse bias break down, transient and AC conditions .Metal semiconductor junctions.

Unit-IV: Transistors: Metal semi conductor-field-effect-transistors (MESFET), Metal-insulator-semi conduct or-field-effect-transistors (MISFET), Metal oxide semiconductor field effect transistor (MOSFET): Construction, Operation and characteristics of above devices. Bipolar junction transistors: Fundamentals of BJT operation, amplification with BJTs,

Unit-V: Some special devices: Photodiodes, photo detectors, solar cell, light emitting diodes, semiconductor lasers, and light emitting materials. Tunnel Diode: degenerate semiconductors.IMPATT diode; the transferred electron mechanism: The GUNN diode. P-N-P-N diode, semiconductor controlled rectifier (SCR), bilateral devices: DIAC, TRIAC, IGBT.

Text Book:

1.B. G. Streetman and S. Banerjee "Solid state electronics devices", 5th Edition, PHI.

Reference Book:

1. Alok Dutta, "Semiconductor Devices and circuits", Oxford University Press

DIGITAL ELECTRONICS (IC-303)

Unit-I: Digital system and binary numbers: Signed binary numbers, binary codes, cyclic codes, error detecting and correcting codes, hamming codes. Floating point representation Gate-level minimization: The map method up to five variable, don't care conditions, POS simplification, NAND and NOR implementation, Quine Mc-Clusky method (Tabular method).

Unit-II: Combinational Logic: Combinational circuits, analysis procedure, design procedure, binary adder-sub tractor, decimal adder, binary multiplier, magnitude comparator, decoders, encoders, multiplexers

Unit-III: Synchronous Sequential logic: Sequential circuits, storage elements: latches, flip flops, analysis of clocked sequential circuits, state reduction and assignments, design procedure. Registers and counters: Shift registers, ripple counter, synchronous counter, other counters.

Unit-IV: Memory and programmable logic: RAM, ROM, PLA, PAL. Design at the register transfer level: ASMs, design example, design with multiplexers.

Unit-V: Asynchronous sequential logic: Analysis procedure, circuit with latches, design procedure, reduction of state and flow table, race free state assignment, hazards.

Text Book:

1. M. Morris Mano and M. D. Ciletti, "Digital Design", 4th Edition, Pearson Education

Reference Books:

1. Hill & Peterson, "Switching Circuit & Logic Design", Wiley.

2. Digital Circuit & Logic Design, by Holsworth.

ELECTROMAGNETIC FIELD THEORY (IC-304)

Unit-I: Coordinate systems and transformation: Cartesian coordinates, circular cylindrical coordinates, spherical coordinates Vector calculus: Differential length, area and volume, line surface and volume integrals, del operator, gradient of a scalar, divergence of a vector and divergence theorem, curl of a vector and Stokes's theorem, Laplacian of a scalar.

Unit-II: Electrostatics: Electrostatic fields, Coulombs law and field intensity, Electric field due to charge distribution, Electric flux density, Gausses' Law – Maxwell's equation, Electric dipole and flux lines, energy density in electrostatic fields. Electric field in material space: Properties of materials, convection and conduction currents, conductors, polarization in dielectrics, dielectric constants, continuity equation and relaxation time, boundary condition. Electrostatic boundary value problems: Poisson's and Laplace's equations, general procedures for soling Poisson's or Laplace's equations, resistance and capacitance, method of images.

Unit-III: Magneto statics: Magneto-static fields, Biot-Savart's Law, Ampere's circuit law, Maxwell's equation, application of ampere's law, magnetic flux density- Maxwell's equation, Maxwell's equation for static fields, magnetic scalar and vector potential. Magnetic forces, materials and devices: Forces due to magnetic field, magnetic torque and moment, a magnetic dipole, magnetization in materials, magnetic boundary conditions, inductors and inductances, magnetic energy.

Unit-IV: Waves and applications: Maxwell's equation, Faraday's Law, transformer and motional electromotive forces, displacement current, Maxwell's equation in final form. Electromagnetic wave propagation: Wave propagation in lossy dielectrics, plane waves in lossless dielectrics, plane wave in free space, plain waves in good conductors, power and the pointing vector, reflection of a plain wave in a normal incidence.

Unit-V: Transmission lines: Transmission line parameters, Transmission line equations, input impedance, standing wave ratio and power, The Smith chart, Some applications of transmission lines.

Text Book:

1. M. N. O. Sadiku, "Elements of Electromagnetic", 4th Ed, Oxford University Press.

Reference Books:

1. W. H. Hayt and J. A. Buck, "Electromagnetic field theory", 7th Ed., TMH.

FUNDAMENTAL OF NETWORK ANALYSIS & SYNTHESIS (IC-305)

Unit-I: Signal analysis, complex frequency, network analysis, network synthesis General characteristics and descriptions of signals, step function and associated wave forms, The unit impulse Introduction to network analysis, network elements, initial and final conditions, step and impulse response, solution of network equations,

Unit-II: Review of Laplace transforms, poles and zeroes, initial and final value theorems, the transform circuit, Thevenin's and Norton's theorems, the system function, step and impulse responses, the convolution integral. Amplitude and phase responses. Network functions, relation between port parameters, transfer functions using two port parameters, interconnection of two ports.

Unit-III: Hurwitz polynomials, positive real functions. Properties of real immittance functions, synthesis of LC driving point immittances, properties of RC driving point impedances, synthesis of RC impedances or RL admittances, properties of RL impedances and RC admittances.

Unit-IV: Properties of transfer functions, zeroes of transmission, synthesis of Y21 and Z21 with 1 terminations.

Unit-V: Introduction to active network synthesis

Reference Book:

1. M. E. Van Valkenberg, "Network Analysis", 2nd Edition, Prentice Hall of India Ltd.

LABORATORY

ELECTRONICS ENGINEERING LAB I (IC-351)

Objective: To attain expertise in lab equipment handling and understanding the basic devices, their Properties, characteristics in detail. Along with their practical usage in the circuit.

1. Study of lab equipments and components: CRO, Multi meter, Function Generator, Power supply-Active, Passive Components & Bread Board.

2. P-N Junction Diode: Characteristics of PN Junction diode-Static and dynamic resistance measurement from graph.

3. Applications of PN junction diode: Half & Full wave rectifier- Measurement of Vrms, Vdc, and Ripple factor-use of filter- ripple reduction (RC Filter)-Clipper & Clamper.

4. Properties of junctions Zener diode characteristics. Heavy doping alters the reverse characteristics. Graphical measurement of forward and reverse resistance.

5. Application of Zener diode: Zener diode as voltage regulator. Measurement of percentage regulation By varying load resistor.

6. Characteristic of BJT: BJT in CB and CE configuration- Graphical measurement of h parameters from input and output characteristics. Measurement of Av, AI, Ro and Ri of CE amplifier with potential

divider biasing.

7. Characteristic of FET: FET in common source configuration. Graphical measurement of its parameters gm, rd & m from input and output characteristics.

8. Characteristic of silicon-controlled rectifier.

9. To plot V-I Characteristics of DIAC.

10. To draw V-I characteristics of TRIAC for different values of Gate Currents.

DIGITAL ELECTRONICS LAB (IC-352)

Objective: To understand the digital logic and create various systems by using these logics.

1. Introduction to digital electronics lab- nomenclature of digital ICs, specifications, study of the data sheet, concept of Vcc and ground, verification of the truth tables of logic gates using TTL ICs.

2. Implementation of the given Boolean function using logic gates in both SOP and POS forms.

3. Verification of state tables of RS, JK, T and D flip-flops using NAND & NOR gates.

4. Implementation and verification of Decoder/De-multiplexer and Encoder using logic gates.

5. Implementation of 4x1 multiplexer using logic gates.

6. Implementation of 4-bit parallel adder using 7483 IC.

7. Design, and verify the 4-bit synchronous counter.

8. Design, and verify the 4-bit asynchronous counter.

9. Mini Project.

ELECTRONIC WORKSHOP & PCB LAB (IC-353)

Objective: To create interest in Hardware Technology.

1. Winding shop: Step down transformer winding of less than 5VA.

2. Soldering shop: Fabrication of DC regulated power supply

3. PCB Lab: (a) Artwork & printing of a simple PCB.

(b) Etching & drilling of PCB.

4. Wiring & fitting shop: Fitting of power supply along with a meter in cabinet.

5. Testing of regulated power supply fabricated..

Fabricate and test the audio amplifier circuit by using above power supply

Syllabus IV semester:

THEORY SUBJECTS

ELECTRONICS CIRCUIT (IC-401)

Unit-I: Operational Amplifier: Inverting and non-inverting configurations, difference amplifier, Effect of finite open loop gain and bandwidth on circuit performance, Large signal operation of op-amp.

Unit-II: MOSFET: Review of device structure operation and V-I characteristics. Circuits at DC, MOSFET as Amplifier and switch, Biasing in MOS amplifier circuits, small-signal operation and models, single stage MOS amplifier, MOSFET internal capacitances and high frequency model, frequency response of CS amplifier

Unit-III: BJT: Review of device structure operation and V-I characteristics, BJT circuits at DC, BJT as amplifier and switch, biasing in BJT amplifier circuit, small-signal operation and models, single stage BJT amplifier, BJT internal capacitances and high frequency model, frequency response of CE amplifier.

Unit-IV: Differential Amplifier: MOS differential pair, small signal operation of the MOS differential pair, BJT differential pair, other non-ideal characteristic of the Differential amplifier (DA), DA with active load.

Unit-V: Feedback: The general feed back structure, properties of negative feed back, the four basic feed back topologies, the series-shunt feedback amplifier, the series-series feedback amplifier, the shunt-shunt and shunt series feedback amplifier. Oscillators: Basic principles of sinusoidal oscillators, op-amp RC oscillator circuits, LC oscillator.

Text Book:

1 A. S. Sedra and K. C. Smith, "Microelectronic Circuits", Oxford University Press, 5th Ed.

ELECTRONIC INSTRUMENTATION AND MEASUREMENTS (IC-402)

Unit-I: Unit, dimensions and standards: Scientific notations and metric prefixes. SI electrical units, SI temperature scales, Other unit systems, dimension and standards. **Measurement** Errors: Gross error, systematic error, absolute error and relative error, accuracy, precision, resolution and significant figures, Measurement error combination, basics of statistical analysis. PMMC instrument, galvanometer, DC ammeter, DC voltmeter, series ohm meter,

Unit-II: Transistor voltmeter circuits, AC electronic voltmeter, current measurement with electronic instruments, multi meter probes Digital voltmeter systems, digital multi meters, digital frequency meter system.

Unit-III: Voltmeter and ammeter methods, Wheatstone bridge, low resistance measurements, low resistance measuring instruments AC bridge theory, capacitance bridges, Inductance bridges, Q meter

Unit-IV: CRO: CRT, wave form display, time base, dual trace oscilloscope, measurement of voltage, frequency and phase by CRO, Oscilloscope probes, Oscilloscope specifications and performance.

Delay time based Oscilloscopes, Sampling Oscilloscope, DSO, DSO applications

Unit-V: Instrument calibration: Comparison method, digital multi meters as standard instrument, calibration instrument Recorders: X-Y recorders, plotters.

Text Book:

1.David A. Bell, “Electronic Instrumentation and Measurements”, 2nd Ed., PHI , New Delhi 2008.

Reference Books:

1. Oliver and Cage, “Electronic Measurements and Instrumentation”, TMH, 2009.

2. Alan S. Morris, “Measurement and Instrumentation Principles”, Elsevier (Buterworth Heinmann), 2008.

SIGNALS AND SYSTEMS (IC-403)

Unit-I: Signals: Definition, types of signals and their representations: continuous-time/discrete-time, periodic/non-periodic, even/odd, energy/power, deterministic/ random, one dimensional/multidimensional; commonly used signals (in continuous-time as well as in discrete-time): unit impulse, unit step, unit ramp (and their interrelationships), exponential, rectangular pulse, sinusoidal; operations on continuous-time and discrete-time signals (including transformations of independent variables).

Unit-II: Laplace-Transform (LT) and Z-transform (ZT): (i) One-sided LT of some common signals, important theorems and properties of LT, inverse LT, solutions of differential equations using LT, Bilateral LT, Regions of convergence (ROC) (ii) One sided and Bilateral Z-transforms, ZT of some common signals, ROC, Properties and theorems, solution of difference equations using one-sided ZT, s-to z-plane mapping

Unit-III: Fourier Transforms (FT):(i) Definition, conditions of existence of FT, properties, magnitude and phase spectra, Some important FT theorems, Parseval's theorem, Inverse FT, relation between LT and FT (ii) Discrete time Fourier transform (DTFT), inverse DTFT, convergence, properties and theorems, Comparison between continuous time FT and DTFT

Unit-IV: Systems: Classification, linearity, time-invariance and causality, impulse response, characterization of linear time-invariant (LTI) systems, unit sample response, convolution summation, step response of discrete time systems, stability. convolution integral, co-relations, signal energy and energy spectral density, signal power and power spectral density, properties of power spectral density,

Unit-V: Time and frequency domain analysis of systems: Analysis of first order and second order systems, continuous-time (CT) system analysis using LT, system functions of CT systems, poles and zeros, block diagram representations; discrete-time system functions, block diagram representation, illustration of the concepts of system bandwidth and rise time through the analysis of a first order CT low pass filter.

Text Book:

1. P. Ramakrishna Rao, `Signal and Systems' 2008 Ed., Tata McGraw Hill, New Delhi

Reference Books:

1. Chi-Tsong Chen, `Signals and Systems', 3rd Edition, Oxford University Press, 2004

2. V. Oppenheim, A.S. Willsky and S. Hamid Nawab, 'signals & System',PEARSON Education, Second Edition, 2003.

TRANSDUCERS AND SENSORS (IC-404)

Unit-I: Generalized configurations, functional description & performance characteristics of measuring instruments: Functional elements of an instrument; active & passive transducers; analog & digital modes of operation; null & deflection methods; I/O configuration of measuring instruments & instrument system – methods of correction for interfering & modifying inputs. Generalized performance characteristics of Instruments: Static characteristics and static calibration- Meaning of static calibration, measured value versus true value, Some basic statistics least square calibration curves, calibration accuracy versus installed accuracy, Combination of component errors in overall system accuracy calculations, static sensitivity, linearity, threshold, noise floor, resolution, hysteresis and dead space. Scale readability. Span, generalized static stiffness & input impedance.

Unit-II: Motion and Dimensional measurement: Fundamental standards, relative displacements-translational and rotational, Calibration, Resistive potentiometers, differential transformers, variable inductance & variable reluctance pickups, capacitance pickup, Piezo-electric transducers, digital displacement transducers, Relative velocity Translational and rotational, calibration, velocity by electrical differentiation of displacement voltage signals, average velocity from measure x and t, mechanical fly ball angular velocity sensor, mechanical revolution counters and timers, tachometer encoder methods, stroboscopic method, translational velocity transducer, eddy current Drag-cup tac ometer, Gyroscopic angular displacement and velocity sensors.

Unit-III: Force, Torque, Shaft power and Pressure measurement: Standards & calibration; basic methods of force measurement; characteristics of elastic force transducer-Bonded strain gauge, differential transformer, Piezo electric transducer, variable reluctance/FM-oscillator, digital systems. Loading effects; Torque measurement on rotating shafts, shaft power measurement (dynamometers).Basic methods of pressure measurement; dead weight gauges & manometer, manometer dynamics; elastic transducers; high pressure measurement; low pressure (vacuum) measurement – McLeod gage, Knudsen gage, momentum transfer (viscosity) gages, thermal conductivity gages, ionization gages, dual gage technique.

Unit-IV: Flow measurement: Local flow velocity, magnitude and direction. Flow visualization. Velocity magnitude from pitot static tube. Velocity direction from yaw tube, pivoted vane, servoed sphere, dynamic wind vector indicator. Hot wire and hot film anemometer. Hot-film shock-tube velocity sensor. Laser Doppler anemo-meter; gross volume flow rate: calibration and standards. Constant-area, variable-pressure-drop meters (obstruction meters). Averaging pitot tubes. Constant pressure drop, variable area meters (Rota meters), turbine meters, positive displacement meters. Metering pumps. Electromagnetic flow meters. Drag force flow meters. Ultrasonic flow meters, vortex shedding flow meters.

Unit-V: Temperature measurement: Standards & calibration; thermal expansion methods- bimetallic thermometers, liquid-in-glass thermometers, pressure thermometers; thermoelectric sensor (thermocouple) – common thermocouple, reference junction considerations, special materials, configuration & techniques; electrical resistance sensors – conductive sensor (resistance thermometers), bulk semiconductor sensors thermistors), bulk semiconductor sensors (thermistors); junction semiconductor sensors; digital thermometers. Radiation Methods – radiation fundamentals, radiation detectors: thermal and photon, automatic null-balance radiation thermometers, monochromatic brightness radiation thermometers, two color radiation thermometers, black body tipped fiber optic radiation thermometer, fluoroptic temperature measurement, infrared imaging systems.

Text Books:

1. E. DOEBELIN and D. N. Manik, “Measurement systems application and design”, 5th Ed.,TMH, 2007, New Delhi

SCIENCE BASED OPEN ELECTIVES

INTRODUCTION TO SOFT COMPUTING (OE-040)

(Neural Networks, Fuzzy Logic and Genetic Algorithm)

Unit-I :Neural Networks-1(Introduction & Architecture) Neuron, Nerve structure and synapse, Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, recurrent networks. Various learning techniques; perception and convergence rule, Auto-associative and hetro-associative memory.

Unit-II :Neural Networks-II (Back propagation networks) Architecture: perceptron model, solution, single layer artificial neural network, multilayer perception model; back propagation learning methods, effect of learning rule co-efficient ;back propagation algorithm, factors affecting back propagation training ,applications.

Unit-III: Fuzzy Logic-I (Introduction) Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory and operations, Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion.

Unit-IV: Fuzzy Logic –II (Fuzzy Membership, Rules) Membership functions, interference in fuzzy logic, fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzy fications & Defuzzi ficataions, Fuzzy Controller, Industrial applications.

Unit-V :Genetic Algorithm(GA) Basic concepts, working principle, procedures of GA, flow chart of GA, Genetic representations, (encoding) Initialization and selection, Genetic operators, Mutation, Generational Cycle, applications.

Text Books:

1. S. Rajsekaran & G.A. Vijayalakshmi Pai, “Neural Networks,Fuzzy Logic and Genetic Algorithm: Synthesis and Applications” Prentice Hall of India.

2. N.P.Padhy,”Artificial Intelligence and Intelligent Systems” Oxford University Press.

Reference Books:

1. Siman Haykin,”Neural Netowrks”Prentice Hall of India

2. Timothy J. Ross, “Fuzzy Logic with Engineering Applications” Wiley India.

3. Kumar Satish, “Neural Networks” Tata Mc Graw Hill

NANO SCIENCES (OE-041)

UNIT -1: Introduction: Difinition of Nano-Science and Nano Technology, Applications of Nano-Technology. Introduction to Physics of Solid State: Structure: Size dependence of properties; crystal structures, face centered cubic nanoparticles; Tetrehedrally bounded semiconductor structures; lattice vibrations. Energy Bands: Insulators, semiconductor and conductors; Reciprocal space; Energy bands and gaps of semiconductors; effective masses; Fermi Surfaces. Localized Particles: Acceptors and deep taps; mobility; Excitons.

UNIT-2: Quantum Theory For Nano Science: Time dependent and time independent Schrodinger wave equations. Particle in a box, Potential step: Refelection and tunneling (Quantum leak). Penetration of Barrier, Potential box(Trapped particle in 3D:Nanodot), Electron trapped in 2D plane (Nano sheet), Quantum confinement effect in nano materials. Quantum Wells, Wires and Dots Preparation of Quantum Nanostructure; Size and Dimensionality effect, Fermi gas; Potential wells; Partial confinement; Excitons; Single electron Tunneling, Infrared electors; Quantum dot laser Super conductivity. Properties of Individual Nano particles Metal Nano clusters: Magic Numbers; Theoretical Modelling of Nano particles; geometric structure; electronic structure; Reactivity; Fluctuations Magnetic Clusters; Bulle to Nano structure. Semi conducting Nano particles: Optical Properties; Photo fragmentation; Columbic explosion. Rare Gas & Molecular Clusters: Inert gas clusters; Super fluid clusters molecular clusters.

UNIT-3: Growth Techniques of Nano materials: Lithographic and Non lithographic techniques, Sputtering and film deposition in glow discharge, DC sputtering technique (p-CuAlO2 deposition). Thermal evaporation technique, E-beam evaporation, Chemical Vapour deposition(CVD), Synthesis of carbon nano-fibres and multi-walled carbon nano tubes, Pulsed Laser Deposition, Molecular beam Epitoxy, Sol-Gel Technique (No chemistry required), Synthesis of nano wires/rods, Electro deposition, Chemical bath deposition, Ion beam deposition system, Vapor-Liquid –Solid (VLS) method of nano wires.

UNIT -4 :Methods of Measuring Properties: Structure: Crystallography, particle size determination, surface structure, Microscopy: Scanning Probe Microscopy (SPM), Atomic Force Microscopy (AFM), Field Ion Microscopy, Scanning Electron Microscopy, Transmission Electron Microscopy (TEM) Spectroscopy: Infra red and Raman Spectroscopy, X-ray Spectroscopy, Magnetic resonance, Optical and Vibration Spectroscopy, Luminescence.

UNIT-5: Buckeye Ball: Nano structures of carbon(fullerene): Carbon nano-tubes: Fabrication , structure. Electrical, mechanical, and vibration properties and applications. Nano diamond, Boron Nitride Nano-tubes, single elecron transistors, Moelcular machine, Nano-Biometrics, Nano Robots.

Text Books /Reference Books:

1. C.P.Poole Jr F.J. Owens, “Introduction to Nanotechnology”.
2. “Introduction to S.S. Physics” - (7th Edn.) Wiley 1996.
3. S. Sugano & H. Koizuoni, “Microcluster Physics” –Springor 1998

4. “Handbook of Nano structured Materials & Nanotechnology” vol.-5. Academic Press 2000

5. A.K.Bandyopadhyay, “Nano Materials” New Age International.

LASER SYSTEMS AND APPLICATIONS (OE-042)

UNIT-I & II: Introduction: Review of elementary quantum physics, Schrodinger equation, concept of coherence, absorption, spontaneous emission and stimulated emission processes, relation between Einstein’s A and B coefficients, population inversion, pumping, gain, optical cavities.

UNIT-III & IV: Lasers & Laser Systems: Main components of Laser, principle of Laser action, introduction to general lasers and their types. Three & four level Lasers, CW & Pulsed Lasers, atomic, ionic, molecular, exciter, liquid and solid state Lasers and systems, short pulse generation and Measurement.

UNIT-V: Applications: Laser applications in medicine and surgery, materials processing, optical communication, metrology and LIDAR and holography. 7

Text/ Reference Books:

1. K.R. Nambiar, “Laser Principles, Types and Application” New Age International.

2. S. A. Ahmad, “Laser concepts and Applications” New Age International.

SPACE SCIENCES (OE-043)

UNIT –I: Introduction: Introduction to space science and applications, historical development

UNIT –II: Solar System: Nebular theory of formation of our Solar System. Solar wind and nuclear reaction as the source of energy. Sun and Planets: Brief description about shape size, period of rotation about axis and period of revolution, distance of planets from sun, Bode’s law, Kepler’s Laws of planetary motion, Newton’s deductions from Kepler’s Laws, Newton’s Law of gravitation, correction of Kepler’s third law, determination of mass of earth, determination of mass of planets with respect to earth. Brief description of Asteroids, Satellites and Comets.

UNIT –III: Stars: Stellar spectra and structure, stellar evolution, nucleo-synthesis and formation of Elements. Classification of stars: Harvard classification system, Hertzsprung-Russel diagram, Luminosity of star, variable stars; composite stars (white dwarfs, Neutron stars, black hole, star clusters, supernova and binary stars); Chandrasekhar limit.

UNIT –IV: Galaxies: Galaxies and their evolution and origin, active galaxies and quasars.

UNIT –V: Creation of Universe: Early history of the universe, Big-Bang and Hubble expansion model of the universe, cosmic microwave background radiation, dark matter and dark energy.

Text Books / Reference Books:

1. K. S. Krishnaswami, “Astrophysics: A modern Perspective” New Age International.

2. K. S. Krishnaswami, “Understanding cosmic Panorama” New Age International.

POLYMER SCIENCE AND TECHNOLOGY (OE-044)

UNIT –I & II: POLYMERS: Introduction, chemistry of polymer synthesis, polymer reaction kinetics, physical properties and characterization of polymers, effect of structure on properties of polymers, organic polymers. Introduction to high performance polymers and composites and their processing.

UNIT –III & IV: POLYMERIZATION: Introduction, step-growth polymerization, free radical chain growth polymerization, emulsion polymerization, ionic and cationic polymerization, chain statistics and rubber elasticity.

UNIT –V & VI: PREPARATION AND APPLICATIONS: Preparation, properties and technical applications of thermo-plastics (PVC, PVA), thermostats (PF, UF) and elastomers (SBR, GR-N), silicones. Application of polymers in space, ocean, electronics, medical, agriculture, automobile, sports and building construction.

NUCLEAR SCIENCE (OE-045)

UNIT-I: Nucleus and Its Basic Features: Nuclear structure; nuclear forces and their properties, nuclear stability, nuclear radius and its measurement, nuclear spin, nuclear magnetic and electrical moments.

UNIT-II: Nuclear Models: Single particle model, liquid drop model and semi-empirical mass formula, nuclear potential and shell model, collective model.

UNIT-III: Nuclear Reaction: Nuclear reaction and laws of conservation, types of nuclear reaction, mechanism of nuclear reaction, nuclear fission & binuclear fusion and their explanation by liquid drop model.

UNIT-IV: Nuclear Decay: Decay constant, half life period and mean life, alpha decay, beta decay, gamma decay, interaction of nuclear radiation with matter.
Nuclear Instruments-I Mass spectrograph,: General principle, Aston’s Mass Spectrograph.

UNIT-V: Nuclear Instruments-II Accelerators: Van de Graph Generator, Cyclotron, And Synchrotron. Detectors: G M Counter, Scintillation counter, cloud chamber, Bubble Chamber, production and detection of neutrons and Gamma-photon. Application of Nuclear Techniques: Nuclear magnetic resonance, positron emission topography, radiotracer techniques and applications in material science and agriculture.

Text Books:

1. Tayal, “Nuclear Physics” Himalaya Publishing House.
2. S.N. Ghosal, “Nuclear Physics” S. Chand & Co.
3. S. B. Patel, “Nuclear Physics: An Introduction New Age International.
4. H. B. Lal, “Introductory Nuclear Physics” United Book Depot.
5. Wang, “Introductory Nuclear Physics”, PHI Learning

Reference Books:

1. Roy & Nigam, “Nuclear Physics” John Wiley & sons.
2. W.E. Burcham, “Nuclear Physics” Longmans Publications.
3. Green, “Nuclear Physics” McGraw Hill.

MATERIAL SCIENCE (OE-046)

UNIT-I: Introduction: Historical perspective, importance of materials, Brief review of modern & atomic concepts in Physics and Chemistry. Atomic models, Periodic table, Chemical bonding. Crystallography and imperfections: Concept of unit cell, space lattice, Brava’s lattices, common crystal structures, Atomic packing factor and density. Miller indices. X-ray crystallography techniques, imperfections, Defects & Dislocations in solids.

UNIT-II: Mechanical Properties and Testing: Stress strain diagram, Ductile and brittle materials, stress Vs strength, toughness, hardness, fracture, fatigue and creep. Testing, such as Strength testing, Hardness testing, Impact testing, Fatigue testing Creep testing, Non-destructive testing (NDT) Micro Structural Exam: Microscope principle and methods, Preparation of samples and microstructure exam and grain size determination, comparative study of microstructure of various metals and alloys, such as Mild steel, CI, Brass. Phase Diagram and Equilibrium Diagram: Unitary and Binary diagrams, Phase rules, Types of equilibrium diagrams: solid solution type, eutectic type and combination type, Iron-carbon equilibrium diagram.

UNIT-III: Ferrous materials: Iron and steel manufacture, furnaces, various types of carbon steels, alloy steels and cast irons, its properties and uses. Heat Treatment: various types of heat treatment, such as Annealing, Normalizing, Quenching, Tempering and Case hardening. Time Temperature Transformation (TTT)diagrams. Non-Ferrous metals and alloys: Non-ferrous metals, such as Cu, Al, Zn, Cr, Ni etc. and its applications. Various types of Brass, Bronze bearing materials their properties and uses. Aluminum alloys, such as Duralumin, Other advanced materials/alloys.

UNIT-IV: Magnetic properties: Concept of magnetism- Dia, para, ferro magnetic materials, Hysteresis, Soft and hard magnetic materials, Magnetic Storages. Electric Properties: Energy band, concept of conductor, insulator and semi conductor. Intrinsic and extrinsic semi-conductors, P-n junction and transistors, Basic devices and their applications. Diffusion of Solid. Super conductivity and its applications, Messier effect. Type I & II superconductors. High Temp. Super conductors.

UNIT-V: Ceramics: Structure, types, properties and applications of ceramics. Mechanical/Electrical behaviour and processing of ceramics. Plastics: Various types of polymers/plastics and their applications. Mechanical behaviour and processing of plastics, Future of plastics.
Other Materials: Brief description of other materials, such as optical and thermal materials, concrete, composite materials and their uses. Other Materials: Brief description of other materials, such as optical and thermal materials, concrete, composite materials and their uses. Performance of materials in service: Brief theoretical consideration of fracture, fatigue, and corrosion and its control.

Text / Reference Books:

1. W.D. Callisster Jr. “Material Science & Engineering Addition” - Wesly Publishing Co.
2. Van Vlash, “Elements of Material Science & Engineering”, John Wiley & Sons
3. V. Raghvan, “Material Science”, Prentice Hall of India
4. Narula, “Material Science”, Tata Mc.Graw Hill
5. Srivastava, Srinivasan, “Science of Materials Engineering” New Age International.

DISCRETE MATHEMATICS (OE-047)

UNIT-I: Set Theory: Definition of Sets, Venn Diagrams, complements, cartesian products, power sets, counting principle, cardinality and count ability (Countable and Uncountable sets), proofs of some general identities on sets, pigeonhole principle. Relation: Definition, types of relation, composition of relations, domain and range of a relation, pictorial representation of relation, properties of relation, partial ordering relation. Function: Definition and types of function, composition of functions, recursively defined functions.

UNIT-II: Propositional logic: Proposition logic, basic logic, logical connectives, truth tables, tautologies, contradiction, normal forms(conjunctive and disjunctive), modus ponens and modus tollens, validity, predicate logic, universal and existential quantification. Notion of proof: proof by implication, converse, inverse, contra positive, negation, and contradiction, direct proof, proof by using truth table, proof by counter example.

UNIT-III: Combinatory: Mathematical induction, recursive mathematical definitions, basics of counting, permutations, combinations, inclusion-exclusion, recurrence relations (nth order recurrence relation with constant coefficients, Homogeneous recurrence relations, Inhomogeneous recurrence relation), generating function (closed form expression, properties of G.F., solution of recurrence relation using G.F, solution of combinatorial problem using G.F.)

Unit-IV :Algebraic Structure: Binary composition and its properties definition of algebraic structure; Groyas Semi group, Monoid Groups, Abelian Group, properties of groups, Permutation Groups, Sub Group, Cyclic Group, Rings and Fields (definition and standard results).

UNIT-V: Graphs: Graph terminology, types of graph connected graphs, components of graph, Euler graph, Hamiltonian path and circuits, Graph coloring, Chromatic number. Tree: Definition, types of tree (rooted, binary), properties of trees, binary search tree, tree traversing (preorder, in order, post order). Finite Automata: Basic concepts of Automation theory, Deterministic finite Automation (DFA), transition function, transition table, Non Deterministic Finite Automata (NDFA), Mealy and Moore Machine, Minimization of finite Automation.

Text/Reference Books:

1. Kenneth H. Rosen, “Discrete Mathematics and its Applications”, Mc.Graw Hill, 2002.
2. J.P.Tremblay & R. Manohar, “Discrete Mathematical Structure with Applications to Computer Science” Mc.Graw Hill, 1975.
3. V. Krishnamurthy, “Combinatories:Theory and Applications”, East-West Press.
4. Seymour Lipschutz, M.Lipson, “Discrete Mathemataics” Tata Mc Graw Hill, 2005.
5. Kolman, Busby Ross, “Discrete Matheamatical Structures”, Prentice Hall International.

LABOROTARY

ELECTRONICS ENGINEERING LAB II (IC-451)

Objective -To design and implement the circuits to gain knowledge on performance of the circuit and its Application.

1. Measurement of Operational Amplifier Parameters-Common Mode Gain, Differential Mode Gain, CMRR, Slew Rate.

2. Applications of Op-amp- Op-amp as summing amplifier, Difference amplifier, Integrator and differentiator

3. Field Effect Transistors- Single stage Common source FET amplifier –plot of gain in dB Vs Frequency, measurement of, bandwidth, input impedance, maximum signal handling capacity (MSHC) of an amplifier

4. Bipolar Transistors- Design of single stage RC coupled amplifier –design of DC biasing circuit using potential divider arrangement –Plot of frequency Vs gain in dB. Measurement of bandwidth of an Amplifier, input impedance and Maximum Signal Handling Capacity of an amplifier.

5. Two stage Amplifier. Plot of frequency Vs gain. Estimation of Q factor, bandwidth of an amplifier

6. Common Collector Configuration-Emitter Follower (using Darlington pair)-Gain and input impedance measurement of the circuit.

7. Power Amplifiers-Push pull amplifier in class B mode of operation –measurement of gain.

8. Differential Amplifier –Implementation of transistor differential amplifier .Non ideal characteristics of differential amplifier

9. Oscillators -Sinusoidal Oscillators- (a) Wein-bridge oscillator (b) phase shift oscillator

10. Simulation of Amplifier circuits studied in the lab using any available simulation software and Measurement of bandwidth and other parameters with the help of simulation software.

TRANSDUCER LAB (IC-452)

1. Characteristics of resistance transducer

(i.) Potentiometer

(ii.) Strain Gauge/ Measurement of Strain using quarter, half and full bridge.

2. Characteristics of LVDT.

3. Characteristics of capacitance transducer:

(i) Variable area

(ii) Variable distance.

4. Characteristics of Thermistors

5. Characteristics of RTD.

6. Thermocouples and AD590.

7. Characteristics of LDR, Photo Diode, and Phototransistor:

(i) Variable Illumination.

(ii) Linear Displacement.

8. Measurement of resistance by Wheatstone bridge and measurement of bridge sensitivity.

9. Measurement of Capacitance by de'Sautys and Schering Bridge.

10. Measure of low resistance by Kelvin's double bridge.

11. Characteristics of diaphragm type pressure transducer.

12. Characteristics of one Solid State sensor/ Fiber optic sensor

MEASUREMENT LAB (IC-453)

1. Study of semiconductor diode voltmeter and its us as DC average responding AC voltmeter.

2. Study of L.C.R. Bridge and determination of the value of the given components.

3. Study of distortion factor meter and determination of the % distortion of the given oscillator.

4. Study of the transistor tester and determination of the parameters of the given transistors.

5. Study of the following transducer (i) PT-100 trans (ii) J- type trans. (iii) K-type trans (iv) Presser trans

6. Measurement of phase difference and frequency using CRO (lissajous figure)

7. Measurement of low resistance Kelvin's double bridge.

8. Radio Receiver

Syllabus V semester:

THEORY SUBJECTS

FLUID MECHANICS (IC-501)

UNIT-I: Introduction: Fluids and continuum: Physical properties of fluids, ideal and rear fluids, Newtonian and non-Newtonian fluids, measurement of surface tension. Kinematics of Fluid Flow: Steady and unsteady, uniform and non-uniform, laminar and turbulent flows, one, two and three dimensional flows, streamlines, streak lines and path lines, continuity equation, rotation and circulation, elementary explanation of stream function and velocity potential, graphical and experimental methods of drawing flow nets. Fluid statics: Pressure-density-height relationship, manometers, pressure on plane and curved surfaces, centre of pressure, buoyancy, stability of immersed and floating bodies.

UNIT-II:Dynamics of Fluid flow: Euler's equation of motion along a streamline and its integration, Bernoulli's equation and its applications-Pitot tube, flow through orifices, mouthpieces, nozzles, notches, free and forced vortex, momentum equation and its application to stationary and moving vanes, pipe bends, Problems related to combined application of energy and momentum equations, flow measurements.

UNIT-III: Dimensional Analysis and Hydraulic Similitude: Dimensional analysis, Buckingham's theorem, important dimensionless numbers and their significance, geometric, Kinematic and dynamic similarity, model studies. Laminar and Turbulent Flow: Equation of motion for laminar flow through pipes, Stoke's law, flow between parallel plates, flow through porous media, fluidization, measurement of viscosity, transition from laminar to turbulent flow, turbulent flow, equation for turbulent flow, eddy viscosity, mixing length concept and velocity distribution in turbulent flow, Hot-wire anemometer and LDA.

UNIT-IV: Boundary Layer Analysis: Boundary layer thickness, boundary layer over a flat plate, laminar boundary layer, application of momentum equation, turbulent boundary layer, laminar sub-layer, smooth and rough boundaries, atmospheric, boundary layer, local and average friction coefficient, separation and its control measurement of shear.

UNIT-V: Pipe Flow: Nature of turbulent flow in pipes, equation for velocity distribution over smooth and rough surfaces, resistance coefficient and its variation, flow in sudden expansion, contraction, diffusers, bends, valves and siphons, concept of equivalent length, branched pipes, pipes in series and parallel, simple networks. Flow past Submerged Bodies: Drag and lift, drag on a sphere, cylinder and disc, lift magnus effect and circulation. Compressibility Effects in pipe flow: Transmission of pressure waves in rigid and elastic pipes, water hammer, and analysis of simple surge tank excluding friction.

Text & Reference Book:

1. Som and Biswas, “Introduction to fluid mechanics and machines”, TMH
2. S. K. Agrawal, “Fluid mechanics and machinery”, TMH
3. R. J. Garde, A. G. Mirajgaoker, “Engineering fluid mechanics including hydraulic machines”,

INTEGRATED CIRCUITS (IC-502)

UNIT-I: IC Design Philosophy: IC Biasing-Current Sources, Current Mirrors and Current Steering Circuits, The Cascode Amplifier, Current Mirror Circuits with Improved Performance, The 741 Op-Amp Circuit, DC Analysis of the 741, Small Signal Analysis of the 741 ,Gain, Frequency Response and Slew Rate of the 741: Small Signal Gain, Frequency Response, A Simplified Model, Slew Rate, Relationship Between f and SR.

UNIT-II: Generation of Square and Triangular Waveforms Using Astable Multivibrator: Operation of As table Multi-vibrator, Generation of Triangular Waveforms Generation of a Standardized Pulse - The Monostable Multi vibrator. Integrated Circuit Timer: The 555 Circuit, Implementing a Monostable Multi vibrator Using the 555 IC, An Astable Multi vibrator Using the 555 IC

UNIT-III: Data Converters-An Introduction: Digital Processing of Signals, Sampling of Analog Signals, Signal Quantization, The A/D and D/A Converters as Functional Blocks ,D/A Converter Circuits: basic Circuit Using Binary Weighted Resistors, R-2RLadders, A Practical Circuit Implementation, Current Switches, A/D Converter Circuits: the Feedback Type Converter, The Dual Slope A/D Converter, The Parallel or Flash Converter, The Charge-Redistribution Converter.

UNIT-IV: Digital Circuit Design-An Overview: Digital IC Technologies and Logic Circuit Families, Logic Circuit Characteristics, Styles for Digital System Design, Design Abstraction and Computer Aids. Designs and Performance Analysis of the CMOS Inverter: Circuit Structure, Static Operation, Dynamic Operation, Dynamic Power Dissipation. CMOS Logic Gate Circuits: Basic Structure, The Two Input NOR Gate, The Two Input NAND Gate, A Computer Gate, Obtaining the PUN from the PDN and Vice Versa, the Exclusive OR Function, Summary of the Synthesis Method, Transistor Sizing, Effects of Fan-in and Fan-out of Propagation Delay.

UNIT-V:Latches and Flip flops: The Latch, The SR Flip-flop, CMOS Implementation of SR Flip-flops, A Simpler CMOS Implementation of the Clocked SR Flip-flop, D Flip-flop Circuits, Multi-vibrator Circuits: A CMOS Monostable Circuit, An Astable Circuit, The Ring Oscillator Semiconductor Memories: Types and Architecture: Memory-Chip Organization, Memory Chip Tuning Random Access Memory (RAM) Cells: Static Memory Cell, Dynamic Memory Cell

Text Book:

1-Sedra & Smith “Micro-Electronic Circuits”, Vth Edition, Oxford University

Reference Books:

1-Donald A. Neaman, “Electronics Circuits analysis and design”,3rd Edition, TMH.
2-Jacob Milliman and Arvin Grabel,” “Microelectronics ” 2nd Edition,TMH(18)

CONTROL SYSTEM – I (IC-503)

UNIT-I: Introduction: Basic Components of a control system, Feedback and its effect, types of feed back control systems. Block diagrams and signal flow graphs, Modeling of Physical systems.

UNIT-II: State-Variable Analysis: Introduction, Vector matrix representation of State equation, State Transition Matrix, State-Transition Equation, Relationship between State Equations and High-order Differential Equations, Relationship between State Equations and Transfer Functions.

UNIT-III: Time domain Analysis of Control Systems: Time response of continuous data systems, typical test signals for the time response of control systems, the unit step response and time domain specifications, Steady-State error, Time response of a First order system, Transient response of a Prototype second order system.

UNIT-IV: Stability of Linear Control Systems: Introduction, Bounded-Input Bounded-output Stability Continuous Data Systems, Zero-input and asymptotic stability of continuous data systems, Methods of determining stability, RH criterion.

UNIT-V: Frequency Domain Analysis: Introduction: Mr ωr and Bandwidth of the Prototype Second Order System, Effects of Adding a zero to the Forward path, Effects of Adding a pole to the Forward Path, Nyquist Stability criterion, Relative Stability: Gain Margin and Phase Margin, Stability Analysis with the Bode Plot.

Text Book:

1. B.C. Kuo, “Automatic Control Systems” ,8th Edition, John Wiley

Reference Books:

1. I. J Nagrath & M Gopal, Control System Engineering; New Age International publishers

2. ,Joseph J Distefano III, Allen R Stubberud, Ivan J Williams, Control Systems Shaums out lines Series , 3rdEdition, Mc Graw Hill.(19)

INDUSTRIAL INSTRUMENTATION (IC-504)

UNIT-I: Pressure measurement: Units of pressure and vacuum, Different type of manometers, diaphragm gauges bellows and force balance type sensors, Bouden gauge, Piezoelectric, Capacitive and Inductive Pressure pickup. Vacuum pressure measurements: Mcleod gauge, Pirani gauge, thermocouple gauge, Knudsen gauge Ionization gauge.

UNIT-II: Temperature measurements: Standards and calibration, thermal expansion methods, Bimetallic thermometer, Liquid-in-gas (thermocouples) common thermocouples, Resistance thermometers: bulk semiconductor sensors. Radiation thermometers, automatic null balance radiation thermometers. Optical pyrometers.

UNIT-III: Differential pressure flow meters: Bernoulli's theorem: pitot tube orifice, venturi, flow nozzle, Hot wire and hot film anemometers, constant pressure drop, variable area meters (rotameter), turbine meters, Electromagnetic flow meters, Ultrasonic flow meters, Measurement of level, Float type gauge, purge method, differential pressure method, conductive and capacitive method; electromechanical method, use of radioscope for level measurement.

UNIT-IV: Measurement of weight- Load cell method, strain gauge, LVDT; piezoelectric, pneumatic and hydraulic load cell, null balance method. Conveyor belt weighting for on line measurement of viscosity, definition of absolute and kinematic viscosity, industrial viscosity meter.

UNIT-V: Measurement of Moisture: Thermal Dying Method, Distillation Method, Chemical Reaction Method, Electrical Method.

Text & Reference Book:

1. Doeblin/Measurements systems: Applications and Design, 4th ed. / Mc.Graw Hill.
2. Beckwith & Beck/Mechanical Measurements/Narosa Publishers, 1988.
3. Eckman/Industrial Instrumentation/Wiley Eastern Ltd.
4. Nakra/Instrumentation: Measurements & Analysis/Tata Mc. Graw Hill(20)

MICROPROCESSORS (IC-505)

UNIT-I: Introduction to Microprocessor, Microprocessor architecture and its operations, Memory, Input & output devices, Logic devices for interfacing, The 8085 MPU, Example of an 8085 based computer, Memory interfacing.

UNIT-II: Basic interfacing concepts, Interfacing output displays, Interfacing input devices, Memory mapped I/O, Flow chart symbols, Data Transfer operations, Arithmetic operations, Logic Operations, Branch operation, Writing assembly language programs. Programming techniques: looping, counting and indexing.

UNIT-III: Additional data transfer and 16 bit arithmetic instruction, Arithmetic operations related to memory. Logic operation: rotate, compare, counter and time delays. Illustrative program: Hexadecimal counter, zero-to-nine, (module ten) counter, generating pulse waveforms, debugging counter and time delay, Stack ,Subroutine, Restart, Conditional call and return instructions, Advance subroutine concepts, The 8085 Interrupts, 8085 vector interrupts.

UNIT-IV: Program: BCD-to-Binary conversion, Binary-to-BCD conversion, BCD-to-Seven segment code converter, Binary-to-ASCII and ASCII-to-Binary code conversion, BCD Addition, BCD Subtraction, Introduction to Advance instructions and Application, Multiplication, Subtraction with carry.

UNIT-V :8255 Programmable peripheral interface, interfacing keyboard and seven segment display, 8254 (8253) programmable interval timer, 8259A programmable interrupt controller, Direct Memory Access and 8237 DMA controller. Introduction to 8086 microprocessor: Architecture of 8086 (Pin diagram, Functional block diagram, Register organization).

Text Book:

1. Ramesh Gaonkar, “Microprocessor Architecture, Programming, and Applications with the 8085”, 5th Edition,Penram International Publication (India) Pvt. Ltd.

2. Douglas V. Hall, “Microprocessors and Interfacing”, 2nd Edition, TMH, 2006. Reference Book:

1. Kenneth L. Short, “Microprocessors and programmed Logic”, 2nd Ed, Pearson Education Inc.

LABOROTARY

INTEGRATED CIRCUITS LAB (IC-551)

Objective: - To design and implement the circuits to gain knowledge on performance of the circuit and its application. These circuits should also be simulated on P spice.

1.Measurement of op-amp parameters(open loop gain, input offset voltage, CMRR, Slew rate)

2. Voltage comparator and zero crossing detectors.

3. Second order filters using operational amplifier for– a. Low pass filter of cutoff frequency 1 KHz.

b. High pass filter of frequency 12 KHz.

c. Band pass filter with unit gain of pass band from 1 KHz to 12 KHz.

4. Wien bridge oscillator using operational amplifier.

5. Determine capture range; lock in range and free running frequency of PLL.

6. Voltage regulator using operational amplifier to produce output of 12V with maximum load current of 50 mA.

7. A/D and D/A convertor.

8. Voltage to current and current to voltage convertors.

9. Function generator using operational amplifier (sine, triangular & square wave)

10. As table and mono stable multi vibrator using IC 555.

11.IC voltage regulators

CONTROL SYSTEM LAB -I (IC-552)

1. To study open loop response of the process.
2. Study of on-off controller.
3. Study of P control action using the software.
4. Study of PI control action using the software.
5. Study of PID control action using the software.
6. Study of the Industrial PID controller as on/off controller.
7. Study of the Industrial PID controller as P controller.
8. Study of the Industrial PID controller as PI controller.
9. Study of the Industrial PID controller as PID controller.
10. Introduction to MATLAB (Control System Toolbox), Implement at least any two experiment in MATLAB.

a. Different Toolboxes in MATLAB, Introduction to Control Systems Toolbox. b. Determine transpose, inverse values of given matrix.

c. Plot the pole-zero configuration in s-plane for the given transfer function.

d. Determine the transfer function for given closed loop system in block diagram representation. e. Plot unit step response of given transfer function and find peak overshoot, peak time.(22) f. Plot unit step response and to find rise time and delay time.

g. Plot locus of given transfer function, locate closed loop poles for different values of k.

h. Plot root locus of given transfer function and to find out S, Wd, Wn at given root & to discuss Stability.

i. Plot bode plot of given transfer function.

j. Plot bode plot of given transfer function and find gain and phase margins

k. Plot the Nyquist plot for given transfer function and to compare their relative stability

l. Plot the Nyquist plot for given transfer function and to discuss closed loop stability, gain and Phase margin.

INSTRUMENTATION LAB (IC-553)

1. Instrumentation Amplifier: Design for specific gain and verification of CMRR.
2. Study the RTD calibration.
3. Study of Storage Oscilloscope & Transient response of RLC.
4. To study & observe the characteristics of Photoconductive Cell.
5. Study of Characteristics of a Strain Gauge.
6. Construction of chopper amplifier.
7. Study of low noise and low frequency amplifier for biomedical application.
8. Study of Piezoelectric transducer.
9. Study of Capacitive and Inductive Pressure pickups.
10. To study & implement Light intensity control using PWM.

MICROPROCESSOR LAB (IC-554)

1. Write a program using 8085 Microprocessor for Decimal, Hexadecimal addition and subtraction of two Numbers.
2. Write a program using 8085 Microprocessor for addition and subtraction of two BCD numbers.
3. To perform multiplication and division of two 8 bit numbers using 8085.
4. To find the largest and smallest number in an array of data using 8085 instruction set.
5. To write a program to arrange an array of data in ascending and descending order.
6. To convert given Hexadecimal number into its equivalent ASCII number and vice versa using 8085 instruction set.
7. To write a program to initiate 8251 and to check the transmission and reception of character.
8. To interface 8253 programmable interval timer to 8085 and verify the operation of 8253 in six different modes.
9. To interface DAC with 8085 to demonstrate the generation of square, saw tooth and triangular wave.
10. Serial communication between two 8085 through RS-232 C port.

Syllabus VI Semester:

THEORY SUBJECTS

ELECTRICAL MACHINES (IC-601)

UNIT-I: Basic concept of rotating machines: Elementary machines –synchronous machines, dc machine, generated emf , rotating magnetic field, torque in round rotor machines. Operations of Basic Machine types – synchronous, asynchronous, ac machines, dc machines, matching characteristics of electric machines and load.

UNIT-II: DC Machine: Introduction, emf equation, torque equation, power balance, linear magnetization, circuit model, generating mode ,motoring mode, armature reaction, compensating winding, commutation, method of excitation, characteristics of dc shunt, series and compound motors and generators. Starting of dc motor, speed control of dc motor, breaking of dc motor.

UNIT-III :Synchronous machines: Introduction of basic synchronous machine model, circuit model of synchronous machine, determination of armature reaction ampere turn and leakage reactance of synchronous machine, synchronizing to infinite bus bar, operating characteristics ,power flow equations, parallel operation of synchronous generators ,hunting in synchronous machines.

UNIT-IV: Induction Motor: Introduction, construction, flux and mmf phasor in induction motors, slip and frequency of rotor currents, rotor emf, power, induction motor phasor diagram, torque slip characteristics, determination of equivalent circuit parameters, circle diagram, starting of induction motor, speed control.

UNIT-V: Single Phase Motors: Introduction, types of single phase motor, single phase induction motor, split phase motors, single phase commutator motor, single phase synchronous motor, stepper motor.

Text Book:

1.D P Kothari & I J Nagrath, “Electric Machines”, Tata McGraw Hill Education Pvt Ltd, 3rd Edition,2004.

Reference Book:

1. A. Fitzgerald, C. Kingsley and S Umans , “Electric Machinery”, Tata McGraw Hill Education Pvt Ltd, 6th Edition, 2002.

MICROCONTROLLER (IC-602)

UNIT-I: Introduction, Microcontrollers and Embedded processors, Overview of the 8051, Inside the 8051, Addressing modes.

UNIT-II: Introduction to 8051 assembly programming, Assembling and running an 8051 program, The program counter and ROM space in the 8051,8051 data types and directives, 8051 flag bits and the PSW register,8051 register banks and stack, 8051 I/O programming, I/O bit manipulation programming.

UNIT-III: Programming the 8051 timers, Counter programming, Basics of serial communications, 8051 connection to RS-232, 8051 serial port programming assembly, 8051 interrupts, Programming timer interrupts, programming external hardware interrupts, programming the Serial communication interrupts, Interrupts priority in the 8051.

UNIT-IV: Interfacing with 8051: Memory address decoding 8031/ 51 interfacing with external ROM, 8051 data memory space, LCD, Keyboard, Parallel and Serial ADC, DAC interfacing, Sensor interfacing and Signal Conditioning, Stepper motor and DC motor

UNIT-V: Programming the 8255 and Interfacing, Introduction to Intel 8096 andMC68HC11 microcontroller.

Text Books:

1. Mazidi Ali Muhammad, Mazidi Gillispie Janice, and McKinlay Rolin D., " The 8051 Microcontroller and Embedded Systems using Assembly and C", Pearson, 2nd Edition.
2. Chhabra Bhupendra Singh, "Microcontrollers & its Applications" Dhanpat Rai Publishing Company

Reference Books:

1. Ayala Kenneth, "The 8051 Microcontroller", Cengage Learning, 3rd Edition
2. Shah Satish, " 8051 Microcontrollers MCS 51 Family and its variants", Oxford
3. Ghoshal Subrata, " 8051 Microcontroller Internals, Instructions, Programming and Interfacing"Pearson(24)

COMMUNICATION ENGINEERING (IC-603)

UNIT-I: Introduction: The Communication Process, The Layered Approach, and Example of communication. Amplitude Modulation: Introduction, Amplitude modulation, Double Sideband-Suppressed Carrier modulation, Quadrature-Carrier Multiplexing, Single-Sideband and Vestigial-Sideband Methods of modulation, VSB Transmission of Analog and Digital Television, Frequency Translation, Frequency-Division Multiplexing

UNIT-II: Phase and Frequency Modulation: Introduction, Basic Definitions, Frequency Modulation, Phase-Locked Loop, Nonlinear Effects in FM Systems, The Super-heterodyne Receiver, Analog and Digital FM Cellular Telephone

UNIT-III: Noise in Analog Modulation: Introduction, Receiver Model, Noise in DSB-SC Receivers, Noise in AM receivers, Noise in FM Receivers, Pre-emphasis and De-emphasis in FM Digital Representation of Analog Signals: Introduction, Digitization of Analog Sources, The Sampling Process ,Pulse-Amplitude Modulation, Time-Division Multiplexing, Pulse-Position Modulation, PPM in Impulse Radio, The Quantization Process, Pulse-Code Modulation, Delta Modulation, Digitization of Video and MPEG.

UNIT-IV: Base band Transmission of digital Signals: Introduction, Baseband Pulses and matched Filter Detection, Probability of Error Due to Noise, Inter symbol Interference, Eye Pattern, Nyquist Criterion for Distortion less Transmission, Baseband M-array PAM Transmission, Tapped Delay Line Equalization, Transmission of 100 Mbps Over Twisted Pair

UNIT-V: Band-Pass Transmission of Digital Signals: Introduction, band-Pass Transmission Model, Transmission Binary PSK and FSK, M-array Data Transmission Systems, Comparison of Noise Performances of various PSK and FSK Systems, Orthogonal Frequency Division Multiplexing (OFDM). Information and Forward Error Correction: Introduction, uncertainty, Information and Entropy, Source-Coding Theorem, Lossless Data Compression

Text Book:

1. Simon Haykin & Michael Moher “Communication Systems”, 5th Edition, Wiley India Publication.

Reference Book:

1. B.P. Lathi & Zhi Ding , “ Modern Digital and Analog Communication Systems” International 4th Ed.Oxford University Press (26)

DIGITAL SIGNAL PROCESSING(IC-604)

UNIT-I: Realization of Digital Systems: Introduction, direct form realization of IIR systems, cascade realization of an IIR systems, parallel form realization of an IIR systems, Ladder structures: continued fraction expansion of H(z), example of continued fraction, realization of a ladder structure, example of a ladder realization.

UNIT-II: Design of Infinite Impulse Response Digital Filters: Introduction to Filters, Impulse Invariant Transformation, Bi-Linear Transformation, All-Pole Analog Filters: Butterworth and Chebyshev, Design of Digital Butterworth and Chebyshev Filters

UNIT-III: Finite Impulse Response Filter Design: Windowing and the Rectangular Window, Other Commonly Used Windows, Examples of Filter Designs Using Windows ,The Kaiser Window

UNIT-IV: Discrete Fourier Transforms: Definitions, Properties of the DFT, Circular Convolution, Linear Convolution.

UNIT-V: Fast Fourier Transform Algorithms: Introduction, Decimation –In T me(DIT) Algorithm, Computational Efficiency, Decimation in Frequency(DIF) Algorithm

Text Books:

1. Johnny R. Johnson, “Digital Signal Processing”, PHI Learning Pvt Ltd., 2009. Reference Books:
1. John G Prokias, Dimitris G Manolakis, “Digital Signal Processing”, Pearson Education.
2. Oppenheim & Schafer, “ Digital Signal Processing” PHI(27)

DEPARTMENTAL ELECTIVE-I

OPTO ELECTRONICS (IC-060)

UNIT-I:Introduction to Optical waveguide, Photo sources and detectors: Optical waveguide modes-Theory of Dielectric slab waveguides-Symmetric and Asymmetric slab wave guide, Channel waveguide Light emitting diode(LED), materials, constructions, Drive circuitry, Fundamentals of lasers and its applications.

UNIT-II: Electro Optic Effects: Birefringence phenomenon EO Retardation, EO Amplitude and Phase Modulator, Electro optic Intensity Modulators ,Beam deflection, Acousto-optics, A-O Modulators, Integrated optic spectrum analyzer, Non linear optics second harmonic generation, Parametric amplification.

UNIT-III: Fourier Optics and Holography: Phase transformation of thin lens ,Fourier transforming property of Lens, Image forming property of Lens, Inter ferrometry, Principles of Holography On axis and Off Axis Holography, Holographic inter ferrometry -Real time, Double exposure, Contour generation, Optical data storage, Holographic optical elements, Speckle Phenomenon and methods of Measurements, Laser Interferometer.

UNIT-IV: Optical Fiber Sensors: Multimode fiber Sensors-Displacement, pressure, stress, strain. Intensity modulated sensors, Active multimode FO sensors, Micro-bend optical fiber sensor, Current sensors, Magnetic sensors, Single mode FO sensors, Phase modulated, Polarization modulated, Fiber Optic Gyroscope.

UNIT-V: Optical Computing: Analog linear optical processing, half tone processing, non linear processing, analog arithmetic operation addition/subtraction, multiplication, division, averaging, differentiation and integration. Digital logic: modified signed digit number system, residue number system, logarithmic number system. Arithmetic operations: MSD, residue, signed logarithmic arithmetic, threshold logic, threshold devices, spatial light modulators, and theta modulation devices shadow casting and symbolic substitution.

Text Books:

1. J. Wilson, J.F.B. Hawkes, “Opto Electronics - An Introduction”, PHI, 2000.
2. M. A. Karim, “Optical Computing –An introduction”, Wiley India,
2010. Reference Book:
1. A. Yariv, P. Yeh, “Photonics”, 6th Ed., Oxford University Press, 2007.(28)

INTELLIGENT INSTRUMENTATION (IC-061)

UNIT-I: Introduction: Introduction to intelligent instrumentation, Historical Perspective, Current status, software based instruments.

UNIT-II: Virtual Instrumentation: Introduction to graphical programming, data flow & graphical programming techniques, advantage of VI techniques, VIs and sub VIs loops and charts, arrays, clusters and graphs, case and sequence structure, formula nodes, string and file I/O, Code Interface Nodes and DLL links.

UNIT-III: Data Acquisition Methods: Analog and Digital IO, Counters, Timers, Basic ADC designs, interfacing methods of DAQ hardware, software structure, use of simple and intermediate Vis. Use of Data Sockets for Networked communication and controls.

UNIT-IV: PC Hardware Review and Instrumentation Buses: Structure, timing, interrupts, DMA, operating system, ISA, PCI, USB, PCM CIA Buses. IEEE488.1 & 488.2 serial interfacing-RS 232C, RS422, RS423, RS485, USB, VXI, SCXI, PXI.

UNIT-V: Analysis Techniques: DSP software, Measurement, filters and wavelets, windows ,curve fitting probability & statistics .Communication: Basic networking methods and their applications in instrumentation ,use of Data sockets for distributed control.

Text Books:

1. G. C. Barney, “Intelligent Instrumentation”, Prentice Hall, 1995.
2. Lisa, K. Wells & Jeffery Travis, “Lab VIEW For every one”, Prentice Hall, 1997.(29)

DATA STRUCTURE(IC-062)

UNIT-I: Introduction: Basic Terminology, Elementary Data Organization, Algorithm, Efficiency of an Algorithm, Time and Space Complexity, Asymptotic notations: Big-Oh, time-Space trade-off, Abstract Data Types (ADT).Arrays: Definition, Single and Multidimensional Arrays, Representation of Arrays: Row major Order, and Column Major Order, Application of arrays, Sparse Matrices and their representations. Linked lists: Array Implementation and Dynamic Implementation of Singly Linked Lists, Doubly Linked List, Circularly Linked List, Operations on a Linked List, Insertion, Deletion, Traversal, Polynomial Representation and Addition, Generalized Linked List.

UNIT-II: Stacks: Abstract Data Type, Primitive Stack operations: Push & Pop, Array and Linked Implementation of Stack in C, Application of stack: Prefix and Postfix Expressions, Evaluation of Postfix expression, Recursion, Tower of Hanoi Problem, Simulating Recursion, Principles of recursion, Tail recursion, Removal of recursion.

Queues: Operations of Queue: Create, Add, Delete, Full and Empty, Circular queues, Array and linked implementation of queues in C, De queue and Priority Queue

UNIT-III: Trees: Basic terminology, Binary Trees, Binary Tree Representation: Array Representation and Dynamic Representation, Complete Binary Tree, Algebraic Expressions, Extended Binary Trees, Array and Linked Representation of Binary trees, Tree Traversal algorithms: In-order, Pre-order and Post-order, Threaded Binary trees, Traversing Threaded Binary trees, Huffman algorithm

UNIT-IV: Graphs: Terminology, Sequential and linked Representations, of Graphs: Adjacency Matrices, Adjacency List, Adjacency Multi list, Graph Traversal: Depth First Search and Breadth first Search, Connected Component, Spanning Trees, Minimum Cost Spanning Trees: Primes and Kurskal algorithm, Transitive Closure and Shortest Path algorithm: Warshal Algorithm and Dijikstra Algorithm, Introduction to Activity Networks.

UNIT-V: Searching: Sequential search, Binary search, Comparison and Analysis, Internal Sorting: Insertion Sort, selection, Bubble Sort, Quick Sort, Two Way Merge Sort, Heap Sort, Radix Sort, Practical consideration for Internal Sorting. Search Trees: Binary Search Trees (BST), Insertion and Deletion in BST, Complexity of search Algorithm, AVL trees, Introduction to m-way Search Trees, B Trees & B+ Trees Storage Management: Garbage Collection and Compaction.

Text Book:

1. Aaron M. Tenenbaum, Yedidyah Langsam and Moshe J. Augenstein “Data structures Using C and C++”, PHI
2. Lipschutz, “Data Structures” Schaum’s Outline Series, TMH

1. Horowitz and Sahani, “Fundamentals of Data Structures”, Galgotia Publication(30)

MICROWAVE ENGINEERING(IC-063)

UNIT-I: Rectangular Wave Guide: Field Components, TE, TM Modes, DominantTE10 mode, Field Distribution, Power, and Attenuation. Circular Waveguides: TE, TM modes. Wave Velocities, Micro strip Transmission line (TL),Coupled TL, Strip TL, Coupled Strip Line, Coplanar TL, Microwave Cavities.

UNIT-II: Scattering Matrix, Passive microwave devices: Microwave Hybrid Circuits. ,Terminations , Attenuators, Phase Shifters, Directional Couplers: Two Hole directional couplers, S Matrix of a Directional coupler, Hybrid Couplers, Microwave Propagation in ferrites, Faraday Rotation, Isolators, Circulators. S parameter analysis of all components.

UNIT-III: Microwave Tubes: Limitation of Conventional Active Devices at Microwave frequency, Two Cavity Klystron, Reflex Klystron, Magnetron, Traveling Wave Tube, Backward Wave Oscillators: Their Schematic, Principle of Operation, Performance Characteristic and their applications.

UNIT-IV: Solid state amplifiers and oscillators: Microwave Bipolar Transistor, Microwave tunnel diode, Microwave Field-effect Transistor, Transferred electron devices, Avalanche Transit –time devices: IMPATT Diode, TRAPPAT Diode,

UNIT-V: Microwave Measurements: General set up of a microwave test bench, Slotted line carriage, VSWR Meter, microwave power measurements techniques, Crystal Detector, frequency measurement, wavelength measurements, Impedance and Refection coefficient, VSWR, Insertion And attenuation loss measurements, measurement of antenna characteristics, microwave link design.

Text Books:
1. Samuel Y. Liao, “Microwave Devices and Circuits”, 3rd Ed, Pearson Education.
2. A. Das and S. K. Das, “Microwave Engineering”, TMH.
Reference Book:
1. R.E Collin, “Foundation for Microwave Engineering “, 2nd Ed., John Wiley India.(31)

LABORATORY

MICRO CONTROLLER LAB (IC-651)

1. Write a program of Flashing LED connected to port 1 of the Micro Controller
2. Write a program to show the use of INT0 and INT1.
3. Write a program to generate 10 kHz square wave.
4. Write a program to generate 10 kHz frequency using interrupts.
5. Write a program for temperature & to display on intelligent LCD display
6. Write a program to demonstrate the polling of Interrupt of 8051/8031 micro controllers.
7. Write a program to generate a Ramp waveform using DAC with micro controller.
8. Write a program to control a stepper motor in direction, speed and number of steps.
9. Write a program to control the speed of DC motor.
10. Write a program to interface Microcontroller with 8255.
11. Write a program to set the Baud rate at 9600 , 8 Bit data and 1 Stop bit, to send the text string “Microcontroller” to serial port 1.

DIGITAL SIGNAL PROCESSING LAB (IC-652)

1. With the help of Fourier series, make a square wave from sine wave and cosine waves. Find out coefficient values.
2. Evaluate 4 point DFT of and IDFT of x (n) = 1, $0 \leq n \leq 3$; 0 elsewhere.
3. Implement the FIR Filters for 2 KHz cutoff frequency and 2 KHz bandwidth for band pass filter.
4. Design FIR filter using Fourier series expansion method.
5. Implement IIR low pass filter for a 4 KHz cutoff frequency and compare it the FIR filter with the same type use chirp as input signal.
6. Verify Blackman and Hamming windowing techniques for square wave as an input which window will give good results.
7. Implement the filter functions.
8. Generate DTMF sequence 1234567890*# and observe its spectrogram.
9. Generate an Amplitude Modulation having side low frequencies 1200 Hz and 800 Hz. Observe and verify the theoretical FFT characteristics with the observed ones.
10. Generate Frequency Modulation having carrier frequencies 1 KHz and modulating frequency 200 Hz with the modulation index of 0.7. Observe and verify the theoretical FFT characteristics with the observed ones.
11. Generate an FSK wave form for transmitting the digital data of the given bit sequence. Predict and verify the FFT for the same one.
12. To study the circular convolution

COMMUNICATION LAB (IC-653)

1. To study DSB/ SSB amplitude modulation & determine its modulation factor & power in side bands.
2. To study amplitude demodulation by linear diode detector
3. To study frequency modulation and determine its modulation factor
4. To study sampling and reconstruction of Pulse Amplitude modulation system.
5. To study Pulse Width Modulation and Pulse Position Modulation.
6. To construct a triangular wave with the help of Fundamental Frequency and its Harmonic component.
7. To construct a Square wave with the help of Fundamental Frequency and its Harmonic component.
8. Study of Pulse code modulation (PCM) and its demodulation using Bread Board.
9. Study of Amplitude shift keying modulator and demodulator.
10. Study of Frequency shift keying modulator and demodulator.
11. Study of Phase shift keying modulator and demodulator

Syllabus VII Semester:

THEORY SUBJECTS

CONTROL SYSTEM –II (IC-701)

UNIT –I: Sampling and Signal Conversion: Sampled-Data Control Systems, Digital to Analog Conversion, Sample and Hold operations, Sample and Hold Devices, frequency–Domain Characteristic of Zero order Hold.

The Z-Transform:

Linear Difference equations, The Pulse Response, The Definition of the Z-transform, Relationship between the Laplace transform and the Z-transform, Relationship between S-plane and the Z plane, The constant-Damping Loci, The constant- Frequency

Loci, The constant-Damping Ratio Loci, The Inverse Z Transform ,Theorems of the Z-transform, Limitations of the Z transform, Application of the Z-transform ,Stability Analysis, Systems with Dead-Time.

UNIT –II: Transfer Functions, Block Diagrams, and Signal flow Graphs The Pulse Transfer Function and The Z-Transfer Function, The Pulse Transfer Function of the Zero-Order Hold and the Relation Between G(s) and G(z), Closed loop systems, The Sampled Signal flow Graph, The Modified Z-transfer function,Multirate Discrete Data System. Transform Design of Digital Controls Design of position Servo Design Specifications, Design on the W- plane, Design of the W-plane, the Digital PID Controllers.

UNIT –III: State Space Analysis of Sampled Data Systems Discrete time state equations. Similarity Transformations, The Cayley-HamiltonTheorem, Realization of Pulse Transfer function; State Equations for sampled Data Systems, Concepts of Controllability and Observability, Liapunov Stability Analysis Systems with Dead time.

UNIT –IV: Design of digital controls using State Space analysis Formulation of the optimal control Problem Optimal State Regulator, Use of State Regulator results, Eigen value Assignment by State feedback, State observers Stochastic optimal State Estimation.

UNIT –V: Mechanization of Control algorithms Using Micro Processors General Description of Microcontrollers, Digital quantization, Microprocessor based Position Control System.

Text Books :

1. M. Gopal, "Digital Control Engineering", New Age International Publishers.
2. B.C. Kuo ,"Digital Control Systems", Oxford University Press

TELEMETRY PRINCIPLES (IC-702)

UNIT –I: Introduction to Telemetry Principles: Basic System, Classification, Non electrical telemetry systems, Voltage and current Telemetry systems, Frequency Tele metering, Power line carrier Communication.

UNIT –II: Multiplexed System: Frequency Division Multiplex System-FDM, IRIG Standards, FM circuits, Phase Modulation Circuits, Receiving end, Phase Locked Local Loop, Mixers. Time Division Multiplexed System – TDM/PAM system, PAM/PM systems, TDM- PCM System, Digital Multiplexer, PCM Reception, Coding for varying level, DPCM, Standards.

UNIT –III: Modems: Modems Introduction, QAM, modem protocol.

UNIT –IV: Transmitter and Receiver: Transmitters, Transmission Techniques, Inter stage Coupling, Receiver Antennas: The Ideal structure, dipoles, arrays, current distribution and design consideration, Microwave Antennas.

UNIT –V: Filters: Polynomial, Filters, Active RC Filters, Universal Filter Circuits, Switched Capacitor Filters, Digital Filters Basics of Satellite and Fiber Optic Telemetry Data Acquisition Systems (DAS), μP based DAS, Remote Control

Text Books :

1. D Patranabis, Telemetry Principle; TMH Ed 1 1999

DIGITAL MEASUREMENT TECHNIQUES (IC-703)

UNIT –I: Philosophy of digital measurements. Digital Time Measurement Techniques: Measurement of time interval between two events, error in time interval measurement,Vernier technique for small time measurement, measurement of time interval with constraints, measurement of periodic time, phase, time interval between two events defined by voltage levels, capacitance, quality factor of ringing circuit, decibel meter, logarithmic A/D converter.

UNIT –II: Digital Frequency Measurement Techniques**:** Measurement of frequency, ratio of two frequencies, product of two frequencies, high frequency, average frequency difference, deviation of power frequency, peak frequency. Fast low-frequency Measurement.

UNIT –III: Digitally Programmable Circuits: Resistor, Potentiometer, amplifiers, Schmitt trigger, dual polarity gain amplifiers. Programmable gain amplifier with dual output, two stage programming, programmable biquads.

UNIT –IV: Digital to Analog Converters: Output input relation, DACs derived from programmable gain amplifiers, Weighted-resistor DAC, Weighted current DAC, Weighted reference voltage DAC, Ladder DAC, switches.

UNIT –V: Digital Voltage Measurement Techniques**:** Sampling theorem, time-division multiplexing, quantization, indirect type A/D converters, direct type A/D converters, Input circuitry of a digital voltmeter.

Text Books :

1. T. S. Rathore, "Digital Measurement Technique", Narosa Publishing House, 1996.

OPEN ELECTIVE -I

ENTREPRENEURSHIP DEVELOPMENT (OE-070)

UNIT -I: Entrepreneurship- definition. Growth of small scale industries in developing countries and their positions vis-a-vis large industries; role of small scale industries in the national economy; characteristics and types of small scale industries; demand based and resources based ancillaries and sub-control types. Government policy for small scale industry; stages in starting a small scale industry.

UNIT -II: Project identification- assessment of viability, formulation, evaluation, financing, field-study and collection of information, preparation of project report, demand analysis, material balance and output methods, benefit cost analysis, discounted cash flow, internal rate of return and net present value methods.

UNIT -III: Accountancy- Preparation of balance sheets and assessment of economic viability, decision making, expected costs, planning and production control, quality control, marketing, industrial relations, sales and purchases, advertisement, wages and incentive, inventory control, preparation of financial reports, accounts and stores studies.

UNIT -IV: Project Planning and control: The financial functions cost of capital approach in project planning and control. Economic evaluation, risk analysis, capital expenditures, policies and practices in public enterprises. Profit planning and programming, planning cash flow, capital expenditure and operations. Control of financial flows, control and communication.

UNIT –V: Laws concerning entrepreneur viz, partnership laws, business ownership, sales and income taxes and workman compensation act. Role of various national and state agencies which render assistance to small scale industries.

Text / Reference Books:

1. Forbat, John, “Entrepreneurship” New Age International.

2. Havinal, Veerbhadrappa, “Management and Entrepreneurship” New Age International

3. Joseph, L. Massod, “Essential of Management", Prentice Hall of India.

QUALITY MANAGEMENT(OE-071)

UNIT-I :Quality Concepts: Evolution of Quality Control, concept change, TQM Modern concept, Quality concept in design, Review of design, Evolution of proto type.

Control on Purchased Product Procurement of various products, evaluation of supplies, capacity verification, Development of sources, procurement procedure.

Manufacturing Quality Methods and techniques for manufacture, inspection and control of product, quality in sales and services, guarantee, analysis of claims.

UNIT-II: Quality Management Organization structure and design, quality function, decentralization, designing and fitting, organization for different type products and company, economics of quality value and contribution, quality cost, optimizing quality cost, seduction program. Human Factor in quality Attitude of top management, cooperation of groups, operators attitude, responsibility, causes of apparatus error and corrective methods.

UNIT-III: Control Charts Theory of control charts, measurement range, construction and analysis of R charts, process capability study, use of control charts.

Attributes of Control Chart Defects, construction and analysis of charts, improvement by control chart, variable sample size, construction and analysis of C charts.

UNIT –IV: Defects diagnosis and prevention defect study, identification and analysis of defects, correcting measure, factors affecting reliability, MTTF, calculation of reliability, building reliability in the product, evaluation of reliability, interpretation of test results, reliability control, maintainability, zero defects, quality circle.

UNIT –V: ISO-9000 and its concept of Quality Management ISO 9000 series, Taguchi method, JIT in some details.

Text / Reference Books:

1. Lt. Gen. H. Lal, “Total Quality Management”, Eastern Limited, 1990.

2. Greg Bounds, “Beyond Total Quality Management”, McGraw Hill, 1994.

3. Menon, H.G, “TQM in New Product manufacturing”, McGraw Hill 1992.

OPERATION RESEARACH(OE-072)

UNIT-I: Introduction: Definition and scope of operations research (OR), OR model, solving the OR model, art of modeling, phases of OR study. Linear Programming: Two variable Linear Programming model and Graphical method of solution, Simplex method, Dual Simplex method, special cases of Linear Programming, duality, sensitivity analysis.

UNIT-II: Transportation Problems: Types of transportation problems, mathematical models, transportation algorithms, Assignment: Allocation and assignment problems and models, processing of job through machines.

UNIT-III: Network Techniques: Shortest path model, minimum spanning Tree Problem, Max-Flow problem and Min-cost problem. Project Management: Phases of project management, guidelines for network construction, CPM and PERT.

UNIT-IV: Theory of Games: Rectangular games, Minim ax theorem, graphical solution of 2 x n or m x 2 games, game with mixed strategies, reduction to linear programming model. Quality Systems: Elements of Queuing model, generalized Poisson queuing model, single server models.

UNIT-V: Inventory Control: Models of inventory, operation of inventory system, quantity discount. Replacement: Replacement models: Equipments that deteriorate with time, equipments that fail with time.

Text / Reference Books:

1. Wayne L. Winston,”Operations Research” Thomson Learning,2003.

2. Hamdy H. Taha, “Operations Research-An Introduction” Pearson Education,2003.

3. R. Panneer Seevam, “Operations Research” PHI Learning, 2008.

4. V.K.Khanna, “Total Quality Management” New Age International, 2008.

INTRODUCTION TO BIOTECHNOLOGY (OE-073)

UNIT-I: Introduction: Concept nature and scope of biotechnology. Cell Structure and Function: Eukaryotic and prokaryotic cells, cell wall, membrane organization, cell organelles, Nucleus, Mitrochondria, endoplasmic reticulum, chloroplast, viruses and toxins into cells. Cell Division: Mitosis and Meiosis.

UNIT-II :Biomolecules: A brief account of structure of carbohydrates, Lipids and Proteins. Genes: Brief idea about Mendel's laws and chromosomes, nature of genetic materials, DN A and RNA, DNA replication.

UNIT-III: Gene Expression: Central dogma, genetic code, molecular mechanism on mutations,regulations of gene expression, house keeping genes, differentiation and development mutations and their molecular basic. Genetic Engineering: Introduction, cloning (vectors and enzymes), DNA and genomic libraries, Transgenics, DNA fingerprinting, genomics.

UNIT-IV :Applications of Biotechnology: Bioprocess and fermentation technology, cell culture, Enzyme technology, biological fuel generation, sewage treatment, environmental biotechnology, biotechnology and medicine, biotechnology in agriculture, food and beverage technology, production of biological invention.

UNIT-V :Safety and Ethics: Safety, social, moral and ethic considerations, environmental ethics, bioethicsand stem cell research, safety of new biotechnology foods, agro biodiversity and donor policies.

Text Books/ Reference Books:

1. Smith, "Biotechnology" Cambridge Press.

2. P.K. Gupta, "Elements of Biotechnology" Rastogi

3. H. D. Kumar, "Modern concepts of Biotechnology" Vikas publishing House.

DEPARTMENTAL ELECTIVES

ELECTIVE –II

OPTICAL INSTRUMENTATION(IC-070)

Unit I: Light Sourcing, Transmitting and Receiving: Concept of Light, Classification of different phenomenon based on theories of light, Basic light sources and its Characterization, Polarization , Coherent and Incoherent sources, Grating theory ,Application of diffraction grating, Electro-optic effect ,Acousto optic effect and Magneto-optic effect.

Unit II: Opto –Electronic devices and Optical Components: Photo diode, PIN, Photo-Conductors, Solar cells, ,Phototransistors, Materials used to fabricate LEDs and Lasers Design of LED for Optical communication, Response times of LEDs ,LED drive circuitry, Lasers Classification :Ruby lasers, Neodymium Lasers, He- Ne Lasers,CO2 Lasers, Dye Lasers, Semiconductors Lasers ,Lasers Applications.

Unit II: Interferometry: Interference effect, Radio-metry, types of interference phenomenon and its Application, Michelson's Interferometer and its application Fabry-perot interferometer, Refractometer, Rayleigh's interferometers, Spectrographs and Mono chromators, Spectrophotometers, Calorimeters, Medical Optical Instruments

Unit IV: Holography: Principle of Holography, On-axis and Off axis Holography, Application of Holography, Optical data storage. Optical Fiber Sensors: Active and passive optical fiber sensor, Intensity modulated ,displacement type sensors, Multimode active optical fiber sensor (Micro bend sensor)Single Mode fiber sensor-Phase Modulates and polarization sensors

Unit V:Fiber optic fundamentals and Measurements: Fundamental of Fibers, Fiber Optic Communication system, Optical Time domain Reflecto meter (OTDR),Time domain dispersion measurement, Frequency Domain dispersion measurement, Laser Doppler velocimeter,

Text Book:

1- J. Wilson & J. F. B. Hawkes, "Optoelectronics: An Introduction" PHI/ Pearson
2. Rajpal S. Sirohi "Wave Optics and its Application", Hyderabad, Orient longman Ltd.
3. A. Yariv, "Optical Electronics", C. B. S. Collage Publishing, New York, 1985.

POWER PLANT INSTRUMENTATION(IC-071)

Unit I: Energy sources, their availability, worldwide energy production, energy scenario of India. Introduction to Power generation- Classification: Renewable and non renewable energy generation resources. Renewable: small hydro; modern biomass; wind power; solar; geothermal and bio-fuels. Non renewable: fossil fuels (coal, oil and natural gas) and nuclear power. Boiler : Types of boilers, boiler safety standards. Boiler instrumentation, control and optimization, combustion control, air to fuel ratio control, three element

drum level control, steam temperature and pressure control, boiler interlocks, sequence event recorder, data acquisition systems.

Unit II: Thermal Power Plant Method of power generation, layout and energy conversion process, Types of Turbines & control, Types of Generators, condensers. Types of pumps and Fans, variable speed pumps and Fans, Material handling system, study of all loops-water, steam, fuel etc.

Unit III: Hydro Electric power plant- Site selection, Hydrology, Estimation electric power to be developed, classification of Hydropower plants, Types of Turbines for hydroelectric power plant, pumped storage plants, storage reservoir plants.

Unit IV: Wind Energy: Power in wind, Conversion of wind power, Aerodynamics of wind turbine, types of wind turbine, and modes of operation, power control of wind turbines, Betz limit, Pitch & Yaw control, wind mill, wind pumps, wind farms, different generator protections, data recording, trend analysis, troubleshooting & safety.

Solar Energy: solar resource, solar energy conversion systems: Solar PV technology: Block diagram of PV system, advantages and limitations. Solar thermal energy system: Principle, solar collector and its types, solar concentrator and its types, safety.

Unit V: Nuclear Power Plant: Nuclear power generation, control station and reactor control.Comparison of various plants: Comparison of thermal power plant, hydro electric power plant, wind, solar, nuclear power plant on the basis of: Performance, efficiency, site selection, Economics-capital and running, safety standards, pollution, effluent management and handling. Power plant safety, Pollution monitoring, control Sound, Air, smoke, dust, study of Electrostatic precipitator.

Text Books:

1. G.F. Gilman, “Boiler Control Systems Engineering”, ISA Publication.
2. P. K. Nag, “Power plant engineering”, McGraw Hill.

Reference Books:

1. B. H. Khan, “Non-conventional energy resources”, McGraw Hill.
2. Chetan Singh Solanki, “Renewable energy Technology”, Prentice Hall Publication.
3. S. P. Sukhatme, “Solar Energy”, Tata McGraw Hill.
4. G. D. Rai, “Nonconventional energy sources”, Khanna Publication.

ARTIFICIAL NEURAL NETWORK (IC-072)

Unit I : Introduction: Introduction and history, human brain, biological neuron, models of neuron, signal flow graph of neuron, feedback, network architecture, knowledge Representation, Artificial intelligence and neural networks. Learning Process: Error correction learning, memory based learning, Hebbian learning, competitive learning, Boltzmann learning, learning with and without teacher, learning tasks, memory and adaptation.

Unit II & III:Artificial neurons, Neural networks and architectures, introduction, neuron

Signal function, mathematical preliminaries, Feed forward & feedback architecture. Geometry of Binary threshold neurons and their networks, Pattern recognition, convex sets and convex hulls, space of Boolean functions, binary neurons for pattern classification, non linear separable problems,capacity of TLN, XOR solution.Perceptrons and LMS Learning objective of TLN, pattern space & weight space, perceptron learning algorithm, perceptron convergence theorem, pocket algorithm, α –LMS learning, MSE error surface, steepest descent search, μ – LMS and application. Back propagation and other learning algorithms Multilayered architecture, back propagation learning algorithm, practical considerations, structure growing algorithms, applications of feed forward neural networks, reinforcement learning.

Unit **IV**:Statistical Pattern Recognition Bayes' theorem, classical decisions with Bayes' theorem, probabilistic interpretation of neuron function, interpreting neuron signals as probabilities, multilayered networks & posterior probabilities, error functions for classification problems.RBF Networks Regularization networks, generalized RBF networks, RBF network for solving XOR problem, comparison of RBF networks & multilayer perceptrons.Stochastic Machines: Statistical mechanics, simulated annealing, Boltzmann machine.

Unit **V:** Adaptive Resonance Theory Building blocks of adaptive resonance, Adaptive Resonance Theory 1.Self Organizing Feature MAP Introduction, Maximal eigenvector filtering, principal component analysis, generalized learning laws, competitive learning, vector quantization, Mexican hat networks.

Text Books:

1. Kumar Satish, "Neural Networks", TMH.
2. Simon Haykin, "Neural Networks", PHI.

FILTER DESIGN(IC-073)

Unit I: Review of op-amps circuits, Categorization of filters-Low-pass filter, High-pass filter, band-pass filter, band-reject filter, Gain equalizers, and Delay equalizers.

Unit II: Approximation Theory: Butterworth approximation, Chebyshev approximation, Inverse Chebyshev approximation, Basic of sensitivity, Frequency Transformations.

Unit III: Three amplifier Bi quad: Basic low pass and band pass circuit, realization of the general Bi quadratic Functions, summing of four Amplifier bi quad, feed forward three amplifier bi quad, Passive Ladder structures, Inductor Substitution using Gyrator, Transformation of elements using the FDNR. Active ladder filters. Active R filters.

Unit IV: Elementary trans conductor building blocks, resistors, integrators, amplifiers, summers, gyrator, First and second order filters, higher order filters.

Unit V: Switched capacitor filters: The MOS switch, The switched capacitor, first order building blocks, second order sections, sampled data operation, Switched capacitor first and

second order filters, Bilinear transformation based SC filter design.

Text Books:

1. Gobind Daryanani, "Principles of active network synthesis and design",John Wiley & Sons.
2. R. Schaumann, M. E. Van Valkenburg, "Design of analog filters", Oxford University

LABORATORY

DIGITAL CONTROL SYSTEM LAB II (IC- 751)

Minimum of 10 experiments to be performed At least four experiments to be done on MATLAB Suggestions are -

1. Discrete Time LTI model
2. Discrete pole locations & transients response

Small damping ($\varepsilon = 0.1\ W_n = 4\pi/5T$) Medium damping ($\varepsilon = 0.4\ W_n = 11\ \pi\ /5T$) Large damping ($\varepsilon = 0.8\ W_n = \pi\ /4T$)

3. Digital DC motor Speed control with PID controller
4. Designing Lead & Lag Compensators
5. Kalman Filter design
6. State space design for the Inverted pendulum

TELEMETRY LAB(IC-752)

Minimum of 10 experiments to be performed

1. Measurement of Temperature Using RTD/ Thermistor and amplification to an Appropriate level suitable for Tele transmission.
2. Sampling through a S/H Circuit and reconstruction of the sampled signal. Observe The effect of sampling rate & the width of the sampling pulses.
3. Realization of PCM signal using ADC and reconstruction using DAC using 4-bit/8 bit systems. Observe the Quantization noise in each case.
4. Fabricate and test a PRBS Generator.
5. Realization of data in different formats such as NRZ-L, NRZ-M and NRZ-S.
6. Clock recovery circuit from NRZ-L data using PLL.
7. Manchester coding & decoding (Bi phase L) of NRZ-L Data.
8. Coding and decoding NRZ-L into URL-L (Uni polar return to Zero coding).
9. ASK – Modulation and Detection
10. FSK – Modulation and Detection
11. PSK - Modulation and Detection.
12. Error introduction, Error Detection & Correction using Hamming Code.
13. Amplitude modulation and Detection of signal obtained from experimen

Syllabus VIII Semester:

THEORY SUBJECT

OPTIMAL CONTROL (IC-801)

Unit I: General Mathematical Procedures: Formulation of the optimal control Problem, Calculus of variations, Minimum principle, Dynamic Programming, Numerical Solution of Two-point Boundary value problem.

Unit II: Optimal Feedback Control: Discrete-Time linear State regulator, Continuous-Time Linear state Regulator results of solves other linear problems, Suboptimal Linear regulators, Minimum-time Control of Linear Time-Invariant System.

Unit III: Stochastic Optimal Linear Estimation and Control Stochastic processes and linear systems, Optimal Estimation for Linear Discrete time Systems Stochastic Optimal Linear Regulator

Unit IV & V: Microprocessor and DSP control Basic computer Architecture, Microprocessor Control of Control System, Single Board Controllers with Custom Designed Chips, Digital Signal Processors, Effect of finite World Length and Quantization on Controllability and Closed Loop –Pole Placement, Effects of Quantization, and Time Delays in Microprocessor Based control systems.

Text Books:

1. M. Gopal, "Modern Control Engineering", New Age International Publishers.
2. B.C. Kuo, "Digital Control Systems", Oxford University Press

1. Brain D.O. Anderson, John B. Moore, "Optimal control Linear Quadratic Methods", Prentice Hall of India Private Limited

BIO-MEDICAL INSTRUMENTATION (IC-802)

UNIT –I: Introduction: Specifications of bio-medical instrumentation system, Man-Instrumentation system Components, Problems encountered in measuring a living system. Basics of Anatomy and Physiology of the body. Bioelectric potentials: Resting and action potentials, propagation of action potential, The Physiological potentials –ECG, EEG, EMG, ERG, EOG and Evoked responses. Electrodes and Transducers: Electrode theory, Bio potential Electrodes – Surface electrodes, Needle electrodes, Microelectrodes. Biomedical Transducer

UNIT –II: Cardiovascular Measurements: Electrocardiography –ECG amplifiers, Electrodes and Leads, ECG recorders –Single channel, Three channel, Vector Cardiographs, ECG System for Stresses testing, Holter recording, Blood pressure measurement, Heart sound measurement. Pacemakers and Defibrillators. Patient Care & Monitoring: Elements of intensive care monitoring, displays, diagnosis, Calibration & Reparability of patient monitoring equipment.

UNIT-III: Respiratory system Measurements: Physiology of Respiratory system .Measurement of

breathing mechanism – Spiro meter. Respiratory Therapy equipments: Inhalators, Ventilators &Respirators, Humidifiers, and Nebulizers & Aspirators. Nervous System Measurements: Physiology of nervous system, Neuronal communication, Neuronal firing measurements.

UNIT-IV: Ophthalmology Instruments: Electro retinogram, Electro occulogram, Ophthalmoscope, Tonometer for eye pressure measurement. Diagnostic techniques: Ultrasonic diagnosis, Eco cardiography, Eco-encephalography, Ophthalmic scans, X-ray &Radio-isotope diagnosis and therapy, CAT-Scan, Emission computerized tomography, MRI.

UNIT –V: Bio-telemetry: The components of a Bio-telemetry system, Implantable units, Telemetry for ECG measurements during exercise, for Emergency patient monitoring. Prosthetic Devices and Therapies: Hearing Aides, Myoelectric Arm, Dia-thermy, Laser applications in medicine.

Text books:
1. Khandpur R.S.- Biomedical Instrumentation- TMH
2. VenkataRam,S.K.-Bio-Medical Electronics&Instrumentation (Revised)- Galgotia.

Reference books:
1.. Cromwell- Biomedical Instrumentation and Measurements- PHI
2. Webster,j.g. –Bio- Instrumentation ,Wiley (2004)
3. Ananthi,S. –A Text Book of Medical Instruments-2005-New Age International
4. carr&Brown –Introduction to Biomedical Equipment Technology – Pearson
5. Pandey& Kumar-Biomedical Electronics and Instrumentation. – Kataria

OPEN ELECTIVE- II

NON-CONVENTIONAL ENERGY RESOURCES (OE-080)

UNIT-I : Introduction Various non-conventional energy resources- Introduction, availability, classification, relative merits and demerits.

Solar Cells: Theory of solar cells. Solar cell materials, solar cell array, solar cell power plant, limitations.

UNIT-II :Solar Thermal Energy: Solar radiation, flat plate collectors and their materials, applications and performance, focusing of collectors and their materials, applications and performance; solar thermal power plants, thermal energy storage for solar heating and cooling, limitations.

UNIT-III: Geothermal Energy: Resources of geothermal energy, thermodynamics of geo-thermal energy conversion-electrical conversion, non-electrical conversion, environmental considerations. Magneto-hydrodynamics (MHD): Principle of working of MHD Power plant, performance and limitations. Fuel Cells: Principle of working of various types of fuel cells and their working, performance and limitations.

UNIT-IV: Thermo-electrical and thermionic Conversions: Principle of working, performance and limitations. Wind Energy: Wind power and its sources, site selection, criterion, momentum theory,

classification of rotors, concentrations and augments, wind characteristics.
Performance and limitations of energy conversion systems.

UNIT-V: Bio-mass: Availability of bio-mass and its conversion theory.

Ocean Thermal Energy Conversion (OTEC): Availability, theory and working principle, performance and limitations. Wave and Tidal Wave: Principle of working, performance and limitations. Waste Recycling Plants.

Text/References Books:

1. Raja etal, “Introduction to Non-Conventional Energy Resources” Scitech Publications.

2. John Twideu and Tony Weir, “Renewal Energy Resources” BSP Publications, 2006.

3. M.V.R. Koteswara Rao, “ Energy Resources: Conventional & Non-Conventional “ BSP Publications,2006.

4. D.S. Chauhan,”Non-conventional Energy Resources” New Age International.

5. C.S. Solanki, “Renewal Energy Technologies: A Practical Guide for Beginners” PHI Learning.

6. Peter Auer, "Advances in Energy System and Technology". Vol. 1 & II Edited by Academic Press.

NON-LINEAR DYNAMIC SYSTEMS (OE-081)

UNIT-I: Dynamic systems: Concept of dynamic systems, importance of non-linearity, nonlinear dynamics of flows (in 1, 2, and 3 dimensions) and Maps (1 and 2 dimensions) in phase space, Equilibrium, Periodicity. Picard’s theorem, Peano’s theorem, boundedness of solutions, omega limit points of bounded trajectories.

UNIT-II: Stability-I: Stability via Lyapunov’s indirect method, converse Lyapunov functions, sublevel sets of Lyapunow functions, Lasalle’s invariance principle.

UNIT-III: Stability-II: Lyapunov’s direct method, converse Lyapunov’s theorems, Brokett’s theorem, applications to control system, stable manifold theorem, centre manifold theorem, normal form theory and applications to nonlinear systems.

UNIT-IV: Bifurcation: Elementary Bifurcation theory, catastrophe, strange attractor, fractals, fractal geometry and fractal dimension.

UNIT-V: Chaos: Deterministic Chaos, routes to chaos (period doubling, quasiperiodicity, intermittency, universality, renormalization); Measurement of Chaos (Poincare section,Lyapunov index, entropy);.control of chaos.

Reference Books:

1. D.K. Arrowsmith and C.M. Place, “An Introduction to Dynamical Systems” Cambridge University press, London, 1990.

2. K.T. Alligood, T.D. Sauer, and J.A Yorke, “CHAOS: An Introduction to Dynamical System” Springer Verlag, 1997.

3. H.K. Khalis, “Nonlinear Systems” Prentice Hall, 1996.

4. R. R. Mohler, “Non linear systems, Vol-I: Dynamics and Control” Prentice Hall, 1991.

5. J.M. T. Thomson and H.B. Stewart, “Nonlinear Dynamics and Chaos” John Wiley & Sons, 1986.

6. Stanislaw H. Zak, “Systems and control” Oxford University Press, 2003.

PRODUCT DEVELOPMENT(OE-082)

UNIT-I: Concept of Product, definition and scope. Design definitions, old and new design methods, design by evolution, examples such as evolution of sewing M/C, bicycle, safety razor etc., need based developments, technology based developments physical reliability & economic feasibility of design concepts.

UNIT –II: Morphology of design, divergent, transformation and convergent phases of product design, identification of need, Analysis of need. Design criteria; functional, aesthetics, ergonomics, form, shape, size, color. Mental blocks, Removal blocs, Ideation techniques, Creativity, Check list.

UNIT –III: Transformations, Brainstorming& Synaptic, Morphological techniques. Utility Concept, Utility Value, Utility Index, Decision making under Multiple Criteria. Economic aspects, Fixed and variable costs, Break-even analysis.

UNIT-IV: Reliability considerations, Bath tub curve, Reliability of systems in series and parallel, Failure rate, MTTF and MTBF, Optimum spares from Reliability considerations. Design of display and controls, Man-machine interface, Compatibility of displays and controls. Ergonomic aspects, Anthropometric data and its importance in design. Application of Computers in Product development & design.

UNIT-V: Existing techniques, such as work-study, SQC etc. for improving method & quality of product. Innovation versus Invention. Technological Forecasting. Use of Standards for Design.

Text/Reference Books:

1. A.K. Chitab & R.C. Gupta “Product design & Manufacturing” – Prentice Hall (EE)

2. R.P. Crewford, “The Technology of creation Thinking” Prentice Hall.

3. C.D. Cain, “Product Design & Decision” Business Books.

5. C.D. Cain, “Engg. Product Design” Business Books.

AUTOMATION AND ROBOTICS (OE-083)

UNIT-I: Introduction: Definition, Classification of Robots, geometric classification and control classification.

UNIT-II: Robot Elements: Drive system, control system, sensors, end effectors, gripper actuators and gripper design.

UNIT-III: Robot Coordinate Systems and Manipulator Kinematics: Robot co-ordinate system representation, transformation, homogenous transform and its inverse, relating the robot to its world. Manipulators Kinematics, parameters of links and joints, kinematic chains, dynamics of kinematic chains, trajectory planning and control, advanced techniques of kinematics and dynamics of mechanical systems, parallel actuated and closed loop manipulators.

UNIT-IV: Robot Control: Fundamental principles, classification, position, path velocity and force control systems, computed torque control, adaptive control, Servo system for robot control, and introduction to robot vision.

UNIT-V: Robot Programming: Level of robot programming, language based programming, task level Programming, robot programming synthesis, robot programming for welding, machine Tools, material handing, assembly operations, collision free motion planning.

UNIT-VI: Applications: Application of robot in welding, machine tools, material handling, and assembly operations parts sorting and parts inspection.

Text/Reference Books:

1. Coifet Chirroza, “An Introduction to Robot Technology”

2. Y. Koren “Robotics for Engineers” McGraw Hill.

3. K. S. Fu, R.C. Gonzalez Y& CSG Lee, “Robotics” McGraw Hill.

4. J.J. Craig, “Robotics” Addison-Wesley.

5. Grover, Mitchell Weiss, Nagel Octrey, “Industrial Robots” McGraw Hill.

6. Asfahl, “Robots & Manufacturing Automation” Wily Eastern.

DEPARTMENTAL ELECTIVE

ELECTIVE -III

COMPUTERISED PROCESS CONTROL (IC-080)

UNIT I: Basics of Computer-Aided Process Control: Role of computers in process control, Elements of a computer aided Process control System, .Classification of a Computer –Aided Process Control System. Computer-Aided Process –control Architecture: Centralized Control Systems, Distributed control Systems, Hierarchical Computer control Systems. Economics of Computer-Aided Process control. Benefits of using Computers in a Process control. Process related Interfaces: Analog Interfaces, Digital Interfaces ,Pulse Interfaces, Standard Interfaces

UNIT II: Industrial communication System: Communication Networking, Industrial communication Systems, Data Transfer Techniques, Computer Aided Process control software, Types of Computer control Process Software, Real Time Operating System.

UNIT III: Process Modeling for computerized Process control: Process model, Physical model, Control Model, Process modeling. Modeling Procedure: Goals Definition, Information Preparation, Model Formulation, Solution Finding, Results Analysis, and Model Validation.

UNIT IV: Advanced Strategies For Computerized Process control: Cascade Control, Predictive control, Adaptive Control, Inferential control, Intelligent Control, Statistical control.

UNIT V:Examples of Computerized Process Control: Electric Oven Temperature Control, Reheat Furnace Temperature control, Thickness and Flatness control System for metal Rolling, Computer-Aided control of Electric Power Generation Plant

Text Book:

1. Singh,S.K /Computer Aided Process control /PHI - 2007

Reference Books:

1. C.L Smith / Digital computer Process Control / Ident Educational Publishers, 72.
2. C.D. Johnson / Process Control Instrumentation Technology / PHI, 88.
3. Krishan Kant / Computer Based Industrial Control.
4. Pradeep B. Deshpande& Raymond.H.Ash / Element of Computer Process Control with Advance

Control Applications / Instrument Society of America, 1981.

5.C.M. Houpis, G.B. Lamond / Digital Control System Theory / Tata McGraw Hill

BIOMEDICAL SIGNAL PROCESSING (IC-081)

UNIT I:Introduction to Bio-Medical Signals: Classification, Acquisition and Difficulties duringAcquisition.BasicsofElectrocardiography,Electroencephalography,Electromyography & electro-retino graphy .Role of Computers in the Analysis, Processing, Monitoring &

Control and image reconstruction in bio-medical field.

UNIT II:ECG: Measurement of Amplitude and Time Intervals, QRS Detection (Different Methods), ST Segment Analysis, Removal of Baseline Wander And Power line Interferences, Arrhythmia Analysis, Portable Arrhythmia Monitors.

UNIT III: Data Reduction: Turning Point algorithm, AZTEC Algorithm, Fan Algorithm, Huffman and Modified Huffman Coding, Run Length Coding.

UNIT IV: EEG: Neurological Signal Processing, EEG characteristic, linear prediction theory, Sleep EEG, Dynamics of Sleep/Wake transition. Study of pattern of brain waves, Epilepsy-Transition, detection and Estimation.

UNIT V: EEG Analysis By Spectral Estimation: The Bt Method, Periodo gram, Maximum Entropy Method & AR Method, Moving Average Method. The ARMA Methods, Maximum Likelihood Method.

UNIT V: EP Estimation: by Signal Averaging, Adaptive Filtering:- General Structures of Adaptive filters, LMS Adaptive Filter, Adaptive Noise Cancelling, Wavelet Detection:- Introduction, Detection By Structural features, Matched Filtering, Adaptive Wavelet Detection, Detection of Overlapping Wavelets.

Text Books:

1. Willis J. Tomkin, “Biomedical Digital Signal Processing”, PHI.
2. D. C. Reddy, “Biomedical Signal Processing”, McGraw Hill
3. Crommwell,Weibel and Pfeifer, “Biomedical Instrumentation and Measurement”, PHI

Reference Books:

1. Arnon Cohen, “Biomedical Signal Processing (volume-I)”, Licrc Press
2. Rangaraj M. Rangayyan, “Biomedical Signal Analysis A Case Study Approach”, John Wiley and Sons Inc.
3. John G. Webster, “Medical instrumentation Application and Design”, John Wiley & Sons Inc.

ANALYTICAL INSTRUMENTS (IC-082)

UNIT I:UV – Visible Spectroscopy: Introduction, Electromagnetic Radiation, and Spectrum, Interaction of Radiation with Matter, Lambert Law, Beer Law, Bear –Lambert Law, Absorption Instruments, Radiation Sources, Optical Filters, Mono chromator : Prism, Diffraction Gratings, Holographic Gratings, Materials of Optical Components. Detectors: Photovoltaic, High Vacuum Photo–Emission Cells, Photomultiplier Tubes, Silicon Diode Detectors, Photo Diode Arrays, Sample Holders. UV – Visible Spectrophotometers; Calorimeters, Single Beam (Spectronic – 21 type), Using Diode array detector, Double Beam spectrophotometer(Optical Diagram & Block Diagram); Microprocessor based Spectrophotometer (Block Diagram)

UNIT II: Infrared Spectroscopy: Introduction, Near – Middle – Far IR range of Spectrum; Basic Components of IR Spectrophotometers: Radiation Source; Monochromaters ; Mirrors, Entrance & Exit Slits, Detectors, Pre – amplifier, Optical Null and Ratio Recording Type Spectrophotometers, Sample Handling Techniques. Nuclear Magnetic Resonance (NMR)NMR Spectroscopy , Principle of

NMR: Nuclear Spin, Nuclear Energy Levels, Resonance Conditions. Block Diagram for continuous wave NMR Spectrometer, Chemical Shift, Spin — Spin Coupling and relaxation Process.

UNIT III: Flame Photometers (FP): Principle of Flame Photometry, Essential Parts of FP, Block Diagram for Flame Photometers, Emission System: Fuel Gases and their Regulation, Atomizer, Burner, Flame. Optical System: Filters, Mono chromators, Other Optical Components, Photo Sensitive Detectors, Recording System: PMT and associated Amplifier Circuit. Type of FP: Single Beam, Double Beam, Recording Type FP, Clinical FP. Atomic Absorption Spectrometers (AAS): Atomic Absorption Spectroscopy, Atomic Absorption Instrumentation : Radiation Sources; Hollow Cathode Lamps, Electrode less Discharge Lamp, Burners and Flames. Nebulizers: Concentric, Cross–Flow, Ultrasonic, Babington and V – groove types. Optical System of A A S – its ray diagram , Block Diagram of the electronic Circuit of AAS including pre – amplifier and EHT for PMT Circuits and their working. Sampling System

UNIT IV: Mass Spectrometers (MS): Basic of Mass Spectrometer (MS): Principle of operation Type of MS : Magnetic Deflection MS, Time of Flight MS, Radio Frequency MS, Quadruple Mass Spectrometer. Sample Ionization Methods: Electron Impact, Chemical Ionization, Field Ionization, Field Desorption and Fast Atomic Bombardment. Ion Detectors: Faraday Cup, Electron Multiplier, Micro Channel Plate. Chromatography : Various Types of Chromatography, Basic definitions, Gas Chromatography, Block Diagram of Instrument. Mobile phase, Sample Injection System, Chromatography Columns, Thermal Compartment Oven, Temperature Programming, Detector Systems (TCD, FID, FPD, ECD). A typical Chromatogram .Electronic Integrator circuit for Chromatogram peaks.

UNIT V: X Ray Spectrometers: Introduction, X-ray Spectrum, Block diagram of X-ray Spectroscopy Instrument, X-ray Generating Equipment, Collimators, Monochromators . Detectors: Photographic Emulsion, Ionization Chamber, The Geiger Muller Counter, Proportional Counter, Scintillation Counter. X-ray Diffrcatometer , X-ray Absorption Meter. X-ray Fluorescence Spectrometry

Text Books :

1. Handbook Of Analytical Instruments: R S Kandpur, TMH 2nd Edition,2003.
2. Instrumental Methods of Analysis: Willard, Merritt, Dean and Settle, Seventh Edition, CBS Publishers

MICRO AND SMART SYSTEMS (IC-083)

UNIT I: Introduction, Why miniaturization? Microsystems versus MEMS, Why micro fabrication? smart materials, structures and systems, integrated Microsystems, applications of smart materials and MicroSystems,.

UNIT II: Micro sensors, actuators, systems and smart materials: Silicon capacitive accelerometer, piezoresistive pressure sensor, conductometric gas sensor, an electrostatic combo-drive, a magnetic micro relay, portable blood analyzer, piezoelectric inkjet print head, micro mirror array for video projection, smart materials and systems.

UNIT III: Micromachining technologies: silicon as a material for micromachining, thin film deposition, lithography, etching, silicon micro machining, specialized materials for Microsystems, advanced processes for micro fabrication.

UNIT IV: Modeling of solids in Microsystems: Bar, beam, energy methods for elastic bodies, heterogeneous layered beams, bimorph effect, residual stress and stress gradients, poisson effect and the anticlastic curvature of beams, torsion of beams and shear stresses, dealing With large displacements, In-plane stresses. Modeling of coupled electromechanical systems: electrostatics, Coupled Electro-mechanics: statics, stability and pull-in Phenomenon, dynamics. Squeezed film effects in electro mechanics.

UNIT V: Integration of micro and smart systems: integration of Micro systems and micro electronics, micro systems packaging, case studies of integrated Microsystems, case study of a smart-structure in vibration control. Scaling effects in Microsystems: scaling in: mechanical domain, electrostatic domain, magnetic domain, diffusion, effects in the optical domain, biochemical phenomena.

Text book:

1. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalakrishnan, K. N. Bhat and V. K. Atre, "Micro and smart systems", Wiley India, 2010.

DIGITAL SYSTEM DESIGN USING VHDL (IC-084)

UNIT I: Introduction to VHDL, reserve words, structures, modeling, objects, data type and operators, sequential statements and processes, sequential modeling and attributes, conditional assignment, concatenation and case, array loops and assert statements, subprograms.

UNIT II: Digital System Design Automation– Abstraction Levels, System level design flow, RTL design flow, VHDL.RTL Design with VHDL – Basic structures of VHDL, Combinational circuits, Sequential circuits, Writing Test benches, Synthesis issues, VHDL Essential Terminologies VHDL Constructs for Structures and Hierarchy Descriptions – Basic Components, Component Instantiations, Iterative networks, Binding Alternatives, Association methods, generic Parameters, Design Configuration.

UNIT III: Concurrent Constructs for RT level Descriptions – Concurrent Signal Assignments, Guarded signal assignment Sequential Constructs for RT level Descriptions – Process Statement, Sequential WAIT statement, VHDL Subprograms, VHDL library Structure, Packaging Utilities and Components, Sequential Statements. VHDL language Utilities - Type Declarations and Usage, VHDL Operators, Operator and Subprogram overloading, Other TYPES and TYPE– related issues, Predefined Attributes

UNITIV : VHDL Signal Model – Characterizing hardware languages, Signal Assignments, Concurrent and Sequential Assignments, Multiple Concurrent Drivers Standard Resolution
UNIT V: Hardware Cores and Models - Synthesis rules and styles, Memory and Queue Structures, Arithmetic Cores, Components with Separate Control and Data parts. Core Design Test and Testability - Issues Related to Design Test, Simple Test benches.

Text books:

1. Z. Navabi, "VHDL-Modular Design and Synthesis of cores and Systems", TMH – 3rd Edition.
2. R.D.M. Hunter, T. T. Johnson, "Introduction to VHDL" Spriger Publication, 2010.

Reference books:

1. J. Bhaskar, "A VHDL Primer", Addison Wesley, 1999.
2. M. Ercegovac, T. Lang and L.J. Moreno, "Introduction to Digital Systems", Wiley,2000
3. C. H. Roth, "Digital System Design using VHDL", PWS Publishing
4. Enoch O. Hwang , "Digital Logic and Microprocessor design with VHDL" – Thomson publication.

LABORATORY

PROJECT (IC-851)

The students are expected to take up a project under the guidance of teacher from the institute. It may include:

- Experimental analysis/verification
- Development of design and verification
- Design & verification of modal or a circuit
- Developing a software for analysis and/or design or decision engineering and management practice

The students may be asked to work individually or in a group having not more than FOUR students in a group.

The student/group shall prepare & submit report on the project. This shall be typewritten on A4 size paper, hard bound, literature view, data collection, experiments conducted, software implementation etc.

Acquaintance with survey & research methods and their use in conducting a systematic investigation and style of report preparation and presentation at the time of oral shall form the basis of evaluation.

An oral examination shall be conducted at the end of the semester VIII.