Syllabus Scheme

For

Bachelor of Technology in

Electronics & Instrumentation Engineering

For 2002 Batch

Punjab Technical University, Jalandhar

B.Tech. Electronics & Instrumentation Engg.

Scheme of Syllabi (3rd Semester)

Course code	Course Title	L	T	P	Int.	Ext.	TOTAL
AM-201	Applied Mathematics-III	4	1	0	40	60	100
EE-201	Network Analysis & Synthesis	3	2	0	40	60	100
EI-201	Electronics Devices & Analog ICs	3	1	0	40	60	100
EC-203	Electronic Measurement & Instrumentation	3	1	0	40	60	100
CS –252	Object Oriented Programming	3	1	0	40	60	100
EI-203	Lab.-I (Electronic Devices & Analog ICs)	0	0	2	30	20	50
EC-207	Lab.-II (Instrumentation)	0	0	2	30	20	50
CS-254	Lab.-III (Object Oriented Programming)	0	0	2	30	20	50
WS	*Workshop Training	-	-	-	60	40	100
	TOTAL	**16**	**6**	**6**	350	400	750

Punjab Technical University, Jalandhar
B.Tech. Electronics & Instrumentation Engg.
Scheme of Syllabi (4th Semester)

Course code	Course Title	L	T	P	Ext.	Int.	TOTAL
EC-202	Analog Electronics	3	1	0	60	40	100
EC-204	Digital Electronics	3	2	0	60	40	100
EC-206	Signals and Systems	3	1	0	60	40	100
EC-208	Electromagnetic Field Theory	3	1	0	60	40	100
IC-204	Linear Control Systems	3	2	0	60	40	100
EC-210	Lab.-IV (Analog Electronics)	0	0	2	20	30	50
EC-212	Lab.-V (Digital Electronics)	0	0	2	20	30	50
IC-212	Lab.VI (Linear Control Systems)	0	0	2	20	30	50
	General Fitness					100	100
	TOTAL	**15**	**7**	**6**	360	390	750

** **There should be industrial/institutional training of 6 weeks duration in the summer vacation after 4th semester**

Punjab Technical University, Jalandhar
B.Tech. Electronics & Instrumentation Engg.
Scheme of Syllabi (5th Semester)

Course code	Course Title	L	T	P	Int.	Ext.	TOTAL
EI-301	Virtual Instrumentation &Data Acquisition,	3	1	0	40	60	100
EI-303	Non-Linear & Sampled Data Control Systems	3	1	0	40	60	100
ME-251	Total Quality Management	3	1	0	40	60	100
EI-305	Process Dynamics & Control	3	1	0	40	60	100
EC-303	Industrial Electronics	3	1	0	40	60	100
EC-309	Micro Processors & its applications	3	1	0	40	60	100
EC-319	Lab. VII: (Micro Processor Applications)	0	0	2	30	20	50
EC-315	Lab. VIII (Industrial Electronics)	0	0	2	30	20	50
EI-307	Lab-IX(Virtual Instrumentation &Data Acquisition)	0	0	2	30	20	50
	Industrial training				60	40	100
	Seminar				50		50
	TOTAL	**18**	**6**	**8**	**440**	**460**	**900**

Punjab Technical University, Jalandhar
B.Tech. Electronics & Instrumentation Engg.
Scheme of Syllabi (6th / 7th Semester)

Course code	Course Title	L	T	P	Int.	Ext.	TOTAL
EI-302/401	Instrumentation System Design	3	1	0	40	60	100
EI - 304/403	Industrial Measurements	3	1	0	40	60	100
CE-216	Environmental Science	3	1	0	40	60	100
EC-310	Digital Signal Processing.	3	1	0	40	60	100
	Elective-I	3	1	0	40	60	100
	Elective-II	3	1	0	40	60	100
EI-306/405	Lab.X:Instrumentation System Design	0	0	2	30	20	50
EC-318	Lab.XI: Digital Signal Processing)	0	0	2	30	20	50
EI-308/407	Minor Project	0	0	2	120	80	200
	General Fitness				100	-	100
	Total				520	480	

List of Elective-1

1. DE-1.1 Pneumatic & Hydraulic Instrumentation
2. DE-1.2 Instrumentation System Reliability
3. DE-1.3 State Space Analysis & Digital Control.
4. DE-1.4 Non-linear Control Systems.
5. DE-1.5 Programmable Logic Controllers & Applications

List of Elective-II:

1. DE-2.1 Industrial Data Communications
2. DE.2.2 Computer Architecture
3. DE.2.3 Intelligence Robotics
4. DE 2.4 Microcontroller & its Applications

Punjab Technical University, Jalandhar
B.Tech. Electronics & Instrumentation Engg.
Scheme of Syllabi (6th / 7th Semester)

Course code	Course Title	L	T	P	Int.	Ext.	TOTAL
	Industrial Training	-	-	-	500	500	1000
	TOTAL	-	-	-	500	500	1000

Punjab Technical University, Jalandhar
B.Tech. Electronics & Instrumentation Engg.
Scheme of Syllabi (8th Semester)

Course code	Course Title	L	T	P	Int.	Ext.	TOTAL
EI-402	Advanced Process control	3	1	0	40	60	100
EI-404	Bio-medical Instrumentation	3	1	0	40	60	100
EI-406	Analytical Instrumentation	3	1	0	40	60	100
	Elective-III	3	1	0	40	60	100
	Elective-IV	3	1	0	40	60	100
EI-408	Major Project	0	0	6	180	120	300
EI-410	Lab-XII: Advanced Process Control	0	0	2	30	20	50
EI-412	Lab-XIII Analytical Instrumentation	0	0	2	30	20	50
	General Fitness	-	-	-	100		100
	TOTAL	**15**	**5**	**10**	540	460	**1000**

List of Elective-III

1. DE-3.1 Optimal Control Systems
2. DE-3.2 Computer Control of Industrial Process
3. DE-3.3 Distributed Control Systems
4. DE-3.4 Nuclear Instrumentation
5. DE-3.5 Environmental Instrumentation. & Safety
6. DE-3.6 Modelling & Simulation

List of Elective-IV

1. DE-4.1 Machine Vision
2. DE-4.2 Neural Networks & Fuzzy Systems
3. DE-4.3 Virtual Instrumentation

3rd Semester

AM- 201 APPLIED MATHEMATICS-III

Internal marks : 40 **L T P**
External marks :60 **4 1 0**
Total marks :100

1. **Fourier Series** Periodic functions, Euler's formula. Even and odd functions, half range expansions, Fourier series of different wave forms.
2. **Laplace Transforms** Laplace transforms of various standard functions, properties of Laplace transforms, inverse Laplace transforms, transform of derivatives and integrals, Laplace transform of unit step function, impulse function, periodic functions, applications to solution of ordinary linear differential equations with constant coefficients, and simultaneous differential equations.
3. **Special Functions** Power series solution of differential equations, Frobenius method, Legendre's equation, Legendre polynomial, Bessel's equation, Bessel functions of the first and second kind. Recurrence relations, equations reducible to Bessel's equation, Error function and its properties.
4. **Partial Differential Equations** Formation of partial differential equations, Linear partial differential equations, homogeneous partial differential equations with constant coefficients Applications : Wave equation and Heat conduction equation in one dimension. Two dimensional Laplace equation, solution by the method of separation of variables. Laplacian in polar coordinates.
5. **Functions of Complex Variable** Limits, continuity, derivative of complex functions, analytic function, Cauchy-Riemann equation, conjugate functions, harmonic functions ; Conformal Mapping : Mapping of a complex function, conformal mapping, standard transforms, mapping of standard elementary transformations, complex potential, applications to fluid flow problems ; Complex Integration : Line integrals in the complex plane, Cauchy's theorem, Cauchy's integral formula and derivatives of analytic function. Taylor's and Laurent's expansions, singular points, poles, residue, complex integration using the method of residues, evaluation of real integrals by contour integration.

Books

1. Advanced Engineering Mathematics by Kreyszing Erwin ; Wiley Eastern, New Delhi
2. Higher Engineering Mathematics by BS Grewal : Khanna Publishers, New Delhi.
3. Numerical Solutions of Differential Equations by NK Jain ; Prentice Hall, Delhi.
4. Differential Equations by Sharma and Gupta ; Krishna Prakashan Media (P) Ltd., Meerut.

EE– 201 **NETWORK ANALYSIS & SYNTHESIS**

Internal marks : 40 **L T P**
External marks :60 **3 2 0**
Total marks :100

CONTENTS

1. 1. **Circuit Concepts: Circuit Elements.**
   Independent & dependent Sources, Signals and waveforms: periodic & singularity voltages, step, ramp, impulse doublet. Loop currents & loop equations, node voltage & node equations. Network theorems, super position Thevinins Norton's, Maximum power transfer, reciprocity.

2. **2. Time & Frequency Domain Analysis**
   Representations of basics circuits in terms of generalized frequencies and their response, laplace transform of shifted functions, transient & steady response. Time domain behaviors from poles and zeros. Convolution theorem

3. **3. Network synthesis:**
   Network functions, Impedance & admittance functions , transfer functions relationship between transfer & impulse response, poles & zeros & restrictions, network functions for two terminals pair network. Sinusoidal network in terms of poles & zeros real liability condition for impedance synthesis of R-L & R- C ckts. Network synthesis techniques for two terminal networks, fostor & cauer forms

4. **4. Filter synthesis:**
   Classification of filters, characteristics impedance & propagation constant of pure reactive network, ladder network, T- section, IT section, terminating half section. Pass & stop bands. Design of constant K, m- derived filters. Composite filters

RECOMMENDED BOOKS

1. Circuit Theory by Chakraborty
2. Network Analysis vby Van Valkenburg
3. Electric Circuits by J.A. Edminister
4. Network analysis & synthesis by Sudhakar Shyam Mohan
5. Network Synthesis by IVS Iyer.

EI-201 ELECTRONIC DEVICES AND ANALOG ICs

Internal marks : 40 **L T P**
External marks :60 **3 1 0**
Total marks :100

1. **Semi Conductor Devices**:
PN-junction characteristics, Zener and Avalanche breakdown, diode equation, junction capacitance, bipolar transistor, transistor current components, transistor characteristics in CB, CE, and CC – configuration, Ebers-Moll model of transistor, D.C. Load line and graphical analysis of CE-amplifier, transistor as a switch, transistor ratings, transistor h-parameters and equivalent circuits, analysis of elementary transistor amplifier, transistor biasing and stabilization.

2. **Field Effect Devices**:
Junction field effect transistor, JFET- V I characteristics, MOSFET devices, FET, small signal model and parameters.

3. **Small signal RC-Amplifiers:**
Different types of transistor, various amplifiers using h-parameters, analysis at high frequency using hybrid pi-model, Darlington and cascade connections.

4. **Large Signal Amplifiers:**
Transformer coupled amplifier-analysis of class A,B,C and AB-amplifiers-complementary symmetry and paraphase-amplifier-graphical analysis for distortion-power dissipation, heat sink.

5. **Multistage and Feedback Amplifiers**:
Types of multistage amplifiers viz. RC, LC and DC – coupled – stability problems.

6. **Tuned Amplifiers:**
Frequency response of a tuned circuit- single, double and stagger tuned amplifiers, RF-amplifiers, neutralization- response of tuned amplifiers.

7. **Cathode ray Oscilloscope**:
Schematic diagram of a CRT, electric and magnetic focusing and deflection, Block diagram of a CRO, uses of CRO.

8. **Some Special Devices:**
Uni junction transistor, zener diode, tunnel and backward diode, varactar diodes – SCR firing optoelectric devices like LED, LCD, photo diode, photo-transistor, photo tube & photo multiplier.

9. **Power Supplies and Rectifiers:**
Half wave, full wave and bridge rectifiers, smoothing filters, regulated power supplies.

10. **Clipping clamping**, D.C. restoration, piecewise linear approximation, wave shaping, working of transistor in saturation region.

BOOKS RECOMMENDED

	Name of Book	Author	Publisher
1.	Integrated Electronics	Millman	T.M.H
2.	Electronic Fundamentals	J.D. Ryder	PHI
3.	Micro Electronics	K.R. Botkar	Khanna
4.	Electronic Devices	Millman	T.M.H

EC-203 ELECTRONICS MEASUREMENT & INSTRUMENTATION

Internal marks : 40 **L T P**
External marks :60 **3 1 0**
Total marks :100

1) **Electronic Instrument** :
Electronic voltmeter , VIVM transistor voltmeter, electronic multimeter, CRO's study of various stages in brief , measurement voltages, current, phase & frequencies, special purpose oscilloscopes, measurement of inductance, capacitance , effective resistance at high frequency, Q meters, LCR meter

2) **Instruments for generation & analysis of waveforms**:
Signal generators, function generators, wave analyzer, harmonic distortion analyzer, spectrum analyzer, spectrum analysis

3) Instrument Transformer
Current & potential transformer, constructional feature, ratio & phase angle error

4) **Transducers:**
Principles of operation, qualitative treatment of strain gauges, LVDT, thermocouple, piezoelectric crystal & photoelectric transducers

5) **Data acquisition system**:
Necessity of recorders, recording requirements, graphic recorders, strip chart recorders, magnetic tape recorders, digital tape recorders

6) Display devices
Electronic indicating instruments, seven segment display, fourteen segmental display, nixie tube

7) Telemetry
Introduction, method of data transmission, types of telemetry systems & applications

BOOKS:
a) A.K.Sawhney Electrical & electronic measurement & instrumentation
b) Stout Basic Electrical measurements
c) Cooper Electronic instrumentation & measurement techniques

CS-252 OBJECT ORIENTED PROGRAMMING

Internal marks : 40 **L T P**
External marks :60 **3 1 0**
Total marks :100

1. **Basics of C & C++:** Introduction, basics, data type, bit field integer, operations, control structures, storage classes, user defined data type, reserved words and standard 110 statements in C & C++
2. **Object oriented programming with C++:** Introduction, object oriented programming concept, objective of OOP, programming structure in C++, data abstraction
3. **Overloading & information hiding:** introduction, function overloading, information hiding
4. **Memory management in C++:** introduction, constructor-automatic initialization of objects, dynamic memory management, default constructor, copy constructor, constructor and information hiding, destructor-automatic clear up of an object
5. **Inheritance:** introduction, Inheritance data & code sharing, class derivation, ambiguity in class member access, virtual base class-A remedy, class initialization in Inheritance, arguments for the base class
6. **Bindings & polymorphism:** introduction, bindings in C++, polymorphism
7. **Generic facility:** introduction, concept of Generic facility, Generic function, overloading a Generic function, Generic classes
8. **File handling in C++:** introduction,, concept of stream in C++, file positioning functions, error handling during file operation

Books for OOPS:

1. Al Stevens **: Teach yourself C++,** 4th Edition, BPB Publications New Delhi**.**

2. Y.P.Kanetkar, **Let us C++,** BPB Publications, New Delhi.

EI-203 LAB-I ELECTRONIC DEVICES & ANALOG ICs

Internal marks : 30 **L T P**
External marks :20 **0 0 2**
Total marks :50

1. To study VI characteristics of PN junction diode(Ge, Si, switching & signal)
2. To study half wave, full wave & bridge rectifier
3. To study transistor characteristics in CB & CE configuration
4. To study FET characteristics
5. To design, study & compare various transistor biasing techniques
6. To study emitter follower ckt.
7. To study & compare the frequency response of single stage & two stage RC coupled amplifier
8. To study the effect of negative feedback on the behavior of amplifiers
9. To study the frequency response of an amplifier & compute gain bandwidth product
10. To find offset voltage, gain, CMRR of an op-amp & study techniques of offset null adjustment
11. To verify superposition, Thevenin, Norton & maximum power transfer theorem
12. Study of response of constant K-filters
13. Study of response of m derived filters
14. Study various voltage & current feedback schemes
15. diode clippers & clampers

EC-207 **LAB II:INSTRUMENTATION**

Internal marks : 30 **L T P**
External marks :20 **0 0 2**
Total marks :50

LIST OF EXPERIMENTS

1. Measurement of inductance by Maxwell's bridge
2. Measurement of small resistance by Kelvin's bridge
3. Measurement of capacitance of Schering bridge
3. Measurement of frequency by Wein's bridge
4. Measurement of medium resistance by Wheat stone's bridge
5. Determination of frequency & phase angle using CRO
6. Drawing of the BH loop using loop tracer
7. To find the Q of a coil by using LCR-Q meter
8. Study of resonance

CS-254 LAB-III: OBJECT ORIENTED PROGRAMMING

Internal marks : 30 **L T P**
External marks :20 **0 0 2**
Total marks :50

i. To write following programs in C/C++
ii. Using basic statements like control statements, looping statements, various I/O statements & various data structures
iii. Creating classes in C++ for understanding of basic OOPS features
iv. Representing concepts of data hiding, function overloading & operator overloading
v. Using memory management features & various constructors & destructors
vi. Representing inheritance, virtual classes & polymorphism
vii. Writing generic functions
viii. File handling programs

4th SEMESTER

EC- 202 ANALOG ELECTRONICS

Internal marks : 40 **L T P**
External marks :60 **3 1 0**
Total marks :100

1. HIGH FREQUENCY TRANSISTOR

The high frequency T model, common base short circuit current frequency response, alpha cutoff frequency, common emitter short circuit current frequency response, hybrid pi CE transistor model, hybrid pi conductance in terms of low frequency h parameters, CE short circuit current gain obtained with hybrid pi model, current gain with resistive load.

2. LARGE SINGAL AMPLIFIERS

Class A direct coupled with resistive load, Transformer coupled with resistive load, design theory, power amplifier design, harmonic distortion, power output, variation of output power with load, thermal runaway, output transformer saturation, push-pull amplifiers, operation of class- A push-pull amplifier, class- B push-pull amplifier, crossover distortion, class AB push-pull amplifier, transistor phase invertor, conversion efficiency of class B amplifiers, design of Class- B push-pull amplifier, complementary- symmetry amplifier.

3. MULTISTAGE AMPLIFIERS

Coupling of transistor amplifiers, frequency response of coupled amplifiers, cascading of RC coupled amplifiers and their analysis. Tuned Amplifiers: single tuned, double tuned and stagger tuned amplifiers and their analysis.

4. FEEDBACK IN AMPLIFIERS

Types of feedback, effect of negative feedback on gain, bandwidth, stability, distortion and frequency response etc. Voltage series, current series, voltage shunt, current shunt feedback circuits and their analysis.

5. OSCILLATORS

Conditions of oscillations. Different types of oscillators: RC Phase Shift, Wein Bridge, Hartley, Colpitts and Crystal Oscillators. Derivation of expression for frequency and amplitude of these oscillators.

6. REGULATED POWER SUPPLIES

Zener diode as Voltage Regulator, Transistor Series and Shunt Regulators, Current limiting, Line and Load Regulation.

Books Recommended

1. Electronic Devices & Circuits by Millman- Halkias, Tata Mcgraw Hill
2. Electronic Devices & Circuits Theory by Boylestad, PH
3. Electronic Devices & Circuits by Allen Mottorshead, PHI

EC-204 **(Digital Electronics)**

Internal marks : 40 **L T P**
External marks :60 **3 2 0**
Total marks :100

1. Number System And Binary Code : Introduction, Binary, Octal and hexadecimal number system. Signed and unsigned number, Binary operations-addition; Subtraction, Multiplication and division; Subtractions using 1's and 2's compliment; ASCII code; Excess 3 code Gray code.

2. Minimization of logic function : OR, AND,NOT,NOR,NAND,EX-OR, Basic theorem of Boolean Algebra, sum of products and product of sums, canonical form, Minimisation using theorems, minimisation using K-map and Q-M method. Incompletely specified functions.

3. Combinational Logic Circuits : Introduction, Combinational circuit design, multiplexers, demultiplexer, encoders, decoders, adders, subtracters and code converters, parity checker, BCD display drive, magnitude comparators.

4. Sequential Circuits : Introduction, flip flop SR, JK, D, T edge triggerred and decked flip-flop, Registers. Type of Registers, circuit diagram, timing wave form and operations counters, counter design with state equation and state diagrams.

5. D/A and A/D Converters : Introduction, Weighted register D/A converter, binary ladder D/A converter, steady state accuracy test, D/A accuracy and resolution, parallel A/D converter, Counter type A/D converter Successive approximation A/D converter. Single and dual slope A/D converter A/D accuracy and resolution, Voltage of frequency conversion, Voltage of time conversion.

6. Semiconductor Memories : Introduction, Memory organisation, Classification and characteristics of memories, Sequential memories, ROMs, R/W memories. Content addressable memories. Programmable logic arrays, Charged-Coupled device memory.

7. Logic Families : RTL, DCTL, DTL, TTL, ECL and its various types, Comparison of logic families.

Recommended Books :

1. Digital principle and applications Malvino (TMH)
2. Modern digital electronics R. P. Jain (PIH)
3. Digital electronics principle Malvino (THM)
4. Modern digital systems design Cheung & ----- (WPC)
5. An Engg. Approach to digital design Eletcher (PIH)

EC-206 **Signals and Systems**

Internal marks : 40 **L T P**
External marks :60 **3 1 0**
Total marks :100

System and Signal Analysis : Classification of signals and systems, signal representation using fourier series, complex exponential fourier series, fourier series representation of periodic signals speriodic signal representation using fourier transform, fourier transform of periodic power signals, power spectral density, system response impulse, step and time domain response analysis, transfer function and frequency, Domain analysis effect of Transfer function on spectral densities, Stationary of non-Transients.

Random Signal Theory : Introduction to probabilities Defination, probability of Random events, Joint and conditional probability, probability Mass function statistical averages. Probability density functions and statistical averages. Examples of P.D. function, transformation of random variables random processes, stationary, true averages and Fygodic.

Signal Transmission Through Linear Networks : Convolution theorem, its graphical intrepretation. Conditional function with a unit Impulse function. The sampling theorem low pass and band pass network, matched filter, input output relations with random inputs, envelope detector, equivalent noise band width Noise. Introduction to thermal noise, shot noise partial noise, low frequency or flicker, Gaussion Noise, burst noise, avalanche noise bipolar transistor noise, F.E.T. noise, Equivalent input noise signal to noise ration, noise factor, amplifier input noise in terms of F-Noise factor or amplifiers, Noise temperature, Noise equivalent Bandwidth, Noise fig. Experimental determination of noise figure, Pulse response & Digital No. & elimination.

Books Recommended

1. Communication Signal and Systems by Simon Haykin
2. Signal and Systems by Oppenheim and Willsky

EC-208 **Electromagnetic Field Theory**

Internal marks : 40 **L T P**
External marks :60 **3 1 0**
Total marks :100

1. Introduction Review of Electrostatic and Magnetostatics.

2. Time Varying Fields Maxwell's equations in differential and integral forms concept of displacement current. Boundary conditions.

3. Electromagnetic Waves Wave equation and its solution in different media, plane wave, Sinusoidal time variation, polarization. Reflection of waves by perfect di electronics and by perfect insulators. Surface impedance, Poynting theorem and Poynting vector.

4. Guided Waves Waves between parallel planes. TE and TM waves and their characteristics. TEM waves, velocities of propagation, Attenuation in parallel plane guides, wave impedance.

5. Transmission Lines Circuit representation of parallel plane transmission lines. Parallel plane transmission line with losses. Law loss RF and UHF transmission lines. Distortionless condition. Transmission line charts-impedance matching.

6. Wave Guides Rectangular and circular wave guides. TE and TM waves in rectangular wave guides. Impossibility of TEM wave in wave guides. Wave impedance and characteristics impedances. Transmission line analogy for wave guides. Attenuation and factor of wave guides. Dielectric slab wave guides.

Recommended Books

Name of Book , Author , Publisher

1. Electromagnetic Wave : Jordan and Balmain : PHI And Radiation System

2. Electromagnetics : Kraus : T.M.H.

3. Telecommunications : Fraser

IC-204 Linear Control System

Internal marks : 40 **L T P**
External marks :60 **3 2 0**
Total marks :100

Purpose This course is aimed at to provide a comprehensive treatment of the analysis and design of control systems so as to empower the students with knowledge which is sufficient to help them understand and analyse the practical problems in industry. Instructional

Objectives At the end of this course, the students should :

1. be familiar with the basic concepts of control systems.

2. Be able to formulate the equations of linear electrical and non-electrical systems and establish analogies between them.

3. Derive characteristics equ. of a given system.

4. Be able to perform time-Domain and frequency domain analysis of systems.

5. Be able to determine stability of any given system.

6. Understand the importance of compensating networks and their design.

7. Be familiar with necessary control components.

Contents

1. Introduction Concepts Plant, Systems Servomechanism, regulating systems, disturbances, Open loop control system, closed loop systems, linear and non-linear systems, time variant & invariant, continuous and sampled data control systems, Block diagrams, some illustrative examples.

2. Modelling Formulation of equation of Linear electrical, mechanical, thermal Pneugmatic and hydraulic system, electrical, Mechanical analogies. Use of Laplace transform, Transfer function, concepts of state variable modelling. Block diagram representation signal flow graphs and associated algebra, characteristics equation.

3. **Time Domain Analysis** Typical test - input signal, Transient response of the first and second order systems. Time domain specifications, Dominant closed loop poles of higher order systems. Steady state error and coefficients. Pole-zero location and stability. Routh-Hurwitz Criterion.

4. Root Locus Technique: The extreme points of the root loci for positive gain. Asympotes to the loci, breakway points, intersection with imaginary axis, location of roots with given gain & sketch of the root locus plot.

5. Frequency Domain Analysis: Closed loop frequency response, bodeplots, stability and loop transfer function. Frequency response specification relative stability, relation between time and frequency response for second order systems. A and N-circles, Log. Magnitude versus phases angle plot. Plot Nyquist criterion.

6. Compensation: Necessity of compensation series and parallel compensations, Compensating network, application of lag and lead compensation.

7. Control Components: Error detectors- potentiometers and synchronous, servo motor A.C. and D.C. technogenerators, Magnetic amplifiers.

Books Recommended

1. Modern Control Engg. by K. Ogata, Prentice Hall, New Delhi, 1974.
2. Control System Components by J.F. Gibsen, Mcgraw Hill, 1963.
3. Automatic Control System by B.C. Kuo, Prentice Hall, 3rd Ed., 1978.
4. Control System Engineering by I.J. Nagrath & Gopal, Wiley Eastern Ltd., New Delhi, 1975.

EC-210 LAB-IV ANALOG ELECTRONICS

Internal marks : 30 **L T P**
External marks :20 **0 0 2**
Total marks :50

1. To study the various coupling techniques for transistor amplifiers.
2. To study the characteristics of a Class- A amplifier.
3. To study the characteristics of Class- B amplifier.
4. To study the characteristics of Class-C amplifier.
5. To study the characteristics of Class- AB amplifier.
6. To study the characteristics of Class- B push-pull amplifier.
7. To study the characteristics of complementary symmetry amplifier.
8. To study transistor series voltage regulator with current limit and observe current fold-back characteristics.
9. To study the response of RC phase shift oscillator and determine frequency of oscillation.
10. To study the response of Hartley oscillator and determine frequency of oscillation.
11. To study the response of Colpitt's oscillator and determine frequency of oscillation.
12. To study the response of Wien Bridge oscillator and determine frequency of oscillation.

EC-212 Lab V (Digital Electronics)

Internal marks : 30 **L T P**
External marks :20 **0 0 2**
Total marks :50

1. (a) Verification of the truth tables of TTL gates, e.g., 7400, 7402,7404, 7408, 7432,7486.
   (b) Design, fabrication and testing of low frequency TTL clocks using NAND gates.

2. (a) Verification of the truth table of the Multiplexer 74150.
   (b) Verification of the truth table of the De-Multiplexer 74154.

3. Design and verification of the truth tables of half adder and full adder circuits using gates 7483.

4. Study and verification of the operations of ALU 74181 with regards to addition / subtraction / comparison.

5. Design fabrication and testing of differentiator and integrator circuits using OP AMP.

6. Design fabrication and testing of clipper and clamper circuits using OP AMP.

7. Design fabrication and testing of
(a) Monostable multivibrator of t=0.1 msec.approx.) using 74121/123. Testing for both positive and negative edge triggering, variation in pulse with and retriggering.

(b) Free running multivibrator at 1 KHz and1 Hz using 555 with 50% duty cycle. Verify the timing from theoretical calculations. 8. Design fabricate and test a switch depouncer using 7400.

9.(a) Design and test of an S-R flip-flop using TOR/NAND gates.
(b) Verify the truth table of a J-K flip-flop (7476)
(c) Verify the truth table of a D flip-flop (7474) and study its operation in the toggle and asyneronous modes.

10. Operate the counters 7490, 7493 and 74192. Verify the frequency division at each stage. With a low frequency clock (say 1 Hz) display the count on LEDs.

11. (a) Verify the truth table of decoder driver 7447 / 7448. Hence operate a 7 segment LED

display through a counter using a low frequency clock.

(b) Repeat the above with the BCD to Decimal decoder 7442 and an array of LEDs.

IC-212 (Lab.- VI) Linear Control Systems

Internal marks : 30 **L T P**
External marks :20 **0 0 2**
Total marks :50

At least eight of the following experiments are to be performed :

1. To study input- output characteristics of a potentiometer and to use two potentiometers as an error detector.

2. To study transmitter- receiver characteristics of a synchro set to use the set as control component.

3. To study the operation of a d-c positional servo system and to investigate the effect of damping and supply voltage on its response.

4. To study the operation of an a.c. position servo-system and to obtain effects of supply voltage and system parameter on its transient response.

5. To design different compensation network for the given cut off frequencies and to plot frequency response of these networks.

6. To use operational amplifiers as multiplier, summer, inverter and integrator.

7. To simulate a servo-system and obtain its characteristics with the use of controllers.

8. To study control action of light control device.

9. To study details of a magnetic amplifier and to obtain input-output characterization of this amplifier.

10. To study details of a two winding a-c servometer and to obtain its T-N characteristics.

11. To study PID- controller and to obtain the effect of proportional, integral and derivative control action.

12. To study details of an analog computer and solve a given second order differential equation using it.

13. To generate a sine-wave using a given analog computer with specified amplifier and frequency.

14. To study a stepper motor and control its direction speed and number of steps with the held of a microprocessor.

15. To obtain dynamic characteristics of a given solar cell array and to obtain the point of operation for maximum power transfer to the load.

16. To obtain T.F. of a field controlled d.c. servometer and to show its pole-zero configuration.

17. To obtain T.F. of an armature controlled d.c. servometer and to obtain its pole zero configuration.

18. To design, fabricate and to obtain characteristics of a high pass T type filter.

19. To design, fabricate and to obtain characteristics of low pass T type filter.

20. To design, fabricate and to obtain characteristics of band pass T type filter.

21. To design, fabricate and to obtain the characteristics of a composite low pass filter.

22. To design, fabricate and to obtain the characteristics of a composite high pass filter.

23. To design, fabricate and to obtain the characteristics of composite band pass filter.

5th Semester

EI-301 VIRTUAL INSTRUMENTATION & DATA ACQUISITION

Internal marks :40 **L T P**
External marks :60 **3 1 0**
Total marks :100

1. **Data Acquisition system:** Analog data acquisition system, Digital data acquisition system, and Data logger.

2. **Data Transmission & Telemetry systems:** Methods of Data Transmission, Telemetry Systems analog / digital & short / long distance type. Electrical Telemetry Systems, Pulse telemetry systems; analog: PAM, FM, PDM & PPM; digital: PCM, Transmission channels & Media , Multiplexing in telemetry system: TDM & FDM techniques.

3. **Basics of Virtual Instrumentation**: Historical Perspective, Need/ Advantages of VI, Defining VI, Block Diagram & architecture of VI, Data Flow Techniques, Graphical Programming in Data Flow. Comparison with conventional programming.

4. **VI Programming Techniques:**

   VIs & Sub-VIs, Loops & Charts, Arrays, Clusters, Graphs, Case/Sequence Structures, Formula modes, Local & Global Variables, String & File Inputs.

5. **Data Acquisition Basics with VI:**

   ADC/DAC, DI/O, Counters/Timers, PC Hardware structures, timing interrupts, DMA, Software & Hardware Installations.

TEXT BOOKS:

1. Electrical and Electronic measurement and Instrumentation – by A. K. Sawhney
2. Gary Johnson, LabVIEW Graphical Programming 2nd Edition, McGraw Hill NY, 1997
3. Lisa K Wells & Jeffrey Travis, LabVIEW for everyone, Prentice Hall, NJ, 1997.

References:

1. Sokodoff, Basic concepts of LabVIEW, Prentice Hall, NJ, 1998.
2. S.Gupta, JP Gupta, PC Interface for Data Acquisition & Process Control, 2nd Ed. Instrument Society of America, 1994.
3. www. ni.com.

EI-303 NON LINEAR & SAMPLED DATA CONTROL SYSTEM

Internal marks :40 **L T P**
External marks :60 **3 1 0**
Total marks :100

1. **State Variable representation of Control Systems:**
   Concepts of state space and state variables. State space representation of systems described by scalar differential equations, solution of state equation ; State transition matrix. State Space representation of discrete systems.

2. **Controllability and observability:**
   Controllability & observability of linear time invariant systems: conditions for C.C. and C.O.

3. **Stability Analysis:-**
   Definition, first & second methods of Liapunov: stability analysis of linear system.

4. **Non-linear systems:**
   Introduction: Common physical non-linearities: phase plane method system analysis by phase plane method: Describing functions: Stability analysis by describing function method Study of stability by liapunov and popov methods.

5. **Sampled data systems:-**
   Sampling process: Impulse modulation: Mathematical analysis of sampling process: Z transform & its evaluation theorems of Z-transform: Modified Z transform : Mapping of J Plane into Z plane, pulse transfer function: stability and analysis in Z plane.

6. **Introduction to Adaptive Control & Parameter Identification:-**

BOOKS RECOMMENDED: -

1) K. Ogata: Modern Control Engg. PH1
2) C.H.Sec. & A.U. Mever: Modern Control Principles & Applications MGH
3) J.E.Gibson: Nonlinear Automatic Control MGH
4) D.P.Lindorf : theory of sampled data control systems. J.W.
5) Atherton D.P.: Non-linear control Engg.
6) B.C. Kuo: Analysis & Synthesis of S.D. Control Systems PH1

ME-251 TOTAL QUALITY MANAGEMENT

Internal marks :40 **L T P**
External marks :60 **3 1 0**
Total marks :100

Detailed Contents

1. Quality and Total Quality Management; Excellence im manufacturing/service, factors of excellence, relevance of TQM.

2. Concept and definition of quality; total quality control (TQC) and Total Quality Management (TQM), salient features of TQC and TQM. Total Quality Management Models, benefits of TQM.

3. Just-in-time (JIT): Definition: Elements, benefits, equipment layout for JIT system, Kanban system MRP (Material Requirement planning) vs JIT system, Waste elimination, workers involvement through JIT: JIT cause and effect chain, JIT implementation.

4. Customer: Satisfaction, data collection and complaint, redressal mechanism.

5. Planning Process: Policy development and implementation; plan formulation and implementation.

6. Process Management: Factors affecting process management, Quality function development (QFD), and quality assurance system.

7. Total Employees Involvement (TEI): Empowering employees: team building; quality circles; reward and Recognition; education and training, Suggestion schemes.

8. Problems solving Defining problem; Problem identification and solving process; QC tools.

9. Benchmarking definition, concept, process and types of benchmarking.

10. Quality Systems: Concept of quality system standards: relevance and origin of ISO 9000; Benefits; Elements of ISO 9001, ISO 9002, ISO 9003.

11. Advanced techniques of TQM: Design of experiments: failure mode effect analysis: Taguchi methods

BOOKS:

1. Total Quality Management by sunder Raju, Tata Mcgraw Hill

2. TQM for engineers by M.Zairi, Aditya Books

3. Total Quality Management Handbook by J.L. Hradeskym MCGraw Hill

4. ISO 9000 quality System by Dalela and Saurabh, standard Publishers

EI-305 PROCESS DYNAMICS AND CONTROL

Internal marks :40 **L T P**
External marks :60 **3 1 0**
Total marks :100

1. **Process :**

Basic components, diagrammatic representation, symbol and terminology.

2. Process Characteristics :
Process variables, mathematical modeling of liquid, gas, thermal and mechanical & Chemical system. Linearizing techniques, Liquid level control in a tank. Dynamics of manometer, response non-interacting and interacting first-order elements in series.

3. Controller Characteristics :
Characteristics of on-off, proportional, integral, derivative modes and their combinations.

4. Automatic control :
Single and combined modes in closed loop, static error, velocity error, dynamic behavior of feedback control processes for different modes, IAE, ISE, IATE criteria, tuning of controllers.

5. Controller Hardware :
Electronic pneumatic and hydraulic controllers implementing, single and composite modes of controllers.

6. Final control elements :
Control valves, types, function, electrical, pneumatic hydraulic-actuators. Solenoid, E-P Converter.

BOOKS RECOMMENDED :

1. D.P.Eckman Automatic process control
2. D.P.Eckman Industrial instrumentation
3. D.P.Eckman Principles of industrial process control.
4. Coughanwr & Koppel Process systems analysis and control
5. Patranabis Principles of process control
6. G.Stephanopoulos Chemical process control, PHI
7. Peter Harriot Process Controls, TMGH.

EC-303 INDUSTRIAL ELECTRONICS

Internal marks :40 **L T P**
External marks :60 **3 1 0**
Total marks :100

Characteristics of Selected Devices: Fast recovery diodes, Schottky diode, SCR, gate trigger and commutation circuits, series and parallel connection of SCRs, Diac, Triac, UJT, Power MOSFETs.

Controlled Rectifier: Half wave and full wave with resistive & R-L-E and resistive-inductive loads. Free-wheeling diode, three phase rectifiers, Bridge rectifiers -half controlled and fully controlled.

Inverter, Chopper And Cycloconverter : Voltage driven, current driven, bridge, parallel, SCR versions, control of output voltage-PWM schemes, harmonic reduction

Motor Control: D.C. and A.C. motor control, reversible drives, closed loop control, commutatorless d.c. motor control.

A.C. Voltage Controllers: Types of AC Voltage Controllers, Integral cycle control, single phase voltage controller, Sequence control of AC voltage (Transformer tap changers)

Books Recommended:

1. Power Electronics - P.C. Sen, Tata McGraw Hill Publishing Co., Ltd., 1987.
2. Power Electronics and Control - S.K. Dutta, Prentice Hall of India Pvt. Ltd., 1986.

EC-309 MICROPROCESSOR AND ITS APPLICATIONS

Internal marks :40 **L T P**
External marks :60 **3 1 0**
Total marks :100

Introduction to Microprocessors:

Overview of microprocessor structure and operation, Microprocessor evolution and types. Review of basic digital devices.

8085 Microprocessor:

Introduction to Intel 8085 Architecture: Instruction cycle, timing diagram; Instruction set of Intel 8085.

Programming of Microprocessors: & Examples of Assembly Language Programs

Peripheral Devices & Their Interfaces:

Introduction to interfacing, Memory & I/O Interfacing, Data Transfer Schemes, Interrupts of Intel 8085, Interfacing devices & I/O Devices: PPI 8255, DMA 8257, PIC 8259, PCI 8251, Prog. Counter/Timer 8253, Special purpose interfacing devices: 8275, 8295, 8279. Elements & circuits for interfaces. CRT/ Printers & Scanners interfacing.

Microprocessor based Data Acquisition Systems:

ADC, S/H Circuits, ADC 0800/0808/0809. DAC 0800.

Introduction to other Microprocessors:

Intel 8086, 80186/286, 8088, 80386/486 & Pentium, Zilog Z80.

Introduction to software development system:

Introduction to microprocessor based software development systems (MDS), Assemblers & Cross assemblers; Trouble shooting of 8085/8086 based simple microcomputer.

Books Recommended:

1. Fundamentals of Microprocessor & Microcomputers by B.Ram.
2. Microprocessor Architecture, Programming & Application with 8085 – R. S. Gaonkar

EC-319: LAB-VII:MICROPROCESSOR APPLICATIONS

Internal marks :30 **L T P**
External marks :20 **0 0 2**
Total marks :50

1. Simple programs for sorting a list of numbers in ascending and descending order.
2. Sorting a list without destroying the original list.
3. Code conversion - Binary to Gray/Gray to Binary.
4. Program for addition of BCD numbers.
5. Program for multiplication of 8-bit numbers using Booth's algorithm.
6. Interface an LED array and 7-segment display through 8255 and display a specified bit pattern/character sequence at an interval of 2 seconds.
7. Generate the given waveform using a DAC after interfacing it with a microprocessor kit. Use any PPI port.
8. Interface an ADC chip with microprocessor kit and verify its operation with d.c. and low frequency inputs. Use of PPI port and sample and holds is required.
9. Interface an external 8253 to the micro processor kit at the address given. Hence,
   i) generate a pulse train of specified duty cycle at the given output line,
   ii) operate as a : N counter,
   iii) count a train of pulses for a given duration.
10. Interface the given microprocessor kit to a personal computer through R.S-232C. The baud rate is specified. Verify data transfer in both directions (P - PC and PC - P)
11. Interface a given printer to the microprocessor kit using on board 8255.
12. Interface an external keyboard to a microprocessor kit through on board 8255.
13. Write a program to demonstrate rolling display from left-to-right using 8279. Do not use any built in routines, instead program the 8279.
14. Use the SOD line to generate a square wave of the specified duty cycle at a given frequency.
15. Write a program to generate a prime series with 8086.
16. Write a program to generate sine wave using 8086.

EC-315 LAB-VIII: INDUSTRIAL ELECTRONICS

Internal marks :30 **L T P**
External marks :20 **0 0 2**
Total marks :50

1. To draw the characteristics of various thyristor families.

2. To determine frequency of a relaxation oscillator for various values of C.

3. To obtain the average current of an SCR as a function of resistance.

4. To vary the frequency of an invertor circuit.

5. To vary the firing angle of an SCR using a phase shift circuit and a peaking transformer.

6. To control the firing angle of thyristor by varying i) dc bias alone ii) dc bias with superimposed ac

7. To vary the speed of a dc motor with the help of an SCR.

8. To determine the ripple factor of a full wave rectifier using SCR for various firing angles.

EI-307 LAB-IX: VIRTUAL INSTRUMENTATION & DATA ACQUISITION

Internal marks :30 **L T P**
External marks :20 **0 0 2**
Total marks :50

1. Data Acquisition using Virtual Instrumentation from an RTD/Thermocouple.
2. Data Acquisition using Virtual Instrumentation from a Pressure Transducer
3. Creation of a CRO using Virtual Instrumentation.
4. Creation of a Digital Multi-meter using Virtual Instrumentation.
5. Creation of Digital Temperature Controller using Virtual Instrumentation.
6. Machine Vision concepts using Virtual Instrumentation.

6th /7th Semester

EI-302/401 INSTRUMENTATION SYSTEM DESIGN

Internal marks :40	**L T P**
External marks :60	**3 1 0**
Total marks :100	

1**. Introduction to Transducers & their classifications:**

Introduction, Transducer terminology, general transducer characteristics, design characteristics, performance characteristics, reliability characteristics, criterion for transducer selection

2. **Basic principle & design of transducers for:**

Temperature / Pressure/ Level / Flow / Displacement/ Acceleration/ Speed/ & Power parameter.

3. Signal conditioning:

3-stage Instrumentation amplifier, Modulators and demodulators, S/H circuits. Active Filter types. Design of Butterworth filter for 3rd order.

4. System Design:

a) Microprocessor-based system design for Temperature & Pressure.

b) PC-based system design for Thermal Power Station & Cement Plant.

BOOKS RECOMMENDED:

1. Handbook of transducers: H.N. Norton Prentice Hall
2. Instrument Transducers: An introduction to their performance H.K.P.Neubert
3. Measurement System: Application and Design: E.O.Doebelin
4. Instrumentation Devices and systems: Rangan, C.S. Mani
5. Microprocessors & Applications: B.Ram
6. Computer-based Industrial Control by Krishan Kant.

EI-304/403 INDUSTRIAL MEASUREMENTS

Internal marks :40 **L T P**
External marks :60 **3 1 0**
Total marks :100

1. **Metrology :** Line & length standards, gauge blocks, mechanical, optical, pneumatic & electrical comparators, interferometer & optical flats, sine bar. Review of displacement, velocity, acceleration & seismic pickups
2. **Pressure Measurement:** standards & calibration, dead weight piston gauges & manometers, elastic transducers, bourdon tube, bellows & diaphragm, high pressure measurement, vacuum measurement- McLeod gauge, Knudsen gauge, thermal conductivity gauges, Pirani & Ionization gauge
3. **Temperature Measurement:** Standards & calibration, thermal expansion methods, bimetallic thermometers, filled in systems, their errors, thermoelectric sensors, electric resistance sensors, junction semiconductor sensors, radiation pyrometer
4. **Flow measurement:** head type, area type, positive displacement type, mass flow meters, vortex type, electrical types- turbo magnetic, electro magnetic, ultrasonic, hot wire anemometers, flow marker, open channel flow metering, their working principle & applications
5. **Other measurements:** mass. weight, force, torque & shaft power measurement, level measurement, humidity & moisture measurement

BOOKS:

1. Measurement System: Application & Design- E.O.Doebelin
2. Instrumentation devices & systems : Rangan, Mani, Sarma
3. A course in mechanical instrument & instrumentation: A.k.Sawhney

CE-216 ENVIRONMENTAL SCIENCE

Internal marks :40 **L T P**
External marks :60 **3 1 0**
Total marks :100

Unit 1 : The Multidisciplinary nature of environmental studies

Definition, scope and importance

(2 Lectures)

Need for public awareness.

Unit 2 : Natural Resources :

Renewable and non-renewable resources :

Natural resources and associated problems.

a) Forest resources : Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
b) Water resources : Use and over-Utilization of surface and ground water, floods, drought, conflicts and water, dams-benefits and problems.
c) Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
d) Food resources : World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
e) Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies.
f) 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.

Unit 3 : Ecosystems

- Concept of an ecosystem.
- Structure and function of an ecosystem.

- Producers, consumers and decomposers.
- Energy flow in the ecosystem.
- Ecological succession.
- Food chains, food webs and ecological pyramids.
- Introduction, types, characteristic features, structure and function of the following ecosystem :-

  a. Forest ecosystem
  b. Grassland ecosystem
  c. Desert ecosystem
  d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

(6 lectures)

Unit 4 : Biodiversity and its conservation

- Introduction – 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 loass, poaching of wildlife, man-wildlife conflicts.
- Endangered and endemic species of India
- Conservation of biodiversity : In-situ conservation of biodiversity.

Unit 5 : Environmental Pollution

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

- Solid 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.

(8 lectures)

Unit 6 : Social Issues and the Environment

- From Unsustainable to Sustainable development
- Urban problems related to energy
- Water conservation, rain water harvesting, watershed management
- Resettlement and rahabilitation 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 Protection Act.
- Air (Preventation 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.

(7 lectures)

Unit 7 : Human Population and the Environment

- 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.

Unit 8 : Field work

- Visit to a local area to document environmental and river forest grassland hill mountain.
- Visit to a local polluted site – Urban / Rural / Industrial / Agricultural
- Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes, etc. (Field work Equal to 5 lecture hours)

EC-310 **DIGITAL SIGNAL PROCESSING**

Internal marks :40 **L T P**
External marks :60 **3 1 0**
Total marks :100

Introduction Limitations of analog signal processing, Advantages of digital signal processing.

Discrete time characteristics of Signals & Systems Some elementary discrete time sequences and systems; Concepts of stability, causality, linearity, time invariance and memory; Linear time invariant systems and their properties; Linear constant coefficient difference equations.

The Z Transform Z-Transform, Region of convergence; Properties of the Z-transform; convolution theorem; Parseval's relation; Unilatera; Z-transfform and its application to difference equations with non-zero initial conditions.

Discrete Fourier Transform DFT and its properties; Linear, Periodic and Circular convolution; Fast Fourier Transform algorithm using decimation in time and decimation in frequency techniques; Linear filtering approaches to computation of DFT.

Structure for Discrete Time Systems Signal flow graph representation, Transposed forms, Lattice structures.

Design of Digital Filters Linear Phase FIR filters; Design methods for FIR filters; IIR filter design by impulse Invariance, Bilinear Transformation, Matched Z-Transformation, Frequency Transformation in the Analog and Digital Domain.

Finite Precision Effects Fixed point and Floating point representations, Effects of coefficient quantization, Effect of round off noise in digital filters, Limit cycles.

Digital Signal Processors Architecture and various features of TMS/ADSP series of digital signal processors. DSP Applications.

Books Recommended :

1. Discrete Time Signal Processing - A. V. Oppenheim & R W. Schafer, Prentice Hall,89
2. Digital Signal Processing - J. G. Proakis & D.G. Manolakis, prentice Hall, 1992.
3. Signal & Systems - A. V. Oppenheim, A. S> Willsky & I.T. Young, PHall, 1983.
4. Digital Signal Processing - A Computer-based Approach. Mitra. Tata McGraw Hill.98.
5. Digital Signal Processing in VLSI. Higgins, Prentice Hall., 1990.
6. http://www.ti.com, Web site of Texas Instruments for TMS series digital signal processor architectures.

DEPTT. ELECTIVE SUBJECTS

DE-1.1: PNEUMATIC AND HYDRAULIC INSTRUMENTATION

Internal marks :40	**L T P**
External marks :60	**3 1 0**
Total marks :100	

1. Introduction, Scope and potential of applications of pneumatics and hydraulics in instrumentation and control.
2. Fundamentals of fluid flow, flow through orifices and restrictions, linearization of flow equations.
3. Pneumatic system elements and devices and their liberalized modeling e.e sources, regulated sources, valves, actuators etc.
4. Hydraulic system elements and devices and their literalized modeling e.e sources, regulated sources, valves, actuators etc.
5. Feedback and its applications to development of hydraulic controllers.
6. Pneumatic controllers, control schemes and control circuits.
7. Hydraulic control schemes and control circuits.
8. Pneumatic telemetering systems and hydraulic power transmission.
9. Electro hydraulic scross, characteristics, transfer function, stability studies etc.
10. Fluidic elements, characteristics and logic devices.
11. Analysis and synthesis of fluid logic systems with applications.

DE-1.2 INSTRUMENTATION SYSTEM RELIABILITY

Internal marks :40 **L T P**
External marks :60 **3 1 0**
Total marks :100

1. **Reliability concepts:** Introduction, reliability, importance of reliability in system instrumentation Failures and failure modes, cause of failure, instantaneous failure rate, general reliability function.
2. **Component Reliability and hazard model:** component reliability from test data, failure data(failure density, failure rate, reliability, probability of failure), mean failure rate, mean time to failure, mean time between failure, MTTF in terms of failure density hazard models, linear hazard model, non linear hazard model.
3. **System reliability:** Logic diagram of system instrumentation, series configuration, parallel configuration, standby configuration, K-out ofn configuration, complex system, Markov method, Fault tree technique, event space method, path tracing methods cut-set and tie-set method.
4. **Reliability Improvement:** Introduction, component versus unit redundancy, weakest link technique, mixed redundancy, standby redundancy.
5. **Maintainability and Availability:** Introduction, Maintainability function, Availability function, frequency of failures two unit parallel system with repair, allocation of redundancy failure rate, time of continuous operation, mean repair time.

BOOKS RECOMMENDED:

1. E.Balagurusamy : Reliability engineering
2. M.L.shooman : Probablistic Reliability an engg. Approach
3. Gerold sandler : Reliability Engg.
4. Siegmand Halpuru : An introduction to quality and reliability

DE-1.3 STATE SPACE ANALYSIS & DIGITAL CONTROL

Internal marks :40 **L T P**
External marks :60 **3 1 0**
Total marks :100

1. **Discrete time signals and systems:** Introduction, SDC systems, sampling and data reconstruction.
2. **Transform analysis of discrete systems:** Introduction, linear difference equations, the pulse T.F. and pulse response, Z-transform equivalence of Z-domain to S-domain, stability analysis.
3. **Design of digital controls:** Introduction, design of a positional servomechanism, digital PID controller, multivariable controllers.
4. **State space models of discrete time systems**: Introduction, discrete time state equation and solution, design examples, concepts of controllability and observability Liapunov stability analysis.
5. **State estimation and filtering:** Introduction, necessity of estimation, principles of least squares, recursive least square algorithm, Kalaman, filtering, parameter estimation.

BOOKS RECOMMENDED:

1. Digital control Engg. : M.Gopal
2. State estimation: Medich
3. Theory and application of Z transform methods E.I.Juny John Wiley
4. Microprocessor based control system by N.K.sinha
5. Analysis and synthesis of Sd-control system : B.C.Kuo
6. State space Engg : K.Ogata
7. Theory of SD control systems : D.P.Lindorff

DE-1.4 NON-LINEAR CONTROL SYSTEMS

Internal marks :40 **L T P**
External marks :60 **3 1 0**
Total marks :100

1. **Non linear systems:** Introduction, mathematical modeling, common physical nonlinearities, concept of linearization of n.l. mathematical models, multivalued responses and jump resonances
2. **Describing Function:** definition, describing functions for common physical n.l. elements, D.F. method for stability analysis, limit cycle, limitations.
3. **Phase plane analysis:** The phase plane method- basic concepts, phase portrait, singular points system analysis using phase plane method.
4. **Linear approximation of NL systems:** Liapunov's, methods, statements of various stability terms in sense of Liapunov, concept of linearization, stability theorems of Liapunov for systems.
5. **Direct method of liapunov:** Introduction, stability theorem for NL systems, various methods for construction of Liapunov function, statement of lure problem Kalman-Yakuborich lemna.
6. **Popouv's Stability criterion:** popov's stability theorem for NL systems, circle criterion, use of popov's criterion to construct optimal Liapunov function:Popov-Liapunov correspondence on generation of V(x).
7. Introduction to direct methods of **Liapunov** to sampled data control system.

BOOKS RECOMMENDED

1. Modern control Engg. By K. Ogata
2. Nonlinear control Engg. By D.P. Atherton, Van Nost Reinhold
3. Control system Engg. By I.J.Nagrath & M.Gopal

DE-1.5 PROGRAMMABLE LOGIC CONTROLLERS & APPLICATIONS

Internal marks :40 **L T P**
External marks :60 **3 1 0**
Total marks :100

1. **Introduction to PLC:-** Definition: Evolution, Advantages/Disadvantages: system description; Internal operation of CPU and I/C modules, installation &testing.

2. **Programs & Software:-** General programming procedures, registers and Addresses, Relation of Digital Gate Logic to contact logic.

3. **Basic PC Functions:-** Programming, On-Off inputs to produce on – off outputs: Timers, Counters: Auxiliary Commands &functions.

4. **Intermediate Functions:-** Arithmetic functions, Number Comparison functions, The skip & master control relay functions, Data nove systems.

5. **Functions involving individual register bits:-** Utilizing digital bits, the sequences functions, Matrix functions.

6. **Advanced Functions:-** Controlling a robot with a PC; Analog PC operator , Immediate update, select continuously, ascending sort, transmit print, FIFO, LIFO,& Loop Control.

Books Recommended:

1. Webb: **Programmable Controllers: Principles & Applications**, Merril Publishing Co.Columbus, Ohio, 1988.
2. Simpson: **Programmable Logic Controllers**, Prentice Hall, Englewood Cliffs, 1994.
3. T.A.Hughes, **Programmable Controllers**, 3rd Edition, ISA Press.
4. Gary Danning, **Introduction to Programmable Logic Controllers**, Delmar Thomson Learning
5. Bela.G.Liptak, **Instrument Engineer's Handbook, Vol:II-Process Control,** 3rd Edition, ISA Press, 1995

ELECTIVES-II:

DE-2.1 INDUSTRIAL DATA COMMUNICATIONS

Internal marks :40 **L T P**
External marks :60 **3 1 0**
Total marks :100

1. **Basics:** ISO/OSI Layer model, LAN etc.
2. **Field Bus Systems:** Profibus, Interbus, Modbus & CAN etc.
3. **Communication Protocols:** Token-Passing, Master-Slave procedures, TCP/IP & Industrial Ethernet.
4. **Communication Mediums:** RS-232, RS-485 RS-422 & Fibre-optics, etc.
5. **Networking of PLCs.**
6. **Role of Information Technology:** RIP & OSPF router technologies, OLE for process control (OPC), Active-X, DCOM, Virtual Private Networks etc.

Books Recommended:

1. L.M.Thompson, **Industrial Data Communications, Fundamentals & applications,** 3rd Edition, ISA Press.
2. Perry.S.Marshall, **Industrial Ethernet, a Pocket Guide**, ISA Press.
3. Jonas Berge, **Field buses for Process Control, Engineering, Operations & Maintenance,** ISA Process.

DE-2.2 COMPUTER ARCHITECTURE

Internal marks :40 **L T P**
External marks :60 **3 1 0**
Total marks :100

1. DIGITAL LOGIC CIRCUITS: Logic Gates, Boolean algebra, Map simplifications, Combination circuits, Flip-flops, Sequential circuits, Decoders, Multiplexers, Registers, Counters & Memory Units.

2. DATA REPRESENTATION: Data Types, complements, Fixed point representation, Floating point representation, Binary Codes & Error detection.

3. REGISTER TRANSFER & MICRO-OPERATIONS: Register transfer language, Bus & Memory transfer, Arithmetic micro-operations, Logic micro-operations, Shift micro-operations, Arithmetic Logic Unit, Instruction codes, Memory reference instructions, Design of accumulator logic.

4. MICRO-PROGRAMMED CONTROL: Machine language, Assembly Language, Assembler, Control Memory, Address Sequence & Design of Control Unit.

5. CENTRAL PROCESSING UNIT: Introduction, general register organization, Stack organization, Instruction formats, Addressing codes, Data transfer, Program control addition, subtraction, multiplication algorithms, division algorithm, floating point arithmetic operations, decimal arithmetic units, parallel processing.

6. INPUT-OUTPUT ORGANISATION: Peripheral devices, Input-ouput interface, Mode of transfer, Priority Interrupt, Direct Memory Access, I/O Processor, Serial Communication.

Books Recommended:

1. Computer System Archtecture by M. Morris Mano

D.E-2.3 **INTELLIGENT ROBOTICS**

Internal marks :40 **L T P**
External marks :60 **3 1 0**
Total marks :100

Unit I: **Fundamentals of Robotics:** Automation & Robotics, Robot Anatomy, Work Volume, Drive systems, Control System & Dynamic Performance Precision of Movement, End Effects, Sensors, Work cell control & Programming.

Unit II: Robot & Peripheral: Control System Concept & Models, Controllers, Control System Analysis, Activation & Feedback Components, Position Sensor, Velocity Sensors. Manipulator, Kinematics, Transformations, Robot Arm Kinematics & Dynamics, End effectors.

Unit III: Sensors in Robotics: Sensors in Robotics, Tactile Sensors, Proximity & Range Sensors, Sensor Based Systems, Uses of Sensors in Robotics.

Unit IV: Machine Vision: Introduction, Sensing & Digitizing Functions in Machine Vision, Image Processing & Analysis, Training & Vision Systems.

Unit V: Robot Programming: Languages, A Robot Program as a Path in Science, Motion Interpolation, Wait, Signal & Delay Commands, Branching, Limitation.

Unit VI: **Artificial Intelligence:** Introduction, Goals, Techniques, AI & Robotics, Machine

Unit VII: Implementation, Safety, Training, Maintenance & Quality.

Reference Books:

Industrial Robotics by MP Groover, M Weiss (McGraw Hill Int'l)
Robotics by Lee (McGraw Hill)

DE.2.4 MICROCONTROLLER & ITS APPLICATIONS

Internal marks :40 **L T P**
External marks :60 **3 1 0**
Total marks :100

1**. Introduction:**

Comparison of microprocessor & microcontrollers, survey of 4,8,16 & 32 bit microcontrollers.

2. **Architecture of 8051:**

Block Diagram, oscillator & clock, Program Counter, registers, Flags, Internal memory, stack & stack pointer, special function register, Input/Output Pins, Ports and Circuits, External memory, Counters & Timers, Serial Data input/output interrupts.

3. **Programming of 8051:**

Assembly language Programming Process, 8051 instruction, Data Move Instructions Addressing modes,External data moves, Code memory read-only data moves, Push & Pop opcodes; Logical instructions Bit level & Byte level logical operations Rotate & Swap operations; Arithmetic Instructions increment & decrement instruction, Addition, Subtraction, Multiplication and Division; Branch instructions Jump & Call Instructions, subroutines, interrupts and returns.

4. **8051 Microcontroller Design:**

External memory and memory space decoding, Reset and clock circuits, Expanding I/O, Memory mapped I/O, part speed, Memory access time, Testing & Design Crystal Test, ROM/ Ram Test; Timing subroutines, lookup table for 8051, serial Data transmission.

5. **Applications:**

Key Boards Key switch factors, Key configrators, Program for Key boards, scanning program, interrupt driven program; Displays Seven segment & LCD Display; Measurements Frequency & Pulse width measurements;D/A & A/D converters, DC motor control, Stepper motor control

6. **Introduction to Embedded Systems:**

Books Recommended:

1. The 8051 Microcontroller by K.J.Ayala

The 8051 Microcontroller and embedded systems by M.A.Mazidi & J.G.Mazidi

EI/306/405 Lab-X: INSTRUMENTATION SYSTEM DESIGN

Internal marks :30 **L T P**
External marks :20 **0 0 2**
Total marks :50

1. Design & Performance of LVDT.
2. Design & Performance of Thermo-couples & Thermo wells.
3. Design & Performance of RTD & Thermistors.
4. Design & Performance of Instrumentation amplifiers and Active filters
5. Design & Performance of Strain Gauge & pressure transducers
6. Design & Performance of PID Controllers.
7. Design & Performance of Microprocessor/Micro-controller based system.
8. Design & Performance of PC-based systems.

EC-318 **Lab XI: DIGITAL SIGNAL PROCESSING**

Internal marks :30 **L T P**
External marks :20 **0 0 2**
Total marks :50

1. DSP hardware from Texas Instruments TMS 320
2. DSP hardware from Analog Devices

3. Turbo C based programs on

    (a) 8-point FFT
    (b) Convolution
    (c) Cor-relation

4. Matlab version 6.0 release 12 with simulinks, Ring Processing, Image processing Toolboxes.

8th Semester

EI-402 ADVANCED PROCESS CONTROL

Internal marks :40 **L T P**
External marks :60 **3 1 0**
Total marks :100

1. **Introduction:** Review& limitations of single loop control, need for multi-loop systems
   P/ I diagrams, standard instrumentation symbols for devices, signal types, representation & reading of instrumentation scheme using P / I diagrams

2. **Advanced process control techniques**: principle, analysis & applications of cascade, ratio, feed forward, override, split range, selective & auctioneering control system with multiple loops, dead time compensation, adaptive control, inferential control

3. **Design of control systems for multivariable process:** multivariable control system, interaction in multiple loops, RGA method for minimizing interactions eg. Distillation column, absorbers, heat exchangers, furnaces 7 reactors

4. **Introduction to computer control systems in process control:** DCS configuration, control console equipment, communication between components, local control units, DCS flow sheet symbols, DCS I/O hardware & set point stations. Supervisory control& data acquisition system

5. **Programmable logic controls:** Introduction, relative merits over DCS & relay, programming languages, hardware & system sizing, PLC installation, maintenance & troubleshooting

BOOKS:

1. D.P.Eckman" INDUSTRIAL INSTRUMENTATION"
2. G.Stephenopolous " Chemical Process Control"
3. Liptak " Handbook of process control"
4. Pane "Handbook of advanced process control
5. Donald R. Goughamonr " Process System analysis and control

EI-404 BIO MEDICAL INSTRUMENTATION

Internal marks :40 **L T P**
External marks :60 **3 1 0**
Total marks :100

1. **Electrodes and Transducers:**
   Bioelectrical signals, Bio-electrodes, Electrode tissue interface, contact impedance. Effect of high contact impedance. Types of electrodes-temperature transducers. Respiration sensors. Bio- medical signal processors, Physiological preamplifier and specialized amplifier.

2. **Bio-medical recorders:**
   ECG machine, Blockdiagram of ECG machine. Application of ECG machine, ECG electrodes, ECG leads, EEG machine, EMG machine.

3. **Patient Care Measurement:**
   Heart rate measurement. Pulse rate measurement. Respiration rate measurement. Blood pressure measurement. PH analyzer. ESR. GSR. X-Rays. Diathermy.

4. **Cardiovascular measurements&stimulations:**
   Cardiac output measurement. Plethysmogrphy, Blood flow measurements. Phono-cardiagraphy. Vector-cardiography. Defibrillators, pacemakers.

5. **Advances in bio medical instrumentation:**
   Computed Tomography, Magnetic Resonance Imaging, Nuclear Medicine, Telemedicine, Ultrasound. Lasers.

BOOKS RECOMMENDED:

1. LA Geddes and LE Baker, “Principles of Applied Biomedical Instrumentation” John
Wiley & sons, new york 1980.
2. JJ Carr and JM Brown, “Introduction to Biomedical Equipment Technology”2nd Prentice Hall, Englewood Cliffs New Jersey 1993.
3. L Gromwell, F.J.Weibell & EA Pfeiffer, “Biomedical Intumentation and measurements, 2nd Prentice Hall of India Pvt. Ltd. New Delhi,1990.

REFERENCE BOOK:

J.G.Wedster “Encyclopedia of Medical Devices & Instrumentation” John Wiley& Sons, New York 1988.

EI-406 **ANALYTICAL INSTRUMENTATION**

Internal marks :40 **L T P**
External marks :60 **3 1 0**
Total marks :100

1. **Introduction:**
   Difference between analytical & other instruments, sampling systems for liquid & gases, sampling components, automatic and faithful sampling

   Gas analysis:

   gas chromatography- principles and components ,thermal conductivity gas analyzers , heat of reaction method, estimation of oxygen , hydrogen , methane , CO2 , carbon monoxide etc. in binary or complex gas mixtures , oxygen analyzers, electro chemical reaction method ,humidity and moisture measurement technique.
2. **Chemical Composition measurement:**
   Newtonian and non Newtonian flow, measurement of viscosity and consistency, laboratory and on line methods, measurement of pH:- definition and methods, red ox potential ,electrical conductivity , conductivity cell and application, density measurement : solids , liquids and gases .
3. **Spectro chemical analysis:**
   Classification of techniques, principles and components, emission spectrometry: - flame emission, atomic absorption type. dispersive and non dispersive techniques ,scheme for UV,IR and near IR analysis , comparison of methods , X-rays analyzers NMR spectroscopy , mass spectroscopy
4. **Analytical Electron microscope:**

Books Recommended:

1) R.E.Sherman, **Analytical Instrumentation**, ISA Press, 1996.
2) Willard, Merritt & Dean, Instrumental Methods of Analysis, Affiliated East-West Press, New Delhi
3) Bela.G.Liptak, **Instrument Engineer's Handbook: Process Measurement & Analysis**, 3rd Ed. ISA Press, 1995.
4) Douglas M.Considine, **Process/Industrial Instruments & Controls Handbook**,4th International Edition, McGraw Hill Inc.1993

ELECTIVE -III

DE-3.1 OPTIMAL CONTROL SYSTEMS

Internal marks :40 **L T P**
External marks :60 **3 1 0**
Total marks :100

1. INTRODUCTION:

Basic Mathematical concept S.V.description , conditions of optimality ,formulation of optimal control problem, different types of optimization problem , review of controllability and observability, concept of parametric optimization and Lagrange multiplier method ,different performance criteria and constraints in optimization.

2. CALCULUS OF VARIATIONS:

Definition and minimization of functions, Euler Langrages equations for scalar case and its generalization to vector case. Langrange Multiplier method ,fixed and free end problems , transversely conditions , formulation of optimization problems in Langrange and Edza-forms .

1. PONTRAYAGIN'S MAXIM(MINIMAL) PRINCIPLE:

Statement of Pontrayagin's maximum principle and Hamilton Jocobi- Bell wan Theory
applications to optimization problem with magnitude constraints on control simple examples.

2. DYANIMIC PROGRAMMING:

Multistage decision processes, Dr. of invariant embedding, principles of optimality, discreet
dynamic programming, Bethman's equation .

3. OPTIMAL FEED BACK CONTROL:

Introduction Lenore regulator and servo mechanism problems, matrix ricaati equation, solution and implementation, sub optimal linear regulator, minimum – time control of linear
time in variant system.

BOOKS RECOMMENDED: -

1. OPTIMAL SYSTEM CONTROL A.P.SAGE,THI NEW DELHI
2. MODERN CONTROL SYSTEM THEORY M.GOPAL WILEY ESTERN DELHI
3. CONTROL SYSTEM ENGINEERING I.J.NAGRATH, M.GOPAL WILEY DELHI
4. LINER OPTIMAL CONTROL B.D.C.ENDERSON AND J.B.NCORE, PRENTICE HALL,N,J,(Englewood cliff)

DE-3.2 COMPUTER CONTROL OF INDUSTRIAL PROCESSES

Internal marks :40 **L T P**
External marks :60 **3 1 0**
Total marks :100

1. Computers:

Algorithms, Languages, Programmes, Analog Simulation, Hybrid Simulation.

2. Control Tasks & Data Communication.

3. Software & Hardwares for Process Control.
Concepts of Real Time Operating Systems. Data &
Symbols for Operating Systems.

4. Application Programs & Data bases on line data-base organization. Distributed Data-bases.

5. Man-Machine Interface:
Introduction, Operator System Communication. Recognition of Process States, Operator
Process Interaction, Operator Role.

6. System Design:
Feasibility study, Communication Design, Data Transmission Unit, Designing Control &
Dispatching centers.

7. Integrated Approach:
Introduction, Mounting & installation procedures, testing & reliability.

Books:

1. Digital design with statndard MSI & LSI by T.R.Blokeslee, J.W & Sons NY.
2. Instrument Engineers Handbook by B.G.Liptak.
3. Computers in Process Control by Fran V.Zevic.
4. Computer based Control by Krishan Kant PHI

DE-3.3 DISTRIBUTED CONTROL SYSTEMS (DCS)

Internal marks :40 **L T P**
External marks :60 **3 1 0**
Total marks :100

1. Computers-Hierarchical Control:

#Introduction to computers, memory organization, and its characteristics, RAM, ROM, magnetic disk memory, magnetic tape memory bubble memory, Introduction to centralized, de-centralized & dedicated computer process control systems.

Application of computer in control system, Introduction to SCADA (Supervisory Control & Data Acquisition).

DCS- Basic Packages:

Introduction, analog control, direct digital control, distributed process control, DCS configuration with associated accessories, control console equipment, control unit (Relay Rack mounted equipments), local control units, attributes of DCS & DCS Flow sheet symbols.

DCS System Integration:

I/O hardware stations, Set-point station control, Supervisory Computer Tasks & configurations, system integration with PLCs and computers. Man-Machine Interface process monitoring and control, Introduction to expert systems, and Statistical Process Controls.

BOOKS RECOMMENDED

1. Instruments engineers handbook Vol-II, Process Control 3rd Edition 1995 By Bela G, LIPTAK
2. Computer-based Industrial Controls by Krishan Kant
3. Applications of computers in Process Control by Considine
4. MODERN CONTROL TECHNIQUES for the process industries By T.H Tsai , J.W Lane , Mareeet Dekkar, N.Y 1986.
5. Digital Control System By Iserman.

DE-3.4 NUCLEAR INSTRUMENTATION

Internal marks :40 **L T P**
External marks :60 **3 1 0**
Total marks :100

1. General: Introduction to Properties of Nuclear Systems & Radiation, Interaction of radiation with matter, Radioactive sources- choice of isotopes

2. Radiation detectors- Ionization chamber, Geiger Xuller counters, Scintillation counters, Semi conductor devices, Neutron detectors based on recoil measuring circuits including modulators; converters& stabilizers, Synchronous detectors.

Counting statistics, correlation sets , standard deviation of ratio meters, error propagation, effect of background, statistical distribution of pulse height distribution ,detector efficiency.

3. Nuclear reactor instrumentation: Diffusion, moderation, absorption and delay processes, neutral flux, control rod calibration, nuclear fuel inspection and testing including poisoning, radiation energy measurement, remote control instrumentation, nuclear instrument maintenance.

4. Application of industrial system:

a) Radioactive tracer technique- gas & liquid flow measurement, lesk detector, residence time & its distribution, application to blending corrosion & wear studies.

b) Thickness & density measurement by beta rays, gamma rays absorption technique, measurement of thickness of surface material by back scattering.

c) Level detection by radioactive devices, interface detection by neutron moderation technique.

d)Measurement of gas pressure and gas analyzers, spectroscopy and frequency methods.

e) Void detection idity meter, moisture meter, smoke detection, ozoniser, radio chromatography and interferometer.

f) Portable instruments, source activity for dynamic properties of instruments

5. Safety: Hazards of ionization radiation, physiological effect of radiation, dose and risk radiological protection (alpha, beta and gamma, X, neutron)-shielding material and effectiveness.

Operational safety instrument, emergency schemes, effluent disposal, application to medical diagnosis and treatment.

BOOKS RECOMMENDED:

1. Vashtell,C.C ,S.G Hewit Nucleonic instrumentation, Newnes,1965

DE-3.5 ENVIRONMENTAL INSTRUMENTATION AND SAFETY

Internal marks :40 **L T P**
External marks :60 **3 1 0**
Total marks :100

1. Characterization of waste and sources of pollution. Effects of pollution– ecological balance, quality standards and legislation.

2. Air pollution: Emission intensity and dispersion measurement and analysis techniques photometric, gas chromatography, and line spectroscopic analysis. Dust collectors, calorimetry and radioactivity detectors. Trace element detectors. Continuous pollution monitoring. Control of air pollution and control instrumentation.

3. Water pollution: Effluents and their characteristics. Concentration and separation methods of measurement and analysis. Waste treatment by biological, physical and chemical (aeration , sedimentation, floctation, coagulation, ion-exchange ,aerobic and anaerobic digestion) process control and instrumentation . colorimetry and spectroscopic remote sensing techniques and instrumentation.

4. Land pollution: Instrumentation in sludge handling. Radioactive waste disposal and safety instrumentation. Soil characteristics and fertility conservation.

5. Instrumentation for noise and thermal pollution monitoring.

6. Control instrumentation of specific industrial pollution in steels, paper, cement, power and petro-chemical plants.

BOOKS RECOMMENDED:-

a) Environmental Engineering by H.S. Peavy, Dr.Rowe and G.Techob analogs, McGraw Hill International Co, New Delhi
b) Environmental Pollution control Engg., By C.S. Rao, W.E. Ltd.New Delhi 1992
c) Environmental Engineers Hand Book by B.G.Liptak, Vol 1,Vol 2&Vol3
d) Air pollution by:H.C.Perkins
e) Waste Water Engg Netcalf and Edley

DE-3.6 MODELLING & SIMULATION

Internal marks :40 **L T P**
External marks :60 **3 1 0**
Total marks :100

1.Systems Models & Studies: Concept of a system, System Environment, stochastic Activities, continuous & discrete systems, systems modeling, types of models, Principles used in Modeling, system analysis for design.

2.System Simulation :- Step in simulation study techniques of simulation, comparison of simulation & analytical methods, experimental nature of simulation, types of system simulation, Numerical computation Technique for continuous models, Distributed lag models.

3.Continuous & Discrete System Simulation:- Continuous system models, differential equations, analog computers, analog methods hybrid computers, discrete events representation of time , Continuous system simulation languages, discrete simulation languages .

4.Probability concepts in simulation :- Stochastic variables, discrete probability functions, continuous probability functions, measures of probability, functions numerical evaluation of continuous probability functions, estimation of means variances, and correlations.

5.Simulation Programming Techniques :- Entity types, list processing, data structure on SIMSCRIPT, data structure in GPSS, simultaneous events.

6.Simulation / Case Study

Books Recommended:-

1.System Simulation by Geoffrey Gorden PHI
2.Simulation Modeling & Analysis by Averill M. Law, W.David Kelton McGraw.Hill International Editions.

ELECTIVES-IV

D.E-4.1 MACHINE VISION

Internal marks :40 **L T P**
External marks :60 **3 1 0**
Total marks :100

1. **Vision in Humans & Machines:** Visual System Mechanics, Visual Perception, Color perception

2. **Image Processing:** Image characterization, Sampling & quantization, Spatial Frequency processes, Neighborhood/ Point processes, Image Processing & Machine vision

3. **Computer Graphics:** Definitions, Graphic objects & procedures, Usefulness to machine vision.

4. **Machine Vision:** Goals, Finite Image spaces, Applications like;

    a. Identification & Sorting of fish
    b. Object counting
    c. Vehicle License Plate Number sensing.

5. **Objects & Regions:**
    a. Thresholding**:** Optimum & Class variance
    b. Segmentation
    c. Mensuration
6. **Recognition:** Representation & Pattern/Feature Analysis

7. **Image Sequences:** Frame-to-Frame Analysis, Image Trackers & Data Management.

8. **Vision Systems:** Survey, Knowledge based vision: VISIONS, ACRONYM & SCERPO etc. Model based vision: VITREO & PARVO,

9. **Design of a Real Time MV System**

Recommended Books:

1. Fundamentals of Machine Vision by Harley R Myler, Prentice Hall of India
2. Machine Vision by R.Jain, E. Kasturi, and B.G, Schunck, McGraw-Hill, 1995
3. Foundations of Vision by B.A.Wandell, Sinauer Associates Inc.
4. Digital Image Processing and Computer Vision by Schalkoff, Robert J., John Wiley & Sons.
5. Vision in Man and Machine by Levine, Martin D., McGraw-Hill.

DE-4.2 NEURAL NETWORKS & FUZZY SYSTEMS

Internal marks :40 **L T P**
External marks :60 **3 1 0**
Total marks :100

3 1 0

1. **Neural Networks & Fuzzy Systems:** - Neural & fuzzy intelligence, fuzziness as Multivalence, the dynamical systems to machine intelligence.

2. **Neural Networks theory:-**Neurams as functions, signals monotanically , biological activation & signals, neuron fields, neuron signal functions, activation models, neuron dynamical systems, additive neuronals dynamics & additive neuronal feedback.

3. **Unsupervised Learning:-** Learning as encoding , charge and quantization , four unsupervised learning laws, probability spaces & random processer.

4. **Supervised Learning:-** Supervised function estimation, supervised learning as operant conditioning , supervised learning as stochastic approximation.

5. **Architectures and Equilibria:-** Neural networks as stockistic gradient systems, global equilibria, aver algorithms, global stability of feedback neural networks, structural stability of unsuperimed learning.

6. **Fuzzy Associative memories:-** Fuzzy systems as between cube mappings, fuzzy and neural function estimators, fuzzy Hebb FAMS, Adeptive FAMS.

Book Recommended:

1 Neural networks & Fuzzy Systems by Bart Kos PHI Pub

DE-4.3 VIRTUAL INSTRUMENTATION

\Internal marks :40 **L T P**
External marks :60 **3 1 0**
Total marks :100

I BASICS OF VIRTUAL INSTRUMENTATION:
Historical Perspective, Need/ Advantages of VI, Defining VI, Block Diagram & architechture of VI, Data Flow Techniques, Graphical Programming in Data Flow. Comparison with conventional programming.

II VI Programming Techniques:
VIs & Sub-VIs, Loops & Charts, Arrays, Clusters, Graphs, Case/Sequence Structures, Formula modes, Local & Global Variables, String & File Inputs.

III Data Acquisition Basics:
ADC/DAC,DIO, Counters/Timers, PC Hardware structures, timing interrupts, DMA, Software & Hardware Installations.

IV: Common Instrument Interface:
Current Loop, RS232/485, GPIB, System Basics, Interface basics, USB, PCMCIA, VXI, SCXI, PXI etc. Networking basics for office & industrial applications. VISA & IVI, Image Acquisition & Processing. Motion Control

V Use of Analysis Tools:
Fourier Transforms, Power spectrum, Corelation methods, Windowing & Filtering.

VI Applications of VI:
Applications in process control projects, majoe equipments like Oscilloscopes, Multimeter etc.

BOOKS RECOMMENDED:
1, Gary Johnson, LabVIEW Graphical Programming 2nd Edition, McGraw Hill NY, 1997
2. Lisa K Wells & Jeffrey Travis, LabVIEW for everyone, Prentice Hall, NJ, 1997.

References:
4. Sokodoff, Basic concepts of LabVIEW, Prentice Hall, NJ, 1998.
5. S.Gupta, JP Gupta, PC Interface for Data Acquisition & Process Control, 2nd Ed. Instrument Society of America, 1994.

EI-410 LAB-XII: ADVANCE PROCESS CONTROL

Internal marks :30 **L T P**
External marks :20 **0 0 2**
Total marks :50

1. To study the control valve, shuttle valve and logic valve on pneumatic trainer.
2. To study PID control & its tuning procedures on a furnace.
3. To study the functioning of a Fuzzy Controller.
4. To study the operation of programmable logic controller.
5. To study the effect of cascade control in temp and flow system using P.C.
6. To study the effect of forward control in temp and flow system using P.C.
7. To study the P.C based pressure control system.
8. To study the P.C operation in level control.
9. To study distribution process control in temp process and level system.
10. To study the supervisory control in process control.
11. To study of a Software-based PLC operation.

EI– 412 LABXIII: ANALYTICAL INSTRUMENTATION

Internal marks :30 **L T P**
External marks :20 **0 0 2**
Total marks :50

1. PH measurement of a given sample on microprocessor based PH meter.
2. To estimate the concentration of given sample in a given solution (PPM) on flame photometer.
3. To measure the viscosity of given solution.
4. To measure the strength of oxygen dissolved (PPM) in a given solution.
5. To analyze a given gas using gas analyzer.
6. To determine fluoride content in a given sample using fluoride meter.
7. To determine moisture content in a given sample using Karl Fischer Titrator.