Course structure for 4-Year 8-Semester B. Tech. Degree in Instrumentation Engineering

Course Structure for 1st Semester

Serial No.	Name	Code	Credit	Weekly Load			Total Load
				L	T	P	
1	Communicative English	HU101	03	2	1	0	03
2	Physics-I	PH102	03	2	1	0	03
3	Chemistry-I	CH103	03	2	1	0	03
4	Engineering Mathematics-I	MA104	03	2	1	0	03
5	Electrical Technology	EE105	03	2	1	0	03
6	Computer Programming and Data Structure	CS106	03	2	1	0	03
7	Language Lab	HU107	02	0	0	3	03
8	Physics-I Lab	PH108	02	0	0	3	03
9	Chemistry-I Lab	CH109	02	0	0	3	03
10	Electrical Technology Lab	EE110	02	0	0	3	03
11	Computer Lab	CS111	02	0	0	3	03
	TOTAL		**28**	**12**	**6**	**15**	**33**

Course Structure for 2nd Semester

Serial No.	Name	Code	Credit	Weekly Load			Total Load
				L	T	P	
1	Sociology	HU201	03	2	1	0	03
2	Physics-II	PH202	03	2	1	0	03
3	Chemistry-II	CH203	03	2	1	0	03
4	Engineering Mathematics-II	MA204	03	2	1	0	03
5	Basic Electronics	ET205	03	2	1	0	03
6	Engineering Mechanics	ME206	03	2	1	0	03
7	Physics-II Lab	PH207	02	0	0	3	03
8	Chemistry-II Lab	CH208	02	0	0	3	03
9	Electronics Lab	ET209	02	0	0	3	03
10	Workshop Practice	ME210	02	0	0	3	03
11	Engineering Drawing	ME211	02	0	0	3	03
	TOTAL		**28**	**12**	**6**	**15**	**33**

Course Structure for 3rd Semester

Serial No.	Name	Code	Credit	Weekly Load			Total Load
				L	T	P	
1	Analog Electronics	EC301	04	**3**	1	0	04
2	Digital Electronics	EC302	04	**3**	1	0	04
3	Electrical and Electronic Measuring Instruments	EI303	04	**3**	1	0	04
4	Engineering Mathematics – III	MA304	03	**2**	1	0	03
5	Circuit theory and Networks	EE305	04	**3**	1	0	04
6	Adv. Electronics Lab	EC306	02	**0**	0	3	03
7	Electrical Measurement Lab	EI307	02	**0**	0	3	03
8	Adv. Programming & Numerical Lab	MA308	02	**0**	0	3	03
	TOTAL		**25**	**14**	**5**	**9**	**28**

Course Structure for 4th Semester

Serial No.	Name	Code	Credit	Weekly Load			Total Load
				L	T	P	
1	Industrial Instrumentation – I	EE401	03	**2**	1	0	03
2	Sensors and Transducers	EI402	04	**3**	1	0	04
3	Control Theory – I	EE403	04	**3**	1	0	04
4	Communication Systems	EI404	04	**3**	1	0	04
5	Microprocessor and Peripheral Devices	EI405	04	**3**	1	0	04
6	Microprocessor Lab	EI406	02	**0**	0	**3**	03
7	Sensor and Transducer Lab	EI407	02	**0**	0	**3**	03
8	Network Theory Lab	EE408	02	**0**	0	**3**	03
	TOTAL		**25**	**14**	**5**	**9**	**28**

Course Structure for 5th Semester

Serial No.	Name	Code	Credit	Weekly Load			Total Load
				L	T	P	
1	Optical Sensors and Nondestructive Evaluation	EI501	04	3	1	0	04
2	Industrial Instrumentation – II	EI502	04	3	1	0	04
3	Control Theory – II	EE503	03	2	1	0	03
4	Digital Signal Processing	EI504	03	2	1	0	03
5	Process Control	EI505	04	3	1	0	04
6	Process Control - I Lab	EI506	02	0	0	3	03
7	Industrial Instrumentation Lab	EI507	02	0	0	3	03
8	Control System Lab	EI508	02	0	0	3	03
	TOTAL		**24**	**13**	**5**	**9**	**27**

Course Structure for 6th Semester

Serial No.	Name	Code	Credit	Weekly Load			Total Load
				L	T	P	

1	Analytical and Biomedical Instrumentation	EI601	04	3	1	0	04
2	Advanced Measurement and Automation Techniques	EI602	04	3	1	0	04
3	Transmitters, Recorders and Hazardous Area Instrumentation	EI603	04	3	1	0	04
4	Advanced Microprocessor, Microcontroller and Interfacing	EI604	04	2	1	0	03
5	Digital Signal Processing Lab	EI605	03	0	0	5	05
6	Communication Lab	EI606	02	0	0	3	03
7	Design and Instrument Workshop Lab	EI607	03	0	0	5	05
	TOTAL		**24**	**11**	**4**	**13**	**28**

Course Structure for 7th Semester

Serial No.	**Name**	**Code**	**Credit**	**Weekly Load**			**Total Load**
				L	T	P	
1	Engineering Management	HU701	03	2	1	0	03
2	Elective – I	EI702	04	3	1	0	04
3	Advanced Process Control Lab	EI703	03	0	1	3	04
4	Seminar on Some Engineering Topic	EI704	03	0	1	3	04
5	Project Ph-I	EI705	05	0	1	6	07
	TOTAL		**18**	**5**	**5**	**12**	**22**

Elective – I

A. Digital Communication
B. Software Engineering
C. Mechatronics
D. Computer Organization and Architecture
E. Database Management Systems
F. Process Plant Instrumentation

Course Structure for 8th Semester

Serial No.	**Name**	**Code**	**Credit**	**Weekly Load**			**Total Load**
				L	T	P	

1	Economics for Engineers	HU801	03	2	1	0	03
2	Elective – II	EI802	03	2	1	0	03
3	Project Ph-II	EI803	10	0	2	12	14
4	General Viva Voce	EI804	02	0	0	0	00
	TOTAL		**18**	**4**	**4**	**12**	20

Elective – II

A. Non-Conventional Energy Sources
B. Sensor Technology
C. Biomedical Signal Processing
D. Computer Networks
E. Advanced Control Engineering
F. Introduction to Robotics

Detailed Syllabus of each course

1st SEMESTER

THEORETICAL PAPERS

Course HU101- Communicative English

i)Developing Listening Comprehension through Language Lab Device

ii)Conversational Practice , Classroom presentation

iii)Group Discussion , Comprehension from selected stories

iv)Correction of errors, Vocabulary, Grammar: Sentence Structures and Transformation;

Active & Passive Voice; Direct & Indirect Narration

Course PH102- Physics-I

i)Viscosity, Electricity, Surface Tension

i)Vectors in particle mechanics: Unit vectors in spherical and cylindrical polar coordinates, Conservative vector fields and their potential functions - gravitational and electrostatic examples, Gradient of a scalar field, Equipotentials, States of equilibrium, Work and Energy, Conservation of energy, Motion in a central field and conservation of angular momentum.

ii) Simple Harmonic Motion: Composition of simple harmonic motion, Forced vibration and resonance, Wave equation in one dimension and travelling wave solution, Standing waves, Wave velocity and group velocity.

iii)Wave Optics : Diffraction- Fresnel and Fraunhofer class, theory of plane transmission grating, missing orders, resolving power. Polarization – Double refraction, ordinary and extra ordinary rays, polaroids, linearly, circularly and elliptically polarized light, half wave and quarter wave plates.
Fiber Optics: Core and cladding, step index and graded index fibers, acceptance angle, numerical aperture, losses, applications.
iv)Acoustics: Propagation of sound waves, acoustics of buildings

Course CH103- Chemistry-I

Chemical Bonding :Valence bond theory, Molecular orbital theory, characteristics of different bonds
Structure and Reactivity of Organic Molecules :Electronic influencing effects, aromaticity, elementary idea of stereochemistry, mechanisms of some selected organic reactions.
Coordination Chemistry**:** Coordination numbers, Chelate effect, Coordination complexes and application, Bio-inorganic chemistry**:** Metal ions in Biological systems, environmental aspects of Metals, NOx, CO, CO_2.
Organic Reaction Mechanism**:** Mechanisms of selected organic, bio-organic, polymerization and catalytic reactions.
Stereochemistry of Carbon Compounds**:** Selected Organic Compounds**:** Natural products and Biomolecules (Amino acids/nucleic acids/proteins).

Course MA104- Engineering Mathematics-I

Differential calculus: Differential, Successive differentiation, Leibnitz Rule. Rolles Theorem. L'Hospital's Rule.Taylor's theorem with Lagrange's and Cauchy's forms of remainders, Taylor's and Maclaurin's series, expansion of functions, curvature, asymptotes.Maxima and minima of functions of a single variable Curvature, concavity. Convexity, Points of inflexion.
Partial derivatives, differentials and total derivatives of composite functions.Euler's theorem on homogeneous functions.Taylor's theorem for a function of two variables.Maxima and minima of a function of several variables.Lagrange's method of undetermined multipliers.

Infinite Series :Geometric series**,** Comparison test, p-series, D'Alembert's Ratio Test, Cauchy's Root Test, Rabbe's test, Gauss' test, Power series, radius of convergence.
Int. Calculus: Properties of definite integrals. Quadrature, Rectification, Numerical integration by Trapezoidal Rule and Simpson's Rule. Double integral, change of order of integration, change of variables, determination of area, volume, moment of inertia, centroid.

Vector calculus: Brief review of vector algebra, scalar and vector triple products, Directional derivatives, gradient, divergence, curl, statements of Gauss's theorem, Green's theorem, Stokes' theorem, examples.

Course EE105- Electrical Technology

D.C. Circuits: Kirchhoff's laws, Maxwell's loop current method, star-delta transformation. Network theorems – Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem.
Magnetic Circuit: MMF, Flux**,**Reluctance. B-H Loop**.**Hysteresis and Eddy current loss**.**Magnetic circuit analysis with air gap.

A.C. Fundamentals: Sinusoidal quantities, phase & phase difference, average & RMS values, form factor & peak factor, concept of Sinusoids, impedance & admittance, power & power factor,
A.C. Circuits: Series and parallel R-L-C Circuits, Form Factor, Peak**.**Factor**.**Phasor concept of Sinusoids.Impedance and Admittance**.**Power**,** Power Factor, V A, V AR.
Balanced 3-phase: 3-phase AC balanced circuits**.**Phase-sequence, Star and Delta connections.
Power Measurement: Wattmeter circuit connection**.**Power Measurment by two wattmeter methods in 3phase system.

DC Machines: Construction and general principle of operation**.**Generator EMF Equation**.** Field connection **,**shunt series and compound**.**Generator characteristics**.**Motor-equation and general operation**.**starting and speed control, torque-speed curve. 1-PhaseTransformer: Construction**.**EMF equation**.**Phasor diagram**.**Equivalent circuits**.**Losses and Efficiency**.** Open circuit and Short circuit test.

3-Phase Induction Machine: Types of induction machines**.** Rotating magnetic field, slip,torque equation, torquespeed curve, DOL starting and reduced voltage starting.

Course CS106- Computer Programming and Data Structure

Introduction to digital computers; introduction to programming – variables, assignments; expressions; input/output; conditionals and branching; iteration; functions; recursion; arrays; introduction to pointers; structures; introduction to data-procedure encapsulation; dynamic allocation; linked structures; introduction to data structures – stacks and queues; time and space requirements.

PRACTICAL PAPERS

Language Lab- HU107
i)Honing 'Listening Skill' and its sub skills through Language Lab Audio device;
ii)Honing 'Speaking Skill' and its sub skills
iii)Linguistic/Paralinguistic features (Pronunciation/Phonetics/Voice modulation/

Stress/ Intonation/ Pitch &Accent) of connected speech
iv)Introducing 'Group Discussion' through audio –Visual input and acquainting them with key

strategies for success
v)Honing 'Conversation Skill' using Language Lab Audio –Visual input; Conversational Practice Sessions

'Group Discussion' through audio –Visual input and acquainting them with key

strategies for success;
vi)G D Practice Sessions for helping them internalize basic Principles (turn- taking, creative

intervention, by using correct body language, courtesies & other soft skills) of GD;
vii)Honing 'Reading Skills' and its sub skills using Visual / Graphics/Diagrams /Chart

Display/Technical/Non Technical Passages;

viii)Learning Global / Contextual / Inferential Comprehension

Physics-I Lab PH108
Determination of:
i)Modulus of elasticity
ii)Coefficient of viscosity by Stoke's law
iii)Refractive index of transparent liquid by travelling microscope
iv)Moment of inertia
v)Surface tension of a liquid
vi)Coefficient of friction

Chemistry-I Lab PH109
1. Titrations: acid-base, redox, complexometric, conductometric
2. To determine calcium and magnesium hardness of a given water sample separately.

3. To determine the value of the rate constant for the hydrolysis of ethyl acetate catalyzed by hydrochloric

acid.

4. Determination of partition coefficient of acetic acid between n-butanol and water

5. Determination of dissolved oxygen present in a given water sample.

6. To determine chloride ion in a given water sample by Argentometric method

Electrical Engineering Lab- EE110
i)Familiarization experiments(Variac,Potential divider, MCV, MIV,MCA,MIA&Wattmeter)
ii)Study of AC series R-L-C series circuit
iii) Characteristics of Tungsten and Carbon filament lamps
iv)No load test on Single phase Transformer
v)Experiments on DC circuits and DC machines
v)Calibration of voltmeter, ammeter and energy meter
vii)Experiments on magnetic circuit principles

Computer Lab- CS111
i)Introduction to: LAN, Server-Client, Microsoft Windows and Linux Platforms, Common OS Commands, Editor, Compiler.
ii) Expression evaluation
iii) Conditionals and branching
iv)Iteration
v)Functions
vi)Recursion
vii) Arrays
viii)Structures

ix) Linked lists
x) Data structures

2nd SEMESTER
THEORETICAL PAPERS

Course HU201-Sociology

i)Sociology: Nature and scope of Sociology - Sociology and other Social Sciences - Sociological Perspectives and explanation of Social issues

ii) Society and Technology: Impact of Technology on the Society - A case study

iii)Social Stratification: Systems of Social Stratification - determinants of Social Stratification - Functionalist, Conflict and Elitist perspectives on Social Stratification

iv)Work: Meaning and experience of work: Post industrial society- Post-Fordism and the Flexible Firm

v)Development - Conceptions of and approaches to development - The Roles of State and the Market in the Development

vi) Globalization: The concept of globalization - globalization and the nation state - Development and globalization in post colonial times.

vii) Industrial Policy and Technological change in India - The nature and Role of the State in India

viii)Technology Transfer: The Concept and Types of Technology Transfer-Dynamics of Technology Transfer

ix)Technology Assessment: The Concept - Steps involved in Technology Assessment 10. Environment: Sociological Perspectives on Environment - Environmental Tradition and values in ancient India 11.The Development of Management: Scientific Management - Organic Organization - Network organization - Post modern Organization - Debureaucratization - Transformation of Management 12. Technological Problems and the Modern Society: Selected Case Studies - Electric Power Crisis, Industrial and/or Environmental Disaster, or Nuclear Accident.

Course PH202- Physics-II

i)Nuclear Physics : Q-value, exoergic and endoergic reaction, threshold energy for endoergic reaction, packing fraction and binding energy, semi empirical mass formula, principle of reactors(qualitative)
ii) Kinetic theory of gases: Expression for pressure, Significance of temperature, Deduction of gas laws, Qualitative idea of (i) Maxwell's velocity distribution. (ii) degrees of freedom and equipartition of energy, Specific heat**s** of gases at constant volume and constant pressure.

iii)Thermodynamics: Carnot cycle, principle of steam engine and refrigeration, entropy, enthalpy, free energy, conduction of heat.

iv)Quantum Mechanics: Planck’s radiation law, Compton effect, wavelength shift and recoil of electrons; de Broglie hypothesis, Schrodinger time dependent and time independent equations, application to free particle and particle in a box.

Course CH203- Chemistry-II

Polymeric Materials: Elementary ideas of Polymer chemistry, thermosetting and thermoplastics, Nylon 6, Nylon 66, polyester, SBR, biopolymers, proteins.
Analytical chemistry: Principles of spectroscopic techniques in Chemistry, Experimental methods of structure determination using UV-VIS, IR and 1H-NMR spectroscopy, Chromatographic methods of separation and analysis, potentometric and amperometric methods of analysis
Electrochemical Systems: Electrochemical cells and EMF, Applications of EMF measurements: Thermodynamic data, activity coefficients, solubility product and pH, corrosion.
Kinetics of Chemical Reactions: Reversible, consecutive and parallel reactions, steady state approximation, chain reactions, photochemical kinetics.

Course MA204- Mathematics-II

Linear dependence of vectors, basis, linear transformations, rank and inverse of a matrix, solution of algebraic equations.Eigenvalues and eigenvectors, Hermitian and skew Hermitian matrices. Convergence of improper integrals, tests of convergence, Beta and Gamma functions**,** elementary properties, differentiation under integral sign, differentiation of integrals with variable limits. Rectification, double and triple integrals, computations of surfaces and volumes, Jacobians of transformations, integrals dependent on parameters applications. Scalar and vector fields, level surfaces, directional derivative, Gradient, Curl, Divergence, Laplacian, line and surface integrals, theorems of Green. Gauss and Stokes, orthogonal curvilinear coordinates.

Finite differences, Newton's forward and backward interpolation formulae, Central difference interpolation.Trapezoidal rule and Simpson's 1/3rd rule of integration.Solution of polynomial and transcendental equations, bisection method, Newton Raphson method and Regulafalsi method.

Course CS205- Basic Electronics

Introduction to electronics and electronic systems, Sem PN junction, V- I characteristics, break down mechanism, Zener diode and their application, half and full wave rectifiers, clipper, clampers.
Semiconductor and devices like diodes, BJT, FET, MOSFET, Rectifier and Filters, Transistor biasing. Bipolar junction transistors, characteristics, Early effect, biasing, different mode**s** of operation, use of BJT as amplifier, single stage amplifier, feedback amplifier.
Small signal transistor amplifiers, Operational amplifier and its application, Feedback and Oscillators, Digital circuit and combinational logic, Sequential logic and flip-flops, ADC & DAC, Data acquisition systems,

Course ME206- Engineering Mechanics

Statics: Basic concepts, Scalars and vectors, parallelogram law, Lami's theorem, Application of Vectors in Mechanics,Force Systems in two Dimensions; Moments and Couples; Resultants and Components in concurrent coplanar forces, parallel forces in a plane, Free Body Diagram Concept, Fundamentals of Friction, Limiting angle of Friction, Centroid, Moment of Inertia , Plane Trusses; Frames and Machines. Applications to wedges.
Dynamics: Introduction to vector calculus, Definition of vectors in Dynamics, Two dimensional article Kinematics in Rectangular Co-ordinates, Cylindrical Co-ordinates and in terms of Normal and Tangential Components;
Rectilinear Motion, Curvilinear motion of particle and description of different coordinate systems, Kinetics, Newton's Law and D' Alembert's principle,and application to rectilinear and curvilinear motion,

constrained motion, Energy and Momentum methods. Linear Impulse; Angular Impulse and Momentum – Central Force Motion.

PRACTICAL PAPERS

Physics-II Lab: PH207

Determination of:

i) Wavelength of light by grating
ii) Focal length of concave mirror
iii) Optical activity of polarimeter
iv) Resistances in series and parallel combinations
v) Mutual inductance
vi) Voltage gain of amplifier

Chemistry-II Lab: CH208

i) Estimation of Copper in brass by iodometry
ii) Estimation of iron in cement by dichromatometry
iii) Determination of different organic groups**:** known and unknown
iv) Preparation of emulsion and study of its stability
v) Determination of hardness of water
vi) Determination of fats and oils

Electronics Lab- ET209

i) Study the Multi-meter
ii) Study of Cathode Ray Oscilloscope
iii) V-I Characteristics of P-N junction Diode
iv) Rectifier Circuit(H.W./F.W./B.R) with different filter arrangement
v) Digital logic trainer
vi) Tenor characteristics

Workshop Pratice- ME210

Fitting Shop **:**Introduction to different hand tools, equipment and measuring devices, sawing, filing & drilling. Practice Jobs on MS Plate, making of nuts and bolts.

Carpentry Shop:Specification of wood and wood products, Introduction to Tools and equipments, different wood joints. Practice jobs on Dove Tail Notch or Dovetail Bridle Joint or Cross Joint

Forging Shop:Arc welding practice, Demonstration of forging a Octagonal Chisel, Sheet metal funnel making

Engineering Drawing- ME211

i) Lettering, Numbering, Dimensioning
ii) Plane Scales, Diagonal Scales &Vernier Scales
iii) Curves – Parabola, Ellipse, Involutes
iv) Projection of Points, Lines, Surfaces, Solids and Section of solids.
v) Orthographic and Isometric projection
vi) Introduction to CAD tools – basics; Introduction of Development and Intersection of surfaces.

3rd SEMESTER
THEORETICAL PAPERS

Course EC301 - Analog Electronics

Opto-electronic devices: LED, LCD, Laser diode, photodiodes, photoconductive cells, photovoltaic cells, phototransistors, Light activated SCRs, phototriacs
Special semiconductor devices: Tunnel diode, CCD, MIS diode
Transistor biasing circuits: Brief overview, h-parameters and their application in analysis. Class A, B, C, D and S power amplifiers. Push-pull operation. JFET: Biasing and CS, CD and CG amplifier. MOSFET: Depletion type, Enhancement type MOSFET and their biasing.
Linear Op-Amp Circuits: V-I Converter with floating and grounded load, Current amplifier, Difference amplifier, Instrumentation amplifier,
Non-linear Op-Amp Circuits: Schmitt trigger and applications, Precision rectifiers, Analog switches, Peak detectors, S/H circuits.
Practical Op-Amp limitations: DC errors, Slew rate, Frequency response, Noise effect, Frequency compensation. Ideal and Practical Integrators, Differentiators and solution of differential equations.
Multivibrators :Astable, Monostable, Bistable.

Integrated Circuit: Timer 555 and its applications

Log/Antilog Amplifiers, Analog Multipliers and their applications.

Voltage Controlled Oscillators, PLL and its applications, IC Voltage regulators, Introduction to Switched-Capacitor Circuits.

Course EC302 –Digital Electronics

Number systems and codes - Position number system, Radix conversion, Different types of codes- BCD, ASCII, EBCDIC, Gray.
Binary Arithmetic - R's and (R-1)'s complement representation, Subtraction using 1's and 2's complement representation, Concept of overflow, BCD addition.

Combinational Logic Design –Truth Table, SOP and POS realization from truth table, Logic minimization using K-map, Minterms and Maxterms, Minimization with don't care terms, Quine-McClusky's method of logic minimization, Error detection & correction: Hamming code.
Concept of combinational hazard, Examples of combinational logic design : Adder / Subtractor circuits; 2's complement ripple carry adder/subtractor circuit, Parity generator/checker circuit, Circuit for Binary to Gray and Gray to Binary conversion.
Encoder, Decoder, Demultiplexer and Multiplexer, Function realization using decoder and multiplexer

Sequential machine design : Concept of Moore and Mealy machine, State transition diagram and State transition table, Various memory elements, NAND-latch and its use, Clocked flip-flops, S-R, J-K, Dand T. Timing constraints on edge triggered flip-flops; Changing one type of Flip-flop to another type, Design of sequence detector. Asynchronous and synchronous counter design. Different types of registers.
Programmable Logic Devices – PROM, PLA, PAL, FPGA.
Integrated Circuit Logic Families - TTL, PMOS, NMOS, CMOS, ECL.
Semiconductor memories - ROM, RAM.

Digital to Analog Converters(weighted R, R-2R, ladder and current steering logic)and Analog to Digital Converters(successive approximation, integrating, flash and sigma-delta).Characteristics of ADCs and DACs (resolution, quantization, significant bits, conversion / settling time)

Course EI303- Electrical and Electronic Measuring Instruments

SI units, systematic and random errors in measurement, expression of uncertainty - accuracy and precision index

Standardization: classification of standards. Measurement of resistance: high, medium and low. Measurement of inductance (self, mutual), capacitance and frequency by ac bridge methods- Owen's, Heaviside-Campbell, Schering bridges, Wagner Earthing device.

DC and AC potentiometers: Crompton potentiometer, Drysdale polar type and Gall Coordinate type potentiometer, application of potentiometers, Magnetic Measurements.

General features of electrical measuring instruments: controlling, damping, and balancing of moving systems.

Instruments mechanism and dynamics: vibration galvanometer, Permanent magnet moving coil, moving iron, electro-thermal, rectifier, induction type and electrodynamic instruments for measuring voltage, current and power. Basic electrostatic instruments: voltmeters, wattmeters. Measurement of three phase power, Measurement of energy, Single Phase and Three Phase induction watt-hour meters, power factor meters, frequency meters, Q-Meter and Waveform analyzer.

Electronic Instruments: True R.M.S Voltmeter, Peak Response Voltmeter, Electronic Ohmmeters.
Cathode Ray Oscilloscopes: Dual-Trace Oscilloscopes, Oscilloscope Controls, Oscilloscope Probes, storage oscilloscope.
Digital instruments: Basic Digital Displays – LEDs and LCD panels.
Digital Voltmeters, digital phase and frequency meter.

Course MA304- EngineeringMathematics – III

Linear Algebra: Matrix algebra, systems of linear equations, Eigen values and Eigen vectors.

Probability and Statistics: Sampling theorems, conditional probability, mean, median, mode and standard deviation, random variables, discrete and continuous distributions: normal, Poisson and binomial distributions.

Fourier Series: Orthogonal functions, sine and cosine series, Gibbs phenomenon.
Fourier Transform: Fourier integrals and its interpretation, Fourier transformation, Frequency spectrum, FT of different time functions, Fourier transform theorem, Inverse Fourier transform.

Laplace Transform: two sided and one sided Laplace Transform, Laplace Transform of standard time functions, LT of periodic and other time functions, Theorems of Laplace Transform, Inverse Laplace

Transform, Lerch's Theorem, Solution of differential equations, boundary value problems, Solving circuit problems using LT.

Functions of complex variable and conformal transformation: Analytical complex function: Cauchy-Rieman differential equations, harmonic function, line integral of complex function, Cauchy's integral theorem, derivative of analytical function, modulus and real value theorem.

Taylor and Laurent series, Residue and Cauchy's residue theorem; Definite integrals by the method of residue; Jordan's lemma, Mapping of complex functions: Conformal mapping, critical point of transformation.

Course EE305- Circuit Theory and Networks

Network Analysis: Generalized mesh and nodal analysis, Duality of networks. Network theorems: analysis with dependent and independent sources, current and voltage sources, network minimization, numerical examples.

One-port and Two-port networks: impedance and admittance parameters, hybrid and inverse hybrid parameters,ABCD parameters, cascading of two port networks. Networks Graphs and Topology: Determination of incidence matrix, cut-set matrix, loop matrix and mesh matrix of large networks.

Filters: Filter classification Lowpass, highpass, bandpass and bandstop filter, Passive filters, Advantages of active filters, Transfer function approximation: Butterworth, Chebychev and other approximations, realization of active filters, all pass filter, characteristic impedance of active filters.

Network synthesis: driving point impedance and admittance functions, positive reality concept. realizability conditions, Hurwitz and Sturm tests, general energy functions, two-elements realizability requirements, canonical realization methods, transfer-function synthesis.

PRACTICAL PAPERS

Adv. Electronics Lab	EC306
Electrical Measurement Lab	EI307
Adv. Programming & Numerical Lab	MA308

4th SEMESTER
THEORETICAL PAPERS

Course EE401- Industrial Instrumentation – I

Industrial Weighing systems: Various types of strain gauges, load cells-column type, shear type and bending beam type, pressductor, application consideration of load cells, belt conveyor weighing systems and weighfeeders.

Measurement of P**ressure and** V**acuum**: manometers, elastic pressure sensors - Bourdon tube, bellows, diaphragm and capsule, Bourdon tube pressure gauge, pressure switch, electronic pressure transmitters - capacitive, piezo-resistive and resonator type, installation of pressure measuring devices, accessories for

pressure measurement - chemical seal and snubbers. Vacuum measurement using Mcleod gauge, thermal conductivity gauge, ionization gauge.

Temperature Measurement: Temperature scales, ITS90, temperature calibrators and simulators, thermowell, thermocouple, RTD, thermistors, IC temperature sensors, temperature switches, thermostats. radiation and optical pyrometry, quartz crystal thermometers, measurement of very high or steller temperature. Low temperature measurements
Acoustical methods: Basic acoustical parameters, psychoacoustic relationship, microphones, frequency weighting network and filters, sound level meter, sound pressure level meter, sound wave analyzers.

Course EI402- Sensors and Transducers

Instrument transducers: description, functional element, active and passive transducers, input-output configuration, static and dynamic characteristics.

Current transformers and potential transformers – their design and performance characteristics, phasor diagrams, magnitude error, phase angle error, composite error, difference with power and distribution transformers, testing of CT and PT, metering and protection ofCT.

Working principle of transducers: elastic deformation, resistance, capacitance, and inductance change, thermoelectric, piezoelectric and photoelectric electro-mechanical, electro-chemical, and ultrasonic principles, digital transducers.
Measurement of displacement, velocity and acceleration: potentiometer, LVDT, capacitive transducer, Tachogenerators, tachometers, stroboscopes, encoders, seismic accelerometers- piezoelectric and piezoresistive types.
Torque measurement in rotating shafts.Introduction to vibration measurement and monitoring.

Proximity sensors: Inductive, optical, magnetic, capacitive, ultrasonic.
Magnetic sensors: Sensors based on Villari effect for assessment of force, torque, proximity; Wiedemanneffect for yoke coil sensors, Thomson effect.
Hall effect and Hall drive, performance characteristics
Geiger counters, Scintillation detectors
Introduction to Smart sensors

Course EE403- Control Theory – I

Control system: block diagram, transfer function, signal flow graph, Mason's gain formula. Mathematical model of dynamic system: electrical, electro-mechanical. Concept of open-loop, closed-loop control, feedback and feed-forward control.Time domain analysis and specification, steady state and transient response, static and dynamic error, system optimization.
Concept of stability: Routh-Hurwitz stability criteria, root locus concept, polar plot, Bode plot, log-magnitude vs. phase plot, Nyquist stability criteria, relative stability, gain and phase margin; Frequency response, constant magnitude and phase shift loci in G-plane.
Control actions: On/off, P, PI, PID controllers and basic compensation techniques.
Basic rules of representing a control loop component, basic control loops.
Control system components: signal comparator, synchro, servomotor, tachogenerator, stepper motor.

Course EE404- Communication Systems

Introduction to communication systems, concepts of baseband signal, transmitter, transmission medium/ channel, Noise, Receiver, past history and different types of communication systems.

Analog communication: Concepts of signal, Noise, Power, SNR, Spectral Density, analog signal sources, Modulation- AM, FM, PM, Double sideband suppressed carrier, Single sideband, Amplitude compensated single sideband and vestigal sideband. IF stages, Detection techniques, PLL, transmission bandwidth and distortion.

Digital Communication: Digital signals, Bandwidth of signals and Noise, Concepts of Pulse Amplitude Modulation, Pulse code modulation, Differential Pulse code modulation, Delta Modulation, Coding : Huffman and CRC, Time Division Multiplexing, Frequency Division Multiplexing, Inter Symbol Interference, Digital signaling formats, Spectral Efficiency, Bit Error Rate, Synchronization, Spread Spectrum Systems- DSSS and FHSS.

Course EI405- Microprocessor and Peripheral Devices

Architecture of 8085: CPU, ALU, Registers organization, pin details, instruction set and addressing modes; programming examples, Fetch cycle, Instruction cycle, machine cycle, timing diagram; Interrupt structure, Data transfer schemes, synchronous, asynchronous, Interrupt driven mode, polled interrupt : software and hardware polling.
Interfacing devices: tristate devices, buffers and latches.
Subroutines, nested subroutines, multiple ending subroutine.
Hardware Interfacing- memory interfacing, I/O interfacing, memory mapped I/O and I/O mapped I/O, programmable I/Os (8212, 8155, 8755, 8255), programmable interrupt controller 8259, ADC and DAC interfacing.

PRACTICAL PAPERS

Microprocessor Lab	EI406
Sensor and Transducer Lab	EI407
Network Theory Lab	EE408

5th SEMESTER
THEORETICAL PAPERS

Course EI501 :Optical Sensors and Nondestructive Evaluation

Opto-electronic Instrumentation: Significance, application of optical sensors in instrumentation, Block diagram of an optical measurement system, Types of sensors, extrinsic and intrinsic, Optical sources and detectors - structure and principles: LEDs, LASERs. pin photodiodes, APD**.** Optical components: Couplers, splitters, connectors.

Different FO sensors- principles and structure: Position sensor, Proximity sensor, Temperature sensor, Pressure sensor, Liquid level sensor, FO accelerometer, strain sensor, Vibration sensors.

NDT: Non Destructive Testing: Significance and application, basic principles, classification, probing media, NDT methods: Penetrant Test, MPI, EPI, Ultrasonic testing, Eddy Current probes, Film Radiography, Tomography, Microwave based NDT measurements.

Course EI502 :Industrial Instrumentation – II

Flow Measurement: Fluid properties, turbulent & laminar flow, Reynolds number, velocity profile, flow conditioners, influence of pressure & temperature on volume flowrate, flow computers, totalization, flow calibration. elbow flowmeter; Variable area flowmeters ; positive displacement meters, magnetic flowmeter, mass flowmeter - Coriolis& thermal types, vortex shedding flowmeter, turbine flowmeter, ultrasonic flowmeter, target flowmeter, Laser Doppler Anemometer, insertion flowmeter, open channel flow metering, measurement of flow of bulk solids. Criteria for selection of flowmeters.

Measurement of level: float and displacer gauges; hydrostatic type, thermal effect type, electrical methods, ultrasonic level gauges, nucleonic level gauges.

Measurement of Humidity and Moisture Content: hygrometer, dew point determination, electrical methods, crystal oscillator instrument, radio frequency absorption, microwave absorption, infrared absorption.
Density and Specific Gravity Measurement : scales, hydrometers, balanced flow vessel, displacement meter, bubbler, nuclear absorption method, fixed volume method.
Measurement of viscosity and consistency: definition, units, Newtonian and Non-Newtonian behavior, Measurement of viscosity using laboratory viscometer, industrial viscometers, viscometer selection and application
pH measurement, electrical conductivity measurement

Course EE503- Control Theory – II
Digital control system: sampling, aliasing, reconstruction; zero, first and fractional order holds; Theory of Z transform, inverse Z transform, pulse transfer function, Time response, Concept of Z-domain stability, Routh stability criteria, Schur-Cohn criterion, Jury's stability test.
State space analysis: state model, canonical representation; solution of linear state dynamical equation, fundamental and state transition matrices, stability concept from state variables. Concept of controllability and observability.Linear state feedback control: pole placement method, concept of observer based system design.
Introduction to Non-linear control: phase-plane method, describing function method, Lyapunov stability criteria.

Course EE504 :Digital Signal Processing

Discrete-time signals: Concept of discrete-time signal, basic idea of sampling and reconstruction of signal, sampling
theorem, Types of discrete-time signal - periodic, energy, power, unit-sample, unit-step, unit-ramp, real & complex exponentials,arithmetic operations on sequences.

LTI Systems: Definition, representation, impulse response, derivation for the output sequence, Convolution sum,Properties of convolution, Calculation of convolution by graphical and tabular method,

Convolution of long duration sequences, Interconnections of LTI systems, stability and causality conditions, recursive and non-recursive systems, Linear Constant coefficient difference equation

Discrete time signals in transform domain - Z transform, Properties of Z transform; Inverse Z transform,Discrete Fourier Transform (DFT), DFT properties, IDFT,Fast Fourier Transform.

Digital processing of continuous-time signals; Digital filters: approximations, transformations, IIR and FIR filters, FIR filter design methods – Window technique, frequency sampling method, Design of IIR filters - pole zero placement method, impulse invariant method, matched z-transform method and bilinear z-transform method of coefficient calculation; realization structure for IIR filters, IIR implementation techniques, Analysis of finite word length effects in fixed point digital signal processing.

Course EI505 :Process Control

Process Characteristics: Process dynamics of liquids, gas and thermal processes, dynamic response of non-interacting and interacting first order elements in series, transient response of control systems in a single or multiple capacity process, set point and load response self regulation, steady state model, dynamic model.
Different control modes: On-off control, suppression of chattering, proportional, proportional-integral, proportional -derivative, proportional-integral-derivative, integral windup, bumpless transfer, derivative overrun, inverse derivative control, controller selection guideline, offset minimization.

Control strategies: Feedback and feedforward control, feedforward load balancing, feedback control with dynamic compensation, continuous control, batch control.

Controllers: Self operated, pneumatic, electric, hydraulic and electronic controllers, different forms of PID controllers.

Tuning of controllers: Concept of good control, close loop and open loop tuning methods, concept of model based and model free tuning, comparison of tuning methods, controller performance indices.

Advanced control techniques: Ratio control of a flow process, ratio station, manual set mode and variable mode, cascade control, primary and secondary loop, cascade loop saturation, feedforward control, feedforward-feedback control, auctioneering control, split range control, override control.

Final control elements: Classification, actuators: self-operated, pneumatic, electro-pneumatic, hydraulic, electric motor operated and stepper motor operated actuators, valve positioner and transmitter, classification of control valves, performance and application of different control valves, valve type and construction, valve sizing, valve characteristics, valve noise, valve testing, valve selection guidelines, safety valve and their selection.

PRACTICAL PAPERS

Process Control - I Lab	EI506
Industrial Instrumentation Lab	EI507
Control System Lab	EI508

6th SEMESTER
THEORETICAL PAPERS

Course EI601 :Analytical and Biomedical Instrumentation

Analytical Instruments : Gas Analysis : Thermal Conductivity Type, Heat of Reaction Method, Paramagnetic for O2, Dumbell and Servomax for O_2, Thermomagnetic for O2, Zirconia Cell Type for O_2, Cell for Continuous O_2 analysis microelectrodes, Spectroscopic Techniques, IR Radiation Absorption Type, Dual-Channel IR Spectrometry, Single-Channel IR Spectrometry, IR Sources, Comparison of their performances, IR detectors.

Dissolved Oxygen Analysis Cells, pH electrodes, circuits and applicatons, Spectroscopic Techniques: Absorption in Visible and UV-range, monochromators and detectors, Sources and their λ - ranges, Colorimetry, Atomic Spectral Methods: Emission and Absorption: Visible, UV and X-rays; sources, principles, detectors, sample preparation etc.
Special Topics: Chromatography, GC, GLC, LC, HPLC, Columns,Detectors; X-ray methods of analysis; Introduction to NMR and ESR.

Biomedical Instruments: Introduction to physiology of cardiac, nervous, muscular systems; Measurement of electrical activities of heart and brain, ECG measurement and instrumentation techniques; Medical equipment: Plethysmography, Diathermy, Defibrillator, pace maker, blood pressure monitor, Blood flow monitor, Endoscope; Instrumentation in clinical laboratory: measurement of pH, ESR, oxygen, Hb in blood; X-ray and Ultrasonography.

Course EI602 :Advanced Measurement and Automation Techniques

Introduction to computer control of processes, elements in a digital control loop, simple case study, intoduction to digital PID control algorithm, advantage and limitations of digital control.

Programmable Logic Controller: characteristic function, classification, block diagram representation of processor, memory layout, different languages used in PLC, types of program loaders. Input and output module, coils and contacts, PLC function block timers, function block counters, arithmetic function blocks, real time LADDER diagram; programming examples for maintenance and control.

PLC communication protocol, RS-232 communication interface, DF1 Full duplex protocol, DF1 half duplex slave protocol, DH-485 communication protocol, I^2C and SPI protocol, PLC interfacing technique.

DCS: Computer based control, History and overviewof DCS, Concept of centralized and distributed control systems, system architecture, brief view on operator station, engineering station, field control station, communication techniques between different modules, concept of different standard panels over view, graphic, tuning, control, alarm etc., applications.

SCADA: Computer based data acquisition, overviewand history of SCADA, primitive and modern SCADA architecture, SCADA hardware and software, modems use in SCADA, communication techniques, RTU structure, comparison of DCS, SCADA and PLC. SCADA applications.

Course EI603 :Transmitters, Recordersand Hazardous Area Instrumentation

Basic requirement, general classification, dead zero & live zero, zero elevation & zero suppression, general block diagram, pneumatic, electric, electro-pneumatic and electronic transmitters: differential pressure transmitter, pressure transmitter, flow transmitter, temperature transmitter and level transmitter, telemetry for current, voltage, frequency, position and impulse, fiber optic transmitter, smart transmitter: smart sensor, HART protocol.

Recorder: moving coil, pen, oscillograph, curvilinear and linear records, servo recorder, potentiometer recorder UV recorder, magnetic tape recorder, X-Y recorder, digital recorder.

Concept of safe area and hazardous area, Hazardous area classification, Protection techniques, Material classification, Methods of explosion prevention-encapsulation; pressurization; purging; immersion; alarms and interlock, Explosion suppression system, Suppression techniques and suppression chemicals, Explosive actuated rupture disc, Deluge system, Intrinsic safety, Classification of Intrinsic safety, Intrinsically safe loop, Safety barrier and their classifications, Enclosure classifications, Fuses and Circuit breakers, Flame arrester, Fire and smoke detector, Flame scanner and Flame sensors.

Course EI604 :Advanced Microprocessor, Microcontroller and Interfacing

Microprocessor architectures: 80X86 configuration; Minimum and maximum mode system; addressing mode, flags, data transfer, string instruction, arithmetic and logic operations, bit manipulation, programme transfer and control operation; Assembly language programming, - Modular programming; assembler, linker, libraries, macros System, bus and timing diagram; Real mode and protected mode of memory addressing, Interrupt processing: hardware and software interrupt, vector table, sequence, multiple interrupt, interrupt service routine; Arithmetic coprocessor; Microcontroller – MCS-51 Family : Introduction, Architecture, Memory Organization, Internal RAM structure, Special Function Registers and their functions, their orientation within the SFR space, I/O ports and their multiplexed functions, Concept of bit address and the bit addressable memory space organization, Interrupts, ISR space allocation and interrupt control, Timer/Counter: various modes of operations, UART for serial communication & its various modes and controls. Internal schematics of timers or serial controller.

Interfacing of MCS-51 with ADC, DAC, ZCD, Peak detector , Keyboard and 7-segment LEDs. Stepper motor control.

Interfacing of computer keyboard, LCD display, Phase control of power electronic devices to have variable ac and dc voltages, Infrared remote control encoder and decoder, interfacing of serial EPROM / flash memory, Flash programming technique of microcontroller.

PRACTICAL PAPERS

Digital Signal Processing Lab	EI605
Communication Lab	EI606
Design and Instrument workshop Lab	EI607

7th SEMESTER
THEORETICAL PAPERS

Course HU701- Engineering Management

Engineering Management: Management, administration: planning, decision making, organization and staff, controlling, communication. Location of factory: building and plant layout, Material handling: maintenance dept procedure. Industrial relation: personnel selection and recruitment, training and placement, transfer and promotion, discipline, redress of grievances. Labour turnover: prevention of accident and safety measure, Welfare scheme, Union relation: workers' participation in management. Wage administration, method of wage payment, Production : projection planning, scheduling, routing of work order, flow chart, inspection and avoidance of waste, time and motion study.

Course EI702 :Elective – I

PRACTICAL PAPERS

Advanced Process Control Lab	EI703
Seminar on Some Engineering Topic	EI704
Project Ph-I	EI705

8th SEMESTER
THEORETICAL PAPERS

Course HU801 : Economics for Engineers

Nature and significance of economics, Concepts of demand, supply, equilibrium, short and long term analysis, static and dynamic state, macro and micro economics, want and utility, marginal analysis: cost, money and real cost. Taxand profit, competition, monopoly, distribution. Economic systems: capitalism, socialism, mixed economy, Factors of production, national income land labour capital, organization and enterprise. Laws of return, pnp, nnp and national income.

Economic development of India: features, industrialization, labour economics, agriculture, economic planning, banking and international trade.

PRACTICAL PAPERS

Elective – II	EI802
Project Ph-II	EI803
General Viva Voce	EI804

ELECTIVE – I PAPERS

Course EI703 (A) :Digital Communication

Pulse Modulation-Sampling process –PAM- other forms of pulse modulation – Bandwidth –Noise trade off –Quantization –PCM- Noise considerations in PCM Systems-TDM Digital

multiplexers-Virtues, Limitation and modification of PCM-Delta modulation –Linear prediction – differential pulse code modulation – Adaptive Delta Modulation. Baseband Pulse Transmission- Matched Filter- Error Rate due to noise –Inter-symbol Interference- Nyquist's criterion for Distortionless Base band Binary Transmission- Correlative level coding –Baseband and M-ary PAM transmission –Adaptive Equalization –Eye patterns. Passband Data Transmission-Introduction – Pass band Transmission model-Generation, Detection, Signal space diagram, bit error probability and Power spectra of BPSK, QPSK, FSK and MSK schemes –Differential phase shift keying – Comparison of Digital modulation systems using a single carrier – Carrier and symbol synchronization. Error Control Coding- Discrete memory-less channels – Linear block codes – Cyclic codes - Convolutional codes –Maximum likelihood decoding of convolutional codes-Viterbi Algorithm, Trellis coded Modulation, Turbo codes. Spread Spectrum Modulation- Pseudo- noise sequences –a notion of spread spectrum – Direct sequence spread spectrum with coherent binary phase shift keying – Signal space Dimensionality and processing gain – Probability of error – Frequencyhop spread spectrum – Maximum length and Gold codes.

Course EI703 (B) - Software Engineering

Module 1: Introduction- Notion of Software as a Product – characteristics of a good Software Product. Engineering aspects of Software production – necessity of automation.Job responsibilities of Programmers and Software Engineers as Software developers.Process Models and Program Design Techniques- Software Development Process Models – Code & Fix model, Waterfall model, Incremental model, Rapid Prototyping model, Spiral (Evolutionary) model. Good Program Design Techniques – Structured Programming, Coupling and Cohesion, Abstraction and Information Hiding, Automated Programming, Defensive Programming, Redundant Programming, Aesthetics. Software Modelling Tools – Data flow Diagrams, UML and XML. Jackson System Development. Verification and Validation: Testing of Software Products – BlackBox Testing and WhiteBox Testing, Static Analysis, Symbolic Execution and Control Flow Graphs – Cyclomatic Complexity. Introduction to testing of Realtime Software Systems.

Course EI703 (C) - Mechatronics

Introduction to Mechatronics and its Systems; Evolution, Scope, Measurement Systems, Control Systems, open and close loop systems, sequential controllers, microprocessor based controllers, mechatronics approach.

Sensors and transducers: Introduction, performance terminology-Displacement, Position and Proximity, Velocity and motion, force, Fluid Pressure-Temperature Sensors-Light Sensors-Selection of Sensors-Signal Processing.

Pneumatic and Hydraulic actuation systems: actuation systems, Pneumatic and hydraulic systems, directional control valves, pressure control valves, cylinders, process control valves, rotary actuators. Mechanical actuation systems -Mechanical systems, types of motions, kinematics chains, cams, gear trains, ratchet and pawl, belt and chain drives, bearings, mechanical aspects of motor selection.

Robotics- Introduction, types of robots, Robotic control, Robot drive systems Robot end effectors, selection parameters of a robot, applications.

Course EI703 (D) – Computer Organization and Architecture

Introduction to basic computer architecture, register transfer, bus and memory transfers, arithmetic, logic and shift micro operations. Instruction codes, computer registers, computer instructions, timing and control, instruction cycle, memory reference instructions, I/O interrupt, complete computer description, design of basic computer, design of accumulator logic. Micro programmed control, control memory, address sequencing, micro program example, design of control unit. Central Processing Unit: Introduction, general register organization, stack organization, instruction formats, addressing modes, data transfer and manipulation, program control, RISC. Pipeline and Vector Processing: Parallel processing, pipelining, arithmetic pipeline, instruction pipeline, RISC pipeline, vector processing, array processors. Input-output Organisation: Peripheral devices, input-output interface, asynchronous data transfer, modes of transfer, priority interrupt, DMA, IOP serial communication. Memory Organisation: Memory hierarchy, main memory, auxillary memory,

associative memory, cache memory, virtual memory, memory management, hardware multiprocessor architectures and their characteristics, interconnection structures, inter processor arbitration, inter-processor communication and synchronization, cache coherence.

Course EI703 (E) - Database Management Systems

Introduction - Database Systems versus File Systems, View of Data, Data Models, database languages, Database Users and Administrators. Transaction Management, Decision Support Systems, Components of a Database management System. Distributed Processing and Client- Server Architecture. Entity-Relationship Model – Basic Concepts, Constraints, Keys, Design Issues, E-R Diagrams. Relational Model- Structures of relational databases, Integrity Constraints, Logical database Design, Tables, Views, Data Dictionary. Relational Algebra, Relational Calculus. SQL – Basic Structures, Query Handling, Embedded SQL, Open Database Connectivity (ODBC), Java Database Connectivity (JDBC), Triggers, Security and Authorization. Query By Example (QBE), User Interfaces and Tools, Forms and Graphical User Interfaces. Report Generators. Overview of Relational Query Optimization.Relational Database Design- Functional Dependencies, Multi-valued Dependencies, Normal Forms, Decomposition into Normalized Relations, Physical Database Design – File Structures. Object-Relational Databases – Nested Relations, Complex Data types, Object-Relational Features in SQL:1999.

Course EI703(F) - Process Plant Instrumentation

Chemical plant instrumentation: description of ammonia, methanol, urea and nitric acid plant, Instrumentation system: shift conversion section, H_2S removal section, absorption and refrigeration section

Power plant instrumentation: description of a plant, major process cycle, Instrumentation scheme: combustion fuel control, air control, furnace draft control, steam temperature control, boiler drum level control; combinational panel: desk design and layout; control room layout.

Steel plant instrumentation: Steel processing, blast furnace instrumentation: Stock line measurements, blast temperature control, air blast moisture control, instrumentation systems of hot strip mill, cold rolling mill and steel melting shop.

ELECTIVE – II PAPERS

Course EE801(A)- Non-Conventional Energy Sources

Introduction : Energy and environment. Conventional sources of energy. Different forms of non conventional Energy sources : Solar, biogas, wind, tidal, geothermal etc. Basic bio-conversion mechanism, sources of waste, simple digesters, composition and calorific value of biogas. Wind and tidal energy generation; special characteristics, turbine parameters and optimum operation, Electric power generation from wind/tidal energy. Ocean thermal energy conversion, Geothermal energy- hot springs and steam injection, power plant based on OTEC and geothermal springs. Energy from the sun: Techniques of collection, storage and utilization, types of solar collectors, selective surfaces, solar thermal processes, heating, cooling, drying, power generation etc. Photovoltaics, amorphous semiconductors, limitation of photovoltaics efficiency.Fuel cells, peak load demands, developments in fuel cells and applications.Direct energy conversion methods : Photoelectric, thermo-electric, thermionic, MHD (magnetohydrodynamics) and electro chemical devices, photovoltaic and solar cells.

Fusion energy : Controlled fusion of hydrogen, helium etc. Energy release rates, present status and problems, future possibilities. Integrated energy packages using solar, biomass, wind etc. Comparative study of non-conventional energy sources, cost considerations and economics.

Course EI802(B): Sensor Technology

Sensors: Classification and Characteristics

Development schemes of different types of conventional sensors with examples. Contrast between conventional and micro/nano sensors. General description of micro-sensor and nano-sensor technologies. sensor design and packaging. Techniques of crystal growing, ion-implementation, doping, etching, masking, embedding, deposition, erosion, encapsulation and packaging. Techniques of metal-semiconductor "plating" for developing sensors for thermal, electrical, magnetic and mechanical parameter sensing.Thin and thick film processes. Singlechip electro-analytic sensor technology, photonic sensors, smart sensors in microelectronic systems, Interface and data acquisition systems. Sensor modeling and design optimization.

Course EI802 (C) - BiomedicalSignal Processing and Analysis

Objectives and difficulties in biomedical signal processing and analysis; Details of biomedical Signals - ECG, EEG and respiration signals and their spectral properties, Signal pattern in normal and different abnormal conditions.

Noise and artifacts in biosignals and its effect in diagnosis; Methods for noise elimination by conventional filtering and adaptive techniques

Detection of events - Time domain analysis of biosignals, Frequency domain analysis of biosignals – Basics of Fourier Transform, Wavelet Transform and their applications in biosignal processing

Diagnostic decision making – feature extraction, feature selection, classification techniques

Introduction to analysis of non- stationary and multi-component signals

Course EI802(D) - Computer Networks

Introduction- Goals and applications of Networks, Network structure and architecture, The OSI reference model, services, Network Topology, Design-Delay Analysis, Back Bone Design, Local Access Network Design. Physical Layer Transmission Media, Switching methods, ISDN, Terminal Handling. Medium Access Control sub layer: Medium Access sub layer:Channel Allocation, LAN protocols-ALOHA protocols-Overview of IEEE standards – FDDI, Data Link Layer –Elementary data Link Protocols, Sliding Window protocols, Error Handling. Network Layer: Network Layer – Point – to Point Networks, routing, Congestioncontrol, Internetworking – TCP /IP –IP packet, IP address, IP v6. Transport Layer: Transport Layer – Design issues, connection management, session Layer – Design issues, remote procedure call, Presentation Layer – Design issues, data compression techniques, cryptography – TCP Window Management. Application Layer: Application Layer-File Transfer, Access and Management, Electronic mail, Virtual Terminals, Other application, Example Networks – Internet and Public Networks.

Course EI802(E) - Advanced Control Engineering

State Space Analysis of Continuous System: Review of state variable representation of continuous system, conversion of state variable models to transfer function and vice-versa, solution of state equations and state transition matrix, controllability and observability, design of state observer and controller. Stability: Lyapunov's stability theorems for continuous and discrete systems, methods for generating Lyapunov function for continuous and discrete system, Popov's criterion. Non linear Systems: Types of non linearities, phenomena related to non –linear systems. Analysis of non linear systems-Linearization method, second order non-linear system on the phase plane, types of phase portraits, singular points, system analysis by phase-plane method, describing function and its application to system analysis.

Optimal Control: Introduction, formation of optimal control problem, calculus of variations minimization of functions, constrained optimization. Pontryagin's Minimum Maximum Principle, Linear Quadratic Problem-Hamilton Jacobi equation, Riccati equation and its solution. Adaptive Control: Introduction, modal reference adaptive control systems, controller structure, self tuning regulators.

Course EI802(F) - Introduction to Robotics

Introduction, components and structure of robotics system.Kinematics of manipulators, rotation translation and transformotion, David – Hastemberg Representation, Inverse Kinematics.Dyamics – modelling using Newton Euler equation. Linearization of Robot Dynamics – State variable continuous and discrete models. Robotic Motion: Different types of trajectories and introduction to their generation. Position Control: Independent joint control. Introduction to advanced control for robot application.