UNIVERSITY DEPARTMENTS

ANNA UNIVERSITY :: CHENNAI 600 025

REGULATIONS – 2008

CURRICULUM FROM III TO VIII SEMESTERS FOR

B.E. ELECTRONICS AND INSTRUMENTATION ENGINEERING

SEMESTER III

CODE NO	COURSE TITLE	L	T	P	C
THEORY					
EI9201	Digital Logic Theory	3	0	0	3
EE9216	Electrical Machines	3	0	0	3
MA9211	Mathematics – III	3	1	0	4
EC9211	Electron Devices and Circuits	3	0	0	3
ME9214	Thermodynamics	2	0	0	2
CE9202	Fluid Mechanics	2	0	0	2
PRACTICAL					
EI9202	Analog and Digital Electronics Laboratory	0	0	3	2
EE9217	Electrical Machines Laboratory	0	0	3	2
ME9212	Mechanical Science Laboratory	0	0	3	2
	TOTAL	**19**	**1**	**9**	**23**

SEMESTER IV

CODE NO	COURSE TITLE	L	T	P	C
THEORY					
MA9264	Linear Algebra and Numerical Methods	3	1	0	4
EE9261	Electrical and Electronic Measurements	3	0	0	3
EI9251	Transducers Engineering	3	1	0	4
EI9253	Linear Integrated Circuits	3	1	0	4
EC9262	Communication Engineering	3	0	0	3
GE9261	Environmental Science and Engineering	3	0	0	3
PRACTICAL					
EI9252	Transducers and Measurements Laboratory	0	0	3	2
EC9263	Integrated Circuits Laboratory	0	0	3	2
	TOTAL	**18**	**3**	**6**	**25**

SEMESTER V

CODE NO	COURSE TITLE	L	T	P	C
THEORY					
EI9301	Industrial Instrumentation – I	3	0	0	3
EI9302	Control Engineering	3	1	0	4
CS9311	Data Structures and Algorithm	3	0	0	3
EC9313	Microprocessors and Microcontrollers	3	0	0	3
EI9303	Virtual Instrumentation	3	1	0	4
	Elective – I	3	0	0	3
PRACTICAL					
EI9304	Programming and Data Structures Laboratory	0	0	3	2
EI9305	Microprocessors and Microcontrollers Laboratory	0	0	3	2
GE9371	Communication Skills and Soft Skills	0	0	2	1
	TOTAL	**18**	**2**	**8**	**25**

SEMESTER VI

CODE NO	COURSE TITLE	L	T	P	C
THEORY					
EI9351	Industrial Instrumentation – II	3	0	0	3
EI9352	Process Control	3	1	0	4
EC9361	VLSI Design	3	0	0	3
EC9362	Digital Signal Processing	3	1	0	4
	Elective – II	3	0	0	3
	Elective –III	3	0	0	3
PRACTICAL					
EI9353	Process Control Laboratory	0	0	3	2
EI9354	Industrial Instrumentation Laboratory	0	0	3	2
EI9355	Technical Seminar	0	0	2	1
	TOTAL	**18**	**2**	**8**	**25**

SEMESTER VII

CODE NO	COURSE TITLE	L	T	P	C
THEORY					
EI9401	Logic and Distributed Control System	3	0	0	3
EI9402	Advanced Process Control	3	1	0	4
EI9403	Analytical Instrumentation	3	0	0	3
EC9411	Real Time Embedded Systems	3	0	0	3
	Elective – IV	3	0	0	3
	Elective –V	3	0	0	3
PRACTICAL					
EI9404	Advanced Process Control Laboratory	0	0	3	2
EI9405	Instrumentation System Design Laboratory	0	0	3	2
EI9406	Comprehension	0	2	0	0
	TOTAL	**18**	**3**	**6**	**23**

SEMESTER VIII

CODE NO	COURSE TITLE	L	T	P	C
THEORY					
	Elective – VI	3	0	0	3
	Elective – VII	3	0	0	3
PRACTICAL					
EI9451	Project Work	0	0	12	6
	TOTAL	**6**	**0**	**12**	**12**

LIST OF ELECTIVES FOR B.E. ELECTRONICS AND INSTRUMENTATION ENGINEERING

ELECTIVE I

CODE NO.	COURSE TITLE	L	T	P	C
EE9021	Power Electronic Devices and Circuits	3	0	0	3
EI9021	Fiber Optics and Laser Instrumentation	3	0	0	3
GE9023	Fundamentals of Nanoscience	3	0	0	3
CS9021	Operating System	3	0	0	3
GE9021	Professional Ethics in Engineering	3	0	0	3
EI9028	Computer Architecture	3	0	0	3
EI9022	Biomedical Instrumentation	3	0	0	3
EI9023	Power plant Instrumentation	3	0	0	3
EI9024	Instrumentation in Petrochemical Industry	3	0	0	3
EI9029	Applied Soft Computing	3	0	0	3
EI9025	System Identification and Adaptive Control	3	0	0	3
EE9050	Industrial Drives and Control	3	0	0	3
EC9052	Micro Controller Based System Design	3	0	0	3
EI9032	Advanced Digital Signal Processing	3	0	0	3
EI9033	Digital Image Processing	3	0	0	3
EI9026	MEMS	3	0	0	3
EI9030	Computer Networks	3	0	0	3
EI9031	Industrial Data Networks	3	0	0	3
GE9022	Total Quality Management	3	0	0	3
GE9074	Engineering Economics and Financial Accounting	3	0	0	3
EI9027	Reliability and Safety Engineering	3	0	0	3

EI9201 **DIGITAL LOGIC THEORY** **L T P C**
3 0 0 3

AIM:

The course is designed to introduce the fundamental concepts and design of digital system.

OBJECTIVES:

- To introduce the basic concept about the number systems, binary codes and combinational circuits.
- To cover the basic postulates of Boolean Algebra and the implementation of circuits using gates.
- To provide an introduction to flip flops and to design a synchronous circuit.
- To introduce the most common digital logic families.

PREREQUISITE

Not Required.

UNIT I BOOLEAN ALGEBRA 9

Review of Number Systems – Fixed point and floating point representations – Review of computer codes - Number complements - Signed number addition and subtraction - Boolean Algebra - Demorgan's theorem - Canonical forms - Simplification of Boolean functions using K-maps and Quine Mclusky methods.

UNIT II COMBINATIONAL LOGIC DESIGN 9

Gates - Universal set of modules - Standard combinational modules - Decoders - Encoders – Multiplexers - Demultiplexers – Comparators - Code Converters - Function realization using Gates and Multiplexers – Adders - Carry Look Ahead Adder - Subtraction using adders - BCD adder.

UNIT III SEQUENTIAL LOGIC DESIGN 9

Basic latch circuit - Flip-flops - Truth table – Excitation table - Analysis and design of synchronous sequential circuits - Transition table - Transition diagram – Introduction to asynchronous sequential circuits - Race in sequential circuits - Hazards - Techniques for controlling hazards.

UNIT IV COUNTERS AND SHIFT REGISTERS 9

Asynchronous Counter design and Synchronous Counter design - Up/Down counter - Modulus counter - Shift Registers - Johnson Counter – Ring Counter -Application of Counters and Shift Registers.

UNIT V INTRODUCTION TO LOGIC FAMILIES 9

Introduction to logic families: - RTL, DTL, ECL, TTL, NMOS, CMOS - GaAs Building blocks - Operating conditions –Interfacing between different families.

L : 45 : TOTAL: 45 PERIODS

TEXT BOOKS:

1. Morris Mano, M., "Digital Design", Prentice Hall, 2006.
2. Malvino, A., and Leach, D., "Digital Principles and Applications", Tata McGraw Hill, 2002.

REFERENCES:

1. Tocci, R.J., "Digital systems: Principles and Applications", Prentice Hall, 8th Edition, 2005.
2. Taub and Schilling, "Digital Integrated Electronics", Tata McGraw Hill,1998.
3. Floyd and Jain, "Digital Fundamentals", Pearson Education, 2003.

EE9216 **ELECTRICAL MACHINES** **L T P C**
3 0 0 3

AIM:

To impart basic knowledge on Electrical machines, principles and its behavior.

OBJECTIVES:

At the end of this course, student would have been exposed to:

- Theory of structures, operating principle, characteristics, and applications of D.C and A.C rotating machines and transformers in detail.
- Introductory knowledge on Special Machines.

PREREQUISITE

Physics, Electromagnetics and Electric circuit analysis.

UNIT I D.C. MACHINES 12

Construction of D.C. Machines - Principle and theory of operation of D.C. generator - EMF equation - Characteristics of D.C. generators - Armature reaction – Commutation - Principle of operation of D.C. motor - Voltage equation - Torque equation - Types of D.C. motors and their characteristics –Starters - Speed control of D.C. motors - Applications.

UNIT II TRANSFORMERS 9

Principle - Theory of ideal transformer - EMF equation - Construction details of shell and core type transformers - Tests on transformers - Equivalent circuit - Phasor diagram - Regulation and efficiency of a transformer - Introduction to three - phase transformer connections.

UNIT III SYNCHRONOUS MACHINES 8

Principle of alternators:- Construction details, Equation of induced EMF and Vector diagram - Synchronous motor:- Starting methods, Torque, V curves, Speed control and Hunting.

UNIT IV INDUCTION MACHINES 9

Induction motor:- Construction and principle of operation, Classification of induction motor, Torque equation, Condition for maximum torque, Equivalent Circuit, Starting methods and Speed control of induction motors.

UNIT V SPECIAL MACHINES 7

Types of single phase motor –Double revolving field theory – Cross field theory – Capacitor start capacitor run motors – Shaded pole motor – Repulsion type motor – Universal motor – Hysteresis motor - Permanent magnet synchronous motor – Switched reluctance motor – Brushless D.C motor.

L : 45: TOTAL: 45 PERIODS

TEXT BOOKS:

1. Nagrath, I.J., and Kothari, D.P., " Electrical Machines", Tata McGraw - Hill, 1997.
2. Fitzgerald A.E, Kingsley C., Umans, S. and Umans S.D., "Electric Machinery", McGraw-Hill, Singapore, 2000.

REFERENCES:

1. Theraja, B.L., "A Text book of Electrical Technology", Vol.II, S.C Chand and Co., New Delhi, 2007.
2. Del Toro, V., "Electrical Engineering Fundamentals", Prentice Hall of India, New Delhi, 1995.
3. Cotton, H., "Advanced Electrical Technology", Sir Isaac Pitman and Sons Ltd., London, 1999.

MA9211 MATHEMATICS III L T P C
(Common to all branches of BE / B.Tech Programmes) 3 1 0 4

AIM:
To facilitate the understanding of the principles and to cultivate the art of formulating physical problems in the language of mathematics.

OBJECTIVES:
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems
- To acquaint the student with Fourier transform techniques used in wide variety of situations in which the functions used are not periodic
- To introduce the effective mathematical tools for the solutions of partial differential equations that model physical processes
- To develop Z- transform techniques which will perform the same task for discrete time systems as Laplace Transform, a valuable aid in analysis of continuous time systems

UNIT I FOURIER SERIES 9+3
Dirichlet's conditions – General Fourier series – Odd and even functions – Half-range Sine and Cosine series – Complex form of Fourier series – Parseval's identity – Harmonic Analysis.

UNIT II FOURIER TRANSFORM 9+3
Fourier integral theorem – Fourier transform pair-Sine and Cosine transforms – Properties – Transform of elementary functions – Convolution theorem – Parseval's identity.

UNIT III PARTIAL DIFFERENTIAL EQUATIONS 9+3
Formation – Solutions of first order equations – Standard types and Equations reducible to standard types – Singular solutions – Lagrange's Linear equation – Integral surface passing through a given curve – Solution of linear equations of higher order with constant coefficients.

UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 9+3
Method of separation of Variables – Solutions of one dimensional wave equation and one-dimensional heat equation – Steady state solution of two-dimensional heat equation – Fourier series solutions in Cartesian coordinates.

UNIT V Z – TRANSFORM AND DIFFERENCE EQUATIONS 9+3
Z-transform – Elementary properties – Inverse Z-transform – Convolution theorem – Initial and Final value theorems – Formation of difference equation – Solution of difference equation using Z-transform.

L: 45, T: 15, TOTAL = 60 PERIODS

TEXT BOOK:
1. Grewal, B.S. "Higher Engineering Mathematics", Khanna Publications (2007)

REFERENCES:
1. Glyn James, "Advanced Modern Engineering Mathematics", Pearson Education (2007)
2. Ramana B.V., "Higher Engineering Mathematics" Tata McGraw Hill (2007).
3. Bali N.P. and Manish Goyal, "A Text Book of Engineering" 7th Edition (2007) Lakshmi Publications (P) Limited, New Delhi.

EC9211 ELECTRON DEVICES AND CIRCUITS L T P C
3 0 0 3

AIM:

To provide an exposure to various electronic devices and electronic circuits.

OBJECTIVES:

- At the end of the course, students' will have the knowledge about functioning of various types of devices and design of various electronic circuits.

UNIT I SEMICONDUCTOR DIODE AND BJT 9

PN Junction – Current components in a PN diode – Junction capacitance – Junction diode switching time – Zener diode – Varactor diode – Tunnel diode – Schottky diode – Transistor Structure – Basic Transistor operation – Transistor characteristics and parameters – The transistor as a switch, as an amplifier – Transistor bias circuits:- Voltage divider bias circuits, base bias circuits, emitter bias circuits, collector feedback bias circuits – DC load line – AC load line- bias stabilization, thermal runaway and thermal stability.

UNIT II FET, UJT and SCR 9

JFET characteristics and parameters – JFET biasing, self bias, voltage divider bias – Q point, stability over temperature – MOSFET D-MOSFET, E-MOSFET – MOSFET characteristics and parameters – MOSFET biasing, zero bias, voltage divider bias method, drain feedback bias – Characteristics and applications of UJT, SCR, DIAC, TRIAC.

UNIT III AMPLIFIERS 9

CE, CC and CB amplifiers - Small signal low frequency transistor amplifier circuits - h parameter representation of a transistor - Analysis of single stage transistor amplifier using parameters voltage gain, current gain, input impedance and output impedance-frequency response - RC coupled amplifier.

Classification of Power amplifiers:- Class A, B, AB and C Power amplifiers-Push-Pull and Complementary Symmetry Push-Pull amplifiers - Design of power output, efficiency and cross-over distortion.

UNIT IV FEEDBACK AMPLIFIERS AND OSCILLATORS 9

Advantages of negative feedback - Voltage/current, series/shunt feedback-Positive feedback - Condition for oscillators - Phase shift - Wein Bridge – Hartley - Colpitts and crystal oscillators.

UNIT V PULSE CIRCUITS AND POWER SUPPLIES 9

RC wave shaping circuits - Diode clampers and clippers – Multivibrators -Schmitt triggers - UJT - Saw tooth oscillators - Single and polyphase rectifiers and analysis of filter circuits - Design of zener and transistor series voltage regulators - Switched mode power supplies.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS:

1. Millman and Halkias, "Electronic Devices and Circuits", Tata McGraw– Hill, 2007.
2. Floyd, T.L, "Electronic Devices" 6th Edition, Pearson Education, 2003.
3. Millman and Halkias, "Integrated Electronics", McGraw-Hill, 2004.

REFERENCES:

1. Mottershead, A., "Electronic Devices and Circuits an Introduction", Prentice Hall of India, 2003.
2. Boylsted and Nashelsky, "Electronic Devices and Circuit Theory", Prentice Hall of India, 6th Edition, 1999.
3. Streetman, B. and Sanjay, B., "Solid State Electronic Devices", Prentice-Hall of India, 5th Edition, 2005.
4. Bell, D.A., "Electronic Devices and Circuits", Prentice Hall of India, 4th Edition, 1999
5. Millman, J., Prakash Rao., M.S. and Taub, H., "Pulse Digital and Switching Wave Forms", McGraw-Hill, 2007.

ME9214 **THERMODYNAMICS** **L T P C**
2 0 0 2

AIM:

To study the basic concepts of thermodynamics and apply it to various applications.

OBJECTIVES:

- To integrate the concepts, Laws and Methodologies from Thermodynamics for the analysis of cyclic process.
- To apply the Thermodynamics concepts into various Thermal applications like, IC Engines, Thermal Power Plant, Air Conditioning and Heat transfer.

PREREQUISITE

Not Required

UNIT I LAWS OF THERMODYNAMICS 6

Thermodynamic System - Zeroth Law of Thermodynamics - First Law of Thermodynamics - Concept of Internal Energy and Enthalpy applications to open and closed systems - Second Law of Thermodynamics - Concept of Entropy.

UNIT II GAS LAWS, AIR CYCLES AND COMPRESSORS 6

Basic IC Engine and Gas turbine cycles – Single stage and Multistage reciprocating compressors.

UNIT III STEAM BOILERS 6

Formation of steam - Properties of steam – Rankine cycle – Modern features of high pressure boilers – Mountings and accessories.

UNIT IV REFRIGERATION 6

Basic Thermodynamics of refrigerators and heat pumps - Various methods of producing refrigerating effects – Vapour compression cycle – P-H and T-S diagrams - Air conditioning.

UNIT V HEAT TRANSFER 6

One dimensional heat conduction:- Plain wall, Cylinder, Sphere and Composite walls – Heat transfer through extended surfaces – Free and forced convections – Radiation:- Black body and Gray body.

L: 30 TOTAL: 30 PERIODS

TEXT BOOK:

1. Nag, P.K., “Basics and Applied Thermodynamics”, Tata McGraw – Hill Pub. Co., 2002.

REFERENCE:

1. Reynolds, W.C. and Perkins, H.C., “Engineering Thermodynamics”, International Student Edition, McGraw-Hill Co. Ltd., 2nd Edition, 1990.

CE9202 FLUID MECHANICS L T P C
2 0 0 2

AIM:
To study the various types of fluid flow, pumps and turbines.

OBJECTIVES:
- This course will give an introduction to the fundamental properties of fluids, dimensional analysis, model analysis, pumps, turbines and their applications.

PREREQUISITE
Not required

UNIT I BASIC CONCEPTS OF FLUID MECHANICS 6
Introduction – Classification – Types of fluids – Properties – Laws of Pressure – Atmospheric Pressure, Gauge Pressure, Absolute Pressure - Pressure measurement:- Manometers and Mechanical gauges.

UNIT II FLOW OF FLUIDS 6
Introduction – Types of fluid flow – Velocity – Rate equation of continuity – Energy of a liquid in motion – Head of a liquid – Bernoulli's theorem – Orifice and Mouthpiece**.**

UNIT III DIMENSIONAL AND MODEL ANALYSIS 6
Introduction – Dimensions – Dimensional analysis – Rayleigh's and Buckingham's method û similitude - Dimensionless numbers and their significance – Similarity Laws.

UNIT IV PUMPS 6
Introduction – Reciprocating pump:- Construction details, Co-efficient of discharge, Slip and Power – Centrifugal pump:- Classification, Working principle and Specific speed.

UNIT V TURBINES 6
Turbine:- Classification of Turbines and Working Principle.

L: 30 TOTAL: 30 PERIODS

TEXT BOOK:
1. Bansal, R.K., "Fluid Mechanics", Laxmi publishers, 2007

REFERENCES:
1. Shames, I.H., "Mechanics of Fluids", Kogakusha, Tokyo, 1998.
2. Radhakrishnan, E., "Introduction to Fluid Mechanics", Prentice Hall, India 1999.
3. Rajput R.K., "Fluid Mechanics and Hydraulic Machines", S.Chand and Co., India, 1998.
4. Kumar, K.L., "Fluid Mechanics", S.Chand Publishers, New Delhi, 2004.

EI9202 ANALOG AND DIGITAL ELECTRONICS LABORATORY L T P C
0 0 3 2

1. Construction of Rectifiers and Voltage Regulators.
2. Frequency responses of BJT and FET based Amplifiers.
3. Characteristic of Transistor under common emitter, common collector and common base configurations.
4. Construction of UJT Relaxation Oscillator.
5. Design of Wave Shaping Circuits.
6. Design of RC and LC Oscillators.
7. Design of Binary Adder / Subtractor / Comparator.
8. Study of Shift Registers and Counters.
9. Design of Multiplexer / Demultiplexer and Encoder / Decoder.
10. Characteristics of FET and UJT.
11. Design of BCD to Seven segment Decoder.
12. Construction and Verification of Circuits using Virtual Instrumentation Package - Characteristics of Semiconductor diodes / SCR / DIAC / TRIAC.

TOTAL: 45 PERIODS

EE9217 ELECTRICAL MACHINES LABORATORY L T P C
0 0 3 2

1. Open circuit characteristic of DC Shunt Generator.
2. Load test on DC Shunt Generator.
3. Speed control of DC Shunt Motor.
4. Brake test on DC Shunt Motor.
5. Brake test on DC Series Motor.
6. Regulation characteristic of three - phase Alternator.
7. Open circuit and short circuit tests on Single - phase Transformer.
8. Load test on Single - phase Transformer
9. Load test on Three - phase Induction Motor.
10. Brake test on Single - phase Induction Motor.
11. 'V' curves of Synchronous Motor.
12. Power measurement in three - phase circuit using two - wattmeter method.

TOTAL: 45 PERIODS

ME9212 MECHANICAL SCIENCE LABORATORY LT P C
0 0 3 2

1. Tension Test
2. Torsion Test
3. Testing of springs
4. Impact test i) Izod, ii) Charpy
5. Hardness test i) Vickers, ii) Brinell, iii) Rockwell, iv) Shore
6. Deflection of Beams
7. Dye Penetrant Test
8. Performance test on a 4 stroke engine
9. Viscosity determination of the given fluid
10. Moment of inertia of connecting rod
11. Determination of Effectiveness of a parallel and counter flow heat exchangers
12. Valve timing of a 4 stroke engine and port timing of a 2 stroke engine
13. Tensile testing of polymers
14. Flex fatigue test for elastomers
15. Hardness test for rubber and plastics.
16. Injection moulding machine operation

TOTAL: 45 PERIODS

MA9264 LINEAR ALGEBRA AND NUMERICAL METHODS L T P C
3 1 0 4

AIM / OBJECTIVES:
The students would be acquainted with the basic concepts of Linear Algebra and numerical methods and their applications.

UNIT I VECTOR SPACE AND LINEAR TRANSFORMATIONS 9
Vector spaces – Subspaces – Linear spans – Linear independence and Linear dependence – Basis and Dimension – Linear Transformation, Null space and range – Dimension theorem (no proof) – Matrix representation of Linear Transformation.

UNIT II INNER PRODUCT SPACES 9
Change of basis – Dual space – Inner Product Spaces – Norms and Cauchy – Schwarz inequality – Orthonormal sets – Gram Schmidt orthonormalization process – Adjoint of linear operator – Method of Least squares.

UNIT III NUMERICAL LINEAR ALGEBRA 9
Gauss elimination method – Pivoting strategy – Gauss elimination method for tridiagonal matrix – Jacobi, Gauss- Seidel iterative Method –Power method and QR method for Eigenvalues.

UNIT IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION 9

Lagrange's and Newton's divided difference interpolation - Newton's forward and backward difference interpolation – Numerical differentiation by finite differences – Trapezoidal, Simpson's 1/3 and Gaussian Quadrature formula.

UNIT V NUMERICAL SOLUTION OF ORDINANRY DIFFERENTIAL EQUATIONS 9

Numerical solution of first order ordinary differential equations by taylor series method – Euler Method - Fourth order Runge-Kutta Method - Finite difference methods for two point boundary value problems.

L: 45 T: 15 TOTAL: 60 PERIODS

TEXT BOOKS:

1. Friedberg, A.H., Insel, A.J. and Spence, L., "Linear Algebra", Prentice Hall of India, New Delhi, 2004.
2. Faires, J.D. and Burder, R., "Numerical Methods", Brooks/Cole (Thomson Publications), New Delhi, 2002.

REFERENCES:

1. Kumaresan, S., "Linear Algebra – A geometric approach", Prentice – Hall of India, New Delhi, 2000.
2. Strang, G., "Linear Algebra and its applications", Thomson (Brooks/Cole), New Delhi, 2005.
3. Jain, M.K, Iyengar, S.R.K, and Jain, R.K., "Numerical methods for Scientific and Engineering Computation", New Age International Publishers, New Delhi, 2003.
4. Gerald, C.F, and Wheatly, P.O., "Applied Numerical Analysis", Pearson Education, New Delhi, 2002.

EE9261 ELECTRICAL AND ELECTRONIC MEASUREMENTS L T P C
3 0 0 3

AIM:

The course is designed to equip the students to apply all types of common electrical and electronic instruments with the knowledge about the construction and working of the instruments.

OBJECTIVES:

- To introduce the construction and working of different types of ammeters, voltmeters and bridges.
- To introduce different types of power and energy meters.
- To provide an introduction to current and voltage transformers and to explain the advantages of these transformers compared to other measuring devices.
- To introduce digital meters, displays and recorders which help in analysing and displaying the data.

PREREQUISITE

Not Required.

UNIT I MEASUREMENT OF ELECTRICAL PARAMETERS 9

Types of ammeters and voltmeters – PMMC Instruments – Moving Iron Instruments – Dynamometer type Instruments – Resistance measurement:- Wheatstone bridge, Kelvin double bridge and Direct deflection methods. Measurement of Inductance:- Maxwell Wein bridge, Hay's bridge and Anderson bridge - Measurement of capacitance:- Schering bridge .

UNIT II POWER AND ENERGY MEASUREMENTS 9

Electrodynamic type wattmeter – Theory and its errors – Methods of correction – LPF wattmeter – Induction type wattmeter – Phantom loading – Induction type kWh meter – Theory and adjustments – Calibration of wattmeter and energy meters.

UNIT III POTENTIOMETERS AND INSTRUMENT TRANSFORMERS 9

Student type potentiometer – Precision potentiometer – A.C. Potentiometers:- Polar and Co-ordinate types – Applications – Instrument Transformer:-Construction and theory of Current Transformers and Potential Transformers and Phasor diagrams.

UNIT IV ANALOG AND DIGITAL INSTRUMENTS 10

Wave analyzers – Signal and function generators - Distortion factor meter – Q meter - Digital voltmeter and multimeter – DMM with auto ranging and self diagnostic features – Frequency and Time interval measurements.

UNIT V DISPLAY AND RECORDING DEVICES 8

Cathode ray oscilloscope – Classification - Sampling and storage scopes – Seven segment and dot matrix displays – X-Y recorders – Magnetic tape recorders – Data loggers.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS:

1. Kalsi H.S., "Electronic Instrumentation", 2nd Edition, Tata McGraw-Hill Company, New Delhi, 2004.
2. Sawhney A.K, "A course in Electrical and Electronic Measurement and Instrumentation", Dhanpat Rai and Sons, New Delhi, 2003.

REFERENCES:

1. Bell, A.D., "Electronic Instrumentation and Measurements", 2nd Edition, Prentice Hall of India, New Delhi, New Delhi, 2003.
2. Bowens, A. J, "Digital Instrumentation", 4th Edition, Tata McGraw - Hill India Ltd., 1986.

EI 9251 TRANSDUCERS ENGINEERING L T P C
3 1 0 4

AIM:

To know how physical quantities are measured and how they are converted to electrical or other forms.

OBJECTIVES:

- This course elaborates the purpose of measurement, the methods of measurements, errors associated with measurements, the principle of transduction, classifications and the characteristics of different transducers and their recent developments and practical applications.

PREREQUISITE

Not Required

UNIT I SCIENCE OF MEASUREMENT AND TRANSDUCTION 9

Units and standards – Calibration methods – Classification of errors - Error analysis – Limiting error - Probable error - Propagation of errors- Odds and uncertainty- Principle of transduction - Classification.

UNIT II CHARACTERISTICS OF TRANSDUCERS 9

Static characteristics – Mathematical model of transducers:- Zero, first and second order transducers –Dynamic characteristics of first and second order transducers for standard test inputs.

UNIT III VARIABLE RESISTANCE TRANSDUCERS 9

Principle of operation - Construction details - Characteristics and applications of Resistance potentiometers - Strain Gauges - Resistance thermometers – Thermistors - Hotwire anemometer - Piezoresistive sensors and humidity sensors.

UNIT IV VARIABLE INDUCTANCE AND VARIABLE CAPACITANCE TRANSDUCERS 9

Inductive potentiometer – Variable Reluctance transducers:- EI pick up and LVDT – Capacitive transducers:- Variable air gap type, Variable area type and Variable permittivity type – Capacitor microphone.

UNIT V SPECIAL TRANSDUCERS 9

Piezoelectric transducer – Magnetostrictive transducer – Semiconductor sensor – Digital transducers – Smart sensors – Fiber optic transducers - Hall effect transducers - Introduction to MEMS Sensors and Nanosensors.

L: 45 T: 15 TOTAL: 60 PERIODS

TEXT BOOKS:

1. Doeblin, E.O., “Measurement Systems: Applications and Design”, 4th Edition, Tata McGraw-Hill Book Co., 2003.
2. Renganathan, S., “Transducer Engineering”, Allied Publishers, 2003.

REFERENCES:

1. Bentley, J. P., “Principles of Measurement Systems”, 4th Edition, Addison Wesley Longman Ltd., UK, 2004.
2. Patranabis, D., “Sensors and Transducers”, 2nd Edition, Prentice Hall India Pvt. Ltd, 2003.
3. Murthy, D.V.S., “Transducers and Instrumentation”, Prentice Hall of India Pvt. Ltd., New Delhi, 2007.
4. Neubert H.K.P., “Instrument Transducers – An Introduction to their Performance and Design”, Oxford University Press, Cambridge, 2003.

EI 9253 LINEAR INTEGRATED CIRCUITS L T P C
3 1 0 4

AIM:

To introduce the concepts for realising functional building blocks in ICs, fabrications & application of ICs.

OBJECTIVES:

- To study the IC fabrication procedure.
- To study characteristics; realize circuits; design for signal analysis using Op-amp ICs.
- To study the applications of Op-amp.
- To study internal functional blocks and the applications of special ICs like Timers, PLL circuits, regulator Circuits, ADCs.

UNIT I FABRICATION OF INTEGRATED CIRCUITS 9

Silicon Wafer Preparation – Epitaxial growth –Photolithography – Etching – Diffusion: - Thermal Diffusion and Ion implantation – Metallization – Packaging – Realization of passive and active devices:- Resistor, Capacitor, diode, BJT, FET and MOS transistors.

UNIT II LINEAR INTEGRATED CIRCUITS 9

Introduction to Linear IC – Operational amplifiers – DC characteristics:- bias, offset and drift –AC characteristics:- bandwidth, slew rate and noise - Inverting and non-inverting amplifiers - Zero crossing detector with hysteresis – Arithmetic Circuits.

UNIT III APPLICATIONS OF OP-AMP 9

Precision rectifiers – Active filters – Butterworth low-pass filter and Butterworth high-pass filter - Waveform generators: - Square, triangular and sine wave – V to I converter and I to V converter- Instrumentation Amplifier - Log and antilog amplifiers.

UNIT IV TIMER AND PHASE-LOCKED LOOP 6

Basic functional block diagram - Characteristics and applications of ICs:- 555, 565, 566, LM 723 voltage regulator and current regulator**.**

UNIT V SPECIAL FUNCTIONS ICs 12

Functional Block diagram of ADC and DAC – Sample and Hold circuit - Successive Approximation ADC - Integrating ADC – Sigma Delta ADC – Study of successive approximation ADC IC – Study of Integrating ADC IC – Study of Sigma Delta ADC IC – Study of 8 bit DAC IC – Temperature Sensor IC - Piezoelectric Pressure Sensor IC – Hall-Effect sensor IC and Level sensor IC.

L: 45 T: 15 TOTAL: 60 PERIODS

TEXT BOOKS:

1. Gayakwad, R.A, "OP-Amps and Linear Integrated Circuits", Prentice Hall of India, New Delhi, 4th Edition, Pearson Education, 2003.
2. Choudhury, R. and Jain, S., "Linear Integrated Circuits", 3rd Edition, New Age Pub., 2007.

REFERENCES:

1. Botkar, K.R., "Integrated circuits", Khanna Publishers, New Delhi, 2003.
2. Millman, J., and Halkias, C. C., "Integrated Electronics - Analog and Digital circuits System", Tata McGraw-Hill, 2003.
3. Coughlin, R.F., Driscoll, F. F., "Operational Amplifiers and Linear Integrated Circuits", Pearson Education (P) Ltd, 6th Edition, 2006.
4. Franco, S., "Design with Operational and Analog Integrated Circuits", Tata McGraw- Hill Publishing Co., 3rd Edition, 2002.
5. Bell, D.A, "Op-amp & Linear ICs", Prentice Hall of India, 2nd Edition, 2007.

EC9262 COMMUNICATION ENGINEERING L T P C
3 0 0 3

AIM:

It provides an idea of different modulation principles and communication systems.

OBJECTIVES:

- To understand the ways of modulation, methods of data transmission for communication.

UNIT I AMPLITUDE MODULATION 10

Amplitude modulation:- Basic principle of AM – Frequency spectrum and Bandwidth, Modulation index, AM power distribution and AM modulator circuits - AM transmitters:- Low level transmitters and High level transmitters - AM reception:- AM Receivers, TRF, Super heterodyne receivers and Double conversion AM Receivers.

UNIT II ANGLE MODULATION 10

Angle modulation:- FM and PM waveforms, Frequency deviation, Phase Deviation and Modulation index, Frequency spectrum of Angle modulated wave - Phase and Frequency modulator and demodulator, Direct FM Transmitter, Indirect transmitters, Angle modulation versus Amplitude Modulation, FM receivers and Frequency versus Phase Modulation.

UNIT III PULSE COMMUNICATION SYSTEMS 6

PAM, PPM, PDM, PCM, Delta modulation, Differential PCM, Merit and demerits - Concept of multiplexing:- FDM and TDM.

UNIT IV DATA TRANSMISSION 9

Base band signal receiver:- Error probability, Optimum and matched filter techniques and Coherent reception - Digital modulation systems:- ASK, FSK and PSK, Comparison of data transmission systems.

UNIT V COMMUNICATION SYSTEMS ANDTELEVISION 10

Optical fibers:- Single Mode Fibers, Graded Index fiber structure, Losses in optical Fibers, Fiber optic communication link - Introduction to micro wave communication system, Principle of satellite communication - Television:- Scanning methods, B/W and color systems – Camera and Picture tubes, Synchronization, Transmitters and Receivers.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS:

1. Singh, R.P. and Sapre, S.D., “Analog and Digital Communication Systems”, McGraw-Hill Publishing Company Ltd., 2003.
2. Kennedy, G., “Electronic Communication Systems”, McGraw-Hill, 4th Edition, 2003.
3. Gulati, R.P., “Modern Television Practice Principles, Technology and Servicing”, New Age International Pvt. Ltd., 2002.

REFERENCES:

1. Taub and Schilling, “Principles of Communication Systems”, 2nd Edition, McGraw Hill, 1986.
2. Haykins, S., “Communication Systems”, 4th Edition, John Wiley Inc., 2000.
3. Carlson, A.B., “Communication Systems”, 3rd Edition, Tata McGraw- Hill, 2001.

GE9261 ENVIRONMENTAL SCIENCE AND ENGINEERING L T P C

3 0 0 3

AIM:

To create awareness in every engineering graduate about the importance of environment, the effect of technology on the environment and ecological balance and make them sensitive to the environment problems in every professional endeavour that they participates.

OBJECTIVE:

At the end of this course the student is expected to understand what constitutes the environment, what are precious resources in the environment, how to conserve these resources, what is the role of a human being in maintaining a clean environment and useful environment for the future generations and how to maintain ecological balance and preserve bio-diversity. The role of government and non-government organization in environment managements.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 14

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

Field study of common plants, insects, birds

Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION 8

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – soil waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides.

Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES 10

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.

Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation-central and state pollution control boards- Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS:

1. Gilbert M.Masters, "Introduction to Environmental Engineering and Science", 2nd edition, Pearson Education, 2004.
2. Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill, New Delhi, 2006.

REFERENCES:

1. R.K. Trivedi, "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol. I and II, Enviro Media.
2. Cunningham, W.P. Cooper, T.H. Gorhani, "Environmental Encyclopedia", Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, "Environmental law", Prentice hall of India PVT LTD, New Delhi, 2007.
4. Rajagopalan, R, "Environmental Studies-From Crisis to Cure", Oxford University Press, 2005.

EI9252 TRANSDUCERS AND MEASUREMENTS LABORATORY L T P C
0 0 3 2

1. Characteristics of Potentiometer and Strain Gauge Transducer.
2. Dynamic characteristics of various types of Thermocouple with and without Thermowell.
3. Static and Dynamic characteristics of RTD using Transducer Analysis Station.
4. Characteristic of LVDT using Transducer Analysis Station.
5. Lead wire compensation for RTD.
6. Cold junction compensation for Thermocouple.
7. Temperature compensation for Strain Gauge.
8. Fiber optic transducer based Level and Force measurements.
9. Study of Synchro - Transmitter and Synchro – Receiver
10. Wheatstone Bridge and Kelvin's Bridge for Measurement of Resistance.
11. Schering Bridge for Capacitance Measurement and Anderson Bridge for Inductance Measurement.
12. Determination of Critical Damping Resistance of a D'Arsonval Galvanometer.
13. Calibration of Single-phase Energy meter and Wattmeter.
14. Testing of Current Transformer.
15. Calibration of Ammeter and Voltmeter using Student type Potentiometer.
16. Design, Construction and Calibration of series and shunt type Ohmmeters.

TOTAL: 45 PERIODS

EC9263 INTEGRATED CIRCUITS LABORATORY L T P C
0 0 3 2

1. Design of arithmetic circuits using Op-Amps.
2. Design of I/V and V/I converters using OP-Amps.
3. Design of F/V and V/F converters using OP-Amps.
4. Characteristics of Instrumentation amplifier.
5. Design of oscillator circuit using Op – Amp.
6. Design of active filters using Op – Amps.
7. Design of precision rectifiers using OP – Amps.
8. Design of Sample and Hold circuit and Schmitt trigger.
9. Design of nonlinear Op – Amp circuits.
10. Regulated power supply using voltage regulator ICs.
11. 555 timer applications.
12. Study of Phase Locked Loop.

TOTAL: 45 PERIODS

EI9301 INDUSTRIAL INSTRUMENTATION – I L T P C
3 0 0 3

AIM:

To provide an exposure to various measuring techniques for force, torque, velocity, acceleration, vibration, density, temperature and pressure.

OBJECTIVES:

- At the end of the course the student will have an insight about different techniques, units and significance of measuring devices.

UNIT I MEASUREMENT OF FORCE, TORQUE AND VELOCITY 9

Electric balance – Different types of load cells:- Hydraulic, Pneumatic strain gauge, Magneto elastic and Piezo electric load cell – Different methods of torque measurements:- strain gauge and Relative angular twist - Speed measurement:- Capacitive tacho, Dragcup type tacho, D.C. and A.C. Tachogenerators and Stroboscope.

UNIT II MEASUREMENT OF ACCELERATION, VIBRATION AND DENSITY 9

Accelerometers:- LVDT, Piezo-electric, Strain gauge and Variable reluctance type accelerometer – Mechanical type vibration instruments – Seismic instruments as an accelerometer – Vibrometers - Calibration of Vibration pickups - Units of density and specific gravity, Baume scale, and API scale – Density Measurement:- Pressure head type densitometers, Float type densitometers, Ultrasonic densitometer and Bridge type gas densitometer.

UNIT III PRESSURE MEASUREMENT 9

Units of pressure – Manometers – Types:- Elastic type pressure gauges, Bourdon tube, Bellows and Diaphragms - Electrical methods:- Elastic elements with LVDT and strain gauges, Capacitive type pressure gauge, Piezo-resistive pressure sensor and Resonator pressure sensor - Measurement of vacuum:- McLeod gauge, Thermal conductivity gauges and Ionization gauges:- Cold cathode type and hot cathode type - Testing and calibration of pressure gauges - Dead weight tester.

UNIT IV TEMPERATURE MEASUREMENT 9

Definitions and standards - Primary and secondary fixed points –Calibration of thermometers - Different types of filled in system thermometers -Sources of errors in filled in systems and their compensation-Bimetallic thermometers – Electrical methods of temperature measurement-Signal conditioning of RTDs and their characteristics - 3 lead and 4 lead RTDs - Thermistors.

UNIT V THERMOCOUPLES AND RADIATION PYROMETERS 9

Thermocouples - Laws of thermocouple – Fabrication of industrial thermocouples – Signal conditioning - Isothermal block reference junctions – Cold junction compensation - High temperature Measurement – Radiation methods of temperature measurement – Radiation fundamentals - Total radiation pyrometers - Optical pyrometers - Two colour radiation pyrometers – Fiber Optic temperature measurement.

L: 45: TOTAL: 45 PERIODS

TEXT BOOKS:

1. Doeblin, E.O., "Measurement Systems Application and Design", International Student Edition, 5th Edition, McGraw - Hill Book Company, 2004.
2. Jones, "Instrument Technology", Vol.2, Butterworth-Heinemann, International Edition, 2003.

REFERENCES:

1. Liptak, B.G., "Instrumentation Engineers Handbook (Measurement)", CRC Press, 2005
2. Patranabis, D., "Principles of Industrial Instrumentation", 2nd Edition, Tata McGraw - Hill Publishing Company Ltd., New Delhi, 1999.
3. Holman, P., "Experimental Methods for Engineers", 6th Edition, McGraw - Hill Book Company, 2000.
4. Nakra, B.C. and Choudhury, K.K., "Instrumentation Measurement and Analysis", Tata McGraw - Hill Pub. Co. Ltd, 2nd Edition New Delhi, 2005.

EI 9302 CONTROL ENGINEERING L T P C
3 1 0 4

AIM:

To provide a sound knowledge in the basic concepts of Linear Control Theory and Design.

OBJECTIVES:

- To understand the methods of representation of systems and their transfer function models.
- To provide adequate knowledge in time response of systems and steady state error analysis.
- To give basic knowledge in obtaining the open loop and closed–loop frequency responses of systems.
- To understand the concept of stability of control system and methods of stability analysis.
- To study the three ways of designing compensators for a control system.

UNIT I SYSTEMS AND THEIR REPRESENTATION 9

Basic elements in control systems – Open and Closed loop systems – Feedback characteristics – Effects of feedback – Mathematical modeling of physical systems:- Mechanical, Thermal, Hydraulic and Pneumatic systems - Transfer function – AC and DC servomotors – Block diagram reduction techniques – Signal flow graph - Control system components - Computer simulation.

UNIT II TIME RESPONSE ANALYSIS 9

Time response – Types of test inputs - I and II order system responses - Error coefficients – Generalized error series - Steady state error - Time domain specifications - Computer simulation.

UNIT III FREQUENCY RESPONSE ANALYSIS 12

Frequency response - Frequency domain specifications - Bode plot- Polar plot - Determination of phase margin and gain margin - Constant M and N circles - Nichols chart - Determination of closed loop response from open loop response - Computer simulation.

UNIT IV STABILITY OF CONTROL SYSTEM 6

Concepts of stability – Location of roots in s-plane for stability – Routh Hurwitz criterion – Root locus techniques – Construction – Nyquist stability criterion - Computer simulation.

UNIT V CONTROL SYSTEM DESIGN 9

PID controllers - Performance criteria - Selection of controller modes – Lag, Lead, and Lag-Lead networks – Compensator design for desired response using Root locus and Bode diagrams - Computer simulation.

L: 45 T: 15 TOTAL: 60 PERIODS

TEXT BOOKS:

1. Gopal, M., "Control Systems, Principles and Design", Tata McGraw-Hill Pub. Co., 2nd Edition, New Delhi, 2006.
2. Nagrath, I.J. and Gopal, M., "Control System Engineering", New-age International (P), 4th Edition Ltd., New Delhi, 2006.

REFERENCES:

1. Ogata, K., "Modern Control Engineering", Prentice Hall of India Ltd., 4th Edition, New Delhi, 2006.
2. Kuo, B.C., "Automatic Control Systems", Prentice Hall of India Ltd., New Delhi, 2003.

CS9311 DATA STRUCTURES AND ALGORITHM L T P C
3 0 0 3

AIM:

To present the concept of different type data structures through algorithm.

OBJECTIVES:

- To introduce the concepts of arrays and its representations.
- To study linked lists, stack and queue structures.
- To study trees, representation of trees, tree traversal and basic operations on trees.
- To study some of the sorting and searching techniques.
- To study the concept of graphs, traversal techniques and minimum spanning tree.

UNIT I ARRAYS AND LINKED LISTS 8

Linear arrays: Representation of linear array, Traversing linear array and Insertion and deletion in linear arrays - Multidimensional arrays:- Representation of N-dimensional arrays in memory - Linked list:- Representation of linked list in memory, Traversing linked list, Insertions and deletions in linked list, Doubly linked list, Circular linked list and Header linked list - Sorted linked list:- Searching, Insertion and Deletion.

UNIT II STACKS AND QUEUES 8

Stack:- Representation of stack with array and linked list, Simple applications, Recursions and Implementation of recursive procedures - Queues:- Representation of queue with array and linked list, Priority queue, Representation of priority queue with array and list, Circular queue and Dequeue.

UNIT III TREES 12

Binary Trees:- Types of binary trees, Representation of binary trees and Traversing binary trees – Binary Search Tree:- Searching, Inserting and Deleting in binary search tree – AVL Search Tree:- Insertion and Deletion in AVL tree – B Trees:- Searching, Inserting and Deleting in B trees – Heap Tree:- Insertion and Deletion in Heap tree – Threading in trees:- Minimum weighted path length tree – General tree to binary tree representation.

UNIT IV GRAPHS 9

Definitions – Representation of graph with adjacency matrix and linked list – Path Matrix – Shortest path algorithms – Warshall's algorithm, Dijkstra's algorithm – Minimum spanning trees:- Prim's algorithm and Kruskal's algorithm –Traversing a graph – Breadth first search and tree – Depth first search and tree – Topological sorting – Operations on graph.

UNIT V SEARCHING AND SORTING 8

Binary search – Hashing:- Hash function, Collision, Separate chaining, Open addressing, Rehashing and Extendible hashing – Sorting:- Selection, Bubble, Insertion, Merge, Quick, Heap and Radix Sort.

L: 45: TOTAL: 45 PERIODS

TEXT BOOKS:

1. Weiss, M. A., "Data Structures and Algorithm Analysis in C", 4th Impression, Pearson Education, 2006.
2. Tanenbaum, A.M., Langsam, Y. and Augenstein, M.J., "Data Structures Using C", 1st Impression, Pearson Education, 2006.
3. Lipschutz, S., Vijalakshmi Pai,G.A., "Data Structures", Tata McGraw - Hill Publishing Company Limited, 2006.

REFERENCES:

1. Kruse, R.L., Bruce, P. and Tondo, L.C.L., "Data Structures and Program Design in C", 16th Printing, Prentice-Hall of India, 2001.
2. Michael Berman, A., "Data Structures Via C++", 1st Indian Edition, Oxford University Press, 2007.
3. Sahni, S., "Data Structures, Algorithms and Applications in Java", 2nd Edition, Universities Press, Hyderabad, 2005.

EC 9313 MICROPROCESSORS AND MICROCONTROLLERS L T P C
3 0 0 3

AIM:

To expose the students to Architecture and Programming of Microprocessors and Microcontrollers.

OBJECTIVES:

- This course lays an in-depth foundation of 8 bit microprocessor using 8085 family and overview of advanced processors, discusses organization, architecture and operation of popular Intel 8051 family of 8 bit microcontroller and the peripherals, memory interfacing with these devices.

UNIT I 8085 MICROPROCESSOR 9

Introduction to 8085 – Architecture, Instruction set, Addressing modes, Interrupts Timing diagram, memory and I/O interfacing – Programming exercises in 8085.

UNIT II ADVANCED MICROPROCESSORS 9

Overview of Microprocessors Architectures:- 8086/8088, 80186/80188, 80286, 80386, 80486, PENTIUM, PENTIUM PRO PROCESSOR, PENTIUM II, PENTIUM III, PENTIUM 4.

UNIT III PERIPHERAL INTERFACING 9

PPI (8255) - USART (8251) –Timer (8253) - Programmable DMA Controller (8257) - Programmable Interrupt controller (8259) - Keyboard display controller (8279) - ADC and DAC Interfacing.

UNIT IV MICROCONTROLLERS 9

Intel 8031 and 8051 Architectures - Special function Registers (SFR) - Instruction set - Addressing modes - Assembly language programming -
Timer and Counter Programming - Serial Communication Interrupts programming - External Memory Interfacing.

UNIT V MICROPROCESSOR BASED SYSTEMS DESIGN 9

Microprocessor based Data acquisition system - Implementation of discrete Control sequence – Implementation of Digital PID Algorithm - Stepper Motor Interfacing - Case studies in Industrial Process Control Systems.

L: 45: TOTAL: 45 PERIODS

TEXT BOOKS:

1. Gaonkar, R.S., “Microprocessor Architecture Programming and Application”, Wiley Eastern Ltd., New Delhi, 5th Edition, 2002.
2. Hall, D.V., “Microprocessor and Interfacing, Programming and Hardware”, Tata McGraw - Hill, 2nd edition, 1999.
3. Ayala, K.J., “The 8051 Microcontroller Architecture and Programming Applications”, Penram International Publishing (India) Pvt. Ltd, 2004.

REFERENCES:

1. Hint, K. and Tabak, D., “Microcontrollers, Architecture, Implementation and Programming”, McGraw - Hill International, USA, 1992.
2. Mazidi, M.A. and Mazidi, J.G., “The 8051 Microcontroller and Embedded Systems”, Prentice Hall, 2000.
3. Ray, A.K. and Bhurchandi, K.M., “Advanced Microprocessor and Peripherals”, Tata McGraw - Hill, 2002.
4. Brey, B.B., “The Intel Microprocessors 8086/8088, 80186/80188, 80286, 80386, 80486, PENTIUM, PENTIUM PRO PROCESSOR, PENTIUM II, PENTIUM III, PENTIUM 4, Architecture, Programming and Interfacing”, 7th Edition, Prentice Hall of India Pvt. Ltd., 2006.

EI9303 VIRTUAL INSTRUMENTATION L T P C
3 1 0 4

AIM:

Focuses on the development of prototype Virtual Instrumentation.

OBJECTIVES:

- To learn the programming, data acquisition hardware and implementing small projects in VI.

UNIT I INTRODUCTION 9

Virtual Instrumentation – Definition and Flexibility – Block diagram and Architecture of Virtual Instruments – Virtual Instruments versus Traditional Instruments – Review of software in Virtual Instrumentation – VI programming techniques - VI, sub VI, Loops and Charts, Arrays, Clusters and Graphs, Case and Sequence Structures, Formula nodes, String and File Input/Output.

UNIT II DATA ACQUISITION IN VI 9

A/D and D/A Converters, plug-in Analog Input/Output cards - Digital Input and Output Cards, Organization of the DAQ VI system - Opto Isolation – Performing analog input and analog output - Scanning multiple analog channels - Issues involved in selection of Data acquisition cards - Data acquisition modules with serial communication - Design of digital voltmeters with transducer input – Timers and Counters .

UNIT III COMMUNICATION NETWORKED MODULES 9

Introduction to PC Buses – Local busses:- ISA, PCI, RS232, RS422 and RS485 – Interface Buses:- USB, PCMCIA, VXI, SCXI and PXI -Instrumentation Buses :- Modbus and GPIB - Networked busses – ISO/OSI Reference model, Ethernet and TCP / IP Protocols.

UNIT IV REAL TIME CONTROL IN VI 9

Design of ON/OFF controller and Proportional controller for a mathematically described processes using VI software – Modeling and basic control of Level and Reactor Processes – Case studies on development of HMI, SCADA in VI.

UNIT V APPLICATIONS 9

PC based digital storage oscilloscope - Sensor Technology and Signal Processing - Virtual Laboratory - Spectrum Analyser - Waveform Generator – Data visualization from multiple locations:- Distributed monitoring and control - Vision and Motion Control.

L: 45 P: 15 TOTAL: 60 PERIODS

TEXT BOOKS:

1. Nadovich, C., “Synthetic Instruments Concepts and Applications”, Elsevier, 2005.
2. Bitter, R., Mohiuddin, T. and Nawrocki, M., “Labview Advanced Programming Techniques”, CRC Press, 2nd Edition, 2007.
3. Gupta, S. and Gupta, J. P., “PC Interfacing for Data Acquisition and Process Control”, 2nd Edition, Instrument Society of America, 1994.

REFERENCES:

1. Jamal, R. and Picklik, H., “Labview – Applications and Solutions”, National Instruments Release.
2. Johnson, G., “Labview Graphical programming”, McGraw-Hill, Newyork, 1997.
3. Wells, L.K. and Travis, J., “Labview for Everyone”, Prentice Hall, New Jersey, 1997.
4. Buchanan, W., “Computer Busses”, CRC Press, 2000.

EI9304 PROGRAMMING AND DATA STRUCTURES LABORATORY **L T P C 0 0 3 2**

AIM:

To practice the various Data Structures through Programming Languages like C, C++ and Java.

OBJECTIVES:

- To facilitate the students, to write programs in C, C++ and Java.
- To implement the various data structures as Abstract Data Types.
- To write programs to solve problems using the ADTs.

1. Implementation of Linear and Binary Search Algorithm using C/C++/Java.
2. Implementation of Selection Sort, Bubble Sort, Insertion Sort Algorithmusing C/C++/Java.
3. Implementation of Merge sort (array) and Quick Sort (Stack) Algorithm using C/C++/Java.
4. Implementation of Heap sort (tree) Algorithm using C/C++/Java.
5. Implementation of Linked List Algorithm (Insertions and Deletions anywhere in the list) Using C/C++/Java.
6. Implementation of Sorted Linked List Algorithm (Searching, Insertions and Deletions) using C/C++/Java.
7. Implementation of Stack Applications (Wellformedness of parenthesis, Evaluation of postfix expression, Infix expression to postfix expression conversion) using C/C++/Java.
8. Implementation of Linear Queue with Linked List using C/C++/Java.
9. Operations in a circular queue with array using C/C++/Java.
10. Queue operations (Priority queue) with priority of items using C/C++/Java.
11. Construction of Binary Search Tree and Traversal (pre, in and post order) using C/C++/Java.
12. Insertions and deletions in Binary Search Tree using C/C++/Java.

TOTAL: 45 PERIODS

EI9305 MICROPROCESSORS AND MICROCONTROLLERS LABORATORY **L T P C 0 0 3 2**

1. 8085 Assembly Language Programming Exercises.
2. Interfacing 8255 and 8253 with 8085.
3. Interfacing 8279 and 8251 with 8085.
4. Interfacing 8259 with 8085.
5. Interfacing Stepper motor with 8085.
6. 8051 Assembly Language Programming Exercises.
7. Interfacing ADC with Microprocessor and Microcontroller.
8. Interfacing DAC with Microprocessor and Microcontroller.
9. Microprocessor based Data Logger.
10. Microprocessor based Traffic light controller.
11. Microprocessor based PID controller.
12. LCD Display Interface with 8051.

TOTAL: 45 PERIODS

GE9371 COMMUNICATION SKILLS AND SOFT SKILLS L T P C

(LABORATORY COURSE) 0 0 2 1

FIFTH / SIXTH SEMESTER

(ELECTIVE COURSE)

AIM:

To enhance the overall capability of students and to equip them with the necessary Communication Skills and Soft Skills that would help them excel in their profession.

OBJECTIVES:

- To equip students of engineering and technology with effective speaking and listening skills in English.
- To help them develop their soft skills and interpersonal skills, which will make the transition from college to workplace smoother and help them excel in their jobs.
- To enhance the performance of students at Placement Interviews, Group Discussions and other recruitment exercises.

A. Viewing and discussing audio-visual materials (6 periods)

1. Resume / Report Preparation / Letter Writing: (2)

Letter writing – Job application with Resume - Project report - Email etiquette.

2. Presentation skills: (1)

Elements of effective presentation – Structure of presentation - Presentation tools – Body language.

3. Soft Skills: (1)

Time management – Stress management – Assertiveness – Negotiation strategies.

4. Group Discussion: (1)

Group discussion as part of selection process, Structure of group discussion – Strategies in group discussion – Mock group discussions.

5. Interview Skills: (1)

Kinds of interviews – Interview techniques – Corporate culture – Mock interviews.
(Career Lab Software may be used for this section).

Note: Career Lab software may be used to learn the skills, to be applied in the practice session.

B. Practice session (24 periods)

1. **Resume / Report Preparation / Letter writing**: Students prepare their own resume and report. (4)
2. **Presentation Skills:** Students make presentations on given topics. (8)
3. **Group Discussion**: Students participate in group discussions. (6)
4. **Interview Skills**: Students participate in Mock Interviews (6)

REFERENCES:

1. Anderson, P.V, **Technical Communication**, Thomson Wadsworth, Sixth Edition, New Delhi, 2007.
2. Prakash P, **Verbal and Non-Verbal Reasoning**, Macmillan India Ltd., Second Edition, New Delhi, 2004.
3. John Seely, **The Oxford Guide to Writing and Speaking**, Oxford University Press, New Delhi 2004.
4. David Evans, **Decisionmaker**, Cambridge University Press, 1997.
5. Thorpe, E and Thorpe, S **Objective English**, Pearson Education, Second Edition, New Delhi 2007.
6. Turton, N.D and Heaton, J.B, **Dictionary of Common Errors**, Addision Wesley Longman Ltd., Indian reprint 1998.

EI 9351 INDUSTRIAL INSTRUMENTATION – II L T P C
3 0 0 3

AIM:

To provide exposure to various measuring techniques for flow, level, viscosity and moisture.

OBJECTIVES:

- The students are exposed to mechanical flow meters, mass flow meters and electrical type flow meters and different techniques for solid and liquid level measurements, viscosity and humidity measurements.

UNIT I VARIABLE HEAD TYPE FLOWMETERS 9

Variable head type flow meters:- Orifice plate, Venturi tube, Flow nozzle and Dall tube – Installation of head flow meters – Pitot tube.

UNIT II QUANTITY METERS, AREA FLOW METERS AND MASS FLOW METERS 9

Positive displacement flow meters: – Nutating disc, Reciprocating piston, Oval gear and Helix type flow meters – Inferential meter – Turbine flow meter – Area flow meter:- Rotameter – Theory and installation – Mass flow meters:- Angular momentum, Thermal and Coriolis – Calibration of flow meters:– Dynamic weighing methods.

UNIT III ELECTRICAL TYPE FLOW METER 9

Principle and constructional details of Electromagnetic flow meter – Ultrasonic flow meters – Laser Doppler anemometer – Vortex shedding flow meter – Target flow meter – Guidelines for selection of flow meter – Open channel flow measurement – Solid flow rate measurement.

UNIT IV LEVEL MEASUREMENT 9

Level measurement:- Float, Displacer type and Bubbler system – Electrical level gauge:- Resistance and Capacitance – Nuclear radiation and Ultrasonic types – Boiler drum level measurement:- Differential Pressure Method and Hydra step method – Solid level measurement.

UNIT V MEASUREMENT OF VISCOSITY, HUMIDITY AND MOISTURE 9

Viscosity:- Say bolt viscometer and Rotameter type viscometer – Consistency meters – Dry and wet bulb psychrometers – Hot wire electrode type hygrometer, Dew cell and Electrolysis type hygrometer – Commercial type dew point meter – Moisture measurement:- Different methods of moisture measurements and Application of moisture measurement .

L: 45: TOTAL: 45 PERIODS

TEXT BOOKS:

1. Doeblin, E.O., "Measurement Systems Application and Design", International Student Edition, 5th Edition, McGraw-Hill Book Company, 2004.
2. Liptak, B.G., "Instrumentation Engineers Handbook (Measurement)",CRC Press, 2005.

REFERENCES:

1. Jain, R.K., "Mechanical and Industrial Measurments", Khanna Publishers, Delhi, 1999.
2. Eckman, D.P., "Industrial Instrumentation", Wiley Eastern Limited, 1990.

EI 9352 PROCESS CONTROL L T P C
3 1 0 4

AIM:

The course is designed to know about process dynamics, different controllers and tuning of different controllers.

OBJECTIVES:

- To know the procedure for modeling different processes.
- To study about various control actions.
- To get the exposure of final control elements.
- To know about the procedure for tuning controllers.
- To study about various complex control schemes.

UNIT I PROCESS DYNAMICS 9

Need for process control – Mathematical model of flow, Level, Pressure and Thermal processes – Interacting and non-interacting systems – Degrees of freedom – Continuous and batch processes – Self regulation – Servo and regulatory operations – Lumped and Distributed parameter models – Heat exchanger – CSTR – Linearization of nonlinear systems.

UNIT II CONTROL ACTIONS 9

Characteristic of on-off, proportional, single speed floating, integral and derivative controllers – P+I, P+D and P+I+D control modes – Electronic PID controller – Auto/manual transfer - Reset windup – Practical forms of PID Controller.

UNIT III FINAL CONTROL ELEMENTS 9

I/P converter - Pneumatic and electric actuators – Valve Positioner – Control Valves – Characteristic of Control Valves:- Inherent and Installed characteristics – Modeling of pneumatic control valve – Valve body:-Commercial valve bodies – Control valve sizing – Cavitation and flashing – Selection criteria.

UNIT IV CONTROLLER TUNING 9

Evaluation criteria – IAE, ISE, ITAE and ¼ decay ratio - Tuning:- Process reaction curve method, Continuous cycling method and Damped oscillation method – Determination of optimum settings for mathematically described processes using time response and frequency response approaches –
Auto tuning.

UNIT V MULTILOOP CONTROL 9

Feed-forward control – Ratio control – Cascade control – Inferential control – Split-range and introduction to multivariable control – Examples from distillation column and boiler systems – IMC– Model Predictive Control – Adaptive control – Introduction to Plant-wide Control – Controller design for a nonlinear process – Introduction to batch process control – P&ID diagram.

L: 45 T: 15 TOTAL: 60 PERIODS

TEXT BOOKS:

1. Bequette, B.W., "Process Control Modeling, Design and Simulation", Prentice Hall of India, 2004.
2. Stephanopoulos, G., "Chemical Process Control - An Introduction to Theory and Practice", Prentice Hall of India, 2005.

REFERENCES:

1. Seborg, D.E., Edgar, T.F. and Mellichamp, D.A., "Process Dynamics and Control", Wiley John and Sons, 2nd Edition, 2003.
2. Coughanowr, D.R., "Process Systems Analysis and Control", McGraw -Hill International Edition, 2004.

EC 9361 VLSI DESIGN L T P C
3 0 0 3

AIM:

Emphasis on advanced Digital Logic and VLSI design.

OBJECTIVES:

- To learn the digital techniques, interfacing**,** PLDs, FPGAs and Principle of VHDL programming for VLSI design.

UNIT I BASIC CIRCUITS FOR DIGITAL SYSTEMS 9

CMOS Inverter – Design principles – Lay out rules - Construction of multiplexers – Transmission gates – Principles and design considerations of specific PROM, EPROM, SRAM and DRAM.

UNIT II VHDL PROGRAMMING 11

Introduction to VHDL – Sequential and concurrent descriptions – Signal, port and variable statements – Sequential statements – Block, process, component and generate descriptions – Test bench creations and principle of operation of VHDL simulator – Introduction to Verilog and brief comparison with VHDL.

UNIT III COMBINATIONAL CIRCUITS FOR DIGITAL SYSTEMS 8

Basics and VHDL programming:- Adder, Fast adder and Multiplier - Synthesis of logic function:- Multiplexers, Decoders, Encoders - Data path circuits.

UNIT IV SEQUENTIAL CIRCUITS FOR DIGITAL SYSTEMS 8

Basics and VHDL programming of the following sequential circuits:- Flip flops, Registers, Counters and Accumulators.

UNIT V PROGRAMMABLE LOGIC DEVICES 9

Principles of PAL, PLD, GAL, FPGA, CPLD and their design considerations – Programmable Logic interconnect principles and types – Programmable logic elements and AND-OR arrays – Routing procedures in FPGA and CPLD – Programming methods for FPGA and CPLD – Comparison of ACTEL – Altera and Xilinx FPGAs.

L: 45: TOTAL: 45 PERIODS

TEXT BOOKS:

1. Rabey, J.M., "Digital Integrated Circuits: A Design Perspective", Prentice Hall, 1995.
2. Bhasker, J., "VHDL Primer", Prentice Hall, 1999.

REFERENCES:

1. Tocci, R., Moss, G. and Widmer, N., "Digital Systems Principles and Applications", Prentice Hall, 2006.
2. Floyd, T.L., "Digital Fundamentals", Prentice Hall, 9th Edition, 2006.
3. Smith, M.J., "Application Specific Integrated Circuits", Addison Wesley Press, 1999.
4. Brown, S. and Vranesic, Z., "Fundamentals of Digital Logic with VHDL Design", Tata McGraw-Hill, New Delhi, 2004.

EC9362 DIGITAL SIGNAL PROCESSING L T P C
3 1 0 4

AIM:

To introduce the concept of signal processing and design of digital filters

OBJECTIVES:

- Understand basic tradeoffs in digital representation of signals: sampling rate, bandwidth, bit rate, fidelity. Analyze minimum phase, linear phase, and all-pass discrete-time systems and to check the stability of filters.

UNIT I DISCRETE TIME SIGNALS AND SYSTEMS 9

Sampling of analog signals – Aliasing - Standard discrete time signals – Classification of discrete time systems:– Linear time invariant systems, causality, stability – Convolution sum – Difference equation representation – Correlation of discrete time signal:- cross correlation and autocorrelation sequences.

UNIT II Z – TRANSFORM AND FOURIER TRANSFORM 9

Review of Z – transform and its properties - Inverse Z – transform - Analysis of linear time invariant systems using Z Transform – Discrete time Fourier transform, Discrete Fourier transform properties – Circular convolution – Linear convolution using DFT – Sectioned convolution:- Overlap add method and Overlap save method – Time response analysis and frequency response analysis of discrete time systems.

UNIT III FAST FOURIER TRANSFORM (FFT) 9

Introduction to Radix 2 FFT - Decimation in time FFT algorithm – Decimation in frequency FFT algorithm - Computing inverse DFT using FFT – Mixed radix FFT – Computer implementation of FFT algorithm.

UNIT III IIR FILTER DESIGN 9

Review of Design of Analog Butterworth and Chebyshev filters – Design of IIR Digital filters using Impulse Invariant technique and bilinear transformation method – Realization of IIR digital filters – Computer simulation of IIR filters.

UNIT V FIR FILTER DESIGN AND DSP PROCESSORS 9

Linear phase FIR filters – FIR design – Fourier series method – Window function method – Frequency sampling method – Realization of FIR digital filters - Computer simulation of FIR filters – Architecture and features of TMS320C6X DSP Processor – Introduction to Adaptive signal processing.

L: 45 T: 15 TOTAL: 60 PERIODS

TEXT BOOKS:

1. Proakis, J.G. and Manolakis, D.G., "Digital Signal Processing Principles, Algorithms and Applications", 4th Edition, Prentice Hall of India, 2006.
2. Openheim, A.V. and Schafer, R.W., "Discrete Time Signal Processing", Prentice Hall of India, 1992.
3. Venkatramani, B. and Baskar, M., "Digital Signal Processors", Tata McGraw - Hill, 1st Edition, 2004.

REFERENCES:

1. Antonian, A., "Digital Filter Analysis and Design", Tata McGraw-Hill, 1998.
2. Mithra, S.K., "Digital Signal Processing: A Computer Based Approach", 3rd Edition, 2005.

EI 9353 PROCESS CONTROL LABORATORY L T P C
0 0 3 2

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. Tuning of PID Controller for mathematically described processes
6. PID Implementation Issues.
7. PID Enhancements (Cascade and Feed-forward Control Schemes)
8. Analysis of Multi-input Multi-output system (Four-tank System).
9. Design and Implementation of Multi-loop PI Controller (Three-tank System).
10. Design and Implementation of Multivariable Controller (Four-tank System).
11. Study of AC and DC drives.
12. Study pH Control Test Rig.

TOTAL: 45 PERIODS

EI 9354 INDUSTRIAL INSTRUMENTATION LABORATORY L T P C
0 0 3 2

1. Determination of Discharge coefficient of Orifice plate and Venturi meter.
2. Measurement of flow rate using Orifice, Venturi, Elbow, Flow nozzle.
3. Characteristics of P/I and I/P Converters.
4. Measurement of pH, Conductivity and Humidity.
5. Level Measurement using DP transmitter and Capacitance probe.
6. Pressure gauge calibration using Dead Weight Tester.
7. Study of UV-Visible Spectrometer.
8. Study of ECG, Audiometer and Spirometer.
9. Study of Smart transmitter and Smart Valve Positioner.
10. Calibration of RTD based Temperature transmitter.
11. Determination of Stoichiometric Ratio in a Combustion Chamber.
12. Flue-gas analyzer.
13. Determination of Transfer function model of Temperature transducers.
14. Determination of Viscosity using Brookfield Viscometer.
15. Study of IR Thermometers.

TOTAL: 45 PERIODS

EI9355 TECHNICAL SEMINAR L T P C
0 0 2 1

OBJECTIVE:

During the seminar session each student is expected to prepare and present a topic on Electronics and Instrumentation Engineering, for a duration of about 8 to 10 minutes. In a session of three periods per week, 15 students are expected to present the seminar. A faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also. Outside experts also may be invited to deliver state of the art technological innovations.

Students are encouraged to use various teaching aids such as overhead projectors, power point presentation and demonstrative models. This will enable them to gain confidence in facing the placement interviews.

EI9401 LOGIC AND DISTRIBUTED CONTROL SYSTEM L T P C
3 0 0 3

AIM:

This course is designed to know about different data networks, to know about various PLC languages. It also provides knowledge about Distributed control Systems.

OBJECTIVES:

- To provide idea about various Data Networks.
- To get an exposure to SCADA.
- To learn about different PLC languages.
- To study about Industrial DCS.
- To have an exposure to HART and Fieldbus.

UNIT I DATA NETWORK FUNDAMENTALS 9

Network hierarchy and switching – ISO/OSI Reference model – Data link control protocol:-HDLC – Media access protocol:-Command/response, Token passing and CSMA/CD **-** TCP/IP – Bridges – Routers – Gateways –Standard ETHERNET and ARCNET Configuration.

UNIT II PLC AND SCADA 9

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.

UNIT III PLC PROGRAMMING 9

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

UNIT IV DISTRIBUTED CONTROL SYSTEMS 9

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.

UNIT V HART AND FIELDBUS 9

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

L: 45: TOTAL: 45 PERIODS

TEXT BOOKS:

1. Petrezeulla, “Programmable Controllers”, McGraw-Hill, 2004.
2. Lucas, M.P., “Distributed Control System”, Van Nastrand Reinhold Company, New York, 1986.
3. Clarke, G., Reynders, D. and Wright, E., “Practical Modern SCADA Protocols: DNP3,
4. 60870.5 and Related Systems”, Newnes, 1st Edition, 2004.

REFERENCES:

1. Hughes, T., “Programmable Logic Controllers”, ISA Press, 2000.
2. Bowden, R., “HART Application Guide”, HART Communication Foundation, 1999.
3. Mc-Millan, G.K., “Process/Industrial Instrument and Controls Handbook”, McGraw-Hill, NewYork, 1999.
4. Berge, J., “Field Buses for Process Control: Engineering, Operation, and Maintenance”, ISA Press, 2004.

EI9402 ADVANCED PROCESS CONTROL LT P C
3 1 0 4

AIM:

The course is designed to introduce advanced topics in Process Control.

OBJECTIVES:

- To represent the Linear System in State Space form.
- To design Digital Controller.
- To analyze nonlinear systems.
- To Identify the Unknown parameters of the transfer function model using Process Identification Techniques.
- Optimal Controller Design.

UNIT I DISCRETE STATE-VARIABLE TECHNIQUE 9

State equation of discrete data system with sample and hold – State transition equation – Methods of computing the state transition matrix – Decomposition of discrete data transfer functions – State diagrams of discrete data systems – System with zero-order hold – Controllability and observability of linear time invariant discrete data system – Stability tests of discrete-data system.

UNIT II NONLINEAR SYSTEMS 9

Introduction – Nonlinear system elements – Linearization – Phase plane analysis – Lyapunov's method – Describing function method – Popov's method - Circle criterion.

UNIT III DIGITAL CONTROLLER DESIGN 9

Review of z-transform – Modified of z-transform – Pulse transfer function – Digital PID controller – Dead-beat control and Dahlin control – Smith predictor – Digital Feed-forward controller – IMC – Model predictive controller.

UNIT IV SYSTEM IDENTIFICATION 9

Non Parametric methods:- Transient analysis – Frequency analysis – correlation analysis – Spectral analysis – Parametric methods:- Least square method – Recursive least square method.

UNIT V OPTIMAL CONTROL SYSTEMS 9

Parameter optimization**:-** Servo mechanisms - Regulators – Optimal control problems:- Transfer function approach - state variable approach – State regulator problem – Infinite-time regulator problem – output regulator and tracking problems - LQR and LQG.

L: 45 T: 15 TOTAL: 60 PERIODS

TEXT BOOKS:

1. Gopal, M. "Modern Control System Theory", 2nd Edtion, Wiley Eastern Ltd, 1994.
2. Deshpande, P.B. and Ash, R.H., "Computer Process Control", ISA Publications, USA, 1995.
3. Nagrath, I.J. and Gopal, M., "Control Systems Engineering", 4th Edition, New-age International publishers, 2005.
4. Soderstorm, T. and Stoica, P., "System Identification", Prentice Hall International Ltd., UK., 1989.

REFERENCES:

1. Gopal, M., "Digital Control and State Variable Methods", Tata McGraw -Hill, 2003.
2. Ogata, K., "Discrete-time Control Systems", 2nd Edition, Eastern Economy Edition, 2005.
3. Kuo, B.C., "Digital Control Systems", 2nd Edition, The Oxford University Press, 2005.

EI 9403 ANALYTICAL INSTRUMENTATION L T P C
3 0 0 3

AIM:
The course is designed to equip the students with adequate knowledge of a number of analytical tools which are useful for Industrial analysis, drugs and pharmaceutical labs and above all for environmental pollution monitoring.

OBJECTIVES:
- To provide various techniques and methods of analysis which occur in the various regions of the spectrum.
- To study important methods of analysis of industrial gases.
- To provide the important radio chemical methods of analysis.

UNIT I SPECTRO PHOTOMETRERS 12
Spectral methods of analysis:- UV, Visible, IR, FTIR, atomic absorption - Flame emission mass spectrophotometers – Sources - Detectors – Applications.

UNIT II ION CONDUCTIVITY AND DISSOLVED COMPONENT ANALYSER 6
Sampling systems – Ion selective electrodes – Conductivity meters – pH meters – Dissolved oxygen analyzer – Sodium analyzer – Silica analyzer – Turbidity meter.

UNIT I II GAS ANALYZER 9
Oxygen analyzer – CO and CO_2 monitor – NO_2 analyzer – H_2S analyzer – Dust and Smoke measurement – Thermal conductivity type – Thermal analyzer – Industrial analyzer.

UNIT IV CHROMATOGRAPHY 9
Gas Chromatography:- Principles, Types, Applications and Detectors – Liquid Chromatography:- Principles, Types, Applications and Detectors – HPLC:- Principle, Types, Applications and Detectors.

UNIT V NMR, X-RAY AND MASS SPECTROMETRIC TECHNIQUES 9
NMR Spectroscopy – Principle and Detection – GM counter – Proportional counters –X-ray spectroscopy – Mass spectrometer - Applications.

L: 45: TOTAL: 45 PERIODS

TEXT BOOKS:

1. Willard, H.H., Merit, L.L., Dean J.A. and Seattle F.L., “Instrumental Methods of Analysis”, CBS Publishing and Distribution, 1995.
2. Skoog, D.A. and West D.M., “Principles of Instrumental Analysis”, Holt Sounder Publication, Philadelphia, 1985.

REFERENCES:

1. Braun, R.D., “Introduction to Instrumental Analysis”, McGraw – Hill, Singapore, 2006.
2. Ewing G.W., “Instrumental Methods of Analysis”, McGraw- Hill, 1992.
3. Mann, C.K, Vickers, T.J. and Guillick, W.H., “Instrumental Analysis”, Harper and Row Publishers, New York, 1974.
4. Liptak, B.G., “Process Measurement and Analysis”, CRC Press, 2005.
5. Settle, F.A., “Handbook of Instrumental Techniques for Analytical Chemistry”, Prentice Hall, New Jersey, 1997.

EC 9411 REAL TIME EMBEDDED SYSTEMS L T P C
3 0 0 3

AIM:

To expose the students to Architecture and Programming of Real Time Embedded Systems.

OBJECTIVES:

- This course discusses organization, architecture, design and development and applications of real-time embedded systems.

UNIT I INTRODUCTION TO EMBEDDED SYSTEMS 9

Brief overview of real time systems and embedded systems - Classification of embedded systems - Embedded system definitions - Functional and nonfunctional requirements - Architectures and standards - Typical applications.

UNIT II EMBEDDED SYSTEM COMPONENTS AND INTERFACE 9

Device choices - Selection criteria and characteristics of Processors and memory systems for embedded applications - Interface and Peripherals - Power sources and management.

UNIT III EMBEDDED SYSTEM DESIGN AND DEVELOPMENT 9

Design methods and techniques - Classification of need - Need analysis - Requirement and specification - Conceptual design - Models and languages - State machine model - State machine tables - Verification – Validation - Simulation and emulation.

UNIT IV REAL TIME SYSTEMS AND MODELS 9

Characteristics and classification of real time systems - Real time specifications and Design techniques - Event based - Process based and graph based models - Real time kernel - Hierarchy services and design strategy - Real time system performance and analysis - Typical real time systems - Their languages and features.

UNIT V CASE STUDIES 9

Case studies of safety-critical and time-critical embedded systems with reference to Aerospace, Automobile, Medical and Industrial applications.

L: 45: TOTAL: 45 PERIODS

TEXT BOOKS:

1. Noergaard, T., “Embedded Systems Architecture: A Comprehensive Guide for Engineers and Programmers”, Elsevier Publications, 2005.
2. Berger, A.S., “Embedded System Design: An Introduction to Process, Tools and Techniques”, CMP Books, 2002.

REFERENCES:

1. David, S., “An Embedded Software Primer”, Addison-Wesley, 1999.
2. Liv, J.W.S., “Real-Time Systems”, Pearson Education, 2001.
3. Vahid and Givargis, T., “Embedded System Design: A Unified Hardware/ Software Introduction”, John Wiley and Sons, 2002.
4. Peatman, J.B., “Design with Microcontrollers”, McGraw-Hill International Ltd., Singapore, 1989.
5. Kang, C.M.K., and Shin, G., “Real Time Systems”, McGraw Hill, 1997.

EI 9404 ADVANCED PROCESS CONTROL LABORATORY L T P C
0 0 3 2

1. Simulation of Lumped Parameter System.
2. Identification of Linear Dynamic model (Black Box) of a Process using Parametric Methods.
3. Study of AC and DC Servo Control Systems.
4. PC based Control of Heat Exchanger.
5. Development of Virtual Instrument using SCADA package.
6. Design of Deadbeat and Dahlin's Controllers for first order process with dead time.
7. Study of Distributed Control System (Delta V and CS 3000).
8. Implementation of Discrete Control Sequence using PLC.
9. Control of Level Process using Embedded Controller.
10. On-line Control using Distributed Control System.
11. Design of Fuzzy Logic Controller for the pH process.
12. Design of Gain Scheduled PI Controller Conical - tank System.

TOTAL: 45 PERIODS

EI 9405 INSTRUMENTATION SYSTEM DESIGN LABORATORY L T P C
0 0 3 2

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/Annunciator 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.

TOTAL: 45 PERIODS

EI 9406 COMPREHENSION L T P C
0 2 0 0

AIM:
To encourage the students to comprehend the knowledge acquired from the first Semester to Sixth Semester of B.E Degree Course through periodic exercise.

EE9021 POWER ELECTRONIC DEVICES AND CIRCUITS L T P C
3 0 0 3

AIM:

To give a comprehensive knowledge on Power Electronic Devices and Circuits.

OBJECTIVES:

The course would expose the student to:

- various power electronic devices, their characteristics and protection.
- Detailed operations of commonly used circuit topologies like Controlled Rectifiers, Inverters, Choppers and A.C Controllers.
- Introduction to popular applications.

UNIT I POWER SEMICONDUCTOR DEVICES AND CHARACTERISTICS 8

Power diodes - Power transistors - Characteristics of SCR, TRIAC, Power MOSFET, IGBT, GTO, MCT, LASCR – Thyristor protection circuits – Thyristor triggering circuits – Series and parallel operation of SCR - Commutation – Natural, forced commutation – Different types.

UNIT II CONVERTERS 10

Single phase – Three phase – Half controlled – Fully controlled rectifiers – Dual converters - Effect of source and load inductance – Cyclo-Converters – Different types – AC regulators.

UNIT I II INVERTERS 10

Voltage Source Inverters – Resonant Inverters – Series and Parallel - Bridge Inverters – Half bridge – Full bridge – McMurray Bedford Inverter – Three Phase Bridge Inverters - Voltage control – PWM Techniques - Current Source Inverters – Auto Sequentially Commutated Inverter.

UNIT IV CHOPPERS 9

Step up and Step down Chopper – Chopper classification – Switching mode Regulators - Buck, Boost, Buck-Boost, and Cuk Regulators - A.C. Choppers.

UNIT V APPLICATION 8

Introduction to A.C and D.C drives – Closed loop control – Stepper and Switched Reluctance motor drive – Uninterrupted power supply – Switched mode power supply.

L: 45: TOTAL: 45 PERIODS

TEXT BOOKS:

1. Rashid, M.H., “Power Electronics – Circuits, Devices and Applications”, PHI, New Delhi, 3rd Edition, 2004.
2. Bimbhra, P.S., “Power Electronics”, Khanna Publishers, 1998.

REFERENCES:

1. Mohan, Udeland and Robbins., “Power Electronics”, John Wiley and Sons, New York, 1995.
2. Subramanian, V., “Thyristor Control of Electrical Drives”, Tata McGraw -Hill, New Delhi, 1998.
3. Moorthi, V.R., “Power Electronics - Devices, Circuits and Industrial Applications”, Oxford University Press, 2005.
4. Bose, B.K., “Modern Power Electronics and AC Drives”, Pearson Education, 2002.
5. Sen, P.C., “Modern Power Electronics”, Wheeler Publishing, 1998.

EI9021 FIBRE OPTICS AND LASER INSTRUMENTATION L T P C
3 0 0 3

AIM:

To provide an exposure to various Fiber optic and Laser sensors.

OBJECTIVES:

- To provide an introduction to the characteristics, losses and fabrication of optical fibers. The use of optical fiber as a sensor for different applications is discussed in detail. An introduction about the characteristics, generation and the use of laser for various measurements are also discussed.

UNIT I OPTICAL FIBRES AND THEIR PROPERTIES 12

Principles of light propagation through a fibre - Different types of fibres and their properties - Transmission characteristics of optical fibre - Absorption losses - Scattering losses - Dispersion - Optical fibre measurement - Optical sources – LED, LD, PIN, APD - Optical detectors.

UNIT II INDUSTRIAL APPLICATION OF OPTICAL FIBRES 9

Fibre optic sensors - Fibre optic instrumentation system - Different types of modulators – Detectors - Application in instrumentation - Interferometric method of measurement of length - Moire fringes - Measurement of pressure, temperature, current, voltage, liquid level and strain – Fibre optic gyroscope – Polarization - Maintaining fibres.

UNIT III LASER FUNDAMENTALS 9

Fundamental characteristics of laser - Three level and four level lasers - Properties of lasers - Laser modes - Resonator configuration – Q - switching and mode locking - Cavity dumping - Types of laser - Gas laser, solid laser, liquid laser, semi conductor laser.

UNIT IV INDUSTRIAL APPLICATION OF LASER 6

Laser for measurement of distance, length, velocity, acceleration, current, voltage, and atmospheric effect - Material processing - Laser heating, welding, melting and trimming materials, removal and vaporization.

UNIT V HOLOGRAM AND MEDICAL APPLICATION 9

Holography - Basic principle, methods - Holographic interferometry and applications – Holography for non destructive testing - Holographic components - Medical application of lasers - Laser and tissue interaction - Laser instruments for surgery - Removal of tumors of vocal cords, brain surgery, plastic surgery, gyaenocology and oncology.

L: 45: TOTAL: 45 PERIODS

TEXT BOOKS:

1. Keiser, G., “Optical Fiber Communications”, 3rd Edition, McGraw-Hill, International Edition, 2000.
2. John and Harry, “Industrial Lasers and Their Applications”, McGraw-Hill, 2002.

REFERENCES:

1. Ready, J.F., “Industrial Applications of Lasers”, Academic press, 1978.
2. Ross, M., “Laser applications”, McGraw-Hill, 3rd Edition, 2001.
3. Singh, J., “Semi Conductor Optoelectronics”, McGraw-Hill, 1995.
4. Ghatak, A.K. and Thiagarajar, K., “Optical Electronics Foundation Book”, Tata McGraw-Hill, NewDelhi, 1995.

GE9023 FUNDAMENTALS OF NANOSCIENCE L T P C
3 0 0 3

AIM:

To make the students understand the importance ,relevance and potentialities of this emerging field of study.

OBJECTIVES:

- Study the basic nano technology and nano science.
- Understand interdisciplinary nature of this field.
- Understand the important role of physics, chemistry ,biology.
- Recognize that the rules of nano science are fundamentally different than those we experience.
- Study the basic fabrication strategies of nano science.

UNIT I INTRODUCTION 10

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II PREPARATION METHODS 10

Bottom-up Synthesis-Top-down Approach: Precipitation, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III PATTERNING AND LITHOGRAPHY FOR NANOSCALE DEVICES 5

Introduction to optical/UV electron beam and X-ray Lithography systems and processes, Wet etching, dry (Plasma /reactive ion) etching, Etch resists-dip pen lithography

UNIT IV PREPARATION ENVIRONMENTS 10

Clean rooms: specifications and design, air and water purity, requirements for particular processes, Vibration free environments: Services and facilities required. Working Practices, Sample cleaning, Chemical Purification, Chemical and Biological contamination, Safety Issues, Flammable and Toxic Hazards, Biohazards.

UNIT V CHARECTERISATION TECHNIQUES 10

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation

TOTAL: 45 PERIODS

TEXT BOOKS:

1. A.S. Edelstein and R.C. Cammearata, eds., “Nanomaterials: Synthesis, Properties and Applications”, Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, “Nanoscale charecterisation of surfaces & Interfaces”, 2nd Edition, Weinheim Cambridge, Wiley-VCH, 2000

REFERENCES:

1. G Timp (Editor), “Nanotechnology”, AIP press/Springer, 1999
2. Akhlesh Lakhtakia (Editor), “The Hand Book of Nano Technology,Nanometer Structure”, Theory, Modeling and Simulations, Prentice-Hall of India (P) Ltd, New Delhi, 2007.

CS9021 OPERATING SYSTEM L T P C
3 0 0 3

AIM:

To introduce the basic concepts of operating systems, process management, scheduling, process synchronization, deadlocks, memory management, storage management and about distributed systems.

OBJECTIVES:

- To study the basic concepts of operating systems, processes and CPU scheduling.
- To study about process synchronization and deadlocks.
- To study about memory management and storage management.
- To study about distributed system structures, distributed file systems and distributed coordination.

UNIT I BASICS OF OPERATING SYSTEMS, PROCESSES AND CPU SCHEDULING 9

Operating System Services – System Calls – Operating System Structure – Process Concept – Process Scheduling – Operations on Processes – Interprocess Communication – Multithreading Models – Java Threads – Threading Issues – Concept of CPU Scheduling – Scheduling Algorithms – Multiple Processor Scheduling – Thread Scheduling – Java Scheduling.

UNIT II PROCESS SYNCHRONIZATION AND DEADLOCKS 9

Process Synchronization:- Basics – The Critical-Section Problem – Peterson's Solution – Synchronization Hardware – Semaphores – Classic problems of Synchronization – Monitors, Deadlocks:- System Model – Deadlock Characterization – Methods for handling Deadlocks – Deadlock Prevention – Deadlock Avoidance – Deadlock Detection – Recovery from Deadlock.

UNIT III MEMORY MANAGEMENT 9

Main Memory Background – Swapping – Memory Partitioning – Paging –Paging Hardware with TLB – Page Table Structure – Multilevel Paging – Inverted Page Table – Segmentation – Address Translation in Segmentation System – Combining Paging and Segmentation – Address Translation in Segmentation / Paging System – Demand Paging – Page Replacement Algorithms – Allocation of Frames – Thrashing.

[

UNIT IV STORAGE MANAGEMENT 9

File-System Interface:- File Concepts – Access Methods – Directory Structure – File System Mounting – File Sharing – Protection, File-System Implementation:- File-System Structure – File-System Implementation – Directory Implementation – Allocation Methods – Free-Space Management, Mass-Storage Structure:- Disk Structure, Disk Attachment and Disk Scheduling – Disk Management:- Swap-Space Management – RAID Structure.

UNIT V DISTRIBUTED SYSTEMS 9

Distributed System Structures:- Types of Network-based Operating Systems – Network Structure – Network Topology – Communication Structure and Protocols – Robustness, Distributed File Systems:- Naming and Transparency – Remote File Access – Stateful Versus Stateless Service – File Replication, Distributed Coordination:- Event Ordering – Mutual Exclusion – Atomicity – Concurrency Control – Deadlock Handling – Election algorithms – Reaching Agreement.

L: 45 TOTAL: 45 PERIODS

TEXT BOOK:

1. Silberschatz, A., Galvin, P.B. and Gagne, G., "Operating System Concepts with Java", 7th Edition, Addison-Wesley, 2006.

REFERENCES:

1. Stallings, W., "Operating Systems: Internal and Design Principles", 5th Edition, Prentice-Hall of India, 2005.
2. Tanenbaum, A.S., "Modern Operating Systems", 2nd Edition, Prentice Hall of India, 2006.
3. Deitel, H.M., "Operating Systems", 2nd Edition, Pearson Education, 2005.

GE9021 PROFESSIONAL ETHICS IN ENGINEERING L T P C
3 0 0 3

AIM:

To sensitize the engineering students on blending both technical and ethical responsibilities.

OBJECTIVES:

- Identify the core values that shape the ethical behavior of an engineer.
- Utilize opportunities to explore one's own values in ethical issues.
- Become aware of ethical concerns and conflicts.
- Enhance familiarity with codes of conduct.
- Increase the ability to recognize and resolve ethical dilemmas.

UNIT I ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral Dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Professions and Professionalism – Professional Ideals and Virtues – Uses of Ethical Theories

UNIT II ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as Experimentation – Engineers as Responsible Experimenters – Research Ethics - Codes of Ethics – Industrial Standards - A Balanced Outlook on Law – The Challenger Case Study

UNIT III ENGINEER'S RESPONSIBILITY FOR SAFETY 9

Safety and Risk – Assessment of Safety and Risk – Risk analysis-Reducing Risk – The Government Regulator's Approach to Risk - Case Studies -Chernobyl and Bhopal

UNIT IV RESPONSIBILITIES AND RIGHTS 9

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination

UNIT V GLOBAL ISSUES 9

Multinational Corporations – Business Ethics - Environmental Ethics – Computer Ethics - Role in Technological Development – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership – Sample Code of Conduct

TOTAL: 45 PERIODS

TEXT BOOKS :

1. Mike Martin and Roland Schinzinger, “Ethics in Engineering”, McGraw Hill, New York (2005).
2. Charles E Harris, Michael S Pritchard and Michael J Rabins, “Engineering Ethics – Concepts and Cases”, Thompson Learning, (2000).

REFERENCES:

1. Charles D Fleddermann, “Engineering Ethics”, Prentice Hall, New Mexico, (1999).
2. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, (2003)
3. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, (2001)
4. Prof. (Col) P S Bajaj and Dr. Raj Agrawal, “Business Ethics – An Indian Perspective”, Biztantra, New Delhi, (2004)
5. David Ermann and Michele S Shauf, “Computers, Ethics and Society”, Oxford University Press, (2003)

EI9028 COMPUTER ARCHITECTURE L T P C
3 0 0 3

AIM:

To introduce the basic operation and architecture of computer.

OBJECTIVES:

- To study about various arithmetic units like Adder, Subtractor, Multiplier and Divider.
- To discuss about the issues involved in the design of control units.
- To learn the various organization of memory and I/O.

UNIT I BASIC STRUCTURE OF COMPUTERS 10

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.

UNIT II ARITHMETIC 8

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.

UNIT III BASIC PROCESSING UNIT 9

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.

UNIT IV MEMORY SYSTEM 9

Basic concepts – Semiconductor RAMs, ROMs – Speed, size and cost – cache memories - Performance consideration – Virtual memory - Memory management requirements – Secondary storage.

UNIT V I/O ORGANIZATION 9

Accessing I/O devices – Interrupts – Direct Memory Access – Buses – Interface Circuits – Standard I/O Interfaces (PCI, SCSI, USB).

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS:

1. Hamacher, C., Vranesic, Z. and Zaky, S., "Computer Organization" 5th Edition, McGraw Hill, 2002.
2. Stallings, W., "Computer Organization and Architecture – Designing for Performance", 6th Edition, Pearson Education, 2003 reprint.

REFERENCES:

1. Hayes, J.P., "Computer Architecture and Organization", 3rd Edition., McGraw-Hill, 2002.
2. Patterson, D.A.D. and Hennessy,J.L., "Computer Organization and Design, the Hardware / Software Interface", 2nd Edition., Morgan Kaufmann, 2002 Reprint.

EI9022 BIOMEDICAL INSTRUMENTATION L T P C
3 0 0 3

AIM:

To provide exposure to various physiological signal measurements and various assisting devices.

OBJECTIVE:

- The students will be exposed to electrical and non-electrical physiological measurements apart from assisting and therauptic devices.

UNIT I ANATOMY, PHYSIOLOGY AND TRANSDUCER 12

Review of human anatomy and physiology of heart, lungs, eye and nervous systems - Introduction to different types of bioelectric potentials - Action and resting potentials - Propagation of action potentials - Components of biomedical instrumentation system - Different type of electrodes, sensors used in biomedicine - Selection criteria for transducer and electrodes.

UNIT II ELECTRO- PHYSIOLOGICAL MEASUREMENT 6

ECG, EEG, EMG, ERG – Lead systems and recording methods - Typical waveforms.

UNIT III NON ELECTRICAL PARAMETER MEASUREMENT 9

Measurement of blood pressure - Ultra sound blood flow meter - Blood flow cardiac output - Heart rate, heart sound, measurement of gas volume, flow rate of CO_2 and O_2 in exhaust air, pH of blood.

UNIT IV MEDICAL IMAGING AND TELEMETRY 9

X-ray machine - Computer tomography - Magnetic resonance imaging system - Positron emission tomography and endoscopy - Introduction to telemetry systems - Different types of telemetry systems.

UNIT V ASSISTING AND THERAPUTIC DEVICES 9

Cardiac pacemakers – Defibrillators – Ventilators - Surgical diathermy - Heart lung machine - Laser in surgery and medicine.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS:

1. Khandpur, R.S., "Hand Book of Biomedical Instrumentation and Measurement", Tata McGraw- Hill, New Delhi, 2005.
2. Cromwell, L., Weibell, F.J. and Pfeiffer, E.A., "Biomedical Instrumentation and Measurements", Prentice Hall of India, 2nd Edition, 2007.

REFERENCES:

1. Geddes and Baker, "Principles of Applied Biomedical Instrumentation", John Wiley and Sons, 3rd Edition, 1989.
2. Webster, J.G., "Medical Instrumentation: Application and Design", John Wiley and Sons 3rd Edition, 1998.

EI9023 POWER PLANT INSTRUMENTATION L T P C
3 0 0 3

AIM:

To provide a detailed insight about the operation and control in thermal power plant.

OBJECTIVES:

- The students will be exposed to a detailed study about different measuring instruments and analyzers used in thermal power plants. The different control schemes for boilers and turbine are also discussed.

UNIT I OVERVIEW OF POWER GENERATION 9

Brief survey of methods of power generation-hydro, thermal, nuclear, solar and wind power – Importance of Instrumentation in power generation – Thermal power plants – Building blocks – Details of Boiler processes - P & I diagram of Boiler – Cogeneration.

UNIT II MEASUREMENTS IN POWER PLANTS 9

Electrical measurements:- Current, Voltage, Power, Frequency, Power-factor - Non-electrical parameters:- Flow of feed water, fuel, air and steam with correction factor for temperature – Steam pressure and steam temperature - Drum level measurement – Radiation detector – Smoke density measurement – Dust monitor.

UNIT III ANALYZERS IN POWER PLANTS 9

Fuel gas oxygen analyzer – Analysis of impurities in feed water and steam – Dissolved oxygen analyzer – Chromatography – pH meter - fuel analyzer – Pollution monitoring instruments.

UNIT IV CONTROL LOOPS IN BOILER 9

Combustion control – Air/fuel ratio control – Furnace draft control – Drum level control – Main steam and reheat steam temperature control – Super heater control – Attemperator – Deaerator control – Distributed control system in power plants - Interlocks in boiler operation.

UNIT V TURBINE-MONITORING AND CONTROL 9

Speed, Vibration, shell temperature monitoring and control - Steam pressure control – Lubricant oil temperature control – Cooling system.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS:

1. Dukelow, S.G., "The Control of Boilers", 2nd Edition, Instrument Society of America, 1991.
2. "Modern Power Station Practice", Vol-16, Instrumentation, Controls and Testing, Pergamon Press, Oxford, 1971.

REFERENCES:

1. Elonka, S.M. and Kohal, A.L., "Standard Boiler Operations", McGraw-Hill, New Delhi, 1994.
2. Jain, R.K. "Mechanical and Industrial Measurements", Khanna Publishers, New Delhi, 1999.

EI9024 INSTRUMENTATION IN PETRO CHEMICAL INDUSTRY LT P C
3 0 0 3

AIM:

The course is designed to equip the students to understand the operations of petrochemical industries.

OBJECTIVES:

- To introduce unit operations in petroleum industries.
- To introduce the process involved in purifying petroleum products.
- An exposure to the chemicals and useful products present in petroleum.
- To provides information about the measurement of various parameters.
- To help the students in identifying different loops and the techniques to control the loops in order to increase the final product in more economical manner.

UNIT I PETROLEUM PROCESSING 9

Petroleum exploration – Recovery techniques – Oil – Gas separation processing wet gases – Refining of crude oil.

UNIT II UNIT OPERATIONS IN PETROLEUM INDUSTRY 9

Thermal cracking – Catalytic cracking – Catalytic reforming – polymerisation – Alkylation – Isomerization – Production of ethylene, acetylene and propylene from petroleum.

UNIT III CHEMICALS FROM PETROLEUM PRODUCTS 9

Chemical from petroleum – Methane derivatives – Acetylene derivatives – Ethylene derivatives – Propylene derivatives – Other products.

UNIT IV MEASUREMENTS IN PETROCHEMICAL INDUSTRY 6

Parameters to be measured in refinery and petrochemical industry – Selection and maintenance of measuring instruments – Protection types for instruments.

UNIT V CONTROL LOOPS IN PETROCHEMICAL INDUSTRY 12

Process control in refinery and petrochemical industry – Control of distillation column – Control of catalytic crackers and pyrolysis unit – Automatic control of polyethylene production – Control of vinyl chloride and PVC production.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS:

1. Waddams, A.L., "Chemical from Petroleum", Butter and Janner Ltd.,1968.
2. Balchan.J.G., and Mumme K.I., "Process Control Structures and Applications", Van Nostrand Reinhold Company, New York, 1988.

REFERENCES:

1. Austin G.T and Shreeves, A.G.T., "Chemical Process Industries", McGraw–Hill International student, Singapore, 1985.
2. Liptak B.G., "Instrumentation in Process Industries", CRC Press, 2005.

EI9029 APPLIED SOFT COMPUTING L T P C
3 0 0 3

AIM:

To understand neural network and Fuzzy logic controllers.

OBJECTIVE:

- This course introduces the basics of neural network, fuzzy logic and its applications in control..

UNIT I INTRODUCTION AND DIFFERENT ARCITECTURES OF NEURAL NETWORKS 12

Artificial neuron – Model of neuron – Network architecture – Learning process – Single layer perceptron – Limitations – Multi layer perceptron – Back propagation algorithm – RBF – RNN – Reinforcement learning, Kohnen's self organising maps and adaptive resonance theory.

UNIT II NEURAL NETWORKS FOR CONTROL 9

Schemes of Neuro-control – Identification and control of dynamical systems – Parameterized Neuro - Controller and optimization aspects – Adaptive neuro controller – Case studies.

UNIT III INTRODUCTION TO FUZZY LOGIC 9

Fuzzy set theory – Fuzzy sets – Operation on Fuzzy sets – Fuzzy relations – Fuzzy membership functions – Fuzzy conditional statements – Fuzzy rules.

UNIT IV FUZZY LOGIC CONTROL SYSTEM 9

Fuzzy Logic controller – Fuzzification – Knowledge base – Decision making logic – Defuzzification – Design of Fuzzy logic controller – Adaptive fuzzy systems - Case study.

UNIT V HYBRID CONTROL SCHEMES 6

Fuzzy Neuron – Fuzzification and rule base Using ANN – Introduction to GA – Optimization of membership function and rule base using Genetic Algorithm - Fuzzy transfer functions in neural networks - Elements of evolutionary computation – Case study.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS:

1. Fausett, L., "Fundamentals of Neural Networks", Prentice Hall, Englewood Cliffs, N.J., 1994.
2. Ross, T.J., "Fuzzy Logic with Engineering Applications", John Wiley and Sons (Asia) Ltd., 2004.
3. Goldberg, "Genetic Algorithm in Search, Optimization, and Machine Learning",
4. Addison Wesley Publishing Company, Inc. 1989.
5. Bose and Liang , "Artificial Neural Networks", Tata McGraw-Hill, New Delhi, 1996.

REFERENCES:

1. Tsoukalas, L.H. and Uhrig, R.E., "Fuzzy and Neural Approach in Engineering", John Wiley and Sons, 1997.
1. Zurada, J.M., "Introduction to Artificial Neural Systems", Jaico Publishing House, Mumbai, 1997.
2. Millon, W.T., Sutton, R.S. and Webrose, P.J., "Neural Networks for Control", MIT Press, 1992.
3. Klir, G.J. and Yuan, B.B., "Fuzzy Sets and Fuzzy Logic", Prentice Hall of India, New Delhi, 1997.
4. Driankov, D., Hellendron, H. and Reinfrank M., "An Introduction to Fuzzy Control", Narosa Publishing House, New Delhi, 1996.
5. Zimmermann, H.J., "Fuzzy Set Theory and its Applications", Allied Publishers Ltd., 1996.
6. Haykin, S., "Neural Networks: A Comprehensive Foundation", 2nd Edition, Prentice Hall Inc., New Jersey, 1999.

EI9025 SYSTEM IDENTIFICATION AND ADAPTIVE CONTROL L T P C
3 0 0 3

AIM:

The aim of the course is to introduce various system identification and adaptive control techniques.

OBJECTIVES:

At the end of this course student will be exposed to:

- Non parametric approaches based system identification.
- Non recursive and recursive parametric identification approaches.
- Design of Adaptive Controllers

UNIT I NON PARAMETRIC METHODS 6

Nonparametric methods:- Transient analysis - frequency analysis - Correlation analysis - Spectral analysis.

UNIT II PARAMETRIC METHODS 10

Linear Regression:- The Least square estimate - Best linear unbiased estimation under linear constraints - Updating the Parameter estimates for linear regression models - Prediction error methods:- Description of Prediction error methods - Optimal Prediction – Relationships between prediction error methods and other identification methods - theoretical analysis.

Instrumental variable methods:- Description of Instrumental variable methods - Theoretical analysis - covariance matrix of IV estimates - Comparison of optimal IV and prediction error methods.

UNIT III RECURSIVE IDENTIFICATION METHODS 9

The recursive least squares method - Recursive Instrumental variable method-the recursive prediction error method-model validation and model structure determination.

Identification of systems operating in closed loop:- Identifiability considerations - Direct identification - Indirect identification - Joint input – Output identification.

UNIT IV ADAPTIVE CONTROL SCHEMES 10

Introduction – Users – Definitions - Auto tuning - Types of adaptive control -Gain scheduling controller - Model reference adaptive control schemes - Self tuning controller - MRAC and STC:- Approaches – The Gradient approach – Lyapunov functions – Passivity theory– pole placement method – Minimum variance control – Predictive control.

UNIT V ISSUES IN ADAPTIVE CONTROL AND APPLICATIONS 10

Stability – Convergence – Robustness – Application of adaptive control.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS:

1. Soderstorm, T. and Stoica, P., "System Identification", Prentice Hall nternational (UK) Ltd., 1989.
2. Astrom, K.J. and Wittenmark, B., "Adaptive Control", Pearson Education, 2nd Edition, 2001.

REFERENCES:

1. Ljung, L., "System Identification:Theory for the user", Prentice Hall, Englewood Cliffs, 1987.
2. Sastry, S. and Bodson, M., "Adaptive Control – Stability, Convergence and Robustness", Prentice Hall inc., New Jersey, 1989.

EE9050 INDUSTRIAL DRIVES AND CONTROL L T P C
3 0 0 3

AIM:

To give a sound knowledge in the field of electric drives.

OBJECTIVES:

- In this course students are exposed to concepts of different types of DC and C motor drives, their closed loop control and introduction to advanced Concepts such as dynamic and adaptive control of AC drives.

UNIT I INTRODUCTION TO DC AND AC MOTORS 9

Motor lead system – steady state stability criteria – Braking and speed reversal of DC and AC motors – transfer function model of separately excited and series DC motor – Equivalent circuit of Induction motor – Torque slip characteristic – Synchronous motor model.

UNIT II CONTROL OF DC DRIVES 10

Analysis of series and separately excited DC motor with single phase and three phase converters operating in different modes and configuration - Problems on DC machines fed by converter supplies CLC and TRC strategies. - Analysis of series and separately excited DC motors fed from different choppers, effect saturation series motors – CLC and TRC strategies – Closed loop control schemes.

UNIT III CONTROL OF AC DRIVES 10

Operation of Induction motor with non - sinusoidal supply wave forms, variable frequency operation of three phase Induction motors, constant flux operation, current fed operations. Dynamic and regenerative braking of CSI and VSI fed drives. Types of rotor choppers, torque equations, constant torque operations, TRC strategies, combined stator voltage control and rotor resistance control, principle of vector control – Direct and indirect FOC.

UNIT IV SPECIAL MACHINES 8

Modeling and control schemes for PMSM, PMBLDC, stepper motor and switched reluctance motor.

UNIT V CASE STUDY 8

Investigation on intelligent adaptive control strategies.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS:

1. Dubey, G.K., "Power Semiconductor Controlled Drives", Prentice hall International, New Jersey, 1989.
2. Krishnan.R., "Electrical Motor Drives-Modeling, Analysis and Control", Prentice Hall International, 1989.

REFERENCES:

1. Bose.B.K. "Modern Power Electronics and AC Drives", Pearson Education, 2002.
2. Sheperd W., Hully L.N., "Power Electronics and Motor Control",Cambridge University press, Cambridge, 1987.
3. Dewan S.B., Slemon G.R., and Straughen A., "Power Semiconductor Drives", John Wiley and sons, New York, 1984.
4. Buxbaum A., Schierau K. and Staughen, "A Design of control system for DC drives", Springer – Verlag, Berlin, 1990.
5. Subharamanyam V., "Electric Drives – Concepts and Applications",Tata McGraw-Hill Publishing Co. Ltd, New Delhi 1994.

EC9052 MICRO CONTROLLER BASED SYSTEM DESIGN L T P C
3 0 0 3

AIM:

Emphasis on advanced Microcontrollers such as PIC and ARM.

OBJECTIVES:

- To learn the architecture and programming of popular microcontrollers such as PIC and ARM.

UNIT I PIC INTRODUCTION 9

Introduction to PIC Microcontroller - PIC 16C6x and PIC 16C7x Architectures - PIC 16Cxx Instruction Set – Simple Operations.

UNIT II INTERRUPTS AND TIMER 9

PIC microcontroller Interrupts – Timers – I/O Port Expansion – Front Panel I/O.

UNIT III PERIPHERALS AND INTERFACING 9

I^2C Bus Peripheral Chip Access – Analog to Digital Converter – UART.

UNIT IV ARM INTRODUCTION 9

ARM Architecture – ARM Development tools - ARM Assembly Language Programming – Simple Examples.

UNIT V ARM ORGANIZATION 9

3-Stage Pipeline ARM Organization – 5-Stage Pipeline ARM Organization – ARM Implementation – ARM Instruction Set.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Peatman, J.B., "Design with PIC Micro Controllers" Pearson Education , 3rd Edition, 2007
2. Furber, S., "ARM System on Chip Architecture" Addison Wesley trade Computer Publication, 2000.

REFERENCE:

1. Mazidi, M.A., "PIC Microcontroller" Rolin Mckinlay, Danny causey Prentice Hall of India, 2007.

EI9032 ADVANCED DIGITAL SIGNAL PROCESSING L T P C
3 0 0 3

AIM:

To introduce the concept of Multi-rate signal processing and Random Signal Processing.

OBJECTIVES:

- It gives the idea of Random signals behavior, manipulation and their processing.

UNIT I DISCRETE RANDOM SIGNAL PROCESSING 9

Discrete Random Processes, Expectations, Variance, Covariance, Scalar Product, Energy of Discrete Signals - Parseval's Theorem, Wiener Khintchine Relation - Power Spectral Density - Periodogram – Sample Autocorrelation - Sum Decomposition Theorem, Spectral Factorization Theorem - Discrete Random Signal Processing by Linear Systems - Simulation of White Noise - Low Pass Filtering of White Noise.

UNIT II SPECTRUM ESTIMATION 9

Non-Parametric Methods - Correlation Method - Co-Variance Estimator- Performance Analysis of Estimators - Unbiased, Consistent Estimators-Periodogram Estimator - Barlett Spectrum Estimation - Welch Estimation- Model based Approach - AR, MA, ARMA Signal Modeling - Parameter Estimation using Yule - Walker Method.

UNIT III LINEAR ESTIMATION AND PREDICTION 9

Maximum likelihood criterion - Efficiency of estimator - Least mean squared error criterion - Wiener filter - Discrete Wiener Hoff equations-Recursive estimators – Kalman filter - Linear prediction, prediction error whitening filter, inverse filter- Levinson recursion, Lattice realization, and Levinson recursion algorithm for solving Toeplitz system of equations.

UNIT IV ADPATIVE FILTERS 9

FIR adaptive filters - Newton's steepest descent method - Adaptive filter based on steepest descent method - Widrow Hoff LMS adaptive algorithm - Adaptive channel equalization - Adaptive echo chancellor - Adaptive noise cancellation - RLS adaptive filters - Exponentially weighted RLS - sliding window RLS - Simplified IIR LMS adaptive filter.

UNIT V MULTIRATE DIGITAL SIGNAL PROCESSING 9

Mathematical description of change of sampling rate - Interpolation and Decimation - continuous time model - Direct digital domain approach - Decimation by an integer factor - Interpolation by an integer factor – Single and multistage realization - Poly phase realization - Application to sub band coding - Wavelet transform and filter bank implementation of wavelet expansion of signals.

L: 45 TOTAL: 45 PERIODS

TEXT BOOK:

1. Hayes, M.H., "Statistical Digital Signal Processing and Modeling", John Wiley and Sons, Inc., New York, 1996.

REFERENCES:

1. Orfanidis, S.J., "Optimum Signal Processing", McGraw-Hill, 1990.
2. Proakis, J.G., and Manolakis, D.G., "Digital Signal Processing" Prentice Hall of India, 1995.

EI9033 DIGITAL IMAGE PROCESSING L T P C
3 0 0 3

AIM:

It provides an introduction to image processing and focuses on the computation aspect of the subject

OBJECTIVES:

- Introduce the student to analytical tools and methods which are currently used in digital image processing as applied to image information for human viewing.

UNIT I DIGITAL IMAGE FUNDAMENTALS 9

Elements of Digital Image Processing systems – Digital image representation - Elements of visual perception- Image sampling and quantization - Imaging geometry - Discrete Image transforms - Properties.

UNIT II PREPROCESSING AND ENHANCEMENT 9

Point Processing methods – Contrast stretching - Gray level slicing- Histogram modification techniques-Spatial filtering - Enhancement in the frequency domain.

UNIT III RESTORATION AND SEGMENTATION 9

Image restoration – Degradation model – Unconstrained and Constrained restoration- Inverse filtering – Wiener filter - Restoration in spatial domain- Segmentation - Detection of discontinuities - Edge linking - Boundary detection - Thresholding - Region oriented segmentation.

UNIT IV REGISTRATION AND COMPRESSION 9

Image registration - Translational misregistration detection - Statistical correlation function, two state methods Image fusion. Fundamentals of Image Compression - Lossy versus Lossless coding techniques, pixel coding, predictive techniques, transform coding, algorithm and case studies.

UNIT V APPLICATIONS OF DIGITAL IMAGE PROCESSING 9

Applications in medicine, manufacturing, measurement - Case studies.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Pratt, W.K., "Digital Image Processing", 2nd Edition John Wiley Pub.1991.
2. Jain A.K., "Fundamentals of Digital Image Processing", Prentice Hall Englewood, 1989.

REFERENCES:

1. Rosenfield, A., and Kak, A.C., "Digital Picture Processing", 2nd Edition, Academic Press New York 1982.
2. Gonzalez R.C., & Woods R.E., "Digital Image processing", Addison Wesley, 1998.
3. Rao, K.R., and Hwang, J.J., "Techniques and Standards for Image Video and Audio Coding", Prentice Hall, N.J., 1996.

EI9026 MICRO ELECTRO MECHANICAL SYSTEMS (MEMS) L T P C
3 0 0 3

AIM:

Introduction to microelectromechanical devices, with an emphasis on their manufacturing and mechanical behavior. Materials properties, microfabrication technology, mechanical behavior of microstructures, design, and packaging. Case studies on sensors, wireless communications, fluidic systems, microengines, and biological devices.

OBJECTIVES:

- This course is an introduction to MEMS. The course covers materials properties, fabrication techniques, basic structure mechanics, sensing and actuation principles, circuit and system issues, packaging, calibration and testing. Interdisciplinary applications will be explored.

UNIT I INTRODUCTION TO MEMS 9

MEMS and Microsystems:- Miniaturization and Typical products - Micro Sensors, Micro actuation - MEMS with micro actuators - Microaccelorometers and Micro fluidics - MEMS materials - Microfabrication.

UNIT II MECHANICS FOR MEMS DESIGN 9

Elasticity, stress, strain and material properties, Bending of thin plates, Spring configurations, torsional deflection, Mechanical vibration, Resonance - Thermo mechanics – Actuators, force and response time, Fracture and thin film mechanics, material, Physical Vapor Deposition (PVD), Chemical Mechanical Polishing (CMP).

UNIT III ELECTROSTATIC DESIGN 9

Electrostatics:- basic theory, electro static instability, Surface tension, gap and finger pull up - Electro static actuators - Comb generators - Gap closers - Rotary motors - Inch worms - Electromagnetic actuators - Bistable actuators.

UNIT IV CIRCUIT MODELING OF MEMS 9

Circuit modeling of MEMS:- Resonator equivalent circuit, Thermal Circuits and Fluidic Circuits – Signal Conditioning Circuits:- Op-Amp models and Circuits, transistor level-design – Electronic and Mechanical Noise:- Electronic noise sources, Brownian motion noise, circuit noise calculation procedure, SNR and dynamic range.

UNIT V CASE STUDIES 9

Microbridge gas sensors – Piezoelectric rate gyroscope – Capacitive Accelerometer – Piezoresistive Pressure Sensor – Thermal Sensors:- Radiation Sensors, Mechanical Sensors and Bio-Chemical Sensors.

TOTAL: 45 PERIODS

TEXT BOOK:

1. Santeria, S., "Microsystems Design", Kluwer publishers, 2000.

REFERENCES:

1. Maluf, N., "An Introduction to Micro Electro Mechanical System Design", Artech House, 2000.
2. Gad-el-Hak, M., "The MEMS Handbook", CRC press Baco Raton, 2000.
3. Hsu, T.R., "MEMS and Micro systems Design and Manufacture" Tata McGraw-Hill, New Delhi, 2002.
4. Gardner, J.W., Vijay k. varadan, V.K. and Osama O.Awadelkarim, "Micro Sensors MEMS and Smart Devices", John Wiley and son LTD, 2002
5. Allen, J.J., "Micro Electro Mechanical System Design", CRC Press published in 2005.

EI9030 COMPUTER NETWORKS L T PC
3 0 0 3

AIM:

To introduce the concepts, terminologies and technologies used in modern days data communication and computer networking.

OBJECTIVES:

- To understand the concepts of data communications.
- To study the functions of different layers.
- To introduce IEEE standards employed in computer networking.
- To make the students to get familiarized with different protocols and network components.

UNIT I PHYSICAL LAYER 9

Computer Networks:- Introduction, Network hardware, Network software, Reference models, Example of networks and Network standardization.

The Physical layer:- The theoretical basis for data communication – Guided Transmission media - Wireless transmission – PSTN - Mobile telephone – Satellite Communication.

UNIT II DATA LINK LAYER 9

The Data Link Layer:- Data link layer design issues - Error detection and correction - Elementary data link protocols - Sliding window protocols - Example of data link protocols - ETHERNET – 802.11, 802.16, Bluetooth- Data link layer Switching.

UNIT III NETWORK LAYER 9

The Network Layer:- Network layer design issues - Routing algorithms - Congestion control algorithms – Internetworking - Network layer in Internet.

UNIT IV TRANSPORT LAYER 9

The Transport Layer:- Transport layer design issues - Transport layer protocols - Simple transport protocol - Internet transport protocols – UDP and TCP/IP.

UNIT V APPLICATION LAYER 9

The Application Layer:- Domain Name System - Electronic Mail - World Wide Web – Multimedia – Cryptography - Digital signature - Communication Security.

TOTAL: 45 PERIODS

TEXT BOOK:

1. Tanenbaum, A.S., "Computer Networks", Prentice Hall of India, 4th Edition, 2002.

REFERENCES:

1. Stallings, W., "Data and Computer Communications", Prentice Hall of India, 2001.
2. Comer, D.E., "Internetworking with TCP/IP Volume-I", Prentice Hall of India, 1997.

EI9031 INDUSTRIAL DATA NETWORKS L T P C
3 0 0 3

AIM:

To introduce the concepts, terminologies and technologies associated with industrial Data Networks.

OBJECTIVES:

- To make the students to get familiarized with different Buses such as Profibus, Modbus, Fieldbus, AS-I interface and Devicenet.

UNIT I RS – 232 AND RS – 485 9

ISO-OSI model – EIA 232 interface standard – EIA 485 interface standard – EIA 422 interface standard - 20mA current loop – Serial interface converters.

UNIT II MODBUS, DATA HIGHWAY (PLUS) AND HART PROTOCOLS 9

MODBUS protocol structure – Function codes – Troubleshooting – Data highway (plus) protocol – Review of HART Protocol.

UNIT III AS – INTERFACE (AS-i) AND DEVICENET 9

AS interface:- Introduction, Physical layer, Data link layer and Operating characteristics. Devicenet:- Introduction, Physical layer, Data link layer and Application layer.

UNIT IV PROFIBUS PA/DP/FMS AND FF 9

Profibus:- Introduction, Profibus protocol stack, Profibus communication model, Communication objects, System operation and Troubleshooting – Foundation fieldbus versus Profibus.

UNIT V INDUSTRIAL ETHERNET AND WIRELESS COMMUNICATION 9

Industrial Ethernet:- Introduction, 10Mbps Ethernet and 100Mbps Ethernet - Radio and wireless communication:- Introduction, Components of radio link, the radio spectrum and frequency allocation and Radio modems – Comparison between various industrial networks.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Mackay, S., Wrijut, E., Reynders, D. and Park, J., "Practical Industrial Data Networks Design, Installation and Troubleshooting", Newnes Publication, Elsevier, 1st Edition, 2004.
2. Buchanan, W., "Computer Busses", CRC Press, 2000.

REFERENCES:

1. Tanenbaum, A.S., "Modern Operating Systems", Prentice Hall of India Pvt. Ltd., 2003.
2. Rappaport,T.S., "Wireless Communication: Principles and Practice" 2nd Edition, Prentice Hall of India, 2001.
3. Stallings, W., "Wireless Communiction and Networks", 2nd Edition, Prentice Hall of India, 2005.

GE9022 TOTAL QUALITY MANAGEMENT L T P C
3 0 0 3

AIM:

To provide comprehensive knowledge about the principles, practices, tools and techniques of Total quality management.

OBJECTIVES:

- To understand the various principles, practices of TQM to achieve quality.
- To learn the various statistical approaches for Quality control.
- To understand the TQM tools for continuous process improvement.
- To learn the importance of ISO and Quality systems.

UNIT I INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of manufacturing and service quality - Basic concepts of TQM - Definition of TQM – TQM Framework - Contributions of Deming, Juran and Crosby – Barriers to TQM.

UNIT II TQM PRINCIPLES 9

Leadership – Strategic quality planning, Quality statements - Customer focus Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement – PDSA cycle, 5s, Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS & TECHNIQUES I 9

The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, Bench marking process – FMEA – Stages, Types.

UNIT IV TQM TOOLS & TECHNIQUES II 9

Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Cost of Quality – Performance measures.

UNIT V QUALITY SYSTEMS 9

Need for ISO 9000- ISO 9000-2000 Quality System – Elements, Documentation, Quality auditing- QS 9000 – ISO 14000 – Concepts, Requirements and Benefits – Case studies of TQM implementation in manufacturing and service sectors including IT.

TOTAL: 45 PERIODS

TEXT BOOK:

1. Dale H.Besterfiled, et at., "Total Quality Management", Pearson Education Asia, Third Edition, Indian Reprint (2006).

REFERENCES:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 6th Edition, South-Western (Thomson Learning), 2005.
2. Oakland, J.S. "TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, 3rd Edition, 2003.
3. Suganthi,L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd.,2006.
4. Janakiraman,B and Gopal, R.K, "Total Quality Management – Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.

GE9074	ENGINEERING ECONOMICS AND FINANCIAL ACCOUNTING	L T P C 3 0 0 3

UNIT I MANAGERIAL ECONOMICS 9

Relationship with other disciplines – Firm: types & Objectives – Managerial decisions. Analysis methods.

UNIT II DEMAND & SUPPLY ANALYSIS 9

Demand –Types of demand – Determinants of demand – demand function – demand elasticity – demand forecasting – supply – Determination of supply – supply function – supply elasticity.

UNIT III PRODUCTION AND COST ANALYSIS 9

Production function – returns to scale – production optimisation – least cost input – Isoquants – Managerial uses of production function. Cost concepts – cost function – Determinants of cost – Short run and long run cost curves – Cost output decisions – Estimation of cost.

UNIT IV PRICING 9

Determinants of price – Pricing under different objectives – Pricing under different market structures – price discrimination – pricing methods in practice.

UNIT V FINANCIAL ACCOUNTING (ELEMENTARY TREATMENT) 9

Balance sheet and related concepts – Profit & Loss statement and related concepts – Financial Ratio Analysis – Cash flow analysis – Fund flow Analysis – Analysis and interpretation of financial statements – Comparative financial statements.

CAPITAL BUDGETING (ELEMENTARY TREATMENT)

Investments – Risks and return evaluation of investment – Net present value – Internal rate of return.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Paul, A.S and Nordhaus W.D., "Economics", Tata Mcgraw Hill Publishing Company Limited, New Delhi 2004.
2. Dominick, S., "Managerial Economics in a global economy", Thomson South Western, 4th edition, 2001.

REFERENCES:

1. Shah, P., "Basic Financial Accounting for Management" Oxford university Press, New Delhi, 2007.
2. Horne J.C.V. and Wachowicz Jr., J.M., "Fundamentals of financial Management", Prentice Hall of India, New Delhi, 11th Edition, 2004.
3. Mote, V.L, Paul, S. and Gupta, G.S., "Managerial Economics Concepts & Cases", Tata Mcgraw-Hill Publishing Company Limited, 38th Reprint, 2005.

EI9027 RELIABILITY AND SAFETY ENGINEERING L T P C
3 0 0 3

AIM:

To introduce the student to the basic concepts of reliability and safety engineering.

OBJECTIVES:

- To learn the concepts of Reliability, Failure modes, Maintainability and safety aspects.

UNIT I RELIABILITY 9

Reliability:- Definition and basic concepts, block diagrams, failure data, failure modes, reliability in terms of hazard rates and failure density function. Hazard models and 'bath-tub' curve. Applicability of Weibull distribution. Reliability calculation for series, parallel series and K-out of M systems.

UNIT II CONCEPTS OF REDUNDANCY AND MAINTENENCE 9

Use of redundancy and system reliability improvement methods - Maintenance:- Objectives, types of maintenance, preventive, condition-based and reliability centered maintenance - Terotechnology, Total Productive Maintenance (TPM).

UNIT III MAINTAINABILITY 9

Maintainability:- Definition, basic concepts, relationship between reliability, maintainability and availability, corrective maintenance time distributions and maintainability demonstration - Design considerations for maintainability – Availability and reliability relationship.

UNIT IV RELIABILITY TESTS 9

Introduction to life-testing, destructive and non-destructive tests, estimation of parameters for exponential and Weibull distributions, component reliability and MIL standards.

UNIT V SAFETY 9

Safety: Causes of failure and unreliability, measurement and prediction of human reliability, human reliability and operator training - Reliability and safety**:** Safety margins in critical devices - Origins of consumerism and importance of product knowledge, product safety, product liability and product safety improvement program.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Govil, A.K., "Reliability Engineering", Tata McGraw -Hill, New Delhi,1983.
2. Sinha and Kale, "Introduction to Life-Testing", Wiley Eastern, New Delhi, 1992.

REFERENCES:

1. Wisley, "Human Engineering - Guide for Equipment Designers",University of California Press, California, 1973.