INDIAN SCHOOL OF MINES
DHANBAD-826 004

DEPARTMENT
OF
ELECTRONICS ENGINEERING

COURSE CURRICULUM & SYLLABUS

of

4 year B.TECH. COURSE
IN
ELECTRONICS & INSTRUMENTATION ENGINEERING

Modified Core Course Structure (I Semester)

(Effective from 2012-2013 Academic Session)

PHYSICS (GROUP-I)

Sr No	Course Number	Course offering Department	Name of the course	L	T	P	Total Credit Hours
			Sem. I – Physics Group				
			THEORY				
1	AMC 11101	AM	Mathematics-I	3	1	0	7
2	APC 11101	AP	Physics	3	0	0	6
3	MMC 11101	ME & MME	Engineering Graphics	1	4	0	6
4	EEC 11101	EE	Electrical Technology	3	1	0	7
5	MMC 11103	ME & MME	Engineering Mechanics	3	1	0	7
6	GLD/CMD 11301	AGL & ESE	Earth System Science (S) [AGL 2-0-0 & ESE 1-0-0]	3	0	0	6
7	HSC 12305	HSS	Value Education, Human Rights and Legislative Procedure (S)	3	0	0	6
			PRACTICAL				
8	APC 12201	AP	Physics Practical	0	0	3/2	1.5
9	EE	EEC 12201	Electrical Technology Practical	0	0	3/2	1.5
			Total	19	7	3	48

Modified Core Course Structure **(I Semester)**
(Effective from 2012-2013 Academic Session)
CHEMISTRY (GROUP-II)

Sr No	Course Number	Course offering Department	Name of the course	L	T	P	Total Credit Hours
			Sem. I – Chemistry Group				
			THEORY				
1	AMC 11101	AM	Mathematics-I	3	1	0	7
2	ACC 11101	AC	Chemistry	3	0	0	7
3	MMC 11102	ME & MME	Manufacturing Process	1	4	0	6
4	ECE 11101	ECE	Electronics Engineering	3	0	0	6
5	CSE 11301	CSE	Computer Programming (S)	3	0	0	6
6	DMS/AP 11301	DMS & AP	Disaster Management [DMS 2-0-0] & Energy Resources [AP 1-0-0] (S)	3	0	0	6
7	HSC 11103	HSS	English for Science & Technology	3	0	0	6
			PRACTICAL				
8	ACC 12201	AP	Chemistry Practical	0	0	3/2	1.5
9	ECE 11201	ECE	Electronics Engineering Practical	0	0	3/2	1.5
10	CSE 12301	CSE	Computer Programming Practical (S)	0	0	2	2
			Total	19	5	5	48

Modified Core Course Structure **(II Semester)**
(Effective from 2012-2013 Academic Session)
CHEMISTRY (GROUP-I)

Sr No	Course Number	Course offering Department	Name of the course	L	T	P	Total Credit Hours
			Sem. II– Chemistry Group				
			THEORY				
1	AMC 12101	AM	Mathematics-II	3	1	0	7
2	APC 11101	AP	Physics	3	0	0	6
3	MMC 11101	ME & MME	Engineering Graphics	1	4	0	6
4	EEC 11101	EE	Electrical Technology	3	1	0	7
5	MMC 11103	ME & MME	Engineering Mechanics	3	1	0	7
6	GLD/CMD 11301	AGL & ESE	Earth System Science (S) [AGL 2-0-0 & ESE 1-0-0]	3	0	0	6
7	HSC 12305	HSS	Value Education, Human Rights and Legislative Procedure (S)	3	0	0	6
8		DSW	Co-Curricular Activities (Only for Second Semester)	0	0	0	(3)
			PRACTICAL				
8	APC 12201	AP	Physics Practical	0	0	3/2	1.5
9	EE	EEC 12201	Electrical Technology Practical	0	0	3/2	1.5
			Total	19	7	3	48 + (3)

Modified Core Course Structure **(II Semester)**
(Effective from 2012-2013 Academic Session)
PHYSICS (GROUP-II)

Sr No	Course Number	Course offering Department	Name of the course	L	T	P	Total Credit Hours
			Sem. II – Physics Group				
			THEORY				
1	AMC 12101	AM	Mathematics-II	3	1	0	7
2	ACC 11101	AC	Chemistry	3	0	0	7
3	MMC 11102	ME & MME	Manufacturing Process	1	4	0	6
4	ECE 12101	ECE	Electronics Engineering	3	0	0	6
5	CSE 11301	CSE	Computer Programming (S)	3	0	0	6
6	DMS/AP 11301	DMS & AP	Disaster Management [DMS 2-0-0] & Energy Resources [AP 1-0-0] (S)	3	0	0	6
7	HSC 11103	HSS	English for Science & Technology	3	0	0	6
8		DSW	Co-Curricular Activities (Only for Second Semester)	0	0	0	(3)
			PRACTICAL				
8	APC 12201	AP	Chemistry Practical	0	0	3/2	1.5
9	ECE 12201	ECE	Electronics Engineering Practical	0	0	3/2	1.5
10	CSE 12301	CSE	Computer Programming Practical (S)	0	0	2	2
			Total	19	5	5	49 + (3)

III SEMESTER

Course No.	Name of the Course	L	T	P	Credit Hours
EIC 13101	Electronic Devices	3	0	0	6
EIC 13102	Digital Circuits	3	1	0	7
EIC 13103	Signals and Networks	3	1	0	7
AMR 13101	**Methods of Applied Mathematics – I**	**3**	**1**	**0**	**7**
CSR 13101	**Data Structures**	**3**	**0**	**0**	**6**
EIC 13201	Electronic Devices Lab	0	0	3	3
EIC 13202	Digital Circuits Lab	0	0	3	3
EIC 13203	Signals and Networks Lab	0	0	3	3
EIC 13801	Project and Seminar	0	0	2	2
	Total	**15**	**3**	**11**	**44**
	Contact Hours			**(29)**	

PS:

- Vocational Training undertaken in Summer Vacation at the end of Semesters II, IV and VI and Marks to be given in Semesters III, V and VII respectively.
- CCA in Semesters IV, VI & VIII and Grades to be sent in the same semester.
- Contact hours for Semesters III, IV and V should be restricted to 27 -30.
- Contact hours for Semesters VI, VII and VIII should be restricted to 25 -28.
- Name of the Courses written in Bold Letters represent Capsule Courses.

IV SEMESTER

Course No.	Name of the Course	L	T	P	Credit Hours
EIC 14101	Analog Circuits	3	1	0	7
EIC 14102	Sensors and Transducers	3	1	0	7
EIC 14103	Communication Engineering	3	1	0	7
MSR 14151	**Managerial Economics**	**3**	**0**	**0**	**6**
AMR 14101	**Numerical & Statistical Methods**	**3**	**1**	**0**	**7**
EIC 14201	Analog Circuits Lab	0	0	3	3
EIC 14202	Sensors and Transducers Lab	0	0	3	3
EIC 14801	Project and Seminar	0	0	2	2
EIC 14501	Composite Viva-voce	0	0	0	(4)
SWC 14701	CCA (Co-curricular Activities) – (Grade to be given in this semester)	0	0	0	(0)
	Total	**15**	**4**	**8**	**46**
	Contact Hours			**(27)**	

V SEMESTER

Course No.	Name of the Course	L	T	P	Credit Hours
EIC 15101	Control Systems	3	0	0	6
EIC 15102	Microprocessors & Embedded Systems	3	1	0	7
EIC 15103	Industrial Instrumentation – I	3	0	0	6
EIC 15104	Electrical & Electronic Instrumentation	3	1	0	7
EIC 15201	Control Systems Lab	0	0	3	3
EIC 15202	Microprocessors & Embedded Systems Lab	0	0	3	3
EIC 15203	Electrical & Electronic Instrumentation Lab	0	0	3	3
EIC 15801	Project and Seminar	0	0	4	4
	Total	**12**	**2**	**13**	**39**
	Contact Hours			**(27)**	

VI SEMESTER

Course No.	Name of the Course	L	T	P	Credit Hours
EIC 16101	Industrial Instrumentation – II	3	0	0	6
EIC 16102	Power Electronics	3	0	0	6
EIC 16103	Digital Signal Processing	3	0	0	6
CSR 16102	**Computer Networks**	**3**	**0**	**0**	**6**
EIC 16201	Industrial Instrumentation Lab	0	0	3	3
EIC 16202	Power Electronics Lab	0	0	3	3
EIC 16203	DSP Lab	0	0	3	3
EIC 16801	Project and Seminar	0	0	4	4
EIC 16501	Composite Viva-voce	0	0	0	(4)
	Vocational Training (To be evaluated in VII Semester)	0	0	0	(0)
	Total	**12**	**0**	**13**	**41**
	Contact Hours			**(25)**	

VII SEMESTER

Course No.	Name of the Course	L	T	P	Credit Hours
EIC 17101	Process & Distributed Control Systems	3	1	0	7
EIC 17102	Analytical Instrumentation	3	0	0	6
EIC 17201	Process & Distributed Control Systems Lab	0	0	3	3
EIC 17202	Analytical Instrumentation Lab	0	0	3	3
EIC 17801	Project & Seminar	0	0	6	6
EIC 17001	Vocational Training (Marks of Vocational Training completed in VI Semester)	0	0	-	(5)
	Elective 1	3	0	0	6
	Elective 2	3	0	0	6
	ELECTIVES (3-0-0)				
EIE 17101	Intelligent Instrumentation				
EIE 17102	Sensor Networks				
EIE 17103	Chaos in Engineering Systems				
EIE 17104	Electromagnetic Theory				
EIE 17105	PC Based Instrumentation Systems				
EIE 17106	Telemetry & Remote Sensing				
EIE 17107	PDE and Finite Element Method				
EIE 17108	Advanced Control Systems				
EIE 17109	Process Modeling & Simulation				
EIE 17110	Digital Control Systems				
EIE 17111	Mine Electronics & Instrumentation				
EIE 17112	Operating Systems				
EIE 17113	MEMS & Nano Technology				
EIE 17114	Data Based Management Systems				
EIE 17115	Mechatronics				
	Total	**12**	**1**	**12**	**42**
	Contact Hours			**(25)**	

VIII SEMESTER

Course No.	Name of the Course	L	T	P	Credit Hours
EIC 18101	VLSI Design	3	0	0	6
EIC 18102	Fiber Optics and Laser Instrumentation	3	1	0	7
EIC 18201	Instrumentation System Design Lab	0	0	3	3
EIC 18202	Fiber Optics and Laser Instrumentation Lab	0	0	3	3
EIC 18801	Project & Seminar	0	0	6	6
EIC 18501	Composite Viva-voce	0	0	-	(4)
	Elective 1	3	0	0	6
	Elective 2	3	0	0	6
	ELECTIVES (3-0-0)				
EIE18101	Digital Image Processing				
EIE 18102	Power Plant Instrumentation				
EIE 18103	Robotics and Automation				
EIE 18104	Reliability Engineering				
EIE 18105	Industrial Drives and Control				
EIE18106	Opto-electronic Devices				
EIE 18107	Instrumentation & Control in Petrochemical Industries				
EIE 18108	Instrumentation & Control in Iron and Steel Industries				
EIE 18109	Digital System Design				
EIE 18110	Computer Architecture				
EIE 18111	Biomedical Instrumentation				
EIE 18112	Advanced Signal Processing				
EIE 18113	Optical Networks				
EIE 18114	Microwave Instrumentation				
EIE 18115	EMI and EMC				
	Total	**12**	**1**	**12**	**41**
	Contact Hours			**(25)**	

SEMESTER –I/ II

EIC 11101 / 12101 ELECTRONICS ENGINEERING 3 0 0 6

Semiconductor Diodes and Applications – Introduction Characteristics, dc and ac resistances of a diode. Half wave and Full wave rectification. Zener Diodes and then use as regulators, Clippers and Clampers.

Bipolar Junction Transistor – Introduction, Transistor operation CB, CE and CC configuration, dc Biasing, Operating Point, Fixed Bias Circuit, Emitter – Stabilized Bias Circuit. Voltage Divider Bias.

BJT Transistor – Amplification in ac domain, Equivalent transistor model. Hybrid Equivalent model, RC coupled amplifier and its frequency response.

Operational Amplifiers – Introduction, Differential and Common Mode Operation, OPAMP Basics, Practical OPAMP Circuits.

Introduction to Field Effect Transistors and their applications.

Digital Electronics – Review of Basic Gates and Boolean Algebra, Introduction to Combinatorial Logic Design. Standard Representations of Logical Functions and their simplification. Combinatorial Logic Design, Half Adder and Full Adder.

Reference Books:

1. Electronic Device and Circuit Theory - Boylestad & Nashelsky
2. Digital Principles & Applications - Malvino & Leach

EIC11201/ 12201 ELECTRONICS ENGINEERING (LAB) 0 0 3/2 1.5

1. Study of Electronic Equipment & Components.
2. Study of diode characteristics.
3. Study of regulated power supply.
4. Study of BJT characteristics.
5. Study of op-amp characteristics.
6. Implementation of Boolean algebra using logic gates.
7. Adder Circuits.

SEMESTER – III

EIC13101 ELECTRONIC DEVICES 3 0 0 6

Band structure of semiconductors, Electrons and Hole distribution, Current transport in semiconductors and concepts about mobility. Diffusivity and recombination. The continuity equation and its solution. P-N junction: I-V and C-V characteristics, Charge control equation and transient response. Types of P-N junction diodes, Diode circuits: Rectifiers, Clipping and clamping circuits. Bipolar transistor: Ebers-Moll model and charge control model, Transient behavior, Small signal equivalent circuit, h-parameter and hybrid-pi, Field effect transistors: JFET operation and I-V characteristics. MOS capacitor theory, MOSFET types. MOSFET operation and I-V characteristics. And equivalent circuit. Metal-semiconductor junctions and MOSFET. Introduction to technology of semiconductor devices and integrated circuits.

Reference Books:

1. Robert. L. Boylestad and Lo Nashelsky, "Electronic Devices and Circuit Theory, Pearson Education.
2. Jacob Millman and Christos.C.Halkias, "Integrated Electronics: Analog and Digital Circuits and System", Tata McGraw Hill.
3. Donald L.Schilling and Charles Belove, "Electronic Circuits", Tata McGraw Hill.

EIC13102 DIGITAL CIRCUITS 3 1 0 7

Basics of Boolean algebra and minimization techniques. Combinational and sequential circuits. Basic digital circuits: Flip-flops, shift registers and counters. Semiconductor memories. Logic implementation on ROM, PAL and PLA. Bipolar logic families: DTL, TTL, ECL, I2L, MOS logic families. Waveform generation using gates. Timing circuits. A/D and D/A converters.

Reference Books:

1. Morris Mano.M, "Digital Design", Prentice Hall of India.
2. Malvino,A and Leach, D, "Digital Principles and Applications", Tata McGraw Hill.
3. John M.Yarbrough, "Digital Logic", Application and Design, Cengage Publishers.
4. Charles H.Roth "Fundamentals Logic Design", Jaico Publishing.
5. Floyd, "Digital Fundamentals", Pearson Education.

EIC 13103 SIGNALS AND NETWORKS 3 1 0 7

Definitions and concepts of different types of signals and systems, Convolution, Differential and Difference equation, LTI systems, Fourier Series, Fourier Transforms, Laplace Transform and Z-transforms.

Graph Theory and Network Equations: Introduction, Incidence Matrix, Loop Matrix and the Cut Set Matrix, Interrelation among Various Matrices.Mesh Equations, Node Equations, Network with Mutual Inductance.

Two Port Networks: Short Circuit Admittances, Open Circuit Impedances, Hybrid Parameters, Chain Parameters, Inverse Transmission Parameters, and Interrelation between Parameters. Transient response in Circuit Analysis.

Reference Books:

1. Gabel R.A. and Robert R.A, "Signals and Linear Systems", John Wiley and Sons, New York.
2. Oppenheim, Wilsky and Nawab, "Signals and Systems", Prentice Hall, New Delhi.
3. Cooper G.R and McGillem C.D, "Probabilistic Methods of Signals and System Analysis", 3rd Edition, Oxford University Press, Cambridge.

4. Van Valkenburg, "Network Analysis", 3rd Edition, Prentice Hall, New Delhi.

AMR 13101 METHODS OF APPLIED MATHEMATICS-I 3 1 0 7

SECTION A

Analysis of complex variables: Limit, continuity and differentiability of function of complex variables, Analytic functions, Cauchy-Reimann's & cauchy's integral theorem, Morera's theorem, Cuachy's integral formula, expansion of function of complex variables in Taylor's and Laurent's Series, singularities and poles. Residues theorem, contour integration, conformal mappings and its applications, bilinear transformation.

SECTION B

Special Functions : Solution in series of ordinary differential equations, Solution of Bessel and Legendre equations, Recurrence relations and generating function for $J_n(x)$, Orthogonal property and integral representation of $J_n(x)$, Legendre polynomial, Rodrigue'sformula,orthogonality properties, generating function for $P_n(x)$. Elliptic integrals and error function and their properties.

SECTION C

Laplace Transform and PDE: Laplace transform of simple functions, first and second shifting theorems, t-multiplication and t-division theorems, Laplace transform of derivative, integrals and periodic functions.Inverse of Laplace transform and convolution property, Use of Laplace transform in evaluating complicated and improper integrals and solution of differential equations related to engineering problems.

Partial Differential Equations: Classification of Partial Differential Equations. Solution of one dimensional wave equation, One dimensional Unsteady heat flow equation and two dimensional steady heat flow equation in Cartesian and polar coordinates by variable separable method with reference to Fourier trigonometric series and by Laplace transform technique.

CSR 13101 DATA STRUCTURES 3 0 0 6

Data structure overview, Data types, Creation and analysis of programs, Algorithm analysis; Different data structures: Arrays, Stacks, Queues, Circular queues, Priority queues, Linked lists together with algorithms for their implementation and uses; Sorting algorithms: Insertion, Selection, Bubble, Quick, Merge, Heap etc;

Searching algorithms: Linear searching, Binary searching, Hashing strategy, Hashing functions and hash search;

Trees: Binary tree representation, Traversal, binary search tree, AVL trees, balancing rotations, Applications: Graphs: Representation, traversals, Shortest-path problems, Applications; Recursive: Divide-and-conquer, tower of Hanoi, etc.

Reference Books:

1. Aaron. M. Tenenbaum,, Yeedidyah Langsam, Moshe J. Augenstein, , "Data structures using C", Pearson Education, 7th Edition, 2004 .
2. Weiss .M. A., "Data Structures and Algorithm Analysis in C", Pearson Education Asia,2nd Edition, 2002.
3. Robert L. Kruse, Bruce P. Leung, Clovis L.Tondo, "Data Structures and Program Design in C", Pearson Education, 3rd Edition, 2000.
4. Langsam. Y, Augenstein M. J and Tenenbaum, A. M. "Data Structures using C", Pearson Education Asia, 2004.

EIC13201 ELECTRONICS DEVICES LAB 0 0 3 3

1. Study of various instruments used in the lab.
2. Study of various components used in the lab.

3. Study the characteristics of Zener diode.
4. Study the characteristic of Bipolar Junction Transistor and measure its h-parameters
5. Study the characteristics of JFET and measure its transconductance
6. (a) To realise and study clipper and clamper circuits using diodes
   (b) To realize and study HW/FW rectification using diodes
7. To study regulated power supply.
8. To study the use CE mode BJT as an amplifier

EIC13202 DIGITAL CIRCUITS LAB 0 0 3 3

1. Verification of IC 7400 and implementation of standard Gates.
2. Realisation of Boolean expressions using only NAND gates.
3. Binary adder.
4. Binary Subtractor.
5. BCD adder.
6. Binary Comparator.
7. Cascading of MUX.
8. Latches and Flip-Flops using Gates and ICs.
9. Counters.
10. Multivibrators using NE555.

EIC 13203 SIGNALS AND NETWORK LAB 0 0 3 3

1. Identification of Fourier series coefficients of a periodic signal.
2. Evaluation of transient response and frequency response of a system.
3. Determination of spectrum of a signal.
4. Determination of Convolution and Correlation of signals.
5. Transient response of RL and RC circuits
6. Determination of resonant frequency and bandwidth of a series RLC circuit.
7. Determination of circuit parameters of two-port networks
8. Low pass and High pass Passive Filters using R, L and C parameters.

SEMESTER – IV

EIC14101 ANALOG CIRCUITS 3 1 0 7

Biasing of discrete devices and integrated circuits; Low frequency amplifiers (Hybrid- □ model); Feedback amplifiers; Frequency response of amplifiers and high frequency effects; Internal stages of OP-AMP: Difference amplifier, Intermediate stage amplifier, Level Shifter, Output buffer, Linear applications of OP-AMP, Gain stage, Level shifter, Output stage; Linear applications of OP-AMP Non-Linear applications of OP-AMPS; Wave generation with OP-AMP, Active filters, Oscillators, Regulators, Power amplifiers.

Reference Books:

1. Millman and Halkias, "Integrated Electronics", McGraw Hill.
2. Ramakant.A and Gayakwad, "Opamp and Linear Integrated Circuits", Pearson Education/PHI.
3. Jacob and J.Michael, "Application and Design with Analog Integrated Circuits", PHI.

EIC14102 SENSORS AND TRANSDUCERS 3 1 0 7

Units and standards, Calibration methods, Static calibration, Classification of errors, Error analysis, Statistical methods, Odds and uncertainty, Classification of transducers, Selection of transducers. Static characteristics, Accuracy, precision, resolution, sensitivity, linearity etc. Dynamic

characteristics, Mathematical model of transducer, Zero, I and II order transducers. Response to impulse, step, ramp and sinusoidal inputs. Principle of operation, construction details, characteristics and application of resistance potentiometer, strain gauge, resistance thermometer, thermistor, hot-wire anemometer, Piezo resistive sensor and humidity sensor. Induction potentiometer, Variable reluctance transducers, EI pick up, LVDT, Capacitive transducer and types, Capacitor microphone, Frequency response. Piezoelectric transducer, magnetostrictive – IC sensor – Digital transducers – Smart sensor – Fibre optic transducer.

Reference Books:

1. D. V. S. Murty – Transducer And Instrumentation; PHI learning Pvt. Ltd.
2. D Patranabis, Sensors and Transducers, PHI, India
3. E. A. Doebelin, Measurement Systems: Application and Design Mc Graw Hill, NewYork
4. H. K. P. Neubert, Instrument Transducers, Oxford University Press, London and Calcutta

EIC 14103 COMMUNICATION ENGINEERING 3 0 0 6

Time and frequency domain representation of signals, amplitude modulation and demodulation, frequency modulation and demodulation.

Pulse code modulation, time division multiplexing, digital T-carrier system. Digital radio system. Digital modulation: Frequency and phase shift keying – Modulator and demodulator, bit error rate calculation.

Data Communication codes, error control. Serial and parallel interface, telephone network, data modem, ISDN, LAN, ISO-OSI seven layer architecture for WAN. Introduction to Satellite, Fiber Optic Communication and Cellular Mobile Communication.

Reference Books:

1. B.P. Lathi, Zhi Ding, "Modern Digital and Analog Communication Systems", Oxford Press.
2. G. Kennedy, 'Electronic Communication Systems', McGraw Hill.
3. Miller, 'Modern Electronic Communication', Prentice Hall of India.

MSR 14151 MANAGERIAL ECONOMICS 3 0 0 6

Different areas of Micro, economics and Macro-economics, Marginal utility analysis, Law of demand and its factors and exceptions, Demand curve, Elasticity of demand and its classification, Indifference curve and its properties, consumer's equilibrium with the help of indifference curve. Law of supply and supply curve. Concept of elasticity of supply, Total revenue, Marginal revenue and average revenue, Different types of returns to scale, Concept of production function and its significance. Different cost concepts and their behaviors, Different cost curves, Significance and measures of cost, control. Features of perfect competition, Equilibrium of a firm under perfect competition both in the short run and in the long run, Equilibrium of monopoly, Conditions of price, discrimination, Equilibrium of discriminating monopoly, Features of monopolistic competition, Equilibrium of a firm under monopolistic competition both in the short run and in the long run.

Different theories of wage-determination, Different theories of interest determination, Sources of profit. Different components of consumption function and investment function, Relationship between money supply and price level, Concepts of demand-pull and cost-push inflation, Effects of inflation, Steps to control inflation. Criteria of economic development, Features of capitalism, Socialism and mixed economy, Characteristics of developed and underdeveloped/developing economy. Economic planning and its types, Significance of economic planning in developed and underdeveloped/developing economy. Labour intensive strategy and capital intensive strategy – Small unit strategy and big unit strategy – Public sector strategy and private sector strategy. Area of public finance, Merits and demerits of direct and indirect tax. Nature of the problem of investment decision, Methods of investment decisions for selecting the best project.

AMR 14101 NUMERICAL & STATISTICAL METHODS 3 1 0 7

A. Numerical Methods :

Solution of algebraic and transcendental equations ; bisection, iteration, false position, secant and Newton-Raphson methods, Generalized Newton's method for multiple roots. Solution of a system of linear simultaneous equations by Gauss elimination, Gaus-Jordan, Crout's triangularisation, Jacobi and Gauss- Seidel methods.

Finite differences, symbolic relations, differences and factorial notation of a polynomial, data smoothing, Interpolation and extrapolation, Newton-Gregory forward and backward, Gauss forward and backward, Stirling, Bessel, Everett, Lagrange and Newton's divided difference formulae, Inverse interpolation by Lagrange and iterative methods, Cubic splines, Numerical differentiation and integration – Trapezoidal, Simpson's $1/3^{rd}$, Simposon's $3/8^{th}$. Weddle and Gaussian quadrature formulae.

Numerical solution of first order ordinary differential equations by Taylor's series, Picard's, Euler's, Modified Euler's, Runge-Kutta, Adams-Moulton and Milne's methods. Solution of simultaneous first order and second order ordinary differential equations with initial conditions by Taylor's series, Runge-Kutta and Milne's methods. Numerical solution of boundary value problems by finite difference and shooting methods.

B. Statistical Methods:

Concept of a frequency distribution : Moments, skewness and kurtosis. Probability : Various approaches of probability – classical, frequency, (statistical), subjective and axiomatic. Theorems on probability, conditional probability, independence, Bayes theorem.Random variable-discrete and continuous, Distribution functions and their properties; probability mass and density functions; Mathematical expectation; Moment generating function and its properties.

Probability distributions: Bernoulli, binomial, negative binomial, Poisson and normal distributions. Theory of least squares and curve fitting. Correlation –Simple, Multiple and partial, Regression lines and regression coefficients; Multiple and partial regression. Tests of significance: Normal test, t-test, Chi-square test and F-test.

EIC14201 ANALOG CIRCUITS LAB 0 0 3 3

1. Frequency response of Bipolar Junction Transistor Amplifier.
2. Realization of Field Effect Transistor Amplifier.
3. Realization of Op-amp inverting and non-inverting amplifiers.
4. Design of Op-amp integrator and differentiator.
5. Frequency response of active filters.
6. Realization of Multivibrator using opamp and IC 555 timer.
7. Realization of Oscillator.
8. Realization of Analog Comparator.
9. Design of Regulated Power Supply.

EIC 14202 SENSORS AND TRANDUCER LAB 0 0 3 3

1. Loading effect of potentiometer.
2. Strain gauge & load cell characteristics.
3. Characteristics of Capacitive transducers.
4. Photoelectric tachometer & Piezoelectric transducers characteristics.
5. Study of Hall effect transducers.
6. Characteristics of LVDT.
7. Characteristics of thermocouple, Thermistor and LDR.
8. Step response characteristics of RTD and thermocouple.
9. Characteristics of P/I and I/P converters.
10. Digital transducer – shaft angle encoder characteristics.

SEMESTER – V

EIC15101 CONTROL SYSTEMS 3 0 0 6

Introduction : Scope of control, Parts of a control system, Multidisciplinary nature, Scope of present course, An example of Control action, Open loop control system, closed loop control system, Use of Laplace transformation in control systems Linear systems and their s-domain representations: Linearity and linearization, Convolution integral, Laplace domain representation of signals and systems, Transfer function and its interpretation in terms of impulse and frequency responses, Block-diagram and signal flow graph manipulations.

Mathematical modeling of physical systems :Differential equation, Difference equation, and State variable representations; Examples of modeling different types (e.g. electrical, mechanical, chemical, biological, social etc.) of systems, Equivalence between the elements of different types of systems, Characterization of systems: Stability -- concept and definition, poles, Routh array, internal stability of coupled systems, Time domain response -damping coefficient, natural frequency, overshoot, settling time, rise time; Frequency domain response -peak and peaking frequency, bandwidth and cut-off rate; Link between time and frequency domain response features.

Advantages of closed loop operation: Sensitivity and complementary sensitivity, Disturbance and noise reduction, Structured and unstructured plant uncertainties, Analysis of closed loop systems : Stability and relative stability using root-locus approach, Nyquist stability criterion, Steady state errors and system types

Compensation techniques: Performance goals - Steady-state, transient and robustness specifications, PID, lag-lead and algebraic approaches for controller design, Sampled-data systems : Necessity of sample and hold operations for computer control, Sampling theorem z-transform, Stability and response of sampled-data systems, Controller design, Special features of digital control systems.

Introduction to state space: The concept of state, State space representation of systems, Block diagram for state equation, Transfer function decomposition, Controllability, Observability, Transfer matrix, Z-transform, Sampling process, Hold circuit

Reference Books:

1. K. Ogata, Modern Control Engineering', 4th edition, Pearson Education, New Delhi,/ PHI.
2. I.J. Nagrath & M. Gopal, 'Control Systems Engineering', New Age International Publishers.
3. B.C. Kuo, 'Automatic Control Systems', Prentice Hall of India Ltd., New Delhi.
4. M. Gopal, 'Control Systems, Principles & Design', Tata McGraw Hill, New Delhi.
5. M.N. Bandyopadhyay, 'Control Engineering Theory and Practice', Prentice Hall of India.

EIC 15102 MICROPROCESSORS & EMBEDDED SYSTEMS 3 0 0 6

Intel 8085 CPU Architecture and Pin Outs, Timing Diagram, Stacks and Subroutines, Addressing Modes, Instruction sets, Programming, Memory and I/O Interface.
Intel 8086 CPU – Architecture and Pin Outs, Minimum and Maximum Mode, Memory Segmentation, Addressing Modes.
Programmable Peripheral Interface (8255), Interfacing of A/D and D/A converters, Multiplexers and Data Selectors with microprocessors. Some Microprocessor Applications.
Embedded System review and applications. 8051 Microcontroller architecture and overview of 8051 Microcontroller manufactured by different companies. Pin Outs, Memory organization and Port

organization of 8051 Microcontroller. 8051 assembly language programming: addressing modes and instructions. Different sections of 8051 Microcontroller and associative SFRs: Interrupt, Timer, Serial Communication and Power Management sections. Hardware and concept of software for programming the internal code ROM of 8051 Microcontroller. Interfacing of conventional 8051.

Reference Books:

1. R.S. Gaonkar, 'Microprocessor Architecture Programming and Application', Wiley Eastern Ltd., New Delhi.
2. Muhammad Ali Mazidi & Janice Gilli Mazidi, 'The 8051 Micro Controller and Embedded Systems', Pearson Education.
3. William Kleitz, 'Microprocessor and Micro Controller Fundamental of 8085 and 8051 Hardware and Software', Pearson Education.

EIC 15103 INDUSTRIAL INSTRUMENTATION I 3 1 0 7

MEASUREMENT OF FORCE, TORQUE AND VELOCITY

Electric balance, Different types of load cells, Magnets, Elastic load cells, Strain gauge load cell, Different methods of torque measurement, Strain gauge, relative regular twist, Speed measurement, Revolution counter, Capacitive tacho, drag cup type tacho, D.C and A.C tacho generators, Stroboscope.

MEASUREMENT OF ACCELERATION, VIBRATION, DENSITY AND VISCOSITY

Accelerometers, LVDT, piezoelectric, strain gauge and variable reluctance type accelerometers, Mechanical type vibration instruments, Seismic instrument as an accelerometer and vibrometer, Calibration of vibration pick-ups, Units of density, specific gravity and viscosity used in industries, Baume scale, API scale, Pressure head type densitometer, Float type densitometer, Ultrasonic densitometer, Bridge type gas densitometer, Viscosity terms, Saybolt viscometer, Rotameter type.

PRESSURE MEASUREMENT

Units of pressure, Manometers, Different types, Elastic type pressure gauges, Bourdon type bellows, Diaphragms, Electrical methods, Elastic elements with LVDT and strain gauges, Capacitive type pressure gauge, Piezo resistive pressure sensor, Resonator pressure sensor, Measurement of vacuum, McLeod gauge, Thermal conductivity gauges, Ionization gauge, cold cathode and hot cathode types, Testing and calibration of pressure gauges, Dead weight tester.

TEMPERATURE MEASUREMENT

Definitions and standards, Primary and secondary fixed points, Calibration of thermometer, different types of filled in system thermometer, Sources of errors in filled in systems and their compensation, Bimetallic thermometers, Electrical methods of temperature measurement, Signal conditioning of industrial RTDs and their characteristics, Three lead and four lead RTDs, Thermocouples, Laws of thermocouple, Fabrication of industrial thermocouples, Signal conditioning of thermocouples output, Thermal block reference functions, Commercial circuits for cold junction compensation, Response of thermocouple, Special techniques for measuring high temperature using thermocouples, Radiation methods of temperature measurement, Radiation fundamentals, Total radiation & selective radiation pyrometers, Optical pyrometer, Two colour radiation pyrometers.

Reference Books:

1. B. G. Liptak, Instrument Engineers Handbook, vol-I and vol-II, Chilton Book Co. Philadelphia.
2. D. M. Considine and G. D. Considine (Eds.) Process Instruments and controls Handbook, Mc Graw Hill, New York
3. D. Patranabis, Principles of industrial Instrumentation, TMH, New Delhi, 2nd Ed.
4. Ernest O. Doeblin, Measurement Systems – Application and Design, Tata-McGraw Hill
5. A. Barua, Fundamentals of Industrial Instrumentation, Wiley India

6. C. R. Alavala, Principles of Industrial Instrumentation and Control Systems, Cengage Learning
7. S. K. Sing - Industrial Instrumentation and control; McGraw Hill
8. K. Krishnaswamy- Industrial Instrumentation; New Age International

EIC 15104 ELECTRICAL AND ELECTRONIC INSTRUMENTATION 3 1 0 7

Functional elements of an instrument, Static and dynamic characteristics, Errors in measurement, Statistical evaluation of measurement data, Standards and calibration. Principle and types of analog and digital voltmeters, ammeters, multimeters, Single and three phase wattmeters and energy meters, Magnetic measurements, Determination of B-H curve and measurements of iron loss, Instrument transformers, Instruments for measurement of frequency and phase, Digital method for measuring frequency, period, phase difference, pulse width, time interval, total count – Digital voltmeter – Types.

Sine wave generator, Frequency synthesized sine wave generator, Sweep frequency generator, pulse and square wave generator, Function generator, Wave analyzer, Applications, Harmonic distortion analyzer, Spectrum analyzer, Applications, Audio Frequency generator, Noise generator. General purpose oscilloscope, Screens for CRT graticules, Vertical & horizontal deflection systems, Delay line, Multiple trace, Dual beam & dual trace, Probes, Oscilloscope techniques, Special oscilloscopes, Storage oscilloscopes, Sampling oscilloscope, Digital CRO, D.C & A.C potentiometers, D.C & A.C bridges, Magnetic disk and tape, Recorders, digital plotters and printers, CRT display, digital CRO, LED, LCD & dot matrix display, Telemetry.

Reference Books:

1. Golding E.W. & Wides F.C. Electrical Measuring Instruments & Measurements ; Wheeler
2. William D. Cooper, Albert D. Helfrick - Electronic Instrumentation And Measurement Techniques; PHI
3. Harris, F. K. – Electrical Measurements, Wiley.
4. M.M.S. Anand, Electronic Instruments and Instrumentation Technology, PHI, Delhi
5. Sawhney A K : A course in Electrical & Electronic Measurements & Instruments, Dhanpat Rai & Co.
6. Reissland M.U.: Electrical Measurement, New Age International
7. H.S. Kalsi, Electronic Instrumentation, Tata McGraw Hill

EIC15201 CONTROL SYSTEMS LAB 0 0 3 3

1. Response of Closed loop control system
2. Realization of basic feedback control system
3. Realization of Type 0, Type 1 and Type 2 control system.
4. Response of Feed forward control system
5. Realization of P, PI, PD and PID control system.
6. Response of PID control system trainer
7. Bode plot of different type of system.
8. Realization of First and second order control system

EIC15202 MICROPROCESSORS AND EMBEDDED SYSTEMS LAB 0 0 3 3

Different 8085 assembly language programming examples using kits. Interfacing of key board, display, A/D and D/A with 8085.

Simple firmware implementation for understanding the uses of 8051 instructions, I/O Ports, Timer/counter of 8051, Interrupts and Serial Communication.

EIC15203 MEASUREMENTS AND ELECTRONIC INSTRUMENTATION LAB 0 0 3 3

1. Calibration of Ammeter, Voltmeter, Wattmeter and Energymeter.
2. Study of CRO and its application to measurement of different signal and electronic parameters.
3. Conversion of galvanometer into multi range voltmeter and ammeters.
4. Design of a FET input electronic dc voltmeter for a given range of voltages and extend its range to different values.
4. Convert an ac signal of a given range into dc using full wave precision rectifier and appropriate RC filter.
5. Measurement of values of the given inductor by using Maxwell Bridge and two Capacitors of different values.
6. Design of a 4-bit D/A converter and generation of an analog signal of 16 continuous steps starting from zero and with a step-difference of 0.5 V from a TTL clock signal.
7. Measurement of high resistance using loss of charge method
8. Time period Measurement.

SEMESTER – VI

EIC 16101 INDUSTRIAL INSTRUMENTATION – II 3 0 0 6

MEASUREMENT OF HUMIDITY & MOISTURE

Humidity terms – Dry and wet bulb psychrometers – Hot wire electrode type hygrometer – Dew cell – Electrolysis type hygrometer – Commercial type dew point meter – Moisture terms – Different methods of moisture measurement – Moisture measurement in granular materials, solid penetrable materials like wood, web type material.

MECHANICAL TYPE FLOW METERS

Theory of fixed restriction valuable head type flow meters – Orifice plate – Venturi tube – Flow nozzle – Dall tube – installation of head flow meters – Piping arrangement for different fluids – Pitot tube.

QUANTITY METERS, AREA FLOW METERS AND MASS FLOW METERS

Positive displacement flow meters – Constructional details and theory of operation of mutating disc, reciprocating piston, oval gear and helix type flow meters – Inferential meter – Turbine flow meter – Rotameter – Theory and installation – Angular momentum mass flow meter – Coriolis mass flow meters – Thermal mass flow meters – Volume flow meter plus density measurement – Calibration of flow meters – Dynamic weighing method.

ELECTRICAL TYPE FLOW METER

Principle and constructional details of electromagnetic flow meter – Different types of excitation schemes used – Different types of ultrasonic flow meters – Laser doppler anemometer systems – Vortex shedding flow meter – Target flow meter – Solid flow rate measurement – Guidelines for selection of flow meter.

LEVEL MEASUREMENT

Gauge glass techniques coupled with photoelectric readout system – Float type level indication – Different schemes – Level switches, level measurement using displacer and torque tube – Bubble system. Boiler drum level measurement – Differential pressure method – Hydra step systems – Electrical types of level gauges using resistance, capacitance, nuclear radiation and ultrasonic sensors.

Reference Books:

1. B. G. Liptak, Instrument Engineers Handbook, vol-I and vol-II, Chilton Book Co. Philadelphia
2. D. M. Considine and G. D. Considine (Eds.) Process Instruments and controls Handbook, Mc Graw Hill, New York

3. D. Patranabis, Principles of industrial Instrumentation, TMH, New Delhi, 2nd Ed.
4. Ernest O. Doeblin, Measurement Systems – Application and Design, Tata-McGraw Hill
5. A. Barua, Fundamentals of Industrial Instrumentation, Wiley India
6. C. R. Alavala, Principles of Industrial Instrumentation and Control Systems, Cengage Learning
7. S. K. Sing - Industrial Instrumentation and control; McGraw Hill
8. K. Krishnaswamy- Industrial Instrumentation; New Age International

EIC16102 POWER ELECTRONICS 3 0 0 6

Brief Introduction of Power Electronics Components – Thyristors, DIACs, TRIACs, GTO's, Power Transistors (BJT, MOSFET and IGBT), Losses and Cooling, Triggering circuits for Thyristors and Power Transistors, Snubber design and protection, Commutation circuit for Thyristors.

AC to DC conversion: Single phase controlled rectifiers – Phase angle control, Single phase half wave controlled rectifier, Single phase full wave controlled rectifier, Single phase half controlled and fully controlled bridge converters, The effect of input source impedance, Dual converter.

Three phase controlled rectifiers – M-3, B-6, Dual converter.

DC to DC conversion: Buck and Boost converters using BJT and IGBT: problems, design, operation and application.

DC to AC conversion: Classification of inverter, Single phase and three phase inverter operation using BJTs and MOS devices for VSI and CSI, Basic concept of PWM controlled inverter.

AC to AC conversion: AC voltage controllers, Single and three phase Cycloconverter circuits, blocked group operation, circulating current mode operation.

Application : UPS, SMPS, electronic ballast, HVDC transmission, Microwave (Dielectric) Heating and induction heating.

REFERENCE BOOKS

1. Elements of Power Electronics – Philip T Krein
2. Thyristorised power controllers – Dubey, Doradla, Joshi & Sinha
3. Power Electronics – M. H. Rashid
4. Power Electronics – P. C. Sen
5. Fundamentals of Power Electronics and Drives – A. Chakrabarti
6. Power Electronics – Mohan

EIC16103 DIGITALSIGNAL PROCESSING 3 0 0 6

Introduction: Sampling of Continuous-time signals: frequncy-domain representation of Sampling, reconstruction of bandlimited signal from its samples, discrete-time processing of continuous-time signals, Sampling rate changes- Upsampling and downsampling. Digital Filter Design: Design of IIR Filters (Analog approximations- Butterworth, Chebyshev and Transformations- Impulse Invariance and Bilinear Transformation), FIR filter design using Windowing and Frequency Sampling methods. Digital Filter Structures: Direct forms, Cascade and Parallel forms, Linear phase and Frequency sampling structures for FIR systems Discrete Fourier Transform: Definition, Properties, Computation of DFTs, radix-2 FFT algorithms (Decimation-in-time and Decimation-in- frequncy), DFT based Spectral analysis. Finite Word Length Effects: Discrete-time Random signals, Quantization effects, Coefficient quantization, Round-off noise. Digital Signal Processors: Introduction to TMS-320 family of Digital Signal Processors Applications of DSP (e.g. Musical Signal Processing, Speech Processing) Introduction to Advanced Topics (Wavelets and Multiresolution analysis, Adaptive Signal Processing)

Reference Books:

1. J.G Proakis and D.G.Manolakis, 'Digital Signal Processing Principles, Algorithms and Applications', Pearson Education, New Delhi, 2003 / PHI.
2. S.K. Mitra, 'Digital Signal Processing – A Computer Based Approach', Tata McGraw Hill, New Delhi, 2001.
3. Alan V. Oppenheim, Ronald W. Schafer and John R. Buck, 'Discrete – Time Signal Processing', Pearson Education, New Delhi, 2003.

CSR 16102 COMPUTER NETWORKS 3 0 0 6

Overview of data communication and networking, Network Architecture; Physical layer communication: Signals, Media, Bits, Digital transmission; Circuit/Packet switching; Error detection/correction techniques; Data link control and protocols, Medium access control: Pure/Slotted ALOHA, CSMA/CD; CSMA/CA; Ethernet addressing and wiring; Internetworking: Architecture; IP addressing; Address binding with ARP; Datagram encapsulation and fragmentation; Link-state and Distance-vector routing; Dijkstra's algorithm; IPv6 Internet Protocols; UDP and TCP; TCP segment format; Protocol ports; ICMP and Error handling; Network applications: Client/Server concept; Socket API; DNS, Electronic mail, HTTP and WWW including HTML.

Reference Books:

1. Andrew S. Tanenbaum, " Computer Networks". PHI, Fourth Edition, 2003.
2. Behrouz A. Forouzan, " Data communication and Networking". Tata Mc Graw Hill, 2004.
3. William Stallings, " Data and Computer Communication", Sixth Edition, Pearson Education, 2000

EIC 16201 INDUSTRIAL INSTRUMENTATION LAB 0 0 3 3

1. Determination of Discharge coefficient of Orifice plate and Venturi meter.
2. Measurement of flow rate using Orifice, Venturi, Elbow, Flow nozzle, rotameter.
3. Characteristics of P/I and I/P Converters.
4. Measurement of Humidity.
5. Level Measurement using DP transmitter and Capacitance probe.
6. Pressure gauge calibration using Dead Weight Tester.
7. Study of Smart transmitter and Smart Valve Positioner.
8. Calibration of RTD based Temperature transmitter.
9. Determination of Stoichiometric Ratio in a Combustion Chamber.
10. Determination of Transfer function model of Temperature transducers.
11. Determination of Viscosity using Brookfield Viscometer.

EIC16202 POWER ELECTRONICS LAB 0 0 3 3

1. Characteristics of power semiconductor devices.
2. Two-transistor model of SCR.
3. Study of various firing circuits of SCR/ TRIAC (R – C firing circuit, UJT based firing circuit, Ramp- pedestal firing circuit, Digital firing circuit etc.).
4. Single-phase converters.
5. Single phase AC power controller.
6. Chopper control of DC motor.
7. Integral cycle control for single phase AC system.
8. Single-phase cycloconverter.

EIC16203 DSP LAB 0 0 3 3

1. Study of Sampling and aliasing effects
2. Implementation of IIR filters
3. Implementation of FIR filters
4. Realization of different Filter structures
5. Spectral analysis using DFT
6. Study of effect of Finite precision
7. Application of Adaptive filter for Noise and Echo cancellation
8. Application of Wavelets e.g. De-noising, edge extraction, compression.

All the experiments will be carried out using MATLAB and TI DSP kits. Implementation of the filters on Xilinx FPGA will also be carried out, depending on the availability of time.

SEMESTER - VII

EIC 17101 PROCESS & DISTRIBUTED CONTROL SYSTEMS 3 0 0 6

Need for process control – Mathematical model of first order liquid level and thermal processes – Higher order process – Process with dead time, process with inverse response – Interacting and non-interacting systems – Continuous and batch process – Servo and regulator operation.

Basic control action – Characteristics of ON-OFF, proportional, integral and derivative control modes – Composite control modes – P+I, P+D and P+I+D control modes – Electronic controllers to realize various control actions – Evaluation criteria – IAE, ISE, ITAE and ¼ decay ratio – Tuning of controllers – Damped oscillation method. Cascade control – Feed forward control – Ratio control – Selective control systems – Split range control – Adaptive and inferential control.

Mixing – Evaporation – Drying – Heat exchanger – Distillation process – Case study of control schemes of binary distillation column.

Evolutions of PLCs – Sequential and Programmable Controllers – Architecture – Comparative study of Industrial PLCs. – SCADA:- Hardware and software, Remote terminal units, Master station, Communication architectures and Open SCADA protocols.

PLC Programming:- Ladder logic, Functional block programming, Sequential function chart, Instruction list and Structured text programming.

Evolution - Different architectures - Local control unit - Operator Interface – Displays - Engineering interface - Study of any one DCS available in market - Factors to be considered in selecting DCS – Case studies in DCS.

Introduction- Evolution of signal standard – HART communication protocol – Communication modes – HART Networks – HART commands – HART applications – Field bus:- Introduction, General Fieldbus architecture, Basic requirements of Field bus standard, Field bus topology, Interoperability and Interchangeability – Introduction to OLE for process control (OPC).

Reference Books:

1. B. G. Liptak, Instrument Engineers Handbook, Chilton Book Co., Philadelphia
2. W. Bolton, Programmable Logic Controllers, Elsevier
3. D. P. Eckman, Automatic Process control, John Wiley, New York
4. P. Harriott, Process control, Mc Graw Hill, New York
5. D. M. Considine and G. D. Considine (Eds.) Process Instruments and controls Handbook, Mc Graw Hill, New York
6. B. W. Bequette, Process Control – Modeling, Design and Simulation, PHI
7. C. D. Johnson, Process Control Instrumentation Technology, PHI
8. K. Krishnaswamy- Process control, New Age International
9. Surekha Bhanot – Principle and application of Process control; Oxford University press

EIC 17102 ANALYTICAL INSTRUMENTATION 3 0 0 6

COLORIMETRY AND SPECTROPHOTOMETRY - Special methods of analysis -Beer-Lambert law - Colorimeters - UV-Visible spectrophotometers - Single and double beam instruments - Sources and detectors -IR spectrophotometers - Types - Attenuated total reflectance flame photometers - Atomic absorption spectrophotometers - Sources and detectors - FTIR spectrophotometers - Flame emission photometers-Applications. CHROMATOGRAPHY Definition-Types of chromatography - Different techniques - Gas chromatography - Detectors - Liquid chromatography - Applications - High-pressure liquid chromatographs -Applications. INDUSTRIAL GAS ANALYZERS Types of gas analyzers - Oxygen, NO2 and H2S types, IR analyzers, thermal conductivity analyzers, analysis based on ionization of gases. Air pollution due to carbon monoxide, hydrocarbons, nitrogen oxides, sulphur dioxide estimation - Dust and smoke measurements-Thermal analyser-Industrial analyser. PH METERS AND DISSOLVED COMPONENT ANALYZERS Principle of pH measurement, glass electrodes, hydrogen electrodes, reference electrodes, selective ion electrodes, ammonia electrodes, biosensors, dissolved oxygen analyzer - Sodium analyzer - Silicon analyzer-Turbidity meter. RADIO CHEMICAL AND MAGNETIC RESONANCE TECHNIQUES Nuclear radiations - Detectors - GM counter - Proportional counter - Solid state detectors - Gamma cameras - X-ray spectroscopy - Detectors - Diffractometers - Absorption meters - Detectors. NMR - Basic principles - NMR spectrometer - Applications. Mass spectrometers -Different types -Applications.

Reference Books:

1. Handbook of Analytical Instruments- R.S. Khandpur, Publisher: Tata McGraw Hill
2. Principles of Instrumental Analysis- Skoog, Holler, Nieman, Publisher: Thomson Brooks/Cole
3. Introduction to Instrumental Analysis- Robert D. Braun, Publisher: Pharma Book Syndicate
4. Principles of Industrial Instrumentation- D.C. Patranabis, Publisher: Tata McGraw Hill

EIC 17201 PROCESS & DISTRIBUTED CONTROL SYSTEMS 0 0 3 3

LAB

1. Study of Process Control Training Plant and Compact Flow Control Unit.
2. Characteristics of Control Valve (with and without Positioner).
3. Level Control and Pressure Control in Process Control Training Plant.
4. Design of ON/OFF Controller for the Temperature Process.
5. Analysis of Multi-input Multi-output system (Four-tank System).
6. Simulation of Lumped Parameter System.
7. PC based Control of Heat Exchanger.
8. Development of Virtual Instrument using SCADA package.
9. Design of Deadbeat and Dahlin's Controllers for first order process with dead time.
10. Implementation of Discrete Control Sequence using PLC.

EIC 17202 ANALYTICAL INSTRUMENTATION LAB 0 0 3 3

1. Measurement of pH.
2. Measurement of Conductivity.
3. Study of UV-Visible Spectrometer.
4. Study of ECG.
5. Study of Audiometer.
6. Study of Pyrometer.
7. Flue-gas analyzer.
8. Study of IR Thermometers.
9. Gas chromatography: Determination of the composition in given sample.

ELECTIVES

EIE 17101 INTELLIGENT INSTRUMENTATION 3 0 0 6

Introduction to smart, intelligent and integrated sensors, recent trends in sensor technology-thick-film and thin film sensors, biometric sensors, biosensors, nano-sensors, and sensors for environment monitoring; Introduction to microelectronic and micro-electro-mechanical systems; Introduction to statistical pattern recognition; Intelligent controllers based on Fuzzy Logic and Artificial Neural Network; Virtual instrumentation: architecture, hardware and software;

Reference Books:

1. N. V. Kirianaki, S. Y. Yurish, N. O. Shpak V. P. Deynega: Data Acquisition and Signal Processing for Smart Sensors, John Wiley.
2. Understanding Smart Sensors - by Randy Frank, 2nd Edition, Artech House Publications.)
3. Chang Liu, Foundations of MEMS, Pearson/Prentice Hall.
4. Chin –Teng Lin and C.S. George Lee, Neural Fuzzy Systems" – A neuro fuzzy synergism to Intelligent systems, Prentice Hall International.
5. Ghosh Control in Robotics and Automation: Sensor Based Integration, Allied Publishers, Chennai.
6. George Barney C. "Intelligent Instrumentation", Prentice Hall of India Pvt. Ltd.
7. Kevin James, PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control, Newnes.
8. N. Mathivanan, "PC-Based Instrumentation", PHI.

EIE 17102 SENSOR NETWORKS 3 0 0 6

Introduction to Sensor networks: Introduction to wired and wireless networks, Challenges of sensor networks, Network topologies, Performance analysis of Network. Applications of sensor networks. Hardware and software for wireless sensor platform: Smart dust, Embedded sensor board - microcontroller, RF antennas, and signal conditioning circuits. Software- Tiny OS, NesC programming, different simulating Tools. Energy Efficient Medium access: Energy consumption and life time, Energy efficient MAC- Channelization based, contention based and hybrid protocols, cellular network concepts. Positioning and localization: Self organization network, local positioning, Global positioning with no distances estimates, Different localization techniques, GPS. Data security, Advances in WSN- MEMS- Micro sensor, RF-MEMS- Micro radios.

Reference Books:

1. C.S.Ragavendra, Krishna M.Sivalingam, Taieb F.Znati, "Wireless sensor Networks", Springer.
2. Laurie Kelly, Mohammad Ilyas, Imad Mahgoub, "Handbook of Sensor Networks: Compact Wireless and Wired Sensing Systems", CRC Press.
3. Nirupama Bulusu, Sanjay Jha, "Wireless Sensor Networks", Artech House .
4. Holger Karl, Andreas Willig, "Protocols and Architecture for Wireless Sensor Networks" 2005, John Wiley and Sons.

EIE 17103 CHAOS IN ENGINEERING SYSTEMS 3 0 0 6

Introduction, Chaos in feedback systems. Types of attractions : Point, periodic, quasiperiodic and strange attractors. Pathways to chaos. Poincare section, Feigenbaum's universality constants, Liapunov exponents. Stable, unstable and chaotic systems; Examples from electrical, mechanical and fluid-ynamic systems.

Modelling of dynamical system: Differential equations and difference equations.

Geometry of fractals; Chaotic dynamics on fractals; Hausdorff, correlation, information and Liapunov dimensions.

Characterization of attractors from experimental data. Basins of attraction and basin boundaries. Applications in engineering systems.

Reference Books:

1. Fractal Calculus (Defunct.Chaos & Dynamical Systems) – Harrison

2. Chaos - Kathleen T. Alligood, Tim D. Sauer, and James A. Yorke

EIE 17104 ELECTROMAGNETIC THEORY 3 0 0 6

Coulomb's and Gauss's law, Electric boundary conditions, Poisson's and Laplace's equation, Uniqueness theorem, Method of images, Boundary value problems.
Biot – Savart's law, Ampere's and Faraday's law, Equation of continuity, Magnetic boundary conditions.
Maxwell equations in differential and integral form, Displacement current, Propagation of uniform plane wave in lossy dielectric, lossless dielectric and good conductors, Poynting theorem. Normal and oblique incidence of plane waves in dielectric – dielectric and dielectric – conductor boundary, Polarization.
Transmission line equations, Input impedance, Standing wave and Transient analysis, Stub matching and Quarter wave transformer matching, Smith chart. TE and TM modes in rectangular and circular waveguides, Wave impedance, Field and current distribution, Phase velocity and group velocity, Power transmission and attenuation.
Introduction to wave propagation in free space. Antenna parameters and antenna fundamentals, Qualitative discussion on basic laboratory antennas – Dipole, Monopole, Loop, Yagi, Log periodic, Helical, Horn, Slot, Dish, Microstrip etc.

Reference Books:

1. Elements of Electromagnetism by M. N. O. Sadiku, Third Edition, Oxford University Press.
2. John.D.Kraus, 'Electromagnetics', McGraw Hill, New York.
3. William.H.Hayt, 'Engineering Electromagnetics', Tata McGraw Hill.
4. Joseph.A.Edminister, 'Theory and Problems of Electromagnetics', Schaum Series, Tata McGraw Hill.

EIE 17105 PC BASED INSTRUMENTATION SYSTEMS 3 0 0 6

Introduction to PC based Instrumentation, PC opened up and architecture - general structure of PC based instrumentation - advantages - disadvantages of computer based instrumentation - comparison with other control systems - Introduction to various instrumentation packages like LABVIEW - genie etc, BUS types- I/O BUS- ISA bus - EISA Bus - PCI bus – GPIB – RS 232 - digital input -output card - block diagram description - opto
input-output card- introduction- block diagram description, Parallel port interfacing techniques - parallel port - parallel port as output port -programming of parallel port - parallel port as input port - its programming, Serial port interfacing techniques - serial port - serial port as output port - programming of serial port - serial port as input port – its programming
Case studies on CNC motion controller - power plant controller - cement plant control - sugar plant control - textile plant control

Reference Books:

1. C. L. Smith, Digital Computer Process Control, Intex Publishers, Scranton
2. B. G. Liptak, Instrument Engineers Handbook, Chilton Book Co., Philadelphia
3. P.B. Deshpande and R. H. Ash, Elements of Computer Process Control, ISA,
4. N. Mathivanan, PC Based instrumentation: conceptc and Practice, PHI

5. Michael H. Tooley, PC based instrumentation and control; Newnes
6. S. K. Sing, Computer Aided Process Control; PHI

EIE 17106 TELEMETRY & REMOTE SENSING 3 0 0 6

Telemetry: Signal conditioning, Multiplexing, Framing and Synchronization, Setup and control, recorders and displays, real-time processing.

Remote Sensing: Different platforms – ground, airborne and space-borne; Types of sensors - Multispectral scanners, Thematic mapper, Microwave radiometer, Synthetic aperture radar; Spectral and spatial resolutions; Data formats, Processing of data, Application of remote sensing in delineation of earth resources, ground water exploration, identification of surface features, delineation of coastal features, study of ocean waves etc.

Reference Books:

1. T. S. Rathore, "Digital Measurement Technique", Narosa Publishing House.
2. Swobada G - Telecontrol Method and Application of telemetering and remote control - Van Nostrand.
3. Schwartz M - Information Transmission - Modulation & Noise - MGH.
4. Gruenberg E L - Handbook of Telemetry and telecontrol - MGH, 67
5. Carley B A - Communication system - Introduction to signals and noise in electrical communications - MGH, Int. student. Edn.
6. D Patranabis - Telemetry principles - Tata McGraw Hill.

EIE 17107 PDE AND FINITE ELEMENT METHOD 3 0 0 6

Partial Differential Equations:
First order equations, Cauchy Problem for Quasilinear equations: The transport equation, Method of Characteristics, Semi linear and quasilinear and general solutions. Classification of Second order PDE, Examples, Initial Value Problems, Non- Homogeneous Equations, Laplace Equation, Poisson Equation, Elliptic Equation and Hyperbolic Equations. Some Engineering Examples to find solution by the method of separation of variables of Heat equation, Wave Equation.

Finite Element Method:
Continuum boundary value problem, Weighted Residuals, Trial Functions, Piecewise Trial Functions, Implementation of FEM, Pre processing, Processing and Post Processing. Various shape like linear, bilinear, triangular and higher order trial functions, Computer implementation of FEM using software Analysis/Fluent/Ideas. Time dependent problems and Convergence criteria and error analysis.

Reference Books:

1. Mark S. Gockenbach—Partial Differential Equations: Analytical and Numerical Methods, SIAM publishers.
2. Robert C. McOwen - Partial Differential Equations: Methods and Applications, Pearson India.
3. O.C. Zienkiewicz and K. Morgan – Finite Elements & Approximations, Dover Publishers.
4. J.N. Reddy – An Introduction to the Finite Element Method, TataMcgra-Hill, India.

EIE 17108 ADVANCED CONTROL SYSTEMS 3 0 0 6

Systems in state space: Concept of states and state model, State equation from transfer function, Modeling of dynamical systems, State space representation of multivariable systems, Building blocks of state space models. Modeling through energy approach of electrical, mechanical and

electromechanical systems. Canonical forms, Solution to state-space equations, state transition matrix, properties of state transition matrix, computation of state transition matrix. Equilibrium points and stability concepts, stability definitions, Modeling energy of the system in terms of quadratic functions, Direct method of Lyapunov criterion for LTI systems. Definition of controllability, observability, stabilizability and detectability. State feedback control for controllable canonical form, State feedback control in general, Output feedback controller. Full-order and reduced-order observers, Introduction to Linear Quadratic problems. Introduction to Discrete time systems, analogies with continuous-time systems, mathematical models for LTI discrete-time systems, Z-transformation of difference equations, analysis of first, second order and higher order systems. State space modeling of discrete-time dynamical systems.

Reference Books:

1. Ogata K, "Modern Control Engineering", Prentice Hall, New Delhi.
2. Richard Dorf & Robert Bishop, "Modern control system", Pearson Education.
3. B.C Kuo, "Automatic control systems", Prentice Hall, New Delhi.
4. Shinners S. M., "Modern Control Engineering", Prentice Hall, New Jersey.
5. Chen C. T, "Analog and Digital Control System Design", Saunders College Publishing, Japan.
6. D'azzo and Houpis, "Linear Control System Analysis and Design", McGraw Hill, Singapore.

EIE 17109 PROCESS MODELLING & SIMULATION 3 0 0 6

Basic Modeling Principles, Mathematical models for chemical engineering systems - analog simulation - digital simulation - time-domain dynamics – frequency domain dynamics - process identification, Stirred Tank Heaters, Absorption-isothermal - continuous stirred tank - chemical reactors - biochemical reactors - adiabatic continuous stirred tank reactor - ideal binary distillation columns, Second order system, Pole-Zero cancellation- system in series – blocks in parallel – linear boundary value problems - parameter estimation of discrete linear systems - phase-plane analysis-generalization of phase-plane behavior - nonlinear systems - bifurcation behavior of systems models, Simulation of start-up transient problems, Dynamic model of a distillation column - computer simulation – state material - heat balances - simulation of heat - mass transfer equipment - chemical reactors, Simulation techniques, Process design - integrated chemical plants - processes – application of simulation packages

Reference Books:

1. Luyben W.L., Process Modelling, Simulation and Control for Chemical Engineers, McGraw Hill International edition.
2. Smith C.A. and Corripio A.B., Principles and practice of automatic process control, John Wiley & Sons.
3. Ingham J., Chemical Engineering Dynamics - Modelling with PC simulation, John Wiley & Sons.
4. Peter harriott., Process Control, Tata Mcgraw hill, New Delhi.

EIE 17110 DIGITAL CONTROL SYSTEMS 3 0 0 6

Introduction to Discrete time systems, analogies with continuous-time systems, mathematical models for LTI discrete-time systems, convolution representation and difference equations in advanced and delayed form, Z-transformation of difference equations, analysis of first, second, and higher order systems, stability of discrete-time systems, the Jury's criterion. State space modeling of discrete-time dynamical systems, canonical forms, solution to state space equations, properties of the state transition matrix, analysis of discrete-time state equations. Equilibrium points and stability definitions, direct method of Lyapunov, definitions of controllability and observability, equivalent controllability/observability conditions. Design of state feedback and output feedback control. Design of observers. Numerical Computations, digital simulation of

state-space models, QR decomposition, singular value decomposition, digital control using digital signal processors. Introduction to Optimal Control, statement of the optimal control problem, dynamic programming, general introduction to the principle of optimality, application to DTS, discrete-time linear quadratic problem, Riccati equation and its solution, optimal state feedback solution.

Reference Books:

1. Ogata K., "Discrete-time Control Systems", Prentice Hall Inc., New Jersey.
2. Kuo B. C, "Digital Control Systems", Saunders College Publishing, Japan.
3. Phillips C. L. and Nagle H. T, "Digital Control System Analysis and Design", Prentice-Hall, New Jersey.
4. Astrom K. J and Wittenmark, "Computer Controlled Systems Theory and Design", Prentice Hall, New Delhi.
5. Gopal M., "Digital Control and State Variable Methods", Tata McGraw Hill, New Delhi.

EIE 17111 MINE ELECTRONICS & INSTRUMENTATION 3 0 0 6

Mine instrumentation- basic principles, multipoint monitoring, health monitoring, and sequence control, intrinsically safe circuits. Signaling and communication- preliminaries, signaling and communication system for AFC and gate belt conveyor, test switch, pre-start warning, loch-out, over-riding stop, amplifiers, generator, surface to underground communication systems, CDS, fiber optic laser beam equipments. Environmental monitoring- transducers, isolators, detector head, control unit, recorder, telemetering, warning system, multiplexing.

Reference Books:

1. Rangan, Sarma, Mani, "Instrumentation – Devices and Systems", McGraw Hill.

EIE 17112 OPERATING SYSTEMS 3 0 0 6

Evolution of Operating Systems, Structural overview, Concept of process and Process synchronization, Process Management and Scheduling, Hardware requirements: protection, context switching, privileged mode; Threads and their Management; Tools and Constructs for Concurrency, Detection and Prevention of deadlocks, Dynamic Resource Allocation, Design of IO systems, File Management, Memory Management: paging, virtual memory management, Distributed and Multiprocessor Systems, Case Studies.

Reference Books:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", Windows XP update, John Wiley and Sons (ASIA) Pvt. Ltd.
2. Harvey M. Deitel, "Operating Systems", Pearson Education Pvt. Ltd.
3. Andrew S. Tanenbaum, "Modern Operating Systems", Pearson Education.
4. William Stallings, "Operating Systems", Pearson Education.
5. Dhamdhere D.M, "Operating Systems: A Concept Based Approach", Tata McGraw Hill, New Delhi.

EIE 17113 MEMS and NANO TECHNOLOGY 3 0 0 6

Introduction, emergence, devices and application, scaling issues, materials for MEMS, Thin film deposition, lithography and etching. Bulk micro machining, surface micro machining and LIGA process. MEMS devices, Engineering Mechanics for Micro System Design, Micro Pressure Sensor, Micro accelerometer. Electronic interfaces, design, simulation and layout of MEMS devices using CAD tools. Introduction to Nanotechnology, Nano sensors, Molecular Nanotechnology, CNT types, Synthesis and applications.

Reference Books:

1. Simon Sze, Semiconductor Sensors, John Wiley & Sons, Inc.
2. Elwenspoek, M. and Wiegerink.R., Mechanical Microsensors, Springer-Verlag Berlin Heidelberg.
3. Poole, P. and Frank J. Owens., Introduction to Nano Technology., John Wiley & Sons., INC.
4. Bharat Bhushan, Hand Book of Nano technology, Springer Publication.
5. Julian W. Gardner and Vijay K. Varadan, Microsensors, Mems, And Smart Devices, John Wiley & sons ltd.
6. Massood Tabib-azar, Micro actuators - electrical, magnetic, thermal, optical, mechanical, chemical and smart structures, Kluwer academic publishers, New York.

EIE 17114 DATA BASED MANAGEMENT SYSTEMS 3 0 0 6

Database System Architecture - Data Abstraction, Data Independence, Data Definition and Data Manipulation Languages. Data Models - Entity-Relationship, Network, Relational and Object Oriented Data Models, Integrity Constraints, and Data Manipulation Operations. Relational Query Languages: Relational Algebra, Tuple and Domain Relational Calculus, SQL and QBE. Relational Database Design : Domain and Data dependency, Armstrong's Axioms, Normal Forms, Dependency Preservation, Lossless design. Query Processing and Optimization: Evaluation of Relational Algebra Expressions, Query Equivalence, Join strategies, Query Optimization Algorithms. Storage Strategies : Indices, B-trees, Hashing; Transaction Processing : Recovery and Concurrency Control, Locking and Timestamp based Schedulers, Multiversion and Optimistic Concurrency Control schemes. Advanced Topics; Object-oriented and Object Relational Databases, Logical Databases, Web Databases, Distributed Databases, Data Warehouse and Data Mining.

Reference Books:

1. Abraham Silberschatz, et al., Database System Concepts, McGraw-Hill.
2. Ramez Elmasri and Shamkant B., Fundamental Database Systems, Pearson Education.
3. Raghu Ramakrishnan, Database Management System, Tata McGraw-Hill Publishing Company.
4. Peter Rob and Corlos Coronel, Database System, Design, Implementation and Management, Thompson Learning Course Technology.

EIE 17115 MECHATRONICS 3 0 0 6

Introduction and overview of mechatronic systems and products; Integrated design issues and design process – Mechanism, load condition, design and flexibility, structures, man-machine interface, industrial design and ergonomics, information transfer, safety; Modeling of mechatronic systems; System interfacing-selection of interface cards, DAQ cards-single and multi-channel-RS232/422/485 communication, IEEE 488 standard interface, GUI card, GPIB, Ethernet switch; Electromechanical transducers and actuators, Electronic controllers and drives for mechanical products, Practical case studies on mechatronic systems; Micro-mechatronic systems: principle and component design, micro actuation, micro robot, micro pump.

Reference Books

1. Mechatronics: Electronics Control Systems in Mechanical and Electrical Engineering by W Bolton, Pearson Education Press.
2. Computer automation in manufacturing - an Introduction, by T. O. Boucher, Chapman and Hall.
3. Robotics technology and flexible automation, by S. R. Deb, Tata McGraw-Hill, New Delhi.
4. "Mechatronic System Design", Devdas Shetty, Richard A.Kolk, PWS Publishing Company.
5. "Automated Manufacturing Systems - Actuators, Controls, Sensors and Robotics", Brian Morriss, Mc Graw Hill International Edition.

6. Mechatronics : Electronics in products and Processes, Bradley, D. Dawson, N.C. Burd and A.J. Loader, Chapman and Hall, London.

SEMESTER – VIII

EIC 18101 VLSI DESIGN 3 0 0 6

CMOS Inverter: Voltage transfer characteristics and determination of critical voltages, calculation of noise margins, Switching characteristics and Power Dissipation; Static complementary gates: NAND & NOR Gates, Complex Logic Circuits, Pseudo n-MOS logic, CMOS Full adder circuit, CMOS XOR & XNOR circuits; Switch logic: Pass Transistors, CMOS Transmission Gates and basic function implementation using CMOS TG; Dynamic CMOS Logic circuits; Layout design and Design rules; Sequential CMOS logic circuits: Behavior of Bi-stable elements, SR Latch Circuit, Clocked SR/JK Latch, Master Slave JK, CMOS D-latch and edge triggered Flip-flop; Interconnect delay modeling; Cross talk; I/O circuits/Off chip connection; VLSI clocking: CMOS clocking styles, clock generation and distribution; Subsystem design: Combinational Shifters, Adders, Multipliers, Memories and PLDs; Introduction to Electronic Design Automation for VLSI Design: Programmable Logic design flow – Design entry, simulation, synthesis, RTL model, mapping and translation, floor planning, bit stream generation and downloading into a FPGA/CPLD chip.

Reference Books:

1. Pucknell, D.A.,Eshraghian, K. “Basic VLSI Design”, Prentice Hall of India.
2. Eugene D.Fabricius , “Introduction to VLSI Design”, Tata McGraw Hill.
3. Weste, N.H. “Principles of CMOS VLSI Design”, Pearson Education.
4. Charles H.Roth, “Fundamentals of Logic Design”, Jaico Publishing House.
5. Douglas Perry, “VHDL Programming by Example”, Tata McGraw Hill.

EIC 18102 FIBER OPTICS AND LASER INSTRUMENTATION 3 1 0 7

Fundamentals of fiber optics, Intrinsic, extrinsic, and interferometric fiber optic sensors for the measurement of strain, temperature, pressure, displacement, velocity, acceleration; acoustic sensors, sensors for measurement of magnetic field and current, humidity, pH, rotation, gyroscope. Fiber optic sensors for remote detection of hydrocarbons, Pressure, temperature, Strain, Magnetic and Electric Field Measurements based on - Intensity, Phase, Polarization, Frequency, Wavelength modulation. Monochromators, Optical time domain reflectometer (OTDR), Optical spectrum analyzer, Optical powermeter. Ellipsometer, Charge coupled Devices (CCD), Measurements: Laser Diode measurements for Optical Communication, Low level Signal detection from noise (Lock-in-Amplifier), Measurements and Standards for attenuation, Bandwidth and Numerical Aperture, Measurements of Optical Communication Fiber, Measurements with Optical Amplifier, SNR and CNR measurements in Optical Cable.

Reference Books:

1. Senior J.M, “Optical Fibre Communication - Principles and Practice”, Prentice Hall of India.
2. Keiser G, “Optical Fiber Communication”, Tata McGraw Hill, New Delhi.
3. John F. Read, “Industrial Applications of Laser”, Academic Press.
4. Monte Ross, “Laser Applications”, Tata McGraw Hill.

EIC 18201 INSTRUMENTATION SYSTEM DESIGN LAB 0 0 3 3

1. Design of square root extractor.
2. Design of linearizing circuit for thermocouples.
3. Design of ON/OFF and PID Controllers (using Operational Amplifier, Microprocessor and Microcontroller).
4. Design of Thyristor Power Controller.

5. Design of RTD based 2-wire/4-wire Temperature Transmitters.
6. Design of Capacitance based Level Transmitter.
7. Design of Alarm/Announciator Circuits using Analog Circuits.
8. Control valve sizing.
9. Orifice sizing and Rotameter design.
10. Piping and Instrumentation Diagram – Case Study.
11. Preparation of documentation of Instrumentation Project. (Process Flow Sheet, Instrument Index Sheet and Instrument Specification Sheet).
12. Preparation of Project Scheduling, Installation Procedure and Safety Regulations.

EIC 18202 Fiber Optics and Laser Instrumentation Lab 0 0 3 3

1. Experiment based on OTDR
2. Experiment based on splice machine
3. Experiment based on Spectrum analyzer.
4. Experiment based on Monochromator
5. Experiment based on He- Ne laser
6. MZI
7. Fiber optic strain, temperature and gas sensor.

ELECTIVES

EIE 18101 DIGITAL IMAGE PROCESSING 3 0 0 6

Introduction – Image formation process, Sensing and recording, Human visual model, applications of Image Processing. Image Transforms – 2D Fourier transform and its properties, Fast Fourier Transform, Walsh Transform, Hadamard Transform, Discrete Cosine Transform. Image Enhancement – Histogram equilization, Lowpass and highpass filtering using Spatial masks, Homomorphic filtering, Filtering in Spatial Frequency domain, Pseudocoloring. Image Restoration – Image degradation models, Inverse filtering, Wiener filter, Power spectrum equalization, Introduction to Non-linear
and Space-varying Deblurring methods. Image Compression – Error-free and Lossy Compression techniques, Image Compression Standards. Image Segmentation – Edge detection and region segmentation, thresholding, edge linking. Image analysis – representation schemes for Boundary and region, Morphological operations, Scene matching.

Reference Books:

1. Rafael. C.Gonzalez, Richard .E.Woods, “Digital Image Processing”, Pearson Education.
2. Jayaraman S.,Esakkirajan S.,Veerakumar T. “Digital Image Processing”, Tata McGraw Hill.
3. David Salomon, “Data Compression - The Complete Reference” Springer Verlag, New York.
4. William K-Pratt “Digital Image Processing”, John Wiley, New York.
5. Kenneth R. Castleman, “Digital Image Processing”, Pearson Son Education, New Delhi.

EIE 18102 POWER PLANT INSTRUMENTATION 3 0 0 6

Brief survey of methods of power generation-hydro, thermal, nuclear, solar and wind power – Introduction to thermal power plant processes – building blocks - ideal steam cycles – Boiler – types, Boiler - turbine units and its range systems, feed water systems, steam circuits, combustion process, products of combustion process, fuel systems, treatment of flue gases, steam turbine, condensate systems, alternator, feed water conditioning, turbine bypass valves. Importance of instrumentation in power generation – details of boiler processes, P & I diagram of boiler – combined cycle power plant, power generation and distribution. Measurement in

boiler and turbine: Metal temperature measurement in boilers, piping system for pressure measuring devices, smoke and dust monitor, flame monitoring. Introduction to turbine supervising system, pedestal vibration, shaft vibration, eccentricity measurement. Installation of non-contracting transducers for speed measurement, rotor and casing movement and expansion measurement. Controls in boiler: Problems associated with control of multiple pulverizers. Draught plant: Introduction, natural draught, forced draught, induced draught, power requirements for draught systems. Fan drives and control, control of air flow. Combustion control: Fuel/Air ratio, oxygen, CO and CO_2 trimming, combustion efficiency, excess air, parallel and cross limited combustion control, control of large systems. Controls in boiler: Boiler drum level measurement methods, feedwater control, soot-blowing operation, steam temperature control, Coordinated control, boiler following mode operation, turbine following mode operation, sliding pressure mode operation, selection between boiler and turbine following modes. Distributed control system in power plants-interlocks in boiler operation. Turbine control: Shell temperature control-steam pressure control – lubricant oil temperature control – cooling system. Nuclear power plant instrumentation: Piping and instrumentation diagram of different types of nuclear power plant, Nuclear reactor control loops, reactor dynamics, excess reactivity, pulse channel and logarithmic instrumentation, control and safety instrumentation, reliability aspects.

Reference Books:

1. K. Krishnaswamy – Power Plant Instrumentation, PHI New Delhi
2. Electric Power Engineering Handbook – Edited by L. L. Grigsby.
3. Instrument Engineers Handbook, B. G. Liptak, Chilton Book Co., Philadelphia
4. David Lindsley – Power Plant Control and Instrumentation; IET

EIE 18103 ROBOTICS AND AUTOMATION 3 0 0 6

Introduction: Basic concepts, definition and origin of robotics, different types of robots, robot classification, applications, robot specifications. Introduction to automation: Components and subsystems, basic building block of automation, manipulator arms, wrists and end-effectors. Transmission elements: Hydraulic, pneumatic and electric drives. Gears, sensors, materials, user interface, machine vision, implications for robot design, controllers. Kinematics, dynamics and control: Object location, three dimensional transformation matrices, inverse transformation, kinematics and path planning, Jacobian work envelope, manipulator dynamics, dynamic stabilization, position control and force control, present industrial robot control schemes. Robot programming: Robot programming languages and systems, levels of programming robots, problems peculiar to robot programming, control of industrial robots using PLCs. Automation and robots: Case studies, multiple robots, machine interface, robots in manufacturing and non-manufacturing applications, robot cell design, selection of a robot.

Reference Books:

1. Saced B. Niku, “Introduction to Robotics: Analysis, Control, Applications”, John Wiley & Sons.
2. John J. Craig, “Introduction to Robotics: Mechanics and Contro”’, Pearson Education.
3. Fu K.S and Co, “Robotics Control, Sensing, Vision and Intelligence”, Tata McGraw Hill.
4. Klafter.R.D, Chimielewski.T.A and Negin.M, “Robotic Engineering- An integrated Approach”, Prentice Hall of India.
5. Mikell P. Groover, Mitchell Weiss, Roger N. Nagel, Nicholas G. Odrey, “Industrial Robotics Technology Programming and Application”, Tata McGraw Hill.

EIE 18104 RELIABILITY ENGINEERING 3 0 0 6

Definition of reliability, types of failures, definition and factors influencing system effectiveness, various parameters of system effectiveness.

Definition of probability, laws of probability, conditional probability, Bay's theorem, various distributions, data collection, recovery of data, data analysis procedures, empirical reliability calculations.
Types of system- series, parallel, series parallel, stand by and complex, development of logic diagram, methods of reliability evaluation. Methods of reliability improvement, component redundancy, system redundancy, types of redundancies-series, parallel, series – parallel, stand by and hybrid, effect of maintenance.
Life testing, requirements, methods, test planning, data reporting system, data reduction and analysis, reliability test standards.

Reference Books:

1. R. Billintan & R. N. Allan, "Reliability Evaluation of Engineering and Systems", Plenum Press.
2. A. K. Govil, "Reliability Engineering", Tata Mc-Graw Hill, New Delhi.
3. K. C. Kapoor & L. R. Lamberson, "Reliability in Engineering and Design", John Wiely and Sons.
4. S. K. Sinha & B. K. Kale, "Life Testing and Reliability Estimation", Wiely Eastern Ltd.
5. L. Balagurusamy, "Reliability Engineering", Tata Mc-Graw Hill, New Delhi.
6. L. S. Srinath, "Reliability Engineering", Affiliated East-West Press, New Delhi.

EIE 18105 INDUSTRIAL DRIVES AND CONTROL 3 0 0 6

Introduction, Basic Elements – types of electric drives – factors influencing the choice of electrical drives – heating - cooling curves – loading conditions - classes of duty – selection of power rating for drive motors with regard to thermal overloading - load variation factors, Drive Motor characteristics, Mechanical characteristics – speed-torque characteristics of various types of load - drive motors – braking of electrical motors – dc motors - single phase - three phase induction motors, Types of D.C Motor starters – typical control circuits for shunt motors - series motors – three phase squirrel cage - slip ring induction motors, Speed control of DC series - shunt motors – armature control – field control - ward-leonard control - controlled rectifiers - DC choppers – applications, Speed control of three phase induction motor – Voltage control - voltage / frequency control - slip power recovery scheme – inverters - AC voltage regulators – IGBT - applications
Reference Books:

1. Vedam subrahmaniam, Electric Drives, Tata Mcgraw-Hill.
2. Nagrath, I.J. and Kothari, D.P., Electrical Machines, Tata Mcgraw-Hill.
3. Pillai, S.K., A first course on electric drives, Wiley Eastern Limited.
4. Partab, H., Art and science and utilisation of electrical energy, Dhanpat rai and Sons.
5. Rashid Muhammad H., Power Electronics, Circuits, Devices and Applications, Pearson Education.

EIE18106 OPTO - ELECTRONIC DEVICES 3 0 0 6

Review of junction theory, optical process in semiconductors- Radiative and non-radiative recombination, band-to-band recombination, transition in direct and indirect band gap semiconductors. Light emitting diodes- basic principle of operation and performance characteristics, structures of SLED and Edge emitting LED. Laser diodes- Einstein's theory of spontaneous and simulated emission, population inversion, optical gain in semiconductor, threshold condition for lasing, device structure and performance characteristics. Detection principle and structure of different types of photodetectors - photoconductor, p-n, p-i-n, Schottky PD, APD and their performance study. Basic principle of operation of solar cell and its characteristics. Optical fibers and amplifiers- structures and materials of fibers, principle of operation of EDFA and Raman amplifier. Modulators- acoustic–optic, electro–optic and magneto–optic. Couplers, connectors and wavelength converters. Integrated photoreceiver and concept of OEIC.

Reference Books:

1. P. Bhattacharjee, Semiconductor Optoelectronic Devices, PHI.

2. W. Hawkes, Optoelectronics- An Introduction, PHI.
3. John M. Senior, Optical Fibre Communications, PHI.
4. Culshaw B. and Dakin J(Ed) - Optical Fibre Sensors, Vol.1.2 Artech House.
5. Chin-Lin-Chon -Elements of Optoelectronic & Fibre Option, MGH

EIE 18107 INSTRUMENTATION & CONTROL IN PERTOCHEMICAL INDUSTRIES **3 0 0 6**

Distillation columns: Piping and Instrumentation diagrams – Instrumentation and control in distillation columns: Distillation equipment, Variables and degrees of freedom, Measurement and control of column pressure, Liquid distillate, Vapour distillate and inerts, Feed control – Reboiler control – Reflux control – Variable Column feed – Super distillation – Analyzers – Feed forward control, Chemical reactors: Instrumentation and control in chemical reactors: Temperature and pressure control in batch reactors – Instrumentation and control in dryers: Batch dryers and Continuous dryers, Heat exchangers: Instrumentation and control in heat exchangers: Variables and degrees of freedom – Liquid to liquid heat exchangers – Steam heaters – Condensers – Reboilers and Vaporizers – Use of cascade and feed forward control, Evaporators: Instrumentation and control in evaporators: Types of evaporators, Measurement and control of absolute pressure, Density, Conductivity, Differential pressure and Flow, Effluent and water treatment: Instrumentation and control in Effluent and Water Treatment: Chemical oxidation, Chemical Reduction, Neutralization, Precipitation and Biological control

Reference Books:

1. Liptak B.G., “Process Measurement and Analysis”, Elseiver Publishers.
2. Douglas M..Considine, “Process / Industrial Instruments and Controls Hand Book”, Tata McGraw Hill.
3. Hobart.H.Willard, Lyne.L..Meritt, John.A.Dean, Frank.A.Settle, “Instrumental method of Analysis”, CBS Publishers and Distributors.
4. D.M.Considine, “Handbook of Analytical Instruments”.
5. Liptak B.G. “Instrumentation in process Industries”, Elseiver Publishers.

EIE 18108 INSTRUMENTATION AND CONTROL IN IRON AND STEEL INDUSTRIES **3 0 0 6**

Description of process: Flow diagram and description of the processes – Raw materials preparation – Iron making – Blast furnaces – Stoves– Raw steel making – Basic Oxygen Furnace – Electric Furnace, Casting of steel: Primary rolling, Cold rolling and Finishing, Instrumentation: Measurement of level, Pressure, Density, Temperature, Flow ,Weight, Thickness and shape, Graphic displays and alarms, Control systems: Blast furnace – Stove combustion control system – Gas and water controls in BOF furnace – Strand Casting Mould Level control – Mould Level sensors – Ingot weight measuring system– Waste water treatment, Computer applications: Model calculation and logging – Rolling Mill Control – Annealing Process Control – Center Utilities Dispatch Computer

Reference Books:

1. Tupkary R.H, “Introduction to Modern Iron Making”, Khanna Publishers, 3rd Edition, New Delhi.
2. Liptak, Bela G, “Instrumentation in the Processing Industries”, Chilton Publishers.
3. Considine D. M, “Process/Industrial Instruments and control Handbook”, Tata McGraw Hill.
4. Serope Kalpakjian, “Manufacturing Engineering and Technology”, Addison Wesley Publishing Company, Massachusetts.
5. Robert H. Perry, D.W. Green and J.O. Maloney, Perry’s, “Chemical Engineers Handbook”, Tata McGraw Hill.

EIE 18109 DIGITAL SYSTEM DESIGN 3 0 0 6

Concepts of Algorithmic State Machine (ASM), ASM Charts and ASM blocks, Data Subsystem, Control Subsystem, Design with Gates, Multiplexer, PLD devices.
Asynchronous Sequential Logic: Transition table, Stability Considerations, Reduction of State, and Flow tables, Hazard and Races.
Programmable Logic Devices (PLD): PLD Devices PROM, PAL, GAL, CPLD, FPGA etc., and their applications. FPGA Programming. Design exercises
Design of a Finite State Machine: Introduction to the design of 8 bit Processor. Implementation in a CPLD and FPGA
Hardware Development Language: Basic Terminology: Entity Declaration, Architecture Body. Behavioral modeling. Data flow modeling. Structural style of modeling, mixed style of modeling. Hardware modeling examples.
Overview of at least one assembler/compiler like ABEL, PALASAM, VERILOG, SYNOPSIS etc.

Reference Books:

1. Donald D.Givone "Digital principles and design", Tata McGraw Hill.
2. Morris Mano "Digital Design", Prentice Hall of India.
3. Samuel C.Lee, "Digital circuits and logic design", Prentice Hall of India.
4. Biswas, N.N "Logic Design Theory", Prentice Hall.

EIE 18110 COMPUTER ARCHITECTURE 3 0 0 6

Basic structure of computers, Functional units - Basic Operational Concepts, Bus Structures, Software, Performance – Memory locations and addresses – Memory operations – Instruction and instruction sequencing – Addressing modes – Assembly language – Basic I/O operations – Stacks and Queues, Addition and subtraction of signed numbers – Design of fast adders – multiplication of positive numbers - Signed operand multiplication and fast multiplication – Integer division – Floating point numbers and operations. Fundamental concepts – Execution of a complete Instruction – Multiple bus organization – Hardwired control – Micro-programmed control - Pipelining – Basic concepts – Data hazards – Instruction hazards – Influence on Instruction sets – Data path and control consideration – Superscalar operation. Memory system, Basic concepts – Semiconductor RAMs, ROMs – Speed, size and cost – cache memories - Performance consideration – Virtual memory - Memory management requirements – Secondary storage, Accessing I/O devices – Interrupts – Direct Memory Access – Buses – Interface Circuits – Standard I/O Interfaces (PCI, SCSI, USB).

Reference Books:

1. Morris Mano, "Computer System Architecture", Pearson Education.
2. Vincent P.Heuring and Harry F.Jordan, "Computer Systems Design and Architecture", Pearson Education.
3. Andrew S.Tanenbaum, "Structured Computer Organization", Prentice Hall of India/Pearson Education.
4. William Stallings, 'Computer Organization and Architecture', Prentice Hall of India/Pearson Education.
5. John P.Hayes, 'Computer Architecture and Organization', Tata McGraw Hill.

EIE 18111 BIOMEDICAL INSTRUMENTATION 3 0 0 6

Introduction to the physiology of cardiac, nervous & muscular and respiratory systems. Transducers and Electrodes: Different types of transducers & their selection for biomedical applications. Electrode theory, selection criteria of electrodes & different types of electrodes such as Hydrogen Calomel, Ag-AgCl, pH, etc
Cardiovascular measurement: The heart & the other cardiovascular systems. Measurement of Blood pressure, Blood flow, Cardiac output and cardiac rate. Electrocardiography, phonocardiography,

Ballistocardiography, Plethysmography, Magnet- cardiography. Cardiac pacemaker & computer applications.
Respiratory System Measurement: Respiratory Mechanism, Measurement of gas volumes & flow rate. Carbon dioxide and Oxygen concentration in inhaled air. Respiratory controllers.
Measurement of Electrical Activities in Muscles and Brain: Electroencephalograph, Electromyograph & their interpretation.
Instrumentation for clinical laboratory: Measurement of pH value of Blood, ESR measurements, Haemoglobin measurements, Oxygen & carbon dioxide concentration in Blood. GSR measurements, polarographic measurements. Computer applications.
Medical Imaging: Ultra sound imaging, Radiography & applications.
Biotelemetry: Transmission & reception aspects of Biological signals. Aspects of patent care monitoring.

Reference Books:

1. Cromwell L – Biomedical Instrumentation and Measurement, Pearson
2. Carr – Introduction to Biomedical Equipment Technology 4/e – Pearson
3. Khandpur R S – Handbook of Biomedical Instrumentation, TMH, N. Delhi 1991
4. Astor B R – Introduction to Biomedical Instrumentation and Measurement, McMillan.
5. Chatterjee Miller – Biomedical Instrumentation, Cengage Learning

EIE 18112 ADVANCED SIGNAL PROCESSING 3 0 0 6

Signal modeling, Optimal filtering – Wiener and Discrete Kalman filter, Spectrum estimation, Adaptive filtering, algorithms for adaptive filtering and typical applications, Multirate systems, Nonlinear filtering, Time-frequency analysis, wavelet transform and its applications in processing and compression of signals, Concept of multidimensional signal and spectrum, 2D and 3D Fourier transform, discrete unitary multidimensional transforms. Applications of signal-theory-based approaches to formalised image processing.

Reference Books:

1. Monson Hays - Statistical Signal Processing, John Wiley and Sons.
2. Roberto Crist, "Modern Digital Signal Processing", Cengage Learning.
3. John G. Proakis, Dimitris G. Manobakis, "Digital Signal Processing, Principles and Algorithms", PHI.

EIE 18113 OPTICAL NETWORKS 3 0 0 6

Introduction to optical networks; Optical components: Couplers, Isolators, and Circulators, multiplexer & Filter (Grating, Fiber Bragg circuits, FP filter, Dielectric Filter, Acousto optic filter etc.,); Transmission system: System model, Power Penalty, Transmission Receiver, Optical amplifier, Crosstalk, Dispersion, Photonic networks: Introduction to computer data networks, Diagrams and virtual circuits, ISO - OSI model, MAC layer protocols, Fibre optic LAN architecture and protocols-ring, star, and bus structures, Fibre distributed data interface (FDDI) ATM JP high speed bus protocols – RATO net, tree net. Wavelength division multiplexed networks (WDM) LAMBDANET. Coherent star, PAS-NET, Shuffle net, all optical networks SONET and SDH- Functional architecture, timing aspects, ESCON, Metropolitan area; Broadcast and select network, Networks, layered architecture Photonic packet Switching: OTDM, MUX, DMUX, Synchronization etc.

Reference Books:

1. WDM optical Networks – Siva Ram Murthy and Mohan Gurusami, PHI.
2. Optical Networks – Rajiv Ramasami, Elseiver Publishers.
3. Optical WDM Networks – B.Mukherjee, Springer Publishers.

EIE 18114 MICROWAVE INSTRUMENTATION 3 0 0 6

Equivalent voltage and currents, Impedance, N-port circuit, Scattering matrix, Transmission matrix, Resonators, Terminators, Attenuators, Phase shifters, Directional couplers, Hybrid junctions, Power dividers, Circulators. Gunn diode, IMPATT diode, Schottky barrier diode, Varactor, PiN diode, Klystron, TWT, Magnetron.

Introduction to microwave measuring instruments: Spectrum analyzer, Network analyzers, Power meter, Frequency meter, Reflectometer, Calorimeter wattmeter etc.

Measurement of Q factor, Frequency and wavelength, Power, Phase, Impendence, VSWR, Attenuation, Noise factor, Dielectric constant, Permeability, Network parameters, Insertion loss etc.

Reference Books:

1. Sucher, Jerome Fox, "Handbook of Microwave Measurements",bPolytecnic Press of the Polytechnic Institute of Brooklyn.
2. Richard Collier and Douglas Skinner, "Microwave Measurements", IET
3. G.H.Bryant, "Principles of Microwave Measurements", IET.

EIE 18115 EMI & EMC 3 0 0 6

EMC requirements for electronic systems, Non-ideal behavior of components, Signal spectra, Radiated emissions and susceptibility, Conducted emissions & susceptibility, Cross talk, Shielding, Electrostatic discharge, System design for EMC.

Reference Books:

1. Introduction to Electromagnetic Compatibility, C. R. Paul, John Wiley and Sons, New York

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