ANNA UNIVERSITY CHENNAI :: CHENNAI 600 025

UNIVERSITY DEPARTMENTS

CURRICULUM – R 2009

B.E. (PART TIME) ELECTRONICS AND INSTRUMENTATION ENGINEERING

SEMESTER I

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTMA9111	Applied Mathematics	3	0	0	3
2.	PTPH9111	Applied Physics	3	0	0	3
3.	PTCY9111	Applied Chemistry	3	0	0	3
4.	PTGE9112	Fundamentals of Computing	3	0	0	3
5.	PTEE9261	Electrical and Electronic Measurements	3	0	0	3
		TOTAL	**15**	**0**	**0**	**15**

SEMESTER II

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTMA9212	Transforms and Partial Differential Equations	3	0	0	3
2.	PTEI 9203	Electron Devices and Circuits	3	0	0	3
3.	PTEI 9201	Digital Logic Theory	3	0	0	3
4.	PTEE 9216	Electrical Machines	3	0	0	3
5.	PTGE 9261	Environmental Science and Engineering	3	0	0	3
		TOTAL	**15**	**0**	**0**	**15**

SEMESTER III

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTEI 9251	Transducer Engineering	3	0	0	3
2.	PTEI 9253	Linear Integrated Circuits	3	0	0	3
3.	PTEC 9262	Communication Engineering	3	0	0	3
4.	PTCS 9161	Object Oriented Programming	3	0	0	3
PRACTICAL						
5.	PTEI 9252	Transducers and Measurements Laboratory	0	0	3	2
		TOTAL	**12**	**0**	**3**	**14**

SEMESTER IV

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTEI 9301	Industrial Instrumentation-I	3	0	0	3
2.	PTEI 9302	Control Engineering	3	0	0	3
3.	PTEC 9313	Microprocessors & Microcontrollers	3	0	0	3
4.	PTCS 9311	Data Structures & Algorithm	3	0	0	3
PRACTICAL						
5.	PTEC 9312	Microprocessors & Microcontrollers Laboratory	0	0	3	2
		TOTAL	**12**	**0**	**3**	**14**

SEMESTER V

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1**.**	PTEI 9351	Industrial Instrumentation-II	3	0	0	3
2.	PTEI 9352	Process Control	3	0	0	3
3.	PTEI 9362	Digital Signal Processing	3	0	0	3
4.		Elective – I	3	0	0	3
PRACTICAL						
5.	PTEI 9354	Industrial Instrumentation Laboratory	0	0	3	2
		TOTAL	**12**	**0**	**3**	**14**

SEMESTER VI

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTEI 9401	Logic and Distributed Control System	3	0	0	3
2.	PTEI 9402	Advanced Process Control	3	0	0	3
3.	PTEI 9303	Virtual Instrumentation	3	1	0	4
4.	PTEI 9403	Analytical Instrumentation	3	0	0	3
5.		Elective-II	3	0	0	3
PRACTICAL						
6.	PTEI 9353	Process Control Laboratory	0	0	3	2
		TOTAL	**15**	**1**	**3**	**18**

SEMESTER VII

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTEC 9361	VLSI Design	3	0	0	3
2.		Elective-III	3	0	0	3
3.		Elective-IV	3	0	0	3
4.		Elective-V	3	0	0	3
PRACTICAL						
5.	PTEI9451	Project Work	0	0	12	6
		TOTAL	**12**	**0**	**12**	**18**

TOTAL CREDITS TO BE EARNED FOR THE AWARD THE DEGREE = 104

ELECTIVES FOR B.E. ELECTRONICS AND INSTRUMENTATION ENGINEERING

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
Elective I						
1.	PTEI 9021	Fibre Optics and Laser Instrumentation	3	0	0	3
2.	PTEI 9022	Biomedical Instrumentation	3	0	0	3
3.	PTEE 9021	Power Electronic Devices and Circuits	3	0	0	3
Elective II						
4.	PTEC 9052	Microcontroller Based System Design	3	0	0	3
5.	PTEC 9411	Real Time Embedded System	3	0	0	3
6.	PTEI 9030	Computer Networks	3	0	0	3
Elective III						
7.	PTEI 9023	Power Plant Instrumentation	3	0	0	3
8.	PTEI 9027	Reliability & Safety Engineering	3	0	0	3
9.	PTEI 9026	Micro Electromechanical Systems (MEMS)	3	0	0	3
Elective IV						
10	PTEI 9029	Applied Soft Computing	3	0	0	3
11	PTEI 9024	Instrumentation in Petrochemical Industry	3	0	0	3
12	PTGE 9071	Robotics and Automation	3	0	0	3
Elective V						
13	PTEI 9031	Industrial Data Networks	3	0	0	3
14	PTGE 9022	Total Quality Management	3	0	0	3
15	PTEI 9028	Computer Architecture	3	0	0	3

PTMA9111 **APPLIED MATHEMATICS**

(Common to all branches of BE / B.Tech (PT) Programmes)

L T P C
3 1 0 4

UNIT I MATRICES **9**

Characteristic equation – Eigenvalues and Eigenvectors of a real matrix – Properties of eigenvalues and eigenvectors – Cayley – Hamilton Theorem – Diagonalization of matrices - Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms .

UNIT II FUNCTIONS OF SEVERAL VARIABLES **9**

Partial derivatives – Homogeneous functions and Euler's theorem – Total derivative – Differentiation of implicit functions – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables - Maxima and minima of functions of two variables.

UNIT III ANALYTIC FUNCTION **9**

Analytic functions – Necessary and sufficient conditions for analyticity – Properties – Harmonic conjugates – Construction of analytic function – Conformal Mapping – Mapping by functions w = a + z , az, 1/z, **-** Bilinear transformation.

UNIT IV COMPLEX INTEGRATION **9**

Line Integral – Cauchy's theorem and integral formula – Taylor's and Laurent's Series – Singularities – Residues – Residue theorem – Application of Residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour with no pole on real axis.

UNIT V LAPLACE TRANSFORMS **9**

Existence conditions – Transforms of elementary functions – Basic properties – Transforms of derivatives and integrals – Initial and Final value theorems – Inverse transforms – Convolution theorem – Transform of periodic functions – Application to solution of linear ordinary differential equations with constant coefficients.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Grewal B.S., Higher Engineering Mathematics (40th Edition), Khanna Publishers, Delhi (2007).
2. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill Co. Ltd., New Delhi (2007).

REFERENCES:

1. Glyn James, Advanced Modern Engineering Mathematics, Pearson Education (2007).
2. Veerarajan, T., Engineering Mathematics (For First Year), Tata McGraw-Hill Pub. Pvt Ltd., New Delhi (2006).

PTPH9111 APPLIED PHYSICS L T P C
3 0 0 3

UNIT I ULTRASONICS 9

Introduction – Production – magnetostriction effect - magnetostriction generator-piezoelectric effect - piezoelectric generator- Detection of ultrasonic waves properties – Cavitations - Velocity measurement – acoustic grating - Industrial applications – drilling, welding, soldering and cleaning – SONAR - Non Destructive Testing – pulse echo system through transmission and reflection modes - A, B and C –scan displays, Medical applications - Sonograms

UNIT II LASERS 9

Introduction – Principle of Spontaneous emission and stimulated emission. Population inversion, pumping. Einstein's A and B coefficients - derivation. Types of lasers – He-Ne, CO_2, Nd-YAG, Semiconductor lasers - homojunction and heterojunction (Qualitative)- Industrial Applications - Lasers in welding, heat treatment and cutting – Medical applications - Holography (construction and reconstruction).

UNIT III FIBER OPTICS & APPLICATIONS 9

Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle - Types of optical fibres (material, refractive index, mode) – Double crucible technique of fibre drawing - Splicing, Loss in optical fibre – attenuation, dispersion, bending - Fibre optical communication system (Block diagram) - Light sources - Detectors - Fibre optic sensors – temperature and displacement - Endoscope.

UNIT IV QUANTUM PHYSICS 9

Black body radiation – Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh – Jeans' Law from Planck's theory – Compton effect - Theory and experimental verification – Matter waves – Schrödinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one-dimensional box - Electron microscope - Scanning electron microscope - Transmission electron microscope.

UNIT V CRYSTAL PHYSICS 9

Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – 'd' spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – NaCl, ZnS, diamond and graphite structures – Polymorphism and allotropy - Crystal defects – point, line and surface defects- Burger vector.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Palanisamy, P.K., 'Engineering Physics' Scitech publications, Chennai, (2008).
2. Arumugam M. 'Engineering Physics', Anuradha Publications, Kumbakonam, (2007)
3. Sankar B.N and Pillai S.O. 'A text book of Engineering Physics', New Age International Publishers, New Delhi, 2007.

REFERENCES:

1. R. K. Gaur and S.C. Gupta, 'Engineering Physics' Dhanpat Rai Publications, New Delhi (2003)
2. M.N. Avadhanulu and PG Kshirsagar, 'A Text book of Engineering Physics', S.Chand and company, Ltd., New Delhi, 2005.
3. Serway and Jewett, 'Physics for Scientists and Engineers with Modern Physics', 6th Edition, Thomson Brooks/Cole, Indian reprint (2007)

PTCY9111 APPLIED CHEMISTRY L T P C
3 0 0 3

UNIT I WATER TREATMENT AND POLLUTION CONTROL 9

Treatment of water –impurities and disadvantages of hard water-Domestic and Industrial treatment - zeolite and ion exchange processes-Portable water-Boiler feed water – conditioning of boiler feed water. Scale and sludge formation –prevention –caustic embrittlement-boiler corrosion–priming and foaming Sewage treatment–Primary, secondary and tertiary treatment–significance of DO, BOD and COD-desalination – reverse osmosis. Control of water,air and land pollution.

UNIT II FUELS 9

Classification of fuels-Proximate and ultimate analysis of coal- coke manufacture-Otto Hoffman by product method-cracking-thermal and catalytic (fixed bed and fluidized bed)-petroleum-refining-factions-composition and uses synthetic petrol-fischer drops methods- Bergius process- knocking-octane number and cetane number-Preparation, composition and uses of producer gas , water gas and natural gas. Flue gas analysis-Orsat apparatus- gross and net calorific values- calculation of minimum requirement of air(simple calculations)- Explosive range –spontaneous ignition temperature

UNIT III THERMODYNAMICS AND SURFACE CHEMISTRY 9

Second law of thermodynamics-entropy and its significance- criteria for spontaneity- free energy-Gibbs, Helmholts and Gibbs-Helmholts equation-applications and problems – Adsorption –types of adsorption- adsorption of gases on solids- adsorption isotherm-Freundlich and Langmuir isotherms-adsorption of solutes from solutions- applications

UNIT IV ELECTROCHEMISTRY - CORROSION AND CATALYSIS 9

Reversible and irreversible cells-electrode potentials-types of electrodes-cell reactions-Nernst equations- electrochemical and galvanic series-fuel cells and solar cells-corrosion-chemical and electrochemical-factors affecting corrosion-sacrifical anode-impressed current cathodic protection-surface treatment and protective coating-Catalysis –classification-characteristics of catalysis – auto catalysis- enzyme catalysis

UNIT V POLYMERS-COMPOSITES AND NANOCHEMISTY 9

Polymers-definition-classification-thermoplastics and thermosetting plastics differences Preparation, properties and uses of polystyrene, bakelite, PET, polyurethane, Teflon, ureafromaldehyde, polycarbonates-Elastomers-Preparation, properties of Buna-S, nitrile, neoperene and butyl rubber, silicon rubber. Composites-FRP. Nanochemistry-introduction to nanochemistry- preparation and properties of nonmaterial-nano rods, nano wires-nanotubes-carbon nanotubes and their applications.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Dhara S S A text book of Engineering Chemistry, S.Chand & Co Ltd, New Delhi,2002
2. Jain. P.C and Monica Jain, Engineering Chemistry, Dhanpet Rai & Sons, New Delhi 2001

REFERENCES:

1. Puri B R.,Sharma L R and Madhan S. Pathania, Principles of Physical Chemistry, Shoban Lal Nagin Chand & Co. Jalandar-2000.
2. G.B. Sergeev, Nanochemistry. Elsevier Science, New York,2006
3. V.R.Gowarikar, N.V.Viswanathan and Jayadev Sreedhar, Polymer Science, Wiley Eastern Limited, Madras (2006).

PTGE9112	FUNDAMENTALS OF COMPUTING	L T P C
	(Common to all branches of BE / B.Tech)	3 0 0 3

UNIT I **9**

Computer systems – Exploring computers – Inside the system – processing data – CPUs – Types of storage devices - Operating systems basics – networking basics.

UNIT II **9**

The internet and the WWW – Internet services – connecting to the internet - Working with applications software – productivity software – graphics and multimedia – Data base Management systems – Creating computer program.

UNIT III **9**

C programming fundamentals – compilation process – variables – Data types – Expressions – looping – decisions.

UNIT IV **9**

Arrays - Working with functions – structures – character strings – pre processor.

UNIT V **9**

Pointers – Dynamic memory allocation – linked list - Applications

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Norton, P., “Introduction to Computers”, 6th Edition, Tata McGraw-Hill, 2007.
2. Kochan, S.G., “Programming in C”, 3rd Edition, Pearson Education, 2007.

REFERENCES:

1. Kernighan, B.W. and Ritchie, D.M., “The C Programming language”, 2nd Edition, Pearson Education, 2006.
2. Kamthane, A.N., “Computer programming”, Pearson Education, 2007.
3. Reek, K.A., “Pointers on C”, Pearson Education, 2007.
4. Dromey, R.G., “How to solve it by Computer”, Pearson Education, 2007.

PTEE9261 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.

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.

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.

PTMA9212 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS

L T P C
3 0 0 3

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

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

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

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

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

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.

TOTAL: 45 PERIODS

TEXT BOOKS:

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.

PTEI9203 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.

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.

PTEI9201 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.

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.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Mano, M.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.

PTEE9216 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.

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.

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.

PTGE9261 ENVIRONMENTAL SCIENCE AND ENGINEERING L T P C
3 0 0 3

AIM

The aim of this course is to create awareness in every engineering graduate about the importance of environment, the effect of technology on the environment and ecological balance and make him/her sensitive to the environment problems in every professional endeavour that he/she participates.

OBJECTIVES

- 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.

UNIT I INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES 9

Definition, Scope and Importance – Need For Public Awareness – Forest Resources:- Use and Over - Exploitation, Deforestation, Case Studies, Timber Extraction, Mining, Dams and their Ground Water, Floods, Drought, Conflicts Over Water, Dams - Benefits and Problems – Mineral Resources:- Use Effects on Forests and Tribal People – Water Resources:- Use and Over-Utilization of Surface 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 II ECOSYSTEMS AND BIODIVERSITY 9

Concepts 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 and Birds - Field Study of Simple Ecosystems – Pond, River, Hill Slopes, etc.

UNIT III ENVIRONMENTAL POLLUTION 9

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 Urban and Industrial 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 IV SOCIAL ISSUES AND THE ENVIRONMENT 9

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 – 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 – Issues Involved in enforcement of Environmental Legislation – Public Awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 9

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.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Masters, G.M., “Introduction to Environmental Engineering and Science”, Pearson Education Pvt., Ltd., 2nd Edition, 2004.
2. Miller, T.G. Jr., “Environmental Science”, Wadsworth Pub. Co.
3. Townsend C., Harper, J. and Begon, M., “Essentials of Ecology”, Blackwell Science, 2003.
4. Trivedi, R.K., and Goel, P.K., “Introduction to Air Pollution”, Techno-Science Publications.

REFERENCES:

1. Erach, B., “The Biodiversity of India”, Mapin Publishing Pvt. Ltd., Ahmedabad, India.
2. Trivedi, R.K., “Handbook of Environmental Law’s, Rules, Guidelines, Compliances and Standards”, Vol - I and II, Envio Media.
3. Cunningham., Cooper, W.P. and Gorhani, T.H., “Environmental Encyclopedia”, Jaico Publishing House, Mumbai, 2001.
4. Wages, K.D., “Environmental Management”, W.B. Saunders Co., Philadelphia, USA, 1998.

PTEI9251 TRANSDUCER ENGINEERING L T P C
3 0 0 3

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.

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.

TOTAL : 45 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.

PTEI9253 **LINEAR INTEGRATED CIRCUITS** **L T P C**
3 0 0 3

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.

TOTAL : 45 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.

PTEC9262 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.

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.

PTCS9161 OBJECT ORIENTED PROGRAMMING L T P C
3 0 0 3

AIM

To present the concepts of Object Oriented Programming through C++ and Java.

OBJECTIVES

- To study the object oriented programming principles.
- To introduce the classes, objects, constructors and destructors in C++.
- To introduce the operator overloading, inheritance, polymorphism concepts and file operations in C++.
- To introduce classes, objects, methods, arrays and strings in Java.
- To introduce the programming approach in Java like interfaces, packages, multi - threading, managing errors and exceptions and Applet programming.

UNIT I OOP CONCEPTS, BASICS OF C++, CLASSES AND OBJECTS 9

Basic concepts of object oriented programming – Object oriented languages – Applications of OOP – Structure of C++ program – Tokens – Data types – Constants – Variables – Initializations – Operators – Expressions – Control structures – Functions – Overloading – Defining of class – Data members - Member functions and its definitions – Object as an array, arguments and return types – Friendly functions.

UNIT II CONSTRUCTORS AND OPERATOR OVERLOADING 9

Constructors – Different types of constructors – Dynamic initialization of objects – Dynamic constructors – Destructors - Defining unary and binary Operators overloading with member function and friend function – Rules for overloading operators – Type conversions.

UNIT III INHERITANCES, POLYMORPHISM, CONSOLE AND FILE OPERATIONS 9

Different types of inheritances – Virtual and abstract classes - Pointers to objects, derived classes – Virtual functions – C++ streams / classes – Unformatted and formatted console operations – Classes for file stream operations – Files – Opening – Closing – Detecting end of files – File modes – Sequential and random files.

UNIT IV JAVA BASICS, CLASSES, METHODS AND INHERITANCES 9

Java features – Java program structures – Java tokens - Statements – Constants – Variables – Data types – Operators – Expressions – Defining a class – Instance variables and methods – Creating objects – Accessing class members – Constructors – Method overloading – Static members – Inheritance: Extending a class – Overriding methods – Final variables, Final methods and Final classes – Abstract methods and classes – Visibility control - Arrays – One and two dimensional arrays – Strings, vectors and wrapper classes.

UNIT V INTERFACES, PACKAGES, THREADING, EXCEPTIONS AND APPLETS 9

Defining interfaces – Extending, implementing, accessing interfaces – Java API packages – Defining user defined packages and usage – Creating threads – Extending the thread class – Life cycle of a thread – Thread priority – Synchronization – Exceptions – Syntax of exception handling code – try, catch and finally statements – Throwing our own exceptions – Preparing to write applets – Applet lifecycle – Executable applet – Designing a web page – Applet tags – Adding applet to HTML file – Running the Applet – Passing parameter to Applets.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Balagurusamy, E., "Object Oriented Programming with C++", 3rd Edition, Tata McGraw-Hill, 2006.
2. Balagurusamy, E., "Programming with JAVA – A Primer", 3rd Edition, Tata McGraw-Hill, 2007.

REFERENCES:

1. Sourav Sahay, "Object Oriented Programming with C++", Second Impression, Oxford University Press, 2006.
2. Herbert Schildt, "C++ - The Complete Reference", 14th Reprint, Tata McGraw-Hill, 2006.
3. Herbert Schildt, "Java - The Complete Reference", 7th Edition, Tata McGraw-Hill, 2007.
4. Deitel, H.M., and Deitel, P.J., "C++ : How to program", 5th Edition, Prentice - Hall of India, 2005.
5. Deitel, H.M., and Deitel, P.J., "Java : How to program', 6th Edition, Prentice - Hall of India, 2006.

PTEI9252 TRANSDUCERS AND MEASUREMENTS LABORATORY L T P C
0 0 3 2

LIST OF EXPERIMENTS

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

PTEI9301 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.

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.

PTEI9302 **CONTROL ENGINEERING** **L T P C**
3 0 0 3

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.

TOTAL : 45 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.

PTEC9313 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.

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.

PTCS9311 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–raversing 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.

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.

PTEC9312 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

PTEI9351 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 .

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.

PTEI9352 **PROCESS CONTROL** **L T P C**
3 0 0 3

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.

PREREQUISITE : Control Engineering.

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.

TOTAL : 45 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.

PTEI9362 DIGITAL SIGNAL CPROESSING L T P C
3 0 0 3

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 IV 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.

TOTAL : 45 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.

PTEI9354 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

PTEI9401 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).

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, 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.

PTEI9402 ADVANCED PROCESS CONTROL L T P C
3 0 0 3

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.

TOTAL : 45 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.

PTEI9403 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 III 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.

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.

PTEI9303 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.

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, NewJersey, 1997.
4. Buchanan, W., "Computer Busses", CRC Press, 2000.

PTEI9353 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

PTEC9361 **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.

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.

PTEI9021 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.

PREREQUISITE

Electronic devices, Industrial Instrumentation I & II

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.

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

PTEE9021 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.

PREREQUISITE

Electronic devices and circuits, Electric circuit analysis and Electrical machines.

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 III 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.

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, NewDelhi, 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.

PTEI9023 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.

PREREQUISITE

Industrial Instrumentation I & II, Process control.

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.

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.

PTEI9024 INSTRUMENTATION IN PETRO CHEMICAL INDUSTRY L T 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.

PREREQUISITE

Knowledge about basic control system and process control is essential.

UNIT I PETROLEUM PROCESSING 9

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

UNIT II 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.

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.

PTEI9031 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.

PTEC9052 MICROCONTROLLER 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.

REFERENCES:

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

PTEI 9030 COMPUTER NETWORKS L T P C
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.

PREREQUISTE Fundamentals of Computing.

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 BOOKS:

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.

PTGE9071 ROBOTICS AND AUTOMATION L T P C
3 0 0 3

AIM

To get an insight of robotics and its application in automation.

OBJECTIVES

- To introduced to geometric configuration of robots and their types.
- To study in detail the power sources, sensors, manipulators, actuators, grippers involved with robots and kinematics.
- To learn about path planning of robot and robot programming techniques.

PREREQUISTE

Transducer Engineering, Electrical Machines.

UNIT I BASIC CONCEPTS 9

Definition and origin of Robotics - Different types of robotics – Various generations of robots – Degrees of freedom - Asimov's laws for intelligent robotics - Dynamic stabilization of robots.

UNIT II POWER SOURCES AND SENSORS 9

Hydraulic, Pneumatic and Electric drives – Determination of HP of motor and gearing ratio - Variable speed arrangements – Path determination – Micro machines in robotics – Machine vision – Ranging – Laser – Acoustic – Magnetic, Fibre optic and tactile sensors.

UNIT III MANIPULATORS, ACTUATORS AND GRIPPERS 9

Construction of manipulators – Manipulator dynamics and force control -Electronic and Pneumatic manipulators control circuits - End effectors - Various types of grippers - Design considerations.

UNIT IV KINEMATICS AND PATH PLANNING 9

Solution of inverse kinematics problem - Multiple solution Jacobian work envelope – Hill climbing techniques - Robot programming techniques.

UNIT V CASE STUDIES 9

Multiple robots - Machine interface – Robots in manufacturing and non -manufacturing applications - Robot cell design - Selection of a robot.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Mikell P., Weiss G.M., Nagel R.N. and Odraj, N.G., “Industrial Robotics”, McGraw Hill, Singapore, 1996.
2. Deb, S.R., “Robotics Technology and Flexible Automation”, John Wiley, USA 1992.

REFERENCES:

1. Asfahl, C.R., “Robots and Manufacturing Automation”, John Wiley, USA 1992.
2. Klaffer, R.D., Chimielewski T.A. and Negin M., “Robotic Engineering- An Integrated Approach”, Prentice Hall of India, New Delhi, 1994.
3. McKerrow, P.J., “Introduction to Robotics”, Addison Wesley, USA, 2004.
4. Issac, “Asimov I Robot”, Ballantine Books, New York, 2004.
5. Ghosh, “Control in Robotics and Automation : Sensor Based Integration”, Allied Publishers, Chennai, 1999.

PTEI9029 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..

PREREQUISITE

Set theory and Boolean algebra

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.

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", Addison Wesley Publishing Company, Inc. 1989.
4. 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.
2. Zurada, J.M., "Introduction to Artificial Neural Systems", Jaico Publishing House, Mumbai, 1997.
3. Millon, W.T., Sutton, R.S. and Webrose, P.J., "Neural Networks for Control", MIT Press, 1992.
4. Klir, G.J. and Yuan, B.B., "Fuzzy Sets and Fuzzy Logic", Prentice Hall of India, New Delhi, 1997.
5. Driankov, D., Hellendron, H. and Reinfrank M., "An Introduction to Fuzzy Control", Narosa Publishing House, New Delhi, 1996.
6. Zimmermann, H.J., "Fuzzy Set Theory and its Applications", Allied Publishers Ltd., 1996.
7. Haykin, S., "Neural Networks: A Comprehensive Foundation", 2nd Edition, Prentice Hall Inc., New Jersey, 1999.

PTEI9028 **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.

PREREQUISTE Digital Logic Theory and Fundamentals of Computing.

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).

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.

PTEI9026 MICRO ELECTROMECHANICAL 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.

PREREQUISTE Transducer Engineering, and Electron Devices and Circuits.

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 BOOKS:

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.

PTEI9027 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.

PTEC9411 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.

PREREQUISITE Microprocessors and Microcontrollers.

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.

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.

PTEI9022 BIOMEDICAL INSTRUMENTATION L T P C
3 0 0 3

AIM

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

OBJECTIVES

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

PREREQUISITE

Transducer engineering, Electronic devices and circuits.

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.

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.

PTGE9022 TOTAL QUALITY MANAGEMENT L T P C
3 0 0 3

AIM

To introduce the students to the core concepts of Total Quality Management.

OBJECTIVES

- To understand the Total Quality Management concept and principles and the various tools available to achieve Total Quality Management.
- To understand the statistical approach for quality control.
- To create an awareness about the ISO and QS certification process and its need for the industries.

UNIT I INTRODUCTION 8

Definition and dimensions of quality – Historical review – Quality Control and Quality Assurance – Total Quality Management: Definition, benefits – Principles of Six Sigma – Teaching of Quality Gurus – Obstacles for TQM implementation.

UNIT II TQM-OLD TOOLS 8

Pareto Diagram – Process Flow Diagram – Cause and Effect Diagram – Check sheets – Histogram – Control Charts for variables – Control Charts for attributes – Process Capability – Scatter Diagram.

UNIT III TQM – MANAGEMENT TOOLS 8

Why Analysis – Forced Field Analysis – NG Technique – Affinity Diagram – Interrelationship Diagram – Tree Diagram – Matrix Diagram – Prioritization Matrices – Process Decision Program Chart – Activity Network Diagram.

UNIT IV TQM – PRINCIPLES 10

Leadership – Role of Senior Management – Customer Satisfaction – Customer Retention – Employee involvement – Juran Trilogy – PDSA Cycle – Kaizen – Supplier Partnership – Supplier certification and rating – Malcolm Baldrige National Quality Award – 5S Principles – Poka Yoke.

UNIT V TQM TECHNIQUES **11**

Quality circles and their applications – Bench Marking – Reasons and Procedure for Bench Marking – Quality Function Deployment (QFD) : Procedure and benefits – Total Productive Maintenance (TPM) – Failure Mode and Effects Analysis (FMEA) : Procedure and applications – Design of Experiments Taguchi's quality engineering : Principles and applications – ISO Systems: Procedure and applications.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Besterfield, D.H., "Total Quality Management", Pearson Education, 2004.

REFERENCES:

1. Zairi, M., "Total Quality Management for Engineers", Wood Head Publishers, 1991.
2. Evans, J.R. and Lindsay, W.M., "The Management and Control of Quality, 5th edition, South – Western (Thomas learning), 2002.
3. Feigenbaum, A.V., "Total Quality Management", McGraw-Hill, 1991.
4. Oakland, J.S., "Total Quality Management", Butterworth – Heinemann Ltd., Oxford, 1999.