BUNDELKHAND UNIVERSITY

(2017-2018)

SYLLABUS

Institute of Engineering & Technology

Course of study and scheme of B.Tech. Examination
For
ELECTRONICS & INSTRUMENTATION ENGINEERING
Based On
CHOICE BASED CREDIT SYSTEM

INSTITUTE OF ENGINEERING & TECHNOLOGY
BUNDELKHAND UNIVERSITY, JHANSI
STUDY AND EVALUATION SCHEME
YEAR I, SEMESTER-I
Common for all branches of B. Tech.

SN	COURSE CODE	SUBJECT	PERIODS			EVALUATION SCHEME				SUBJECT TOTAL	Credit
						SESSIONAL EXAM			ESE		
			L	T	P	CT	TA	TOTAL			
1	MA-1841/ MA*-1842/ BT*-1852	Maths-I/ Elementary Mathematics-I /Remedial Biology-I/	3	1	0	30	20	50	100	150	4
2	ME-1850/CE-1851	Manufacturing Process/ Environment And Ecology	2	1	0	15	10	25	50	75	3
3	PH-1843	Engineering Physics-I	2	1	0	15	10	25	50	75	3
4	CY-1844/ ME-1845	Engineering Chemistry/ Engineering Mechanics	3	1	0	30	20	50	100	150	4
5	EC-1846/ CS-1847	Electrical Engineering/ Computer concepts and programming in C	3	1	0	30	20	50	100	150	4
6	EC -1848/ HU-1849	Electronic Engineering/ Professional Communication	3	1	0	30	20	50	100	150	4
PRACTICAL/TRAINING/PROJECT											
7	PH-10859/ HU-10860	Physics Lab/ Professional Communication Lab	0	0	2	10	10	20	30	50	1
8	CY-10853/ ME-10854	Engineering Chemistry/ Engineering Mechanics Lab.	0	0	2	10	10	20	30	50	1
9	WS-10857/ ME-10858	Workshop Practice/ Computer Aided Engg. Graphics Lab..	0	0	3	10	10	20	30	50	1
10	EE-10855/ CS-10856	Electrical Engineering Lab/ Computer Programming Lab.	0	0	2	10	10	20	30	50	1
11	10861/GP-101	General Proficiency	-	-	-	-	-	50	-	50	-
		Total	16	6	9	-	-	-	-	1000	26

Note:- *Elementary Mathematics is for the students who passed 10+2 examination with Biology and Remedial Biology is for the students who passed 10+2 with Mathematics (Only for the students of Biotechnology stream).

INSTITUTE OF ENGINEERING & TECHNOLOGY
BUNDELKHAND UNIVERSITY, JHANSI
STUDY AND EVALUATION SCHEME
YEAR I, SEMESTER-II
Common for all branches of B. Tech.

SN	COURSE CODE	SUBJECT	PERIODS			EVALUATION SCHEME				SUBJECT TOTAL	Credit
						SESSIONAL EXAM			ESE		
			L	T	P	CT	TA	TOTAL			
1	*MA-1855/ 1856 BT-1866	Maths-II/Elementary Mathematics-II /Remedial Biology-II	3	1	0	30	20	50	100	150	**4**
2	ME-1859/HU-1858	Engg. Mechanics / Engineering Chemistry	3	1	0	30	20	50	100	150	**4**
3	PH-1857	Engineering Physics-II	2	1	0	15	10	25	50	75	**3**
4	EE-18/ HU-1863	Electronics Eng./Professional Communication	3	1	0	30	20	50	100	150	**4**
5	CS-1861/EE-1860	Computer Concepts and Programming in C/Electrical Engg.	3	1	0	30	20	50	100	150	**4**
6	CE-1865/ME-1864	Environment and Ecology/Manufacturing process	2	1	0	15	10	25	50	75	**3**
PRACTICAL/TRAINING/PROJECT											
7	PH-10873/HU-10874	Physics Lab/Professional Communication Lab	0	0	2	30	20	50	-	50	**1**
8	CS-10870/EE-10869	Computer Programming Lab/Electrical Engg. Lab	0	0	2	10	10	20	30	50	**1**
9	CE-10872/WS-10871	Computer Aided Engineering Graphics/Workshop Practice	0	0	3	10	10	20	30	50	**1**
10	ME-10868/CY-10867	Engineering Mechanics Lab/Engg. Chemistry Lab	0	0	2	10	10	20	30	50	**1**
11	10875/GP-201	General Proficiency	-	-	-	-	-	50	-	50	**-**
		Total	**16**	**6**	**9**	**-**	**-**	**-**	**-**	**1000**	**26**

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INSTITUTE OF ENGINEERING & TECHNOLOGY
BUNDELKHAND UNIVERSITY, JHANSI
STUDY AND EVALUATION SCHEME
YEAR II, SEMESTER-III
B. Tech. Electronics & Instrumentation

SN	COURSE CODE	SUBJECT	PERIODS			EVALUATION SCHEME				SUBJECT TOTAL	Credit
						SESSIONAL EXAM			ESE		
			L	T	P	CT	TA	TOTAL			
1	MA-301	Mathematics-III	3	1	0	30	20	50	100	150	4
2	IC-301	Fundamentals of Electronics Devices	3	1	0	30	20	50	100	150	4
3	IC-302	Digital Electronics	3	1	0	30	20	50	100	150	4
4	IC-303	Electromagnetic Field Theory	3	1	0	30	20	50	100	150	4
5	IC-304	Fundamentals of Network Analysis & Synthesis	3	1	0	30	20	50	100	150	4
PRACTICAL/TRAINING/PROJECT											
6	IC-351	Electronics Engineering Lab-I	0	0	2	-	20	20	30	50	1
7	IC-352	Digital Electronics Lab	0	0	2	-	20	20	30	50	1
8	IC-353	Electronics Workshop & PCB Lab	0	0	4	-	50	50	50	100	2
9	GP-301	General Proficiency	-	-	-	-	-	50	-	50	-
		Total	15	5	8	-	-	-	-	1000	24

INSTITUTE OF ENGINEERING & TECHNOLOGY
BUNDELKHAND UNIVERSITY, JHANSI
STUDY AND EVALUATION SCHEME
YEAR II, SEMESTER-IV
B. Tech. Electronics & Instrumentation

SN	COURSE CODE	SUBJECT	PERIODS			EVALUATION SCHEME				SUBJECT TOTAL	Credit
						SESSIONAL EXAM			ESE		
			L	T	P	CT	TA	TOTAL			
1	OE-04*	Open Elective**	3	1	0	30	20	50	100	150	4
2	IC-401	Electronic Circuits	3	1	0	30	20	50	100	150	4
3	IC-402	Electrical Measurement & Measuring Instruments	3	1	0	30	20	50	100	150	4
4	IC-403	Signal & Systems	3	1	0	30	20	50	100	150	4
5	IC-404	Transducers & Signal Conditioning	3	1	0	30	20	50	100	150	4
PRACTICAL/TRAINING/PROJECT											
6	IC-451	Electronics Engineering Lab-II	0	0	2	-	20	20	30	50	1
7	IC-452	Transducers & Signal Conditioning Lab	0	0	4	-	50	50	50	100	2
8	IC-453	Electrical Measurement & Measuring Instruments Lab	0	0	2	-	20	20	30	50	1
9	GP-401	General Proficiency	-	-	-	-	-	50	-	50	-
		Total	15	5	8	-	-	-	-	1000	24

****Open Elective –I**

1. OE-040-Introduction to soft computing (Neural Networks, Fuzzy Logic& Genetic Algorithm)

2. OE-041-Numerical Methods

3. OE-042-Data Structure

4. OE-043-Material Science

INSTITUTE OF ENGINEERING & TECHNOLOGY
BUNDELKHAND UNIVERSITY, JHANSI
STUDY AND EVALUATION SCHEME
YEAR III, SEMESTER-V
B. Tech. Electronics & Instrumentation (w.e.f. 2017-18)

SN	COURSE CODE	SUBJECT	PERIODS			EVALUATION SCHEME				SUBJECT TOTAL	Credit
						SESSIONAL EXAM			ESE		
			L	T	P	CT	TA	TOTAL			
1	IC-501	Power Electronics	3	1	0	30	20	50	100	150	4
2	IC-502	Integrated Circuits	3	1	0	30	20	50	100	150	4
3	IC-503	Control systems-I	3	1	0	30	20	50	100	150	4
4	IC-504	Industrial Instrumentation & Measurement	3	1	0	30	20	50	100	150	4
5	IC-505	Microprocessors	3	1	0	30	20	50	100	150	4
PRACTICAL/TRAINING/PROJECT											
6	IC-551	Integrated Circuits Lab	0	0	2	-	20	20	30	50	1
7	IC-552	Control systems-I Lab	0	0	2	-	20	20	30	50	1
8	IC-553	Instrumentation Lab	0	0	2	-	20	20	30	50	1
9	IC-554	Microprocessor Lab	0	0	2	-	20	20	30	50	1
10	GP-501	General Proficiency	-	-	-	-	-	50	-	50	-
		Total	15	5	8	-	-	-	-	1000	24

INSTITUTE OF ENGINEERING & TECHNOLOGY
BUNDELKHAND UNIVERSITY, JHANSI
STUDY AND EVALUATION SCHEME
YEAR III, SEMESTER-VI
B. Tech. Electronics & Instrumentation (w.e.f. 2017-18)

SN	COURSE CODE	SUBJECT	PERIODS			EVALUATION SCHEME				SUBJECT TOTAL	Credit
						SESSIONAL EXAM			ESE		
			L	T	P	CT	TA	TOTAL			
1	IC-06*	Departmental Elective-I*	3	1	0	30	20	50	100	150	4
2	IC-601	Electrical Machines	3	1	0	30	20	50	100	150	4
3	IC-602	Microcontroller	3	1	0	30	20	50	100	150	4
4	IC-603	Communication Engineering	3	1	0	30	20	50	100	150	4
5	IC-604	Digital Signal Processing	3	1	0	30	20	50	100	150	4
PRACTICAL/TRAINING/PROJECT											
6	IC-651	Seminar	0	0	2	-	50	50	-	50	1
7	IC-652	Communication Lab	0	0	2	-	20	20	30	50	1
8	IC-653	Microcontroller Lab	0	0	2	-	20	20	30	50	1
9	IC-654	DSP Lab	0	0	2	-	20	20	30	50	1
10	GP-501	General Proficiency	-	-	-	-	-	50	-	50	-
		Total	15	5	8	-	-	-	-	1000	24

***Departmental Electives-I**

1. IC-060-Optoelectronics
2. IC-061-Process Dynamics and Control
3. IC-062-Digital Control System
4. IC-063-Microwave Engineering

INSTITUTE OF ENGINEERING & TECHNOLOGY
BUNDELKHAND UNIVERSITY, JHANSI
STUDY AND EVALUATION SCHEME
YEAR IV, SEMESTER-VII
B. Tech. Electronics & Instrumentation (w.e.f. 2018-19)

SN	COURSE CODE	SUBJECT	PERIODS			EVALUATION SCHEME				SUBJECT TOTAL	Credit
						SESSIONAL EXAM			ESE		
			L	T	P	CT	TA	TOTAL			
1	OE-07**	Open Elective-II**	3	1	0	30	20	50	100	150	4
2	IC-07*	Departmental Elective-II*	3	1	0	30	20	50	100	150	4
3	IC-701	Control Systems-II	3	1	0	30	20	50	100	150	4
4	IC-702	Data Acquisition &Transmission	3	1	0	30	20	50	100	150	4
5	IC-703	Digital Measurement Techniques	3	1	0	30	20	50	100	150	4
PRACTICAL/TRAINING/PROJECT											
6	IC-751	Control System Lab-II	0	0	2	-	20	20	30	50	1
7	IC-752	Data Acquisition &Transmission Lab	0	0	2	-	20	20	30	50	1
8	IC-753	Industrial Training	0	0	4	-	20	20	30	50	2
9	IC-754	Project (Minor)	0	0	4	-	50	50	-	50	2
10	GP-701	General Proficiency	-	-	-	-	-	50	-	50	-
		Total	15	5	12	-	-	-	-	1000	26

Note-4 to 6 week industrial training after VI semester exams to be evaluated in VII semester.

****Open Electives –II**

1. OE-070-Transducer
2. OE-071-Computer Organization & Architecture
3. OE-072-Operation Research
4. OE-073-Advanced Sensors

***Departmental Electives-II**

1. IC-070-Optical Instrumentation
2. IC-071-Power Plant Instrumentation
3. IC-072-Artificial Neural Network
4. IC-073-Fluid Mechanics

INSTITUTE OF ENGINEERING & TECHNOLOGY
BUNDELKHAND UNIVERSITY, JHANSI
STUDY AND EVALUATION SCHEME
YEAR IV, SEMESTER-VIII
B. Tech. Electronics & Instrumentation (w.e.f. 2018-19)

SN	COURSE CODE	SUBJECT	PERIODS			EVALUATION SCHEME				SUBJECT TOTAL	Credit
						SESSIONAL EXAM			ESE		
			L	T	P	CT	TA	TOTAL			
1	OE-08**	Open Elective-III**	3	1	0	30	20	50	100	150	4
2	IC-08*	Departmental Elective-III*	3	1	0	30	20	50	100	150	4
3	IC-801	Optimal Control Systems	3	1	0	30	20	50	100	150	4
4	IC-802	Biomedical Instrumentation	3	1	0	30	20	50	100	150	4
PRACTICAL/TRAINING/PROJECT											
5	IC-851	Biomedical Instrumentation Lab	0	0	2	-	20	20	30	50	1
6	IC-852	Project**	0	0	18	-	100	100	200	300	9
7	GP-801	General Proficiency	-	-	-	-	-	50	-	50	-
		Total	12	4	20	-	-	-	-	1000	26

**Out of 18 periods, 06 periods per week should be allotted for interaction of group with project guide and 12 periods per week should be allotted for self studies and project work.

***Open Electives-III**

1. OE-080 Non Conventional Energy Resources
2. OE-081-Computer Network
3. OE-082-Embedded System
4. OE-083-Nano Science

***Departmental Elective-III**

1. IC-080-Computerized Process Control
2. IC-081-Biomedical Signal Processing
3. IC-082-Analytical Instrumentation
4. IC-083-Filter Design

Syllabus III Semester:

THEORY SUBJECTS

MATHEMATICS –III (MA-301) (3L+1T+0P) (4Cr) Marks-150

Unit – I

Function of Complex variable

Analytic function, C-R equations, Cauchy's integral theorem, Cauchy's integral formula for derivatives of analytic function, Taylor's and Laurent's series, singularities, Residue theorem, Evaluation of real integrals of the type $\int_0^{2\pi} f(Cos\,\theta, Sin\,\theta)\,d\theta$ and $\int_{-\infty}^{+\infty} f(x)\,dx$

Unit – II

Statistical Techniques - I

Moments, Moment generating functions, Skewness, Kurtosis, Curve fitting, Method of least squares, Fitting of straight lines, Polynomials, Exponential curves etc., Correlation, Linear, non –linear and multiple regression analysis, Probability theory.

Unit – III

Statistical Techniques - II

Binomial, Poisson and Normal distributions, Sampling theory (small and large), Tests of significations: Chi-square test, t-test, Analysis of variance (one way) , Application to engineering, medicine, agriculture etc.

Time series and forecasting (moving and semi-averages), Statistical quality control methods, Control charts, $\bar{X}$, R, p, np, and c charts.

Unit – IV

Numerical Techniques – I

Zeroes of transcendental and polynomial equation using Bisection method, Regula-falsi method and Newton-Raphson method, Rate of convergence of above methods.

Interpolation: Finite differences, difference tables, Newton's forward and backward interpolation , Lagrange's and Newton's divided difference formula for unequal intervals.

Unit – V

Numerical Techniques –II

Solution of system of linear equations, Gauss- Seidal method, Crout method. Numerical differentiation, Numerical integration , Trapezoidal , Simpson's one third and three-eight rules, Solution of ordinary differential (first order, second order and simultaneous) equations by Euler's, Picard's and forth-order Runge- Kutta mehthods.

Books Recommended

1. Peter V. O'Neil, Advance Engineering Mathematics Thomson (Cengage) Learning, 2007.
2. Jain, Iyenger & Jain, Numerical Methods for Scientific and Engineering Computation, New Age International, New Delhi , 2003.
3. J.N. Kapur, Mathematical Statistics, S. Chand & company Ltd.,2000
4. R.K. Jain & S.R.K. Iyenger, Advance Engineering Mathematics, Narosa Publication House, 2002.
5. Chandrika Prasad, Advanced Mathematics for Engineers, Prasad Mudralaya, 1996.

6. E. Kreysig, Advanced Engineering Mathematics, John Wiley & Sons, 2005.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 2005.
8. Devi Prasad, An introduction to Numerical Analysis, Narosa Publication house, New Delhi 2006.
9. T. Veerajan & T. Ramchandrandran, Theory & Problems in Numerical Methods, TMH, New Delhi, 2004.
10. S.P.Gupta, Statistical Methods, Sultan and Sons, New Delhi, 2004.
11. Devore, Probability and Statistics, Thomson(Cengage) Learning, 2007.
12. Walpole, Myers, Myers & Ye, Probability and Statistics for Engineers & Scientists, Pearson Education, 2003.

FUNDAMENTALS OF ELECTRONIC DEVICES (IC-302) (3L+1T+0P) (4Cr)

Marks-150

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.

Books Recommended

1. B. G. Streetman and S. Banerjee “Solid state electronics devices”, 5th Edition, PHI.
2. Alok Dutta, “Semiconductor Devices and circuits”, Oxford University Press

DIGITAL ELECTRONICS (IC-303) (3L+1T+0P) (4Cr) Marks-150

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.

Books Recommended

1. M. Morris Mano and M. D. Ciletti, "Digital Design", 4th Edition, Pearson Education
2. Hill & Peterson, "Switching Circuit & Logic Design", Wiley.
3. Digital Circuit & Logic Design, by Holsworth.

ELECTROMAGNETIC FIELD THEORY (IC-304) (3L+1T+0P) (4Cr) Marks-150

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.

Books Recommended

1. M. N. O. Sadiku, "Elements of Electromagnetic", 4th Ed, Oxford University Press.
2. W. H. Hayt and J. A. Buck, "Electromagnetic field theory", 7th Ed., TMH.

FUNDAMENTAL OF NETWORK ANALYSIS & SYNTHESIS (IC-305)

(3L+1T+0P) (4Cr) Marks-150

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

Books Recommended

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

LABORATORY

ELECTRONICS ENGINEERING LAB- I (IC-351) (0L+0T+2P) (1Cr) Marks-50

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. Zener diode :Characteristics of Zener diode-forward bias and reverse bias characteristics. Graphical measurement of Zener breakdown voltage.
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.
7. To observe the action of a Transistor as an electronic switch.
8. Characteristic of FET: FET in common source configuration. Graphical measurement of its parameters gm, rd & m from input and output characteristics.
9. Characteristic of silicon-controlled rectifier.
10. To plot V-I characteristics and transfer characteristics of MOSFET.

DIGITAL ELECTRONICS LAB (IC-352) (0L+0T+2P) (1Cr) Marks-50

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 and D flip-flops using NAND gate & TTL ICs.
4. Implementation and verification of Decoder/De-multiplexer and Encoder using logic gates.
5. Implementation of different type of multiplexer and demultiplexer using 16 to 1 line multiplexer and 1to 16 line demultiplexer.

6. To verify the truth table of 4 bit full Adder and Subtractor.
7. Design and verify the truth table of 2 input half adder and `half subtractor.
8. To verify the truth table of 4-bit synchronous and asynchronous counter.
9. Mini Project.

ELECTRONIC WORKSHOP & PCB LAB (IC-353) (0L+0T+4P) (2Cr) Marks-100

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) (3L+1T+0P) (4Cr) Marks-150

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 feedback, the four basic feed**b**ack 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.

Books Recommended

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

ELECTRICAL MEASUREMENT AND MEASURING INSTRUMENTS (IC-402)

(3L+1T+0P) (4Cr) Marks-150

Unit-I

Analog Measuring Instruments: Classification of analog instruments, operating forces in indicating instruments, T/W ratio, pointers and scales. Working principle, theory, construction and salient features of electromechanical indicating / registering instrument viz. PMMC, Electrodynamometer, Moving iron, Rectifier type, Induction type for the measurement of dc and ac voltage, current, power, energy (1 -phase induction type wattmeter), power factor (single phase Electrodynamometer).

Unit-II

Ammeter, Voltmeter and Ohmmeter: galvanometer, DC ammeter, DC voltmeter, series ohm meter, AC electronic voltmeter, current measurement with electronic instruments, multi meter probes , digital multi meters.

Unit-III

Measurement of Resistances: Classification of resistances, measurement of medium resistance, Measurement of low resistance (Kelvin double bridge, Ammeter -Voltmeter) and Measurement of high resistance including loss of charge method and Mega ohm bridge method.

AC Bridges: General theory of ac bridge, Measurement of self inductance, Measurement of capacitance, Measurement of mutual inductance, Measurement of frequency, Sources of error in ac bridges and their minimization.

Unit-IV

Instrument Transformers: Theory and construction of current and potential transformers, transformation ratio and phase angle errors and their minimization, effects of pf, secondary burden and frequency.

Unit-V

Cathode Ray Oscilloscope: Principle and working of CRO, Block diagram presentation of CRO and brief description of various elements of CRO – CRT, horizontal Deflecting system, Vertical deflecting system, CRO screen, Measurement of voltage, frequency and phase angle using CRO, CRO probes, DSO ,DSO Probe,Wave analyzer.

Books Recommended

1. Cooper W D, "Electronic Instrumentation and Measurement Techniques", Prentice Hall, New Delhi (1982)
2. Sawhney A K, "Electrical and Electronics Measurements and Instrumentation", Dhanpat Rai and Sons, New Delhi (1993)

3. Bell David A, "Electronic Instrumentation and Measurements", Prentice Hall, Inc, New Delhi (1994)
4. Reissland Martin V, "Electrical Measurements Fundamentals, Concepts, Applications", Wiley Eastern Limited, New Delhi (1989)
5. Wolf S and Smith R F M, "Student Reference Manual for Electronic Instrumentation Laboratories", Prentice Hall, New Delhi (1996).

SIGNALS AND SYSTEMS (IC-403) (3L+1T+0P) (4Cr) Marks-150

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.

Books Recommended

1. P. Ramakrishna Rao, `Signal and Systems' 2008 Ed., Tata McGraw Hill, New Delhi
2. Chi-Tsong Chen, `Signals and Systems', 3rd Edition, Oxford University Press, 2004
3. V. Oppenheim, A.S. Willsky and S. Hamid Nawab, 'signals & System',PEARSON Education, Second Edition, 2003.

TRANSDUCERS AND SIGNAL CONDITIONING (IC-404) (3L+1T+0P) (4Cr)
Marks-150

UNIT-I
Introduction: Measurement systems, Basic electronic measuring system, Transduction principles, Classification of transducers, General transducers characteristics, Criteria for transducer selection.

UNIT-II
Resistive Transducers: Principles of operation, construction, theory, advantages and disadvantages, applications of Potentiometers, strain gauges, (metallic and semi-conductor type), Resistance Thermometer, Thermistors.
Inductive Transducers: Types of Inductive transducer, Principles of operation, construction, Advantages & disadvantages and applications. Various variable Inductive Transducers, LVDT (Linear variable differential transformer).
Capacitive Transducers: Types of capacitive transducer, Principles of operation, construction, theory, advantages and disadvantages and applications, of capacitive transducers based upon familiar equation of capacitance.
Elastic Transducers: Spring bellows, diaphragm, bourdon tube – their special features and application

UNIT-III
Active Transducers: Principle of operation, construction, theory, advantages and disadvantages and applications of following transducers: Thermocouple, Piezo-electric transducer, Magneto-strictive transducer, Hall effect transducer, Photo-voltaic transducer and electrochemical transducer.

UNIT-IV
Other Transducers : Optical transducers: photo-emissive, photo-conductive and Photo-voltaic cells, Digital Transducers: Optical encoder, Shaft encoder. Feedback fundamentals, introduction to Inverse transducer.

UNIT-V
Signal Conditioning: Concept of signal conditioning, Introduction to AC/DC Bridges. Op - amp circuits used in instrumentation, Instrumentation amplifiers, analogue-digital sampling, introduction to A/D and D/A conversion, signal filtering, averaging, correlation, Interference, grounding , and shielding.

Books recommended

1. Murty d v s, “transducers & instrumentation”, phi, new delhi (2000)
2. Sawhney a k, “electrical and electronics measurements and instrumentation”, dhanpat rai and sons, New delhi (2000).
3. Kalsi h s, “electronic instrumentation “ tata mcgraw hill, New delhi, 4th ed. (2001).
4. Patranabis d, “sensors and transducers”, phi, new delhi (2003).
5. Doebelin ernest o, ”measurement systems: application and design”, tata mcgraw hill ltd., New delhi (2004).

OPEN ELECTIVES-I

INTRODUCTION TO SOFT COMPUTING (OE-040) (3L+1T+0P) (4Cr) Marks-150

(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.

Books Recommended

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.
3. Siman Haykin,”Neural Netowrks”Prentice Hall of India
4. Timothy J. Ross, “Fuzzy Logic with Engineering Applications” Wiley India.
5. Kumar Satish, “Neural Networks” Tata Mc Graw Hill

NUMERICAL METHODS (OE-041) **3L+1T+0P) (4Cr) Marks-150**

UNIT-I

Roots of algebraic and transcendental equations, Bisection Method, Regula – Falsi method, Newton –Raphson method, Bairstow's method and Graeffe's root squaring method.

Solution of simultaneous algebraic equations, matrix inversion and eigen-value problems, triangularisation method, Jacobi's and Gauss-Siedel iteration method, partition method for matrix inversion, power method for largest eigen-values and Jacobi's method for finding all eigen-values.

UNIT-II

Finite differences, interpolation and numerical differentiation, forward, backward and central differences, Newton's forward, backward and divided difference interpolation formulas, Lagrange's interpolation formula, Stirling's and Bessel's central difference interpolation formulas, numerical differentiations using Newton's forward and backward difference formulas and Numerical differentiations using Stirling's and Bessel's central difference interpolation formulas.

UNIT-III

Numerical integration, Trapezoidal rule, Simpson's one-third rule and numerical double integration using Trapezoidal rule and Simpson's one-third rule.

UNIT-IV

Taylor's series method, Euler's and modified Euler's methods, Runge -Kutta fourth order methods for ordinary differential equations, simultaneous first order differential equations and second order differential equations.

UNIT-V

Boundary value problems, finite difference methods for boundary value problems.

Partial differential equations, finite difference methods for elliptic, Parabolic and hyperbolic equations.

Books Recommended

1. S S Sastry, Introductionary Methods of Numerical Analysis, 3rd Edition, Prentice Hall of India Pvt.Ltd., New India -1999
2.
3. S C Chapra and R P Canale, Numerical Methods for Engineers, 2nd Edition, McGraw Hill Book Company, Singapore 1990.
4. Grewal, B S ,"Numerical Methods", Khanna Publishers ,Delhi.

DATA STRUCTURE (OE-042) **3L+1T+0P) (4Cr) Marks-150**

Unit - I

Introduction: Basic Terminology, Elementary Data Organization, Structure operations, Algorithm Complexity and Time-Space trade-offArrays: Array Definition, Representation and Analysis, Single and Multidimensional Arrays, address calculation, application of arrays, Character String in C, Character string operation, Array as Parameters, Ordered List, Sparse Matrices and Vectors.Stacks: Array Representation and Implementation of stack, Operations

on Stacks: Push & Pop, Array Representation of Stack, Linked Representation of Stack, Operations Associated with Stacks, Application of stack: Conversion of Infix to Prefix and Postfix Expressions, Evaluation of postfix expression using stack.Recursion: Recursive definition and processes, recursion in C, example of recursion, Tower of Hanoi Problem, simulating recursion, Backtracking, recursive algorithms, principles of recursion, tail recursion, removal of recursion.

UNIT - II

Queues: Array and linked representation and implementation of queues, Operations on Queue: Create, Add, Delete, Full and Empty, Circular queues, D-queues and Priority Queues.

Linked list: Representation and Implementation of Singly Linked Lists, Two-way Header List, Traversing and Searching of Linked List, Overflow and Underflow, Insertion and deletion to/from Linked Lists, Insertion and deletion Algorithms, Doubly linked list, Linked List in Array, Polynomial representation and addition, Generalized linked list, Garbage Collection and Compaction.

UNIT – III

Trees: Basic terminology, Binary Trees, Binary tree representation, algebraic Expressions, Complete Binary Tree, Extended Binary Trees, Array and Linked Representation of Binary trees, Traversing Binary trees, Threaded Binary trees, Traversing Threaded Binary trees, Huffman algorithm.

Searching and Hashing: Sequential search, binary search, comparison and analysis, Hash Table, Hash Functions, Collision Resolution Strategies, Hash Table Implementation.

UNIT – IV

Sorting: Insertion Sort, Bubble Sorting, Quick Sort, Two Way Merge Sort, Heap Sort, Sorting on Different Keys, Practical consideration for Internal Sorting.

Binary Search Trees: Binary Search Tree (BST), Insertion and Deletion in BST, Complexity of Search Algorithm, Path Length, AVL Trees, B-trees.

UNIT - V

Graphs: Terminology & Representations, Graphs & Multi-graphs, Directed Graphs, Sequential Representations of Graphs, Adjacency Matrices, Traversal, Connected Component and Spanning Trees, Minimum Cost Spanning Trees.

File Structures: Physical Storage Media File Organization, Organization of records into Blocks, Sequential Files, Indexing and Hashing, Primary indices, Secondary indices, B+ Tree index Files, B Tree index Files, Indexing and Hashing Comparisons.

Books Recommended

1. Horowitz and Sahani, “Fundamentals of data Structures”, Galgotia Publication Pvt. Ltd., New Delhi.
2. R. Kruse etal, “Data Structures and Program Design in C”, Pearson Education Asia, Delhi-2002
3. A. M. Tenenbaum, “Data Structures using C & C++”, Prentice-Hall of India Pvt. Ltd., New Delhi.
4. Supplementary reference books:
5. K Loudon, “Mastering Algorithms With C”, Shroff Publisher & Distributors Pvt. Ltd.
6. Bruno R Preiss, “Data Structures and Algorithms with Object Oriented Design Pattern in C++”, Jhon Wiley & Sons, Inc.
7. Adam Drozdek, “Data Structures and Algorithms in C++”, Thomson Asia Pvt. Ltd.(Singapore)

MATERIAL SCIENCE(OE-043) **3L+1T+0P) (4Cr) Marks-150**

UNIT-I

Crystal Structure: Fundamental concepts, Crystal systems, Closed packed structures, Crystallographic planes and directions, Miller indices, Crystal defects.

UNIT-II

Electrical Properties: Classical free electron theory of metals, Quantum theory – Particle in a box, Wave function and energy states, Finite potential barrier, Tunneling, Fermi-Dirac distribution law, Density of energy states, Classification of solids into conductors, Semiconductors and insulators, Hall effect and its applications.

UNIT-III

Semiconductor Materials: Intrinsic and extrinsic materials, Electron and hole concentrations at equilibrium, Temperature dependence of carrier concentrations, Conductivity and mobility.

UNIT-IV

Magnetic Properties: Basic concepts, Soft and hard magnetic materials, Ferrites, Selection techniques for applications, Magnetic recording, Magnetic memories.

Superconductivity: Properties of superconductors, London equations, Quantum explanation of superconductivity, Applications of superconductors.

UNIT-V

Dielectric & Optical Properties: Dielectric materials, Polarization mechanisms, Dipole moment, Dielectric strength, Methods for producing polarization, Application of dielectric materials, Index of refraction, Damping constant, Characteristic penetration depth and absorbance, Reflectivity and transmissivity, Optical storage devices.

Nanomaterials: Introduction to nanotechnology, Nanowire and nanotube, Carbon nanotubes, Single wall carbon nanotubes, Multiwall carbon nanotubes, Fabrications, Properties and applications.

Books Recommended

1. Hummel R E, “Electronic Properties of Materials”, Narosa Publishing House, New Delhi (1997).
2. William D Callister, Jr, “Materials Science and Engineering”, John Wiley and Sons, Inc. New York (2002).
3. Dekker A J, “Solid State Physics”, MacMillan, India Limited, Madras (2000).
4. Pillai S O, “Solid State Physics”, New Age International Publishers, New Delhi (1999).
5. Van Vlack L H, “Elements of Material Science and Engineering”, Addison Wesley Publishers (1980).
6. Poole C.P. and Owens F.J., “Introduction to Nanotechnology”, Wiley Edition (2003)

LABOROTARY

ELECTRONICS ENGINEERING LAB II (IC-451) (0L+0T+1P) (1 Cr) Marks-50

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

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 –To study the voltage gain, output impedance and frequency response of a common source FET amplifier.
4. Bipolar Transistors- To study RC Coupled Transistor amplifier –Plot of frequency Vs output gain in dB.
5. To observe and verify the various characteristics of Emitter coupled amplifier or Darlington pair amplifier and also measure voltage gain, output impedance, and output power.
6. PNP Transistor-To calculate H parameters of PNP Transistor in CE mode.
7. To study class A amplifier.
8. To study class B amplifier.
9. To study Differential Amplifier using transistor.
10. Oscillators -Sinusoidal Oscillators- (a) Wein-bridge oscillator (b) phase shift oscillator

TRANSDUCERS AND SIGNAL CONDITIONING LAB(IC-452) (0L+0T+4P) (2 Cr) Marks-100

1. To measure displacement using an LVDT (linear variable differential transformer)
2. To measure the temperature using thermocouple and to plot variation of temperature with the voltage
3. To measure the force using a full bridge strain gauge based transducer
4. To measure the strain of a deflecting beam with the help of a strain gauge
5. To measure speed-using a proximity type sensor
6. To measure temperature using a thermistor and to plot variation of resistance with temperature
7. To study the recording of different signals from sensors on a magnetic tape recorders
8. To study the acquisition data from strain gauge transducer using a DAS
9. To study the acquisition of data from inductive transducer using a data acquisition system
10. To measure the vibrations of system using a piezoelectric crystal
11. To study the performance of an LCD, LED, BCD to 7-segment display
12. To measure a load using a load cell
13. To study the characteristics of a given bourdon tube

ELECTRICAL MEASUREMENT AND MEASURING INSTRUMENTS LAB (IC-453)

(0L+0T+1P) (1 Cr) Marks-50

1. To measure amplitude and frequency of the signal using CRO (Y-t mode)
2. To measure frequency of an unknown signal and phase angle between two signals obtaining Lissajous pattern using a CRO
3. Measurement of medium resistance with the help of a Wheatstone Bridge
4. Measurement of low resistance with the help of a Kelvin Double Bridge
5. Measurement of inductance by Maxwell's inductance Bridge
6. Measurement of inductance by Anderson's bridge.
7. Measurement of inductance by Owen's bridge.
8. Measurement of capacitance by DeSauty's Bridge.
9. Measurement of capacitance by Schering Bridge
10. Measurement of frequency by Wein's Bridge
11. To study potentiometer and to plot EMF Vs. Displacement characteristics of a potentiometer

Syllabus V semester:

THEORY SUBJECTS

POWER ELECTRONICS (IC-501) **(3L+1T+0P) (4 Cr)** **Marks-150**

UNIT-I

Introduction: concept of power electronics, applications of power electronics, advantages and disadvantages of power electronics.

Diode Circuits and Rectifiers: diode circuits with DC source, freewheeling diodes, single phase diode rectifiers.

UNIT-II

Thyristors: thermal characteristics of thyristors, thyristor turn-on methods, switching characteristics of thyristors, thyristor gate characteristics, two transistor model of a thyristor, thyristor ratings, thyristor protection, series and parallel operation of thyristors.

Thyristor Commutation Techniques: class A commutation: load commutation, class B commutation: resonant pulse commutation, class C commutation: complementary commutation, class D commutation: impulse commutation, class E commutation: external pulse commutation, class F commutation: line commutation.

UNIT-III

Phase Controlled Rectifiers: principle of phase control, full-wave controlled converters, single phase full-wave converters, three-phase converter systems using diodes, three-phase thyristor converter circuits, effect of source impedance on the performance of converters.

UNIT-IV

Choppers: principle of chopper operation, control strategies, step-up choppers, types of chopper circuits, thyristor chopper circuits: voltage-commutated chopper, current-commutated

chopper, load-commutated chopper.

UNIT-V

Inverters: operating principle of single-phase voltage source inverters, force -commutated thyristor inverters, three-phase bridge inverters, voltage control in single phase inverters, PWM inverters, operating principle of current source inverters.

Books Recommended

1. Dr. P S Bimbhra, "Power Electronics", Khanna Publishers.
2. P C Sen, "Power Electronics", Tata McGraw Hill.
3. Muhammad H Rashid, "Power Electronics", Prentice Hall of India.
4. Harish C Rai, "Industrial and Power Electronics", Umesh Publications, Delhi. G K Mithal, M Gupta, "Industrial and Power electronics", Khanna Publishers..

INTEGRATED CIRCUITS (IC-502) (3L+1T+0P) (4 Cr) Marks-150

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

Linear Applications of IC op-amps: An Overview of Op-Amp (ideal and non ideal) based Circuits V-I and I-V converters, generalized Impedance converter simulation of inductors .
Filters: First and second order LP, HP, BP BS and All pass active filters, KHN, Tow-Thomas and State Variable Biquad filters; Sinusoidal oscillators .

UNIT-III

Digital Integrated Circuit Design-An Overview: CMOS Logic Gate Circuits: Basic Structure CMOS realization of Inverters, AND, OR, NAND and NORGate
Latches and Flip flops: The Latch, The SR Flip-flop, CMOS Implementation ofSR Flip-flops, A Simpler CMOS Implementation of the Clocked SR Flip-flop,D flip-flop circuits.

UNIT-IV

Non-Linear applications of IC Op-amps: Log–Anti Log Amplifiers, Precision Rectifiers, Peak Detectors, Simple and Hold Circuits, Analog Multipliers and their applications. Op-amp as a comparator, Zero crossing detector, Schmitt Trigger, Astable multivibrator, Monostable multivibrator, Generation of Triangular Waveforms

UNIT-V

A/D and D/A convertors.

Integrated Circuit Timer: The 555 Circuit, Implementing a Monostable Multivibrator Using the 555 IC, Astable Multivibrator Using the 555 IC.

Phase locked loops (PLL): Ex-OR Gates and multipliers as phase detectors,block diagram of IC PLL and applications of PLL.

Books Recommended

1. Sedra & Smith "Micro-Electronic Circuits", Vth Edition, Oxford University
2. Donald A. Neaman, "Electronics Circuits analysis and design",3rd Edition, TMH.
3. Jacob Milliman and Arvin Grabel," "Microelectronics " 2nd Edition,TMH(18)

CONTROL SYSTEM – I (IC-503) (3L+1T+0P) (4 Cr) Marks-150

UNIT-I

Introduction: Basic Components of a control system, Feedback and its effect, types of feedback 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

Books Recommended

1. B.C. Kuo, "Automatic Control Systems" ,8th Edition, John Wiley
2. J Nagrath & M Gopal, Control System Engineering; New Age International publishers
3. Joseph J Distefano III, Allen R Stubberud, Ivan J Williams, Control Systems Shaums out lines Series , 3rdEdition, Mc Graw Hill.(19)

INDUSTRIAL INSTRUMENTATION AND MEASUREMENT(IC-504) (3L+1T+0P) (4 Cr) Marks-150

UNIT-I

Metrology: Line and length standards, gauge, gauge block, mechanical, optical, pneumatic and electrical comparators, interferometry and flats, sine bar, review of displacement, velocity, acceleration and seismic pickups.

UNIT-II

Pressure Measurement: Standards and calibration, Deadweight piston gauges and manometers, elastic transducers, bourdon tube, bellows and diaphragm, high pressure measurement, vacuum measurement-McLeod gauge, Knudsen gauge, thermal conductivity gauges, Pirani and lionization gauge.

UNIT-III

Temperature Measurement: Measurement, Standards and calibrations, thermal expansion methods, bimetallic thermometers, filled in systems, their errors, thermoelectric sensors electric resistance sensors, junction semiconductor sensors, radiation pyrometry.

UNIT-IV

Flow Measurement: Head type, area type, positive displacement type, mass flow meters vortex type, electrical type, Turbo magnetic, Electromagnetic, ultrasonic Hot wire anemometer, flow marker, open channel flow metering, their working principle and applications.

UNIT-V

Other Variable measurements: Mass, weight, force, torque and shaft power measurement, level measurement, Humidity and moisture measurement.

Books Recommended

1. Doeblin E O, "Measurement System: Application & Design", McGraw Hill Book Co., New Delhi (2004).
2. Rangan, Mani Sharma, "Instrumentation Devices & Systems", Tata McGraw Hill Book Co., 16th Reprint, New Delhi (1996).
3. Sawhney A K, "A course in Mechanical Measurement & Instrumentation", Dhanpat Rai & Sons Book Co., New Delhi (2003).
4. Patranabis D "Principles of Industrial Instrumentation " TMGH ,(1993).
5. Beckwith T G, Lienhard J H and Marangoni R D, "Mechanical Measurements" Addison –Wesley (Pearson Edu Asia), (2000).

MICROPROCESSORS (IC-505) (3L+1T+0P) (4 Cr) Marks-150

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).

Books Recommended

1. Ramesh Gaonkar, "Microprocessor Architecture, Programming, and Applications with the 8085", 5th Edition,Penram International Publication (India) Pvt. Ltd.
2. 2. Douglas V. Hall, "Microprocessors and Interfacing", 2nd Edition, TMH, 2006.
3. Kenneth L. Short, "Microprocessors and programmed Logic", 2nd Ed, Pearson Education Inc.

LABOROTARY

INTEGRATED CIRCUITS LAB (IC-551) **(0L+0T+2P) (1 Cr)** **Marks-50**

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. Applications of Op-amp- Op-amp as summing amplifier, Difference amplifier, Integrator and differentiator
3. Voltage comparator and zero crossing detectors
4. Operational amplifier as a Schimtt trigger.
5. Operational amplifier as a Logrithmic amplifier.
6. 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.

7. To study Phase Lock Loop.
8. A/D and D/A convertor.
9. Voltage to current and current to voltage convertors.
10. Function generator using operational amplifier (sine, triangular & square wave)
11. As table and mono stable multi vibrator using IC 555.

CONTROL SYSTEM LAB -I (IC-552) (0L+0T+2P) (1 Cr) Marks-50

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.
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) (0L+0T+2P) (1 Cr) Marks-50

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) **(0L+0T+2P) (1 Cr)** **Marks-50**

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 8257 DMA with 8085.
10. To interface Keyboard with 8085

Syllabus VI Semester:

THEORY SUBJECTS

ELECTRICAL MACHINES (IC-601) **(03 L+1T+0P) (4 Cr)** **Marks-150**

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.

Books Recommended

1. D P Kothari & I J Nagrath, "Electric Machines", Tata McGraw Hill Education Pvt Ltd, 3rd Edition,2004.
2. A. Fitzgerald, C. Kingsley and S Umans , "Electric Machinery", Tata McGraw Hill Education Pvt Ltd, 6th Edition, 2002.

MICROCONTROLLER (IC-602) **(03 L+1T+0P) (4 Cr)** **Marks-150**

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.

Books Recommended

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

COMMUNICATION ENGINEERING (IC-603) (03 L+1T+0P) (4 Cr) Marks-150

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

Books Recommended

1. Simon Haykin & Michael Moher "Communication Systems", 5th Edition, Wiley India Publication.
2. B.P. Lathi & Zhi Ding , " Modern Digital and Analog Communication Systems" International 4th Ed.Oxford University Press (26)

DIGITAL SIGNAL PROCESSING(IC-604) (03 L+1T+0P) (4 Cr) Marks-150

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

Books Recommended

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

DEPARTMENTAL ELECTIVE-I

OPTO ELECTRONICS (IC-060) (03 L+1T+0P) (4 Cr) Marks-150

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.

Books Recommended

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

PROCESS DYNAMICS AND CONTROL (IC-061) (03 L+1T+0P) (4 Cr)
Marks-150

UNIT-I
Basic Considerations: Introduction, Basic components, diagrammatic representation, symbol and Terminology, changes at arbitrary points in the loop, offset and its analysis.

UNIT-II
Process Characteristics: Process variables, mathematical modeling of liquid, gas, thermal, mechanical and chemical systems. Linearzing techniques, Liquid level control in a tank. Dynamics of manometer, response of non-interacting and interacting first-order elements in series, Mixing process, Heat transfer process, Distillation column.

UNIT-III
Controller Characteristics: Control modes, characteristics and comparison of on-off, proportional, integral, derivative modes and their combinations (PI, PD and PID), Introduction to Digital controllers.
Automatic Control: Single and combined modes in closed loop, static error, velocity error. Dynamic behavior of feedback control processes for different modes, IAE, ISE, IATE criteria, Tuning of controllers, process reaction curve.

UNIT-IV
Controller Hardware: Electronic pneumatic and hydraulic controller's implementation, single and composite modes of controllers.
Final Control Elements: Control valves, types, functions, Electrical, Pneumatic hydraulic-actuators, Solenoid, E-P converters, stepper motors.

UNIT-V
Introduction to Computerized Process Controls: Control algorithm, PID Control action with Dead time.

Books Recommended

1. Coughanowr R Donald, "Process Systems Analysis & Control", McGraw Hill, New Delhi (1991).
2. Patranabis.D, "Principles of Process Control", TMH, New Delhi (1994).
3. Stephanopoulos G, "Chemical Process Control: An Introduction to Theory and Practice", PHI New Delhi (1995).
4. Johnson Curtin, "Process Control Instrumentation Technology", PHI, New Delhi (1999).
5. Harriott P, "Process Control " 10th Reprint, TMH, New Delhi (1992).

DIGITAL CONTROL SYSTEMS (IC-062) (03 L+1T+0P) (4 Cr) Marks-150

UNIT-I
Discrete Data and Digital Control Systems: Introduction, basic elements of Discrete-data control systems, signals conversion and processing, data conversion and quantization.

Sampling and Data Reconstruction of Sampled Signals: mathematical modeling of ideal & actual samplers, sampling theorem, Hold circuits and comparison between hold circuits based on step response and frequency domain characteristics.

UNIT-II

Transform Analysis of Digital Control System: Introduction, Linear Difference equations, the pulse TF and pulse response, z- transform, relationship between the s-plane and the z-plane, Limitation of z-transform, the delayed & modified z-transforms.

UNIT-III

The State Variable Technique for Digital Systems: Introduction, state equations and solutions of continuous and digital systems, Development of state formulation of Discrete-data system with S/hold -devices, relationship between state equation and T.F., diagonalization of system-matrix, Jordon Canonical form, state diagrams, state variable analysis of response between sampling instants.

UNIT-IV

Controllability, Observability and Stability: Concept of controllability for LTIV-discrete data systems, observability & TF, stability of Linear digital control systems, various methods of stability test, the second method of Liapunov & its applications to LTIV – discrete data system for stability analysis.

UNIT-V

Design of Discrete-Data Control Systems: Concept of cascade compensation, Digital controllers including PID-controller, Design of digital control systems with digital controllers, Introduction to design of robust control systems, Pole-placement design by state and output – feedback, DSP control – digital signal processors.

Digital Control Systems using MATLAB.

Books Recommended

1. Kuo B C, “Digital Control Systems”, Oxford Univ. Press, Noida, New Delhi, 2nd Edition (2004)
2. Gopal M, “Digital Control Engg”, WE Ltd. New Delhi – (1993)
3. Jury E I, “Theory and application of Z-transform methods” John Wiley (1964).
4. Medich K, “State Estimation”, McGraw Hill International, 1963
5. Lindorff D P, “Theory of SD-control systems”, John Wiley, (1966)

MICROWAVE ENGINEERING(IC-063) (03 L+1T+0P) (4 Cr) Marks-150

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.

Books Recommended

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

LABORATORY

MICRO CONTROLLER LAB (IC-651) (0 L+0T+2P) (1 Cr) Marks-50

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) (0 L+0T+2P) (1 Cr) Marks-50

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 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.

COMMUNICATION LAB (IC-653) (0 L+0T+2P) (1 Cr) Marks-50

1. To study DSB/ SSB amplitude modulation & determine its modulation factor & power in side bands.
2. To study frequency modulation and determine its modulation factor
3. To study the functioning of Pre-Emphasis and De-Emphasis circuits.
4. To study frequency division multiplexer and demultiplexer for modulation and demodulation system.
5. To study sampling and reconstruction of Pulse Amplitude modulation system
6. To study Pulse Width Modulation and Pulse Position Modulation.

7. Study of Pulse code modulation (PCM) and its demodulation.
8. Study of Amplitude shift keying modulator and demodulator.
9. Study of Frequency shift keying modulator and demodulator.
10. Study of Phase shift keying modulator and demodulator
11. To study Delta Modulation and Demodulation.

Syllabus VII Semester:

THEORY SUBJECTS

CONTROL SYSTEM –II (IC-701) **(03 L+1T+0P) (4 Cr)** **Marks-150**

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.

Books Recommended

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

DATA ACQUISITION AND TRANSMISSION (IC-702)(03 L+1T+0P) (4 Cr)Marks-150

UNIT-I

Data Acquisition System: Definition and generalized block diagram of data acquisition system (DAS), Classification of DAS, working principle block diagram, construction and salient features of the following data acquisition systems: Analog data acquisition system using time division multiplexing, Analog data acquisition system using frequency division multiplexing, Digital data acquisition system with different configurations and Data logger.

UNIT-II

Data Transmission Systems: Definition, generalized block diagram of Telemetry system, classification of Telemetry system the working principle, block diagram, construction, salient features and applications of the following Telemetry systems: DC voltage, current and position telemetry system (Landline Telemetry system), Radio frequency amplitude modulated and frequency modulated telemetry system – theory related to amplitude and frequency modulation techniques, Pulse telemetry system – pulse amplitude modulated (PAM) system, pulse width modulated system (PWM), pulse code modulated system (PCM) system, Coding for varying levels .Modem based telemetry system, Satellite Telemetry system and Fiber optic Telemetry system.

UNIT-III

Display Systems: Construction, principle of operation and salient features of various kinds of display devices such as LED, Nixie tube, LCD, segmental gas discharge type, single and multi digit LED 7-segmental display system (study of BCD to 7 segment code converter / decoder), Nixie tube based display system for numeric display (study of BCD to decimal decoder), to design LED Dot Matrix (3 x 5) numeric display system and LCD 7-segmental numeric display system

UNIT-IV

Digital Instruments: Digital voltmeters (DVMs): working principle, construction, operation, salient features, range selection– Ramp type, dual slope integrating type, successive approximation type, Digital Fre quency Meter: working principle, construction (block diagram), range selection and operation of, time period meter, frequency ratio meter, Digital Clock: block diagram construction and working, Analog Storage Oscilloscope and Digital storage oscilloscope: working principle, construction, operation and salient features.

UNIT-V

Recorders: The working principle, construction, operation and salient features of X-t strip chart recorder, X-Y strip chart recorder and Magnetic tape recorder.

Books Recommended

1. Sawhney A K, "Electric and Electronic Measurement and Instrumentation", Dhanpat Rai and Sons, New Delhi (1993).

2. Bell David A, "Electronic Instrumentation and Measurement", PHI, Inc, New Delhi (1994).
3. Tocci Ronald J , "Digital Systems Principles and Applications", PHI, New Delhi (2002)
4. Doebelin E O, "Measurement systems – Applications and Deign", McGraw Hill, New Delhi (1990
5. Mani and Rangan, "Instrumentation Devices and Systems", Tata McGraw Hill, New Delhi (1997).

DIGITAL MEASUREMENT TECHNIQUES (IC-703) (03 L+1T+0P) (4 Cr) Marks-150

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.

Books Recommended

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

OPEN ELECTIVE -I

TRANSDUCERS (OE-070) **(03 L+1T+0P) (4 Cr) Marks-150**

UNIT-I

Introduction: Measurement systems, Basic electronic measuring system, Transduction principles, Classification of transducers, General transducers characteristics, Criteria for transducer selection.

UNIT-II

Resistive Transducers: Principles of operation, construction, theory, advantages and disadvantages, applications of Potentiometers, strain gauges, (metallic and semi-conductor type), Resistance Thermometer, Thermistors.

UNIT-III

Inductive Transducers: Types of Inductive transducer, Principles of operation, construction, Advantages & disadvantages and applications. Various variable Inductive Transducers, LVDT (Linear variable differential transformer).

UNIT-IV

Capacitive Transducers: Types of capacitive transducer, Principles of operation, construction, theory, advantages and disadvantages and applications, of capacitive transducers based upon familiar equation of capacitance.

Elastic Transducers: Spring bellows, diaphragm, bourdon tube – their special features and application.

UNIT-V

Other Transducers: Optical transducers: photo-emissive, photo-conductive and Photo-voltaic cells, Digital Transducers, Encoder., Hall effect transducer, Photo-voltaic transducer

Books Recommended

1. Murty D V S, “Transducers & Instrumentation”, PHI, New Delhi (2000)
2. Sawhney A K, “Electrical and Electronics Measurements and Instrumentation”, Dhanpat Rai and Sons, New Delhi (2000).
3. Kalsi H S, “Electronic Instrumentation “ Tata McGraw Hill, New Delhi, 4th Ed. (2001).
4. Patranabis D, “Sensors and Transducers”, PHI, New Delhi (2003).
5. Doebelin Ernest O, ”Measurement Systems: Application and Design”, Tata McGraw Hill Ltd., New Delhi (2004).

COMPUTER ORGANIZATION AND ARCHITECTURE (OE-071) **(03 L+1T+0P) (4 Cr) Marks-150**

UNIT-I

Introduction: Historical overview, economic trends, underlying technologies, Data Representation- Data Types, Complements, Fixed -Point Representation, Floating-Point Representation, Error detection and correction, Addition, subtraction, multiplication and division algorithms and hardware.

UNIT-II

Computer Performance: The metrics of performance, popular performance metrics, Comparing and summarizing performance- Transaction Processing Benchmarks.

Arithmetic Logic Unit: Arithmetic, logic and shift micro operations, Constructing an arithmetic logic shift unit. **Basic Computer Architecture and Design:** Computer registers, Computer Instructions-Instruction Set Completeness, Classifying Instruction Set Architecture, Basic steps of Instruction Execution, Hardwired control, Microprogrammed Control, Horizontal and Vertical Microprogramming, Interrupts.

UNIT-III

Central Processing Unit: General Register Organization, Stack Organized CPU, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, RISC Vs CISC.

Pipelining: Parallel and pipeline Processing, Pipeline Control, Pipeline Implementations, Conflicts Resolution, and Pipeline Hazards. Vector Processing, and Array Processors.

UNIT-IV

Memory Organization: Memory Systems: principle of locality, principles of memory hierarchy Caches, associative memory, main memory, Virtual memory, Paging and Segmentation, Memory Interleaving.

Input Output Organization: I/O performance measures, types and characteristics of I/O devices, I/O Modes-Programmed I/O, Interrupt Initiated I/O and DMA. Buses: connecting I/O devices to processor and memory, interfacing I/O devices to memory, processor, and operating system.

UNIT-V

Parallel Computers: Classification, SIMD, MIMD Organizations, Connection Networks, Data Flow Machines, and Multithreaded Architectures.

Books Recommended

1. M Moris Mano, "Computer System Architecture", Pearson Education, 3rd Edition (1993)
2. David A. Patterson and John L. Hennessy, "Computer Organization & Design-The Hardware/Software Interface", Morgan Kaufmann, 2nd Edition (1997)
3. William Stallings, "Computer Organisation and Architecture, Designing for Performance", Pearson Education Asia, 6th Edition (2003)
4. Harry F. Jordan and Gita Alaghband, "Fundamentals of Parallel Processing", Pearson Education, 1st Edition (2003)
5. Barry Wilkinson Michael Allen, "Parallel Programming", Prentice hall, (1999)

OPERATION RESEARACH (OE-072) **(03 L+1T+0P) (4 Cr) Marks-150**

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.

Books Recommended

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.

ADVANCED SENSORS(OE-073) **(03 L+1T+0P) (4 Cr) Marks-150**

UNIT-I

Micro mechanical sensing and actuating structures: SAW micro sensors, Resonant micro sensors, micro accelerometers, Pressure micro sensors, micro actuators and micro motors, semiconductor strain gauges, Piezo resistive elements.

UNIT-II

Temperature and Light Sensitive Microstructures: Solid state temperature sensors – silicon resistive temperature sensors, Transistor based sensors, Integrated thermocouple, Photo detectors, Pneumatic detectors, Pyro electric detectors, Photo emissive, photo conductive, Schottky, CCDs, Radiation detectors, Fibre optic sensors: Pressure, Temperature and Phase modulated, Gyroscopes.

UNIT-III

Miscellaneous Miniature Sensors: Magnetic sensors, solid-state, chemical sensors: silicon based, Metal oxide based, Catalyst.

UNIT-IV

Sensor Fusion: Introduction to sensor fusion and sensor selection. Bayesian theory of sensor fusion and its applications.

Books Recommended

1. Khazan Alexander D, " Transducers and their elements – Design and Applications", PTR Prentice Hall, Englewood Cliff, NJ07632 (1994)
2. Middlehoek S and Audet S A, "Silicon Sensors", Academic Press, London (1989)
3. Edmonds T E, "Chemical Sensors", Blackie, London (1988)
4. "Sensors and Actuators", No 8, 1985 (pp 227-233); No 10, 1986 (pp 65-82); No 12, (1987), pp 129-144.
5. Sloman Sabrie " sensor and control system in manufacturing "TMH ,India (1994).

DEPARTMENTAL ELECTIVES

ELECTIVE –II

OPTICAL INSTRUMENTATION(IC-070) (03 L+1T+0P) (4 Cr) Marks-150

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,

Books Recommended

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) (03 L+1T+0P) (4 Cr) Marks-150

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.

Books Recommended

1. G.F. Gilman, "Boiler Control Systems Engineering", ISA Publication.
2. P. K. Nag, "Power plant engineering", McGraw Hill.
3. B. H. Khan, "Non-conventional energy resources", McGraw Hill.
4. Chetan Singh Solanki, "Renewable energy Technology", Prentice Hall Publication.
5. S. P. Sukhatme, "Solar Energy", Tata McGraw Hill.
6. G. D. Rai, "Nonconventional energy sources", Khanna Publication.

ARTIFICIAL NEURAL NETWORK (IC-072) (03 L+1T+0P) (4 Cr) Marks-150

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.

Books Recommended

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

FLUID MECHANICS (IC-073) **(03 L+1T+0P) (4 Cr) Marks-150**

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.

Books Recommended

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",

LABORATORY

DIGITAL CONTROL SYSTEM LAB II (IC- 751) (0 L+0T+2P) (1 Cr) Marks-50

At least four experiments to be done on MATLAB
Suggestions are -

1. Discrete Time LTI model
2. Discrete pole locations & transients response
3. Small damping ($\varepsilon = 0.1$ $Wn= 4\pi/5T$) Medium damping ($\varepsilon = 0.4$ $Wn= 11\ \pi\ /5T$) Large damping ($\varepsilon = 0.8$ $Wn= \pi\ /4T$)
4. Digital DC motor Speed control with PID controller
5. To study Lead & Lag Compensators
6. Kalman Filter design
7. State space design for the Inverted pendulum

DATA ACQUISITION AND TRANSMISSIONLAB (IC-752) (0 L+0T+2P) (1Cr) Marks-50

1. Sampling through an S/H Circuit and reconstruction of the sampled signal. Observe the effect of sampling rate & the width of the sampling pulses.
2. PCM- Modulation and Detection
3. Delta - Modulation and Detection
4. ASK – Modulation and Detection
5. FSK – Modulation and Detection
6. PSK - Modulation and Detection.
7. Frequency modulation and Detection of signal obtained from experiment.
8. Amplitude modulation and Detection of signal obtained from experiment
9. Measurement of Temperature Using RTD/ Thermistor and amplification to an Appropriate level suitable for Tele transmission

Syllabus VIII Semester:

THEORY SUBJECT

OPTIMAL CONTROL (IC-801) (03 L+1T+0P) (4 Cr) Marks-150

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.

Books Recommended

1. M. Gopal, "Modern Control Engineering", New Age International Publishers.
2. B.C. Kuo, "Digital Control Systems", Oxford University Press
3. Brain D.O. Anderson, John B. Moore, "Optimal control Linear Quadratic Methods", Prentice Hall of India Private Limited

BIOMEDICAL INSTRUMENTATION(IC-802) (03 L+1T+0P) (4 Cr) Marks-150

UNIT-I
Physiological Systems of the Body: Brief description of musculoskeletal, endocrine, gastrointestinal, nervous, circulatory and respiratory systems; the body as a control system; the nature of bioelectricity, action events of nerve; the origin of biopotentials.

UNIT-II
Bio potential Electrodes: Signal acquisition; electrodes for biophysical sensing; electrode-electrolyte interface; skin preparation, electrode-skin interface and motion artifact; surface electrodes; microelectrodes; Internal electrodes; electrode arrays; electrodes for electric stimulation of tissues; electrode polarization, electrical interference problems in biopotential measurement; electrical safety.

UNIT-III

The Heart System and Its Measurements: The heart; electro conduction system of the heart; the ECG waveform; the standard lead system; the ECG preamplifier; ECG machines; Cardiac monitors; Transient protection; common-mode and other interference-reduction circuits.

Physiological Pressure and other Cardiovascular Measurements and Devices: Physiological pressure; blood pressure measurements; sphygmomanometer; oscillometric and ultrasonic methods; practical problems in pressure monitoring; cardiac output measurement; plethysmography; blood flow measurements; phonocardiography; vectorcardiography; defibrillators; pacemakers; heart lung machines.

UNIT-IV

The Human Respiratory System and Its Measurement: Respiratory anatomy (lungs, conducting airways, alveoli, pulmonary circulation, respiratory muscles); lung volumes and gas exchange, mechanics of breathing; parameters of respiration; regulation of respiration; unbalanced and diseased states; environmental threats to the respiratory system; respiratory system measurements; respiratory transducers and instruments; spirometry, body plethysmography.

UNIT-V

Measurement of Electrical activity in Neuromuscular System and Brain: Neuron potential; muscle potential; electromyography (EMG); electroencephalography (EEG); EEG electrodes and the 10- 20 system; EEG amplitude and frequency bands; the EEG system – simplified block diagram; preamplifiers and EEG system specifications; EEG diagnostic uses and sleep patterns; visual and auditory evoked potential recordings; EEG system artifacts.

Books Recommended

1. Carr Joseph J. and Brown John M., "Introduction to Biomedical Equipment Technology", 4th Ed., New Delhi: Pearson Education India (2001) (ISBN 81-7808-327-2)
2. Webster John G (Ed.), "Medical Instrumentation, Application and Design", 3rd ed., Singapore: John Wiley & Sons (Asia) Pte. Ltd. (2003). (ISBN 9971-51-270-X)
3. Webster J G (ed.), "Encyclopedia of Medical Devices and Instrumentation", Vols. 1-4, New York: Wiley (1988).
4. Bronzino J D (ed.), "The Biomedical Engineering Handbook". FL: CRC Press (1995).
5. Khandpur R S, "Handbook on Biomedical Instrumentation", TMH, 13th reprint, New Delhi (2000).

OPEN ELECTIVE- III

NON-CONVENTIONAL ENERGY RESOURCES (OE-080) **(03 L+1T+0P) (4 Cr)**
Marks-150

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.

Books Recommended

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.

COMPUTER NETWORKS (OE-081) (03 L+1T+0P) (4 Cr) Marks-150

UNIT-I

Introduction to Computer Networks: Use and types of Computer Networks, Network Hardware and Software and Reference Models.

UNIT-II

Physical Layer: Transmission Media and Public Switched Telephone Network.

Data Link Layer: Design Issues, Error Detection and Correction, Data Link Protocols and

Protocol Verification Methods.

UNIT-III
Medium Access Control Sub layer: Channel Allocation Problem, Multiple Access Protocols, Ethernet and Wireless LANs.
Network Layer: Network layer design issues, Routing Algorithms, Congestion Control Algorithms and Quality of Service.

UNIT-IV
Transport Layer: The Transport Service, Elements of Transport Protocols, A Simple Transport Protocol, The Internet Transport Protocols and Performance Issues.
Application Layer: Domain Name System, Electronic Mail, World Wide Web and Multimedia.

UNIT-V
Network Security: Cryptography, Symmetric-Key Algorithms, Public-Key Algorithms, Digital Signatures and Authentication Protocols .

Books Recommended

1. Tanenbaum Andrew S "Computer Networks" Ed Pearson Education 4th Ed. (2003)
2. Kurose James F and Ross Keith W. "Computer Networking" Ed Pearson Education (2002)
3. Nance "Introduction to Networking" Ed PHI of India 4th Ed. (1998)
4. Jain S, "Computer Networks" Ed 1st Ed. (2000)
5. Stalling W, "Data and Computer Communication ", 7th Ed. Pearson Education, (2004).

EMBEDDED SYSTEMS(OE-082) (03 L+1T+0P) (4 Cr) Marks-150

UNIT-I
Embedded Processing Systems – Introduction, Components of Embedded Systems

UNIT-II
Embedded Processors: Microprocessors, Microcontrollers, DSP and ASICs, Comparative Assessment of Embedded Processors

UNIT-III
Memory Devices: ROM family, RAM family, Interfacing memory
Embedded Programming - C and C++

UNIT-IV
Input-output Ports and Interfacing, I/O Programming
Interrupts and Their Servicing, timing devices and interfacing, Analog I/O techniques
Embedded Communications: Serial Bus, Parallel Bus, Networking and Wireless Standards
Introduction to Real- time operating system (RTOS), RTOS: memory management, I/O

UNIT-V

Management and Device Drivers, scheduling

Software Engineering Practices: Embedded Software Development Process

Hardware- Software Co-design in an embedded system Tools and Trends in Embedded systems design

Books Recommended

1. Raj Kumar, "Embedded Systems: Architecture, Programming and Design", Tata McGraw Hill, Third Reprint, (2003).
2. John Catsoulis, O'Reilly, "Designing Embedded Hardware", First Indian Reprint, (2003).
3. David E. Simon, "An Embedded Software Primer", Pearson Education Asia, Fifth Indian Reprint(2002)
4. Michael Barr, O'Reilly, "Programming Embedded Systems in C and C ++", (1999).
5. Vahid and Givargis, "Embedded System Design", A Unified Hardware/Software Introduction, John Wiley and Sons, (2002).

NANO SCIENCES (OE-041) (03 L+1T+0P) (4 Cr) Marks-150

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.

Books Recommended

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.

DEPARTMENTAL ELECTIVE

ELECTIVE -III

COMPUTERISED PROCESS CONTROL (IC-080) (03 L+1T+0P) Marks-150

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

Books Recommended:

1. Singh,S.K /Computer Aided Process control /PHI – 2007
2. 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
5. C.M. Houpis, G.B. Lamond / Digital Control System Theory / Tata McGraw Hill

BIOMEDICAL SIGNAL PROCESSING (IC-081) (03 L+1T+0P) (4 Cr) Marks-150

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.

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- I 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.

Books Recommended

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
4. Arnon Cohen, "Biomedical Signal Processing (volume-I)", Licrc Press
5. Rangaraj M. Rangayyan, "Biomedical Signal Analysis A Case Study Approach", John Wiley and Sons Inc.
6. John G. Webster, "Medical instrumentation Application and Design", John Wiley & Sons Inc.

ANALYTICAL INSTRUMENTATION(IC-082) (03 L+1T+0P) (4 Cr) Marks-150

UNIT-I

Introduction: Difference between analytical and other instruments, sampling, sampling system for liquids and gases, sampling components, automatic and faithful sampling.

UNIT-II

Gas Analysis: Gas Chromatography – principles & components, Thermal conductivity gas analyzers, Heat of reaction method, Estimation of Oxygen, Hydrogen, Methane, CO_2, Carbon monoxide etc. in binary or complex gas mixtures, paramagnetic oxygen analyzer, Electro chemical reaction method, Polarography, Density measurement.

UNIT-III

Humidity and Moisture Measurements: Humidity measurement: definitions – absolute, specific, relative humidity and dew point, Dry and wet bulb psychrometer, Hair hygrometer, dew point meter. Moisture Measurement: definitions, electrical methods, NMR method, IR method.

UNIT-IV

Chemical Composition Measurements: Newtonian and Non Newtonian flow, Measurement of viscosity and consistency, Laboratory and on line methods, Measurement of pH: - definition and methods, redox potential, electrical conductivity, conductivity cell and applications, density measurement: solids, liquids, gages.

UNIT-V

Spectrochemical Analysis: Classification of techniques, Principles and components, emission spectrometry:-flame emission, atomic absorption type, Dispersive techniques, scheme for UV, IR and near IR analysis, comparison of methods, X-ray analyzers NMR spectrometry, ESR spectroscopy, Mass spectrometry.

Books Recommended

1. Patranbis D, "Principles of Industrial Instrumentation" , Tata McGraw Hill Pub., New Delhi (1991)
2. Jones E B, "Instrument Technology vol II", Butterworths Scientific Publication, London (1985)
3. Khare R P, "Analytical Instrumentation an Introduction" C.B.S. Publication, Delhi (1993)
4. Khandpur R S, "Handbook of Analytical Instruments (7th reprint)", Tata McGraw Hill Pub, New Delhi (2000)
5. Considine D M, "Process Instruments and Control " Hand Book, 3rd (1985).

FILTER DESIGN(IC-083) (03 L+1T+0P) (4 Cr) Marks-150

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.

Books Recommended

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

BIOMEDICAL INSTRUMENTATION LABORATORY(IC-851) (0 L+0T+2P) (1 Cr)
Marks-50

1. Data acquisition and analysis system
   a) To become familiar with the format of data display in the BIOPAC Student Lab data window
   b) To learn how to position data within the data window by using software tools and pull-down menus.
   c) To learn how to select and use the correct measurement tools for extracting information from the data.
   d) To learn how to use the journal to record measurements and write notes.
2. Electroencephalography: Alpha, Beta, Delta and Theta rhythms
   a) To record an EEG from an awake, resting subject with eyes open and eyes closed
   b) To identify and examine alpha, beta, delta and theta components of the EEG complex.
3. Electrocardiography-I: elements of electrocardiogram
   a) To become familiar with the electrocardiograph as a primary tool for evaluating electrical events within the heart.
   b) To correlate electrical events as displayed on the electrocardiogram with the mechanical events that occur during the cardiac cycle.
   c) To observe changes in the electrocardiogram associated with breathing, body position, exercise, body size and age.
   d) To anticipate the nature of changes in the electrocardiogram associated with pathology of the heart.
4. Systemic blood pressure
   a) To use an auscultatory method for an indirect determination of systemic arterial systolic and diastolic blood pressures and to correlate the appearance and disappearance of vascular sound with systolic and diastolic pressures, respectively.
   b) To measure, record, and compare systemic arterial blood pressure in the right arm and the left arm of the same subject under identical conditions.
5. The cardiac cycle and heart sounds
   a) To listen to human heart sounds and qualitatively describe them as to intensity or loudness, pitch, and duration.
   b) To correlate the human heart sounds with the opening and closing of cardiac values during the cardiac cycle and with systole and diastole of the ventricles.
6. The electrocardiogram and the peripheral pressure pulse
   a) To become familiar with the principle of plethysmography and its usefulness in qualitatively assessing peripheral changes in blood volume.
   b) To observe and record changes in peripheral blood volume and pressure pulse under a variety of both experimental and physiologic conditions.
7. The respiratory cycle
   a) To observe and record normal respiratory rate and depth utilizing pneumograph and air temperature transducers.
8. Pulmonary function tests: volumes and capacities
   a) To observe experimentally, record, and /or calculate selected pulmonary volumes and capacities.
   b) To compare the observed values of volume and capacity with predicted normals.
   c) To compare the normal values of pulmonary volumes and capacities of subjects

differing in sex, age, weight, and height.

9. Pulmonary function tests: forced expiratory capacity, maximum voluntary ventilation
   a) To observe experimentally, record, and/or calculate forced vital capacity (FVC), forced expiratory volume (FEV), and maximal voluntary ventilation (MVV).
   b) To compare observed values of FVC, FEV, and MVV with predicted normal.
   c) To compare normal values of pulmonary flow rates of persons differing in gender, age, and body surface area.

Note: At least 8-experiments are to be performed

PROJECT (IC-852) (0 L+0T+18P) (9Cr) Marks-300

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.