

**Punjab Technical University, Jalandhar**  
**B.Tech. Applied Electronics & Instrumentation Engg.**  
**Scheme of Syllabi (3<sup>rd</sup> Semester)**

**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 & Networks)   | 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        |
|             | <b>TOTAL</b>                             | <b>16</b> | <b>6</b> | <b>6</b> |      |      | <b>750</b> |

|                                |
|--------------------------------|
| <b>4<sup>th</sup> Semester</b> |
|--------------------------------|

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

| <b>5<sup>th</sup> Semester</b> |   |           |          |          |             |             |              |
|--------------------------------|---|-----------|----------|----------|-------------|-------------|--------------|
| <b>Course code</b>             | <b>Course Title</b>                                 | <b>L</b>  | <b>T</b> | <b>P</b> | <b>Int.</b> | <b>Ext.</b> | <b>TOTAL</b> |
| 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          |
| EI-309                         | 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 & Its Applications)      | 0         | 0        | 2        | 30          | 20          | 50           |
| EI-311                         | 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           |
|                                | <b>TOTAL</b>  | <b>18</b> | <b>6</b> | <b>8</b> |             |             | <b>900</b>   |

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

**The syllabi for EI-309 is same as that of the syllabi for DE-2.1 of ECE branch**

| 6 <sup>th</sup> /7 <sup>th</sup> 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         |
| * EI-310                                  | Programmable Logic Controllers & Applications | 3         | 1        | 0        | 40   | 60   | 100         |
|   | Elective-I                                    | 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         |
|   | <b>TOTAL</b>                                  | <b>18</b> | <b>6</b> | <b>6</b> |      |      | <b>1000</b> |

**List of Elective-I:**

1. DE-2.1 Industrial Data Communications
2. DE.2.2 Computer Architecture
3. DE.2.3 Intelligence Robotics
4. DE 2.4 Embedded Systems

\* indicates that syllabi of EI-310 is same as that of DE-1.5 (EIE branch)

**6<sup>th</sup>/7<sup>th</sup> Semester**

| <b>Course code</b> | <b>Course Title</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>Int.</b> | <b>Ext.</b> | <b>TOTAL</b> |
|--------------------|---------------------|----------|----------|----------|-------------|-------------|--------------|
|                    | Industrial Training | -        | -        | -        | 500         | 500         | 1000         |
|                    | <b>TOTAL</b>        | -        | -        | -        | 500         | 500         | 1000         |
|                    |                     |          |          |          |             |             |              |

| 8 <sup>th</sup> 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         |
| EI-414                   | Computer Control of Industrial Process | 3         | 1        | 0         | 40   | 60   | 100         |
|                          | Elective-II                            | 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         |
|                          |  |           |          |           |      |      |             |
|                          | <b>TOTAL</b>                           | <b>15</b> | <b>5</b> | <b>10</b> |      |      | <b>1000</b> |
|                          |  |           |          |           |      |      |             |
|                          | <b>List of Elective-II</b>             |           |          |           |      |      |             |
| 1.                       | DE-4.1 Machine Vision                  |           |          |           |      |      |             |
| 2.                       | DE-4.2 Neural Networks & Fuzzy Systems |           |          |           |      |      |             |
| 3.                       | DE-4.3 Virtual Instrumentation         |           |          |           |      |      |             |
| 4.                       | DE-4.4. Microcontrollers               |           |          |           |      |      |             |
| 5.                       | DE 4.5. Microelectronics.              |           |          |           |      |      |             |

## AM 201

## APPLIED MATHEMATICS-III

Internal Marks: 40  
 External Marks: 60  
 Total Marks: 100

L T P  
 4 1 0

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**  
**External Marks: 60**  
**Total Marks: 100**

**L T P**  
**3 2 0**

**CONTENTS**

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. **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. **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, foster & cauer forms
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**  
**External Marks: 60**  
**Total Marks: 100**

**L T P**  
**3 1 0**

**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, varactor 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 ELECTRONIC MEASUREMENT & INSTRUMENTATION**

**Internal Marks: 40**  
**External Marks: 60**  
**Total Marks: 100**

**L T P**  
**3 1 0**

**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  
External Marks: 60  
Total Marks: 100

L T P  
3 1 0

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++**, 4<sup>th</sup> Edition, BPB Publications New Delhi.
2. Y.P.Kanetkar, **Let us C++**, BPB Publications, New Delhi.

**EI-203            LAB-I   ELECTRONIC DEVICES & NETWORKS**

**Internal Marks: 30**  
**External Marks: 20**  
**Total Marks: 50**

**L T P**  
**0 0 2**

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**  
**External Marks: 20**  
**Total Marks: 50**

**L T P**  
**0 0 2**

**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
4. Measurement of frequency by Wein's bridge
5. Measurement of medium resistance by Wheat stone's bridge
6. Determination of frequency & phase angle using CRO
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**  
**External Marks: 20**  
**Total Marks: 50**

**L T P**  
**0 0 2**

To write following programs in C/C++

1. Using basic statements like control statements, looping statements, various I/O statements & various data structures
2. Creating classes in C++ for understanding of basic OOPS features
3. Representing concepts of data hiding, function overloading & operator overloading
4. Using memory management features & various constructors & destructors
5. Representing inheritance, virtual classes & polymorphism
6. Writing generic functions
7. File handling programs

**EC- 202 Applied Electronics**

**Internal Marks: 40**  
**External Marks: 60**  
**Total Marks: 100**

**L T P**  
**3 1 0**

**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 inverter, 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**  
**External Marks: 60**  
**Total Marks: 100**

**L T P**  
**3 2 0**

**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 triggered and deked 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 Signal and Systems**

**Internal Marks: 40**  
**External Marks: 60**  
**Total Marks: 100**

**L T P**  
**3 1 0**

**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, Gaussian 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**  
**External Marks: 60**  
**Total Marks: 100**

**L T P**  
**3 1 0**

- 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. Low 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**  
**External Marks: 60**  
**Total Marks: 100**

**L T P**  
**3 2 0**

**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 Pneumatic 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. Asymptotes 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, 3<sup>rd</sup> Ed., 1978.
4. Control System Engineering by I.J. Nagrath & Gopal, Wiley Eastern Ltd., New Delhi, 1975.

**EC-210                      LAB-IV APPLIED ELECTRONICS**

**Internal Marks: 30**  
**External Marks: 20**  
**Total Marks: 50**

**L T P**  
**0 0 2**

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**  
**External Marks: 20**  
**Total Marks: 50**

**L T P**  
**0 0 2**

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 width and retriggering.
  - (b) Free running multivibrator at 1 KHz and 1 Hz using 555 with 50% duty cycle. Verify the timing from theoretical calculations.
8. Design fabricate and test a switch debouncer 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 asynchronous 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**  
**External Marks: 20**  
**Total Marks: 50**

**L T P**  
**0 0 2**

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 help 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.

**EI-301          VIRTUAL INSTRUMENTATION & DATA ACQUISITION**

**Internal Marks: 40**  
**External Marks: 60**  
**Total Marks: 100**

**L T P**  
**3 1 0**

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 2<sup>nd</sup> 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, 2<sup>nd</sup> Ed. Instrument Society of America, 1994.
3. www.ni.com.

**EI-303      NON LINEAR & SAMPLED DATA CONTROL SYSTEM**

**Internal Marks: 40**  
**External Marks: 60**  
**Total Marks: 100**

**L T P**  
**3 1 0**

**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**  
**External Marks: 60**  
**Total Marks: 100**

**L T P**  
**3 1 0**

**Detailed Contents**

1. Quality and Total Quality Management; Excellence in 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**  
**External Marks: 60**  
**Total Marks: 100**

**L T P**  
**3 1 0**

**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.                   |

## EI-309 INDUSTRIAL ELECTRONICS

**Internal Marks: 40**  
**External Marks: 60**  
**Total Marks: 100**

**L T P**  
**3 1 0**

**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**  
**External Marks: 60**  
**Total Marks: 100**

**L T P**  
**3 1 0**

**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 & ITS APPLICATIONS**

**Internal Marks: 30**  
**External Marks: 20**  
**Total Marks: 50**

**L T P**  
**0 0 2**

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.

**EI-311****LAB-VIII: INDUSTRIAL ELECTRONICS**

**Internal Marks: 30**  
**External Marks: 20**  
**Total Marks: 50**

**L T P**  
**0 0 2**

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 inverter 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**  
**External Marks: 20**  
**Total Marks: 50**

**L T P**  
**0 0 2**

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.

**6<sup>th</sup> /7<sup>th</sup> Semester****EI-302/401 INSTRUMENTATION SYSTEM DESIGN**

**Internal Marks: 40**  
**External Marks: 60**  
**Total Marks: 100**

**L T P**  
**3 1 0**

**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 3<sup>rd</sup> 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**  
**External Marks: 60**  
**Total Marks: 100**

**L T P**  
**3 1 0**

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**  
**External Marks: 60**  
**Total Marks: 100**

**L T P**  
**3 1 0**

### **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 loss, 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 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 Protection 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.

(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**  
**External Marks: 60**  
**Total Marks: 100**

**L T P**  
**3 1 0**

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-transform 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.

**ELECTIVES-I:**

DE-2.1            **INDUSTRIAL DATA COMMUNICATIONS**

|                        |            |          |          |          |
|------------------------|------------|----------|----------|----------|
| <b>Internal Marks:</b> | <b>40</b>  | <b>L</b> | <b>T</b> | <b>P</b> |
| <b>External Marks:</b> | <b>60</b>  | <b>3</b> | <b>1</b> | <b>0</b> |
| <b>Total Marks:</b>    | <b>100</b> |          |          |          |

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**, 3<sup>rd</sup> 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**  
**External Marks: 60**  
**Total Marks: 100**

**L T P**  
**3 1 0**

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 Architecture by M. Morris Mano

**D.E 2.3 INTELLIGENT ROBOTICS**

**Internal Marks: 40**  
**External Marks: 60**  
**Total Marks: 100**

**L T P**  
**3 1 0**

**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 EMBEDDED SYSTEM**

**Internal Marks: 40**  
**External Marks: 60**  
**Total Marks: 100**

**L T P**  
**3 1 0**

**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 configurators, 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**  
**External Marks: 20**  
**Total Marks: 50**

**L T P**  
**0 0 2**

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**  
**External Marks: 20**  
**Total Marks: 50**

**L T P**  
**0 0 2**

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.

8<sup>th</sup> Semester

EI-402

## ADVANCED PROCESS CONTROL

Internal Marks: 40  
 External Marks: 60  
 Total Marks: 100

L T P  
 3 1 0

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**  
**External Marks: 60**  
**Total Marks: 100**

**L T P**  
**3 1 0**

**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. Plethysmography, Blood flow measurements. Phono-cardiography. 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" 2<sup>nd</sup> Prentice Hall, Englewood Cliffs New Jersey 1993.
3. L Gromwell, F.J.Weibell & EA Pfeiffer, "Biomedical Intumentation and measurements, 2<sup>nd</sup> Prentice Hall of India Pvt. Ltd. New Delhi,1990.

**REFERENCE BOOK:**

J.G.Wedster "Encyclopeda 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 , CO<sub>2</sub> , 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:**

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

**EI-414 COMPUTER CONTROL OF INDUSTRIAL PROCESSES**

**Internal Marks: 40**

**External Marks: 60**

**Total Marks: 100**

**L T P**

**3 1 0**

**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 standard MSI & LSI by T.R. Bloseslee, 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

**ELECTIVES-II****D.E-4.1****MACHINE VISION**

**Internal Marks: 40**  
**External Marks: 60**  
**Total Marks: 100**

**L T P**  
**3 1 0**

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**  
**External Marks: 60**  
**Total Marks: 100**

**L T P**  
**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 monotonically , 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

**DE4.3 VIRTUAL INSTRUMENTATION**

**Internal Marks: 40**  
**External Marks: 60**  
**Total Marks: 100**

**L T P**  
**3 1 0**

**I 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.

**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 2<sup>nd</sup> 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, 2<sup>nd</sup> Ed. Instrument Society of America, 1994.

**EI-410          LAB-XII: ADVANCED PROCESS CONTROL**

**Internal Marks: 30**  
**External Marks: 20**  
**Total Marks: 50**

**L T P**  
**0 0 2**

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**  
**External Marks: 20**  
**Total Marks: 50**

**L T P**  
**0 0 2**

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.

**EI-310 PROGRAMMABLE LOGIC CONTROLLERS & APPLICATIONS**

**Internal Marks: 40**  
**External Marks: 60**  
**Total Marks: 100**

**L T P**  
**3 1 0**

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 move 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**, 3<sup>rd</sup> 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**, 3<sup>rd</sup> Edition, ISA Press, 1995

**DE-4.5****MICROELECTRONICS****Internal Marks: 40****L T P****External Marks: 60****3 1 0****Total Marks: 100**

**INTRODUCTION:** Advantages of IC's, General classification of IC's(Linear/Digital IC's , Monolithic/ Hybrid IC's), Basic IC fabrication steps

**CRYSTAL GRTOWTH AND EPITAXY:** Starting material for formation of crystal, Horizontal Bridgeman Method, Czochralski growth, Distribution of dopants, Zone refining, Silicon Float Zone process, Si-Wafer preparation, Epitaxial growth, Techniques used for epitaxial growth(LPE,VPE,MBE)

**SILICON OXIDATION:** Thermal oxidation process (Kinetics of growth , Thin oxide growth), Effect of impurities on the oxidation rate, Preoxidation Cleaning, Various oxidation techniques, Masking properties of  $\text{SiO}_2$  , IV PHOTOLITHOGRAPHY AND ETCHING, Pattern generation/Mask making, Contact and Proximity printing, Photoresistsl, Photolithography Process(Lift off technology , Fine line photolithography), Wet/Dry etching, Reactive Plasma etching techniques and applications

**DIFFUSION AND ION IMPLANTATION:** Basic diffusion process(Diffusion equation, Diffusion profiles), Extrinsic diffusion, Lateral Diffusion, Ion Implantation Process (Ion distribution , Ion Stopping), Implant Damage and Annealing process (Furnace and RTA), VI IC PACKAGING, Isolation Techniques, Testing of the Chip, Wire Bonding techniques, Flip Chip technique, Various Packaging methods and Materials, VII FABRICATION OF MONOLITHIC COMPONENTS, Fabrication of Diodes, Resistors, capacitors and inductors, Fabrication of BJT and FET, Fabrication of MOS Devices , CMOS fabrication techniques(n-well and p-well process sequences), Introduction to MEMS.

**Recommended Text Books:**

1. Fundamental of Semiconductor Fabrication:Gray S.May and Simon M.Sze
2. VLSI Technology : Sze.

**Reference Books:**

1. Microelectronics: Jacob and Millman

\* The syllabi of DE-4.5 Microelectronics is same as that of the syllabi for DE-1.2 Microelectronics of ECE branch

**DE. 4.4 MICROCONTROLLER**

**Internal Marks: 40**  
**External Marks: 60**  
**Total Marks: 100**

**L T P**  
**3 1 0**

**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 configurators, 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:**

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

