Electronics and Instrumentation Engineering (EI)

EN010301A ENGINEERING MATHEMATICS II
(Common to all branches except CS & IT)

Teaching scheme **Credits: 4**

2 hours lecture and 2 hour tutorial per week

Objectives

- *To apply standard methods and basic numerical techniques for solving problems and to know the importance of learning theories in Mathematics.*

MODULE 1 Vector differential calculus (12 hours)

Scalar and vector fields – gradient-physical meaning- directional derivative-divergence an curl - physical meaning-scalar potential conservative field- identities - simple problems

MODULE 2 Vector integral calculus (12 hours)

Line integral - work done by a force along a path-surface and volume integral-application of Greens theorem, Stokes theorem and Gauss divergence theorem

MODULE 3 Finite differences (12 hours)

Finite difference operators Δ, ∇, E, μ and δ - interpolation using Newtons forward and backward formula – problems using Stirlings formula, Lagrange's formula and Newton's divided difference formula

MODULE 4 Difference Calculus (12 hours)

Numerical differentiation using Newtons forward and backward formula – Numerical integration – Newton's – cotes formula – Trapezoidal rule – Simpsons $1/3^{rd}$ and $3/8^{th}$ rule – Difference equations – solution of difference equation

MODULE 5 **Z** transforms (12 hours)

Definition of Z transforms – transform of polynomial function and trignometric functions – shifting property , convolution property - inverse transformation – solution of 1^{st} and 2^{nd} order difference equations with constant coifficients using Z transforms.

Reference

1. Erwin Kreyszing – Advance Engg. Mathematics – Wiley Eastern Ltd.
2. B.S. Grewal – Higher Engg. Mathematics - Khanna Publishers
3. B.V. Ramana - Higher Engg. Mathematics – McGraw Hill
4. K Venkataraman- Numerical methods in science and Engg -National publishing co
5. S.S Sastry - Introductory methods of Numerical Analysis -PHI
6. T.Veerarajan and T.Ramachandran- Numerical Methods- McGraw Hill
7. Babu Ram – Engg. Mathematics -Pearson.
8. H.C.Taneja Advanced Engg. Mathematics Vol I – I.K.International

EN010 302 Economics and Communication Skills

(Common to all branches)

Teaching scheme
2hours lecture and 2 hours tutorial per week **Credits: 4(3+1)**
Objectives

- To impart a sound knowledge of the fundamentals of Economics.

Economics

Module I (7 hours)
Reserve Bank of India-functions-credit control-quantitative and qualitative techniques
Commercial banks-functions- Role of Small Industries Development Bank of India and National Bank for Agriculture and Rural Development
The stock market-functions-problems faced by the stock market in India-mutual funds

Module II (6 hours)
Multinational corporations in India-impact of MNC's in the Indian economy
Globalisation-necessity-consequences
Privatisation-reasons-disinvestment of public sector undertakings
The information technology industry in India-future prospects
Module III (6 hours)
Direct and indirect taxes- impact and incidence- merits of direct and indirect taxes-progressive and regressive taxes-canons of taxation-functions of tax system-
tax evasion-reasons for tax evasion in India-consequences-steps to control tax evasion
Deficit financing-role-problems associated with deficit financing

Module IV (5 hours)
National income-concepts-GNP, NNP, NI, PI and DPI-methods of estimating national income-difficulties in estimating national income
Inflation-demand pull and cost push-effects of inflation-government measures to control inflation

Module V (6 hours)
International trade-case for free trade-case for protectionism
Balance of payments-causes of disequilibrium in India's BOP-General Agreement on Tariffs and Trade-effect of TRIPS and TRIMS in the Indian economy-impact of WTO decisions on Indian industry

Text Books

1. Ruddar Datt, Indian Economy, S.Chand and Company Ltd.
2. K.K.Dewett, Modern Economic Theory, S.Chand and Company Ltd.

References

1. Paul Samuelson, Economics, Tata McGraw Hill
2. Terence Byres, The Indian Economy, Oxford University Press
3. S.K.Ray, The Indian economy, Prentice Hall of India
4. Campbell McConnel, Economics, Tata McGraw Hill

Communication Skills

Objectives

- To improve Language Proficiency of the Engineering students
- To enable them to express themselves fluently and appropriately in social and professional contexts
- To equip them with the components of different forms of writing

MODULE – 1 (15 hours)

INTRODUCTION TO COMMUNICATION

Communication nature and process, Types of communication - Verbal and Non verbal, Communication Flow-Upward, Downward and Horizontal, Importance of communication skills in society, Listening skills, Reading comprehension, Presentation Techniques, Group Discussion, Interview skills, Soft skills

MODULE – II (15 hours)

TECHNICAL COMMUNICATION

Technical writing skills- Vocabulary enhancement-synonyms, Word Formation-suffix, affix, prefix, Business letters, Emails, Job Application, Curriculum Vitae, Report writing- Types of reports

Note: No university examination for communication skills. There will be internal evaluation for 1 credit.

REFERENCES

1. The functional aspects of communication skills, P.Prasad and Rajendra K. Sharma, S.K. Kataria and sons, 2007
2. Communication skills for Engineers and Scientists, Sangeeta Sharma and Binod Mishra, PHI Learning private limited, 2010
3. Professional Communication, Kumkum Bhardwaj, I.K. International (P) House limited, 2008
4. English for technical Communication, Aysha Viswamohan, Tata Mc Graw Publishing company limited, 2008

EI010 303 Network Theory

(Common to AI010 303, EC010 303 and IC010 303)

Teaching scheme **Credits:** 4

2 hours lecture and 2 hours tutorial per week

Objectives

- *To study time domain, phasor and Laplace transform methods of linear circuit analysis*

Module I (12 hrs)

Reference directions for two terminal elements - Kirchhoff's Laws - Independent and Dependent Sources – Resistance Networks: Node and Mesh analysis of resistance networks containing both voltage and current independent and dependent sources – Source Transformations – Superposition, Thevenin, Norton and Maximum Power Transfer Theorems applied to resistance networks

Module II (12 hrs)

Capacitors and Inductors – Current-voltage relationships – Step and Impulse functions – Waveshapes for Capacitor and Inductor – Series and Parallel combinations – Coupled coils – Mutual Inductance – First order Circuits: Excitation by initial conditions – Zero input response – Excitation by sources – Zero state response – Step and impulse response of RL and RC circuits - Excitation by sources and initial conditions – Complete response with switched dc sources

Module III (12 hrs)

Sinusoidal Steady State Analysis: Review of complex numbers – Rectangular and Polar forms – Phasors and the sinusoidal steady state response - Phasor relationships for R, L and C – Impedance and Admittance – Node and Mesh analysis, Superposition, Source transformation, Thevenin and Norton's theorems applied to Phasor circuits – Sinusoidal Steady State power – Average Power – Maximum power transfer theorem – Phasor analysis of Magnetically coupled circuits

Module IV (12 hrs)

Laplace Transform: Definition of Unilateral Laplace Transform- Properties –Laplace Transform of common time functions – Inverse Laplace Transform by Partial Fraction Expansion – Initial value and Final value theorems –Solution of network differential equations - Transformation of a circuit into s-domain – Transformed equivalent of resistance, capacitance, inductance and mutual inductance – Impedance and Admittance in the transform domain – Node and Mesh analysis of the transformed circuit - Network theorems applied to the transformed circuit – Network Functions: Driving point and Transfer functions - Poles and zeros

Module V (12 hrs)

Frequency Response: Network functions in the sinusoidal steady state with s = jω – Magnitude and Phase response - Magnitude and Phase response of First order Low pass and High pass RC circuits –- Bode Plots – First order and Second order factors.
Two port networks: Characterization in terms of Impedance, Admittance, Hybrid and Transmission parameters – Interrelationships among parameter sets - Reciprocity theorem – Interconnection of two port networks- series, parallel and cascade.

References

1. W H. Hayt, Kemmerly and S M Durbin, *Engineering Circuit Analysis*, TMH
2. DeCarlo, Lin, *Linear Circuit Analysis*, OUP
3. B Carlson, *Circuits*, Ceneage Learning
4. M E. Van Valkenburg, *Network Analysis*, PHI
5. L P .Huelsman, *Basic Circuit Theory*, PHI
6. Robert L.Boylestad , *Introductory Circuit Analysis* , 12th e/d ,PHI
7. C A Desoer & E S Kuh, *Basic Circuit Theory*, TMH
8. F F Kuo, *Network Analysis and Synthesis*, Wiley

EI010 304 Electronic Devices and Circuits I

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

1. *To provide adequate knowledge to various electronic devices and electronic circuits.*
2. *To impart the basic concepts of electronic devices such as diodes, BJT, FET and MOSFET.*
3. *To give a basic introduction of different types of special devices.*
4. *To have an adequate knowledge in power supplies and wave shaping circuits.*
5. *To provide basic knowledge in transistor biasing and amplifier configurations.*

Module 1 (12 Hours)

Band theory of solids: Energy band structure of Metals, Semi conductors and Insulators. Intrinsic material - Electron Hole pair- Fermi level- Doping- Extrinsic material- Effect of temperature.
Semi conductor diodes: Theory of PN junction diode- Energy band structure- Diode equation.
Space charge and diffusion capacitance (concepts only)-Break down mechanisms.
Fabrication of PN junction –Different techniques

Module 2 (12 Hours)

Bipolar Junction Transistors: Fundamentals of BJT operation- Amplification with BJT-Switching--Drift in base region—Base narrowing—Frequency limitations of transistors.
Field Effect Transistors: Basic structure- Operation- Pinch off and saturation—V I characteristics.
MOSFETS: n MOS and p MOS- Enhancement and Depletion types—MOS capacitance.

Module 3 (12 Hours)

Special Devices: Tunnel diode, IMPATT diode, GUNN diode, Schottkey diode, Varactor diode, Photo diode, PIN diode, LED, Schottkey transistor, Photo transistor, UJT, SCR, DIAC, TRIAC, IGBT, OptoCoupler, Seven Segment Displays, Liquid Crystal Displays, LDR.

Module 4 (12 Hours)

DC power supplies: Analysis of half wave, full wave and bridge rectifiers-Analysis of shunt capacitor filter.
Regulated power supplies: series and shunt voltage regulators—design of regulated power supplies—IC regulated power supplies
Wave shaping circuits: Clipping and Clamping circuits—Integrator—Differentiator.

Module 5 (12 Hours)

Transistor biasing: Operating point—DC and AC load lines—Q point selection—Different types of biasing—Biasing stability factors.

Different transistor amplifier configurations – Comparison -- h parameter model analysis of CE configuration.

Text Books:-

1. Streetman, B. and Sanjay, B., “Solid State Electronics Devices”, Pearson Education.
2. Boylsted and Nashelsky, “Electronic Devices and Circuit Theory”, Prentice Hall of India.

References:

1. Millman and Halkias, “Electronic Devices and Circuits”, Tata McGraw– Hill.
2. Floyd, T.L, “Electronic Devices” Pearson Education..
3. Millman and Halkias, “Integrated Electronics”, McGraw-Hill.
4. J B Gupta, “Electronic Devices and Circuits” , S K Kataria & Sons Pub.
5. David A. Bell, ‘Electronic Devices & Circuits’, Prentice Hall of India/Pearson Education,

.

EI010 305 Basic Instrumentation

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

1. *To create a strong base in the fundamental philosophies of Instrumentation engineering.*
2. *To study the different instruments, different static and dynamic characteristics of instruments, performance, errors etc.*
3. *To give basic knowledge in different types of electrical machines used in instrumentation field.*
4. *To have an adequate knowledge in fluid mechanics and air compressors.*
5. *To give an idea about unit operations and different process involved in a process industry.*

Module 1 (12 Hours)

Historical development of Instrumentation engineering- Introduction to Instruments and Measurements - Typical applications of Instruments systems- Functional elements of an instrumentation system and examples- Classification of instruments.
Measurement System performance- Units and standards- Calibration methods- Need for calibration- Standards of measurement- Classification of errors- Error analysis.
Static characteristics – Accuracy, Precision, Sensitivity, Linearity, Resolution, Hysteresis, Threshold, Input impedance, Loading effect etc.
Dynamic characteristics.

Module 2 (12 Hours)

Electrical machines : A C and D C servo motors – Synchros – Constructional features – Working of a Tachogenerator – Stepper motors – Construction, working, applications and specifications of stepper motors – Universal motors - Constructional features – Typical applications – Criteria for selection of motors – Gyroscope- Electromagnetic relays – Contactors.

Module 3 (12 Hours)

Fluid mechanics: Introduction-Types of fluids- Properties of fluids- Pressure head- Vapor pressure- Flow of fluids- Types of fluid flow- Fluid velocity- Rate equation of continuity- Energy of a liquid in motion- Bernoulli's theorem- Venturi meter- Orifice meter- Pitot tube- Rotameter- Notches.
Fluid friction losses in pipe fittings.

Module 4 (12 Hours)

Air compressors: Positive displacement compressors- Reciprocating air compressors-multi-stage air compressors with inter cooling- rotary positive displacement compressors- Construction and working principle of centrifugal and axial flow compressors.
Introduction to pumps-centrifugal, rotary and reciprocating pumps-classification of centrifugal pumps and applications.

Module 5 (12 Hours)

Introduction to process systems: Unit operations- Transport of liquids, solids and gases- Mixing process - Separation process - Combustion process- Evaporators- Crystallization-Drying- Distillation (concepts only) – Description of the process of food industry and paper industry.

References:

1. A.K Sawhney, A course in Mechanical Measurement and Instrumentation, Dhanpat Rai & CO
2. Doeblin E .O.Measurement systems, application & Design, McGrawHill
3. Theraja, B.L., "A Text book of Electrical Technology", Vol.II, S.C Chand and Co
4. Nagoor kani, control systems, RBA publications.
5. R.K.Bensal, Hydraulics and fluid mechanics, Laxmi publications.
6. P.N Modi and Seth, Hydraulics and Fluid mechanics- Std book house.
7. Rajput R.K., 'Fluid Mechanics and Hydraulic Machines', S.Chand and Co.
8. Bellani, Thermal engineering, Khanna publishers.
9. Balchen J.G. and Mumme, K.J., Process Control structures and applications, Van Nostrand Reinhold Co., New York, 1988.

EI010 306 COMPUTER PROGRAMMING

(Common to AI010 306, EC010 306 and IC010 306)

Teaching Scheme

L T P : 3 1 0 **4 credits**

Objectives

- *To develop the programming skill using C*

Module 1 (12 hrs)

Problem solving with digital Computer - Steps in Computer programming - Features of a good program, Algorithms – Flowchart.

Introduction to C: C fundamentals - The character set - identifiers and keywords - Data types - constants - variables and arrays - declarations - expressions - statements - symbolic constants- arithmetic operators - Relational and Logical operators - The conditional operator - Library functions - Data input and output - getchar – putchar, scanf, printf - gets and puts functions - interactive programming.

Module 2 (12 hrs)

Control Statements: While - do while - for - nested loops -if else switch- break - continue - The comma operator - go to statement, Functions - a brief overview - defining a function - accessing a function - passing arguments to a function - specifying argument - data types - function prototypes - Recursion.

Module 3 (12 hrs)

Program structure: storage classes - Automatic variables - external variables - multi file programs. Arrays: defining an array - processing an array - passing arrays in a function – multi dimensional arrays - array and strings. Structures and unions: defining a structure - processing a structure - user defined data types - passing structure to a function – self referential structures - unions.

Module 4 (12hrs)

Pointers: Fundamentals - pointer declaration - passing pointers to a function - pointers and one dimensional arrays - operations on pointers - pointers and multi dimensional arrays – passing functions to other functions.

Module 5 (12 hrs)

Data files: Opening and closing of a data file - creating a data file - processing a data file, low level programming - register variables – bit wise operation - bit fields - enumeration - command line parameters - macros - the C pre-processor.

References

1. Byron Gottfried, *Programming with C, Schaum's Outlines* ,Tata Mc.Graw Hill.
2. Kernighan & Ritchie , "*The C programming language:"*, PHI.
3. Venkateshmurthy , "*Programming Techniques through* C":, Pearson Education.
4. Al Kelley, Ira Pohl , "*A book on C*" , Pearson Education.
5. Balaguruswamy , "*Programming in C"* , Tata Mc Graw Hill.
6. Ashok N Kanthane , "*Programming with ANSI and Turbo C*", Pearson Education.
7. Stephen C. Kochan , "*Programming in C*" , CBS publishers.

EI010 307 Electronic Circuits Lab I

Teaching scheme **Credits:** 2

3 hours Practical per week

1. Familiarization of Multi meter, Signal generators, CRO, DVM etc and measurement of electrical quantities (V, I, frequency, phase)

2. Characteristics of active devices :

   a) Forward & Reverse characteristics of a diode.
   b) Common Base characteristics of a transistor. Measurement of current gain, input resistance and out put resistance.
   c) Common Emitter characteristics of a transistor. Measurement of current gain, input and output resistance.
   d) Common Source characteristics of a JFET.
   e) UJT characteristics.

   f) LDR and Opto-Coupler characteristics.

3. Rectifying circuits

   g) HW rectifier
   h) FW rectifier
   i) FW Bridge rectifier
   j) Filter circuits –Capacitor filter (Measurement of ripple factor, efficiency)

4. Design and implementation of Power supplies.

5. Series Voltage Regulator using transistors.

6. Design and testing of Clipping, Clamping, RC differentiator, RC integrator circuits.

7. Simulation of simple circuits using spice.

EI010 308:PROGRAMMING LAB

(Common to AI010 308, EC010 308 and IC010 308)

Teaching scheme **Credits:** 2

3 hours practical per week

Objectives

- *To familiarize with computer hardware, operating systems and commonly used software packages*
- *To learn computer programming and debugging*

Part 1

1. Computer hardware familiarization.
2. Familiarization/installation of common operating systems and application software.

Part 2

Programming Experiments in C/C++: Programming experiments in C/C++ to cover control structures, functions, arrays, structures, pointers and files.

EN010401 Engineering Mathematics III

(Common to all branches)

Teaching scheme **Credits: 4**

2 hours lecture and 2 hour tutorial per week

Objectives: *Apply standard methods of mathematical &statistical analysis*

MODULE 1 Fourier series (12 hours)

Dirichlet conditions – Fourier series with period 2 π and 2l – Half range sine and cosine series – Harmonic Analysis – r.m.s Value

MODULE 2 Fourier Transform (12 hours)

Statement of Fourier integral theorem – Fourier transforms – derivative of transforms- convolution theorem (no proof) – Parsevals identity

MODULE 3 Partial differential equations (12 hours)

Formation by eliminating arbitrary constants and arbitrary functions – solution of Lagrange's equation – Charpits method –solution of Homogeneous partical differential equations with constant coefficients

MODULE 4 Probability distribution (12 hours)

Concept of random variable , probability distribution – Bernoulli's trial – Discrete distribution – Binomial distribution – its mean and variance- fitting of Binominal distribution – Poisson distribution as a limiting case of Binominal distribution – its mean and variance – fitting of Poisson distribution – continuous distribution- Uniform distribution – exponential distribution – its mean and variance – Normal distribution – Standard normal curve- its properties

MODULE 5 Testing of hypothesis (12 hours)

Populations and Samples – Hypothesis – level of significance – type I and type II error – Large samples tests – test of significance for single proportion, difference of proportion, single mean, difference of mean – chi –square test for variance- F test for equality of variances for small samples

References

1. Bali& Iyengar – A text books of Engg. Mathematics – Laxmi Publications Ltd.
2. M.K. Venkataraman – Engg. Mathematics vol II 3rd year part A & B – National Publishing Co.
3. I.N. Sneddon – Elements of partial differential equations – Mc Graw Hill
4. B.V. Ramana – Higher Engg. Mathematics – Mc Graw Hill
5. Richard A Johnson – Miller Fread's probability & Statistics for Engineers- Pearson/ PHI

6. T. Veerarajan – Engg. Mathematics – Mc Graw Hill
7. G. Haribaskaran – Probability, Queueing theory and reliability Engg. – Laxmi Publications
8. V. Sundarapandian - probability ,Statistics and Queueing theory – PHI
9. H.C.Taneja – Advanced Engg. Mathematics Vol II – I.K.International
10. A.K.Mukhopadhyay-Mathematical Methods For Engineers and Physicists-I.K.International

EN010 402(ME): Principles of Management

(Common with EN010 502(ME))

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

- *To develop an understanding of different functional areas of management.*
- *To understand the functions and duties an individual should perform in an organisation.*

Module I (12 hours)

Management Concepts: Vision, Mission, Goals and Objectives of management-MBO-Scientific management- Functions of management- Planning- Organizing- Staffing-Directing- Motivating- Communicating- Coordinating- Controlling- Authority and Responsibility- Delegation- Span of control- Organizational structure- Line, Line and staff and Functional relationship.

Module II (12 hours)

Personnel Management: Definition and concept- Objectives of personnel management-Manpower planning- Recruitment and Selection of manpower- Training and development of manpower- Labour welfare- Labour turnover- Quality circle- Industrial fatigue- Industrial disputes-Method of settling disputes- Trade unions.

Module III (12 hours)

Production management: Objectives and scope of production management- Functions of production department- production management frame work- product life cycle-Types of production- Production procedure- Project planning with CPM and PERT- Basic concepts in network.

Module IV (12 hours)

Financial Management: Objectives and Functions of Financial Management- Types of Capital- Factors affecting working capital- Methods of financing.
Cost Management: Elements of cost- Components of cost- Selling Price of a product.

Module V (12 hours)

Sales and Marketing Management: Sales management- Concept- Functions of sales department- Duties of sales engineer- Selling concept and Marketing concept- Marketing-Definition and principles of marketing- Marketing management and its functions- Sales forecasting- Pricing- Advertising- Sales promotion- Channels of distribution- Market research.

Text Books

1. Koontz and Weihrich, *Essentials of Management*, Tata McGraw Hill.
2. Mahajan M., *Industrial Engineering and Production Management*, Dhanpat Rai and Co.
3. Kemthose and Deepak, *Industrial Engineering an Management*, Prentice Hall of India.

Reference Books

1. Martand Telsang, *Industrial Engineering and Production Management.*
2. Khanna O.P., *Industrial Engineering and Management*, Dhanpat Rai and Co.
3. Philip Kotler, *Marketing Management*, Prentice Hall of India.
4. Sharma S. C. & Banga T. R., *Industrial Organisation and Engineering Economics*, Khanna Publishers.
5. Prasanna Chandra, *Financial Management*, Tata McGraw Hill.

EI010 403 Signals and Systems

(Common to AI 010403 and EC010 403)

Teaching scheme **Credits:** 4
2 hours lecture and 2 hours tutorial per week

Objectives

- *To study the methods of analysis of continuous time and discrete time signals and systems to serve as a foundation for further study on communication, signal processing and control*

Module I (12 hrs)

Classification of signals: Continuous time and Discrete time, Even and Odd , Periodic and Non-periodic , Energy and Power – Basic operations on signals: Operations performed on the dependent variable , operations on the independent variable: Shifting , Scaling – Elementary Discrete time and Continuous time signals: Exponential , Sinusoidal , Step , Impulse , Ramp – Systems: Properties of Systems: Stability, Memory, Causality, Invertibility, Time invariance, Linearity – LTI Systems: Representation of Signals in terms of impulses – Impulse response – Convolution sum and Convolution integral – Cascade and Parallel interconnections – Memory, Invertibility, Causality and Stability of LTI systems – Step response of LTI systems – Systems described by differential and difference equations (solution by conventional methods not required)

Module II (12 hrs)

Fourier analysis for continuous time signals and systems: Representation of periodic signals: Continuous Time Fourier Series – convergence of Fourier series – Gibbs phenomenon – Representation of aperiodic signals: Continuous Time Fourier Transform – The Fourier Transform for periodic signals – Properties of Fourier representations – Frequency Response of systems characterized by linear constant coefficient differential equations

Module III (12 hrs)

Fourier analysis for discrete time signals and systems: : Representation of periodic signals: Discrete Time Fourier Series – Representation of aperiodic signals: Discrete Time Fourier Transform – The Fourier Transform for periodic signals – Properties of Fourier representations – Frequency Response of systems characterized by linear constant coefficient difference equations

Module IV (12 hrs)

Filtering: Frequency domain characteristics of ideal filters – Time domain characteristics of ideal LPF – Non-ideal filters – First and Second order filters described by differential and difference equations – Approximating functions: Butterworth, Chebyshev and elliptic filters (Magnitude response only) –

Sampling: The sampling theorem – Reconstruction of a signal from its samples using interpolation – Aliasing

Module V (12 hrs)

Bilateral Laplace Transform – ROC – Inverse – Geometric evaluation of the Fourier transform from pole-zero plot – Analysis and characterization of LTI systems using Laplace Transform – The Z Transform – ROC – Inverse – Geometric evaluation of the Fourier Transform from pole-zero plot – Properties of Z transform - Analysis and characterization of LTI systems using Z-Transform

References:

1) A V Oppenheim, A S Willsky and S H Nawab, *Signals and Systems*, PHI
2) S Haykin, and B V Veen, *Signals and Systems*, Wiley
3) B P Lathi, *Signal Processing and Linear Systems*, OUP
4) E W Kamen, and B Heck, *Fundamentals of Signals and Systems using the web and Matlab*, Pearson
5) Luis F Chaparro , *Signals and Systems Using MATLAB*, Elsevier
6) R E Ziemer, and W H Tranter, *Signals and Systems*, Pearson.
7) R A Gabel and R A Roberts, *Signals and Linear Systems*, Wiley

EI010 404: DIGITAL ELECTRONICS
(Common to AI010404 , EC010404 and IC010404)

Teaching scheme **Credits: 4**
L T P : 3 1 0

Objectives

- *To Work with a variety of number systems and numeric representations, including signed and unsigned binary, hexadecimal, 2's complement.*
- *To introduce basic postulates of Boolean algebra and show the correlation between Boolean expression.*
- *To introduce the methods for simplifying Boolean expressions.*
- *To outline the formal procedures for the analysis and design of combinational circuits and sequential circuits.*

Module I (12hours)

Positional Number System: Binary, Octal, Decimal, Hexadecimal number system, Number base conversions, complements - signed magnitude binary numbers - Binary Arithmetic-addition, subtraction - Binary codes- Weighted, BCD, 8421, Gray code, Excess 3 code, ASCII, Error detecting and correcting code, parity, hamming code.

Boolean postulates and laws with proof, De-Morgan's Theorems, Principle of Duality, Minimization of Boolean expressions, Sum of Products (SOP), Product of Sums (POS), Canonical forms, Karnaugh map Minimization, Don't care conditions

Module II (12 hours)

Digital Circuits: Positive and Negative logic, Transistor transistor logic, TTL with totem pole, open collector and tri state output, Emitter coupled logic – basic ECL inverter, NMOS NOR gate, CMOS inverter, NAND and NOR, Gate performance parameters – fan in, fan out, propagation delay, noise margin, power dissipation for each logic, characteristics of TTL and CMOS, subfamilies of TTL and CMOS.

Module III (12 hours)

Introduction to Combinational Circuits: Basic logic gates, Universal gates, Realization of Boolean functions using universal gates, Realization of combinational functions: addition – half and full adder – n bit adder – carry look ahead adder, subtraction, comparison, code conversion, and decoder, encoder, multiplexer, demultiplexer, parity checkers, and parity generator.

Introduction to Sequential Circuits: latches, timing, Flip Flops, types, characteristic equations, excitation tables, Realization of one flip flop using other flip flops.

Module IV (12 hours)

Application of flip flops as bounce elimination switch, register, counter and RAM, Binary ripple counter, synchronous binary counter, Design of modulo 'n' synchronous counter, up/down counters,

Shift registers – SISO, SIPO, PISO, PIPO, bidirectional shift register and universal register, counters based on shift registers

Module V (12 hours)

Hazards in combinational circuits: Static hazard, dynamic hazard, essential hazards, hazard free combinational circuits.

Introduction to programmable logic devices: PLA- block diagram, PAL – block diagram, registered PAL, Configurable PAL, GAL - architecture, CPLD – classification internal architecture, FPGA - architecture, ASIC – categories , full custom and semi custom.

Reference Books

1. Donald D Givone, *Digital Principles and Design*, Tata McGraw Hill, 2003.
2. G K Kharate, *Digital Electronics*, Oxford university press, 2010
3. Ronald J Tocci, *Digital Systems*, Pearson Education, 10th edition 2009.
4. Thomas L Floyd, *Digital Fundamentals*, Pearson Education, 8th edition, 2003.
5. Donald P Leach, Albert Paul Malvino, *Digital Principles and Applications*, Tata McGraw Hill 6th edition, 2006.
6. Charles H.Roth, *Fundamentals of Logic Design*, Thomson Publication Company 5th edition, 2004.
7. Milos Ercegovac, *Introduction to Digital Systems*, Wiley India, 2010
8. Moris mano, *Digital Design*, PHI, 3rd edition, 2002.
9. Anada kumar, *Fundamentals of Digital Circuits*, PHI, 2008.
10. Brain Holdesworth, *Digital Logic Design*, Elsevier, 4th edition, 2002.

EI010 405 Electronic Instrumentation

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

1. *To equip the students to apply all types of common electrical and electronic instruments with the knowledge about the construction and working of the instruments.*
2. *To provide the details of various electronic instruments which are used to measure current, voltage, power, energy, resistance, capacitance and inductance.*
3. *To introduce the construction and working of different types of ammeters, voltmeters and bridges.*
4. *A clear idea has been given about digital electronic instruments which are used to measure voltage, frequency, period, total count etc.*
5. *An exposure is given to the student about signal generation, display and recording devices which help in analysing and displaying the data.*

Module 1 (12 Hours)

Measurement of electrical parameters: Types of ammeters and voltmeters – Principle of operation , construction and sources of errors and compensation of d'Arsonval galvanometers- PMMC Instruments – Moving Iron Instruments – Dynamometer type Instruments – Rectifier type ammeters and volt meters.
Electro dynamic type Watt meter- Single phase induction type Energy meters. Calibration of Wattmeter and Energy meters.

Module 2 (12 Hours)

Resistance measurement:: Measurement of low, medium and high resistance- Wheatstone bridge, Kelvin double bridge, series and shunt type Ohm meter- Meggar –Earth resistance measurement.
Measurement of Inductance and capacitance:- Maxwell Wein bridge, Hay's bridge and Anderson bridge - Campell bridge –Owen's bridge- Measurement of capacitance:- Schering bridge .

Module 3 (12 Hours)

Analog meters :– DC volt meters- chopper amplifier type – peak responding volt meter- true RMS volt meter- Vector voltmeter -calibration of DC instrument --Ammeters – Multi meter – Power meter – Q-meter .
Digital Instruments : Digital method for measuring frequency, period – Phase difference – Pulse width – Time interval, Total count. Digital voltmeter — DMM – Microprocessor based DMM- Digital tacho meter- Digital ph meter.

Module 4 (12 Hours)

Signal generators and analyzers : Sine wave generator – Sweep frequency generator, Pulse and square wave generator – Function generator – Wave analyzer – Applications – Harmonic distortion analyzer – Spectrum analyzer – Applications – Audio Frequency generator – Noise generator.

Module 5 (12 Hours)

Display and Recording devices : Cathode Ray Oscilloscope – Classification - Sampling and storage scopes- Digital Storage Osilloscope (DSO)- Typical measurements using CRO- Probes for CRO- Applications of CRO.

Display devices: Classification of Displays- LED- LCD- Seven segment and dot matrix displays –- Typical uses of display devices

Recorders: Strip chart recorders- Galvanometric recorders- Null type recorders- Circular chart recorders- XY recorders – UV recorder-Magnetic tape recorders –Digital waveform recorders- FM recorders- Data loggers- Printers.

Text Books

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

Reference Books

1. Albert D. Helfrick & William D. Cooper, 'Modern Electronic Instrumentation & Measurement Techniques', Prentice Hall of India.
2. B.M.Oliver and J.M.cage, 'Electronic Measurements & Instrumentation', McGraw Hill International Edition.
3. Joseph. J. Carr, 'Elements of Electronic Instrumentation & Measurements', Pearson Education.
4. D. A. Bell, 'Electronic Instrumentation and Measurements', Prentice Hall of India.
5. Rajendra Prasad, 'Electrical Measurements and Instrumentation', Khanna Publishers,
6. B.R. Gupta, 'Electronics and Instrumentation', S. Chand Co. (P) Ltd., Delhi

EI010 406 Electronic Devices and Circuits II

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

1. *To study the working, analysis and design of RC coupled and FET amplifiers.*
2. *To get an idea about feed back amplifiers and oscillators.*
3. *To familiarize with different types of amplifier circuits.*
4. *To have an adequate knowledge in multivibratotrs and power amplifiers.*

Module 1 (12 Hours)

Transistor amplifiers: RC coupled amplifier—Working—Analysis and design –Frequency response—Band width.
FET amplifier: FET biasing—Analysis and design –FET common source amplifier—FET source follower—Comparison of FET with BJT.

Module 2 (12 Hours)

Feedback amplifiers: Negative and positive feedback - Different types of negative feedback amplifier - Voltage shunt - Voltage series - Current shunt - Current series
Oscillators: Condition for oscillation - BarkHausen criteria --RC oscillators –RC phase shift—Wienbridge-- LC oscillators - Hartley , Colpitts , Clapp, Crystal oscillator .

Module 3 (12 Hours)

Amplifier circuits: Emitter follower- Darlington emitter follower- Cascade amplifier- Cascode amplifier- Difference amplifier- Tuned amplifier- Principle- Single tuned and double tuned amplifiers- Frequency response- Applications (no analysis)- Multi stage amplifiers- Frequency response.

Module 4 (12 Hours)

Multi vibrators: Analysis and design of Astable, Monostable and Bistable multi vibrators. –Applications—Schmitt trigger—Working- Design. –Sweep generator- Voltage and current sweeps- Time base generators- Miller and boot strap sweeps- Applications.

Module 5 (12 Hours)

Power amplifiers: Classification- Class A , Class B; Class AB, Class C and class D. Transformer coupled class AB Power amplifier - Transformer less class AB -Push pull Power amplifier--complementary symmetry power amplifier--Harmonic distortion in Power amplifiers --Transistor rating --Heat sinks --Switching amplifiers .

References:

1. Boylsted and Nashelsky, “Electronic Devices and Circuit Theory”, Prentice Hall of India
2. Millman and Halkias, “Electronic Devices and Circuits”, Tata McGraw– Hill,
3. Floyd, T.L, “Electronic Devices” 6th Edition, Pearson Education,
4. Millman and Halkias, “Integrated Electronics”, McGraw-Hill,
5. J B Gupta, “Electronic Devices and Circuits” , S K Kataria & Sons Pub.
6. Malvino, “Electronic Principles”, Tata Mc Graw Hill.

EI010 407 Electronic Circuits Lab II

Teaching scheme **Credits:** 2

3 hours Practical per week

1. Amplifying circuits
   a) Design of RC coupled amplifier (with and without feed back)---gain and bandwidth.
   b) Common source FET amplifier
2. Power amplifiers: Design of class A, class B, class AB
3. Oscillators: Design of RC phase shift, Wein bridge, Hartley& Colpitts
4. Design and testing of Cascade amplifiers. –Frequency response
5. Design and testing of Tuned amplifiers—Frequency response
6. Multivibrators; Astable, Monostable, Bistable.
7. Schmitt trigger
8. Design of sweep generators-Simple and Boot strap
9. SCR, TRIAC circuits
10. Simulation of above circuits using PSPICE, ISIS Proteus.

EI010 408 (S) Basic Instrumentation Lab

Teaching scheme **Credits:** 2

3 hours Practical per week

1) Measurement of L, C, R using bridges
2) Measurement of Earth resistance.
3) Construction and testing of a digital frequency /phase meter
4) Construction and testing of a digital volt meter gating circuit
5) Construction and testing of a true RMS volt meter
6) Construction and testing of a FET input volt meter
7) Construction and testing of a multi range rectifier type volt meter and ammeter
8) Calibration of voltmeter and ammeter using precision potentiometer
9) Calibration of wattmeter
10) Calibration of energy meter
11) Usage of Digital storage oscilloscope
12) Experimental verification of Bernoulli's theorem
13) Determination of Reynolds number
14) Calibration of Venturi meters
15) Calibration of Orifice meter
16) Calibration of Notches
17) Test to estimate frictional losses in pipe flow.

EN010501A ENGINEERING MATHEMATICS IV

(Common to all branches except CS & IT)

Teaching scheme **Credits: 4**

2 hours lecture and 2 hour tutorial per week

Objectives: *Use basic numerical techniques to solve problems and provide scientific techniques to decision making problems.*

MODULE 1 Function of Complex variable (12 hours)

Analytic functions – Derivation of C.R. equations in cartision co-ordinates – harmonic and orthogonal properties – construction of analytic function given real or imaginary parts – complex potential – conformal mapping of z^2 , $\frac{1}{z}$ - Bilinear transformation – cross ratio – invariant property (no proof) – simple problems

MODULE 2 Complex integration (12 hours)

Line integral – Cauchy's integral theorem – Cauchy's integral formula – Taylor's series- Laurent's series – Zeros and singularities – types of singularities – Residues – Residue theorem – evaluation of real integrals in unit circle – contour integral in semi circle when poles lie on imaginary axis.

MODULE 3 Numerical solution of algebraic and transcendental equations (10 hours)

Successive bisection method – Regula –falsi method – Newton –Raphson method - Secant method – solution of system of linear equation by Gauss – Seidel method

MODULE 4 Numerical solution of Ordinary differential equations (10 hours)

Taylor's series method – Euler's method – modified Euler's method – Runge – Kutta method (IV order) - Milnes predictor – corrector method

MODULE 5 Linear programming problem (16 hours)

Definition of L.P.P., solution, optimal solution, degenerate solution – graphical solution –solution using simplex method (non degenerate case only) Big -M method – Duality in L.P.P. – Transportation problem –Balanced T.P. – initial solution using Vogel's approximation method - modi method (non degenerate case only)

References

1. B.V. Ramana – Higher Engg. Mathematics – Mc Graw Hill
2. M.R.Spicgel , S.Lipschutz , John J. Schiller, D.Spellman – Complex variables, schanm's outline series - Mc Graw Hill
3. S.Bathul – text book of Engg.Mathematics – Special functions and complex variables –PHI
4. B.S. Grewal – Numerical methods in Engg. and science - Khanna Publishers
5. Dr.M.K Venkataraman- Numerical methods in science and Engg -National publishing co

6. S.S Sastry - Introductory methods of Numerical Analysis -PHI
7. P.K.Gupta and D.S. Hira – Operations Research – S.Chand
8. Panneer Selvam– Operations Research – PHI
9. H.C.Taneja – Advanced Engg. Mathematics Vol II – I.K.International

EI010 502 Industrial Electronics and Applications

(Common to AI010 502 and IC010 502)

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Module 1

Power semiconductor Devices-ratings and specification -Power diodes – power transistor – power MOSFET - characteristics of SCR, Triac–IGBT – MCT – LASCR – SCR turn on, turn off characteristics — thyristor protection circuits – series and parallel operations of SCR- Thyristor trigger circuits – R ,RL,RC triggering.

Module 2

AC to DC converters – single phase – three phase – half controlled and fully controlled rectifiers – free wheeling diodes -free wheeling effect - effect of source and load inductance – power factor improvement methods for phase controlled rectifiers- PWM chips:SG3524 and TL 494- dual converters – cyclo converters.

Module 3

Inverters and voltage source inverters – series, parallel and bridge inverters – current source inverters – PWM inverters – D.C. chopper – step up and step down chopper – AC chopper: AC converters: – uninterrupted power supply (UPS) – (circuit diagram approach), rectifier — inverter – static transfer switch.
DC to DC converters: choppers: SMPS, battery charger circuits

Module 4

D.C Motor control: phase control, Single phase SCR drive – Three phase SCR drive – speed control of dc series motor – Chopper controlled dc drives – PLL control of dc motor, A.C. Motor control : controlled – slip system – slip power recovery system - stepper motor drive - synchronous motor control.

Module 5

Control circuits for power electronics: basic schemes for pulse generation using analog and digital ICs. Single, double and four quadrant systems. Series and parallel operations of thyristor, cable firing, isolation etc.

Text Books

1. P.S.Bimbhra, 'Power Electronics', Khanna Publishers, New Delhi, 2002
2 G.K.Dubey, Doradia, S.R. Joshi and R.M.Sinha, Thyristorised Power Controllers, New Age International Publishers, New Delhi, 1996.

References

1. M.H.Rashid, Power Electronics – circuits, devices and applications, PHI, New Delhi, 1995.
2. Joseph Vithyathi, Power Electronics, McGraw Hill, USA, 1995.
3. Mohan, Undeland and Robbins, Power Electronics, John Wiley and Sons, New York, 1995.

4. P.C.Sen, Modern Power Electronics, Wheeler publishers, New Delhi, 1998
5. M.D.Singh, K.B. Khanchandani: Power Electronics, TMH, 1998

EI010 503 Linear Integrated Circuits and Applications

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

1) To study different parameters, characteristics of op- Amps
2) To know about the different applications of op- Amp
3) To give the basic concepts of special ICs like timers, PLL, regulators etc.
4) To introduce the theory and applications of ADC and DAC.

Module 1 (12 Hours)

Introduction to op-Amps, Internal block schematic of op-amp, Op-Amp parameters, measurement of Op-Amp parameters ,Ideal OP-AMP, transfer curve, equivalent circuit, open loop configurations, frequency response of op-amp, frequency compensation networks, slew rate- methods of improving slew rate.

Module 2 (12 Hours)

Applications of op-Amp: Inverting and Non-inverting amplifier- Summer-Log and antilog amplifier- Differentiator- Integrator- Instrumentation amplifier- V/I and I/V converters- V/F and F/V converters – Clippers- Clampers -Precision rectifiers – Comparators- Applications of comparator- Schmitt trigger – Multivibrators - Waveform generators (Triangular, Sawtooth), Peak detector, Sample and hold circuit.

Module 3 (12 Hours)

Filters: LPF, HPF, BPF, Notch and All pass filters - I order and II order filters - Switched capacitor filter.
555 timer: Functional block diagram - Astable multivibrator - Monostable multivibrator and its applications
RC phase shift and Wein bridge oscillators.

Module 4 (12 Hours)

PLL- Capture and lock range - Analog and Digital phase detector - 566 VCO chip- 565 PLL IC- Applications of PLL- Frequency multiplication and division, AM Demodulation.
DAC: Weigted resistor, R-2R ladder network, Current steering, Charge scaling DACs, Cyclic DAC, Pipeline DAC.
ADC: Dual slope, Counter ramp, Successive approximation, Flash ADC, Pipeline ADC, Over sampling ADC.

Module 5 (12 Hours)

Specialized ICs and applications: Voltage regulator ICs- 78xx and 79xx series, 317 Variable regulators, Switching regulators, LM 380 Power amplifier, Intercom using LM 380, Isolation amplifier, Opto coupler ICs.

Text Books:

1. Ramakant A.Gayakward, ‘Op-amps and Linear Integrated Circuits’, Pearson Education, / PHI.
2. D.Roy Choudhary, Sheil B.Jani, ‘Linear Integrated Circuits’, New Age,.

References:

1. Robert F.Coughlin, Fredrick F.Driscoll, ‘Op-amp and Linear ICs’, Pearson Education, /PHI.
2. David A.Bell, ‘Op-amp & Linear ICs’, Prentice Hall of India.
3. K R Botkar : Integrated circuits , Khanna Publishers.
4. Baker R Jacob: CMOS circuit design, layout and simulation, PHI

EI010 504 Transducer Engineering

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

1) *This course introduces the various types of transducers and their working principle.*
2) *To give an insight about classification and characteristics of transducers*
3) *To have an adequate knowledge in passive transducers.*
4) *To obtain a basic knowledge in active and digital transducers and exposure to other special transducer.*

Module 1 (12 Hours)

Definition of Transducers- Role of transducers in instrumentation- Advantages of electrical transducers - Classification of transducers- Analog and Digital, Active and passive, Primary and Secondary transducers- Inverse transducer- Sensitivity and specification for transducers - Characteristics and Choice of transducer-Factors influencing choice of transducer.

Module 2 (12 Hours)

Passive transducers: Principle of operation, Construction details, Characteristics and applications of Resistance potentio meter- Strain gauge- Resistance thermometer- Thermistor- Hot wire anemometer- Piezo resistive sensor.
Induction potentiometer- Variable reluctance transducer- EI pick up- LVDT- RVDT. Capacitive transducers – Variable air gap, Variable area, Variable permittivity- Capacitor microphone- Frequency response- Merits, Demerits and Uses.

Module 3 (12 Hours)

Active transducers: Principle of operation, Construction details, Characteristics and Applications of Thermo electric transducers- Piezo electric transducers- Magnetostrictive transducers- Hall effect transducers- Electro mechanical transducers – optical transducers - Photo electric transducers- Pyro electric radiation detectors. Merits and demerits- Frequency response.

Module 4 (12 Hours)

Digital transducers: Construction, Operation and features of Digital transducers- Digital displacement transducer- Frequency domain transducer- Digital encoder- Magnetic encoder- shaft encoder – optical encoder - Digital pots – Digital tacho meters- Drag cup tachometric generator- Transducer oscillators- Eddy current transducer.

Module 5 (12 Hours)

Special transducers: Semiconductor sensor- Ionization transducer- Geiger muller and Scintillation counters- Ultrasonic transducer- colour sensor- Proximity sensors- Indigent instruments - Smart sensors-Smart transmitters - IC sensor- Fiber optic transducer-SQUID sensors- Film sensors - Nano sensors- - Introduction to MEMS.

References

1. D V S Murthy, Transducers and Instrumentation, prentice Hall of India Pvt. Ltd., New Delhi

2. A.K. Sawhney, A course in mechanical measurements and instrumentation., Dhanpat Rai.
3. B S Sonde, Transducers and Display Systems, Tata Mc Graw Hill, New Delhi
4. Patranabis, D, Sensors and Transducers, Wheeler Publishing Co., Ltd. New Delhi
5. Renganathan, S., Transducer Engineering, Allied Publishers, Chennai
6. Alan S Morris: Measurement and instrumentation principles. Elsevier.
7. Hermann K.P. Neubert, 'Instrument Transducers', Oxford University Press

EI010 505 Control Engineering I
(Common to AI010 505)

Teaching scheme **Credits:** 4
2 hours lecture and 2 hour tutorial per week

Objectives

1) *To give the fundamental concept of the analysis and design techniques of control systems by transfer function approach.*
2) *To get an adequate knowledge in the time response of systems and steady state error analysis.*
3) *To learn the concept of stability of control system and methods of stability analysis.*
4) *To study the three ways of designing compensation for a control system.*
5) *To get an exposure to MAT lab programs for control system analysis.*

Module 1 (12 Hours)

System modeling - Transfer function approach :
Introduction to control system – Classification of control systems. Principles of automatic control- Feed back systems –Practical examples – Transfer function – Transfer function of electrical, mechanical and electromechanical system – Block diagram – Signal flow graph – Mason's gain formula.

Module 2 (12 Hours)

Time domain analysis :
Standard test signals - Response of systems to standard test signals – Step response of second order systems in detail – Time domain specifications – Steady state response – Steady state error- Static & Dynamic error coefficients- MAT lab programs for time domain analysis.

Module 3 (12 Hours)

Stability of linear systems in time domain – Routh's criterion of stability. Root locus - Construction of root locus – Effect of addition of poles and zeros on root locus-MAT lab programs for stability analysis.

Module 4 (12 Hours)

Frequency domain analysis :
Frequency response – Frequency domain specifications – Stability in the frequency domain - Nyquist stability criterion – Stability from polar and Bode plots - Relative stability – Gain margin and phase margin – M & N circles – Nichol's chart – MAT lab programs for frequency domain analysis.

Module 5 (12 Hours)

Design of compensators:
Introduction to design – compensation techniques – Lead, Lag and Lead -Lag compensation using RC network --Design of Lead, Lag and Lead-Lag compensators using bode plots.

References

1. Modern control engineering – Katsuhiko Ogata, Pearson Edn.
2. Control systems principles and design: M. Gopal, TMH.
3. Automatic control system – B.C. Kuo, PHI.
4. Control system design: Graham C Goodwin, PHI.
5. Modern Control Systems: Dorf, Pearson Education.

EI010 506 Microprocessors & Microcontrollers
(Common to AI010 506 and IC010 506)

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

1. *To Create an exposure to basic microprocessors, peripherals and its programming.*
2. *To impart the basic concepts of advanced microprocessors.*
3. *To have an adequate knowledge in 8-bit microcontrollers.*
4. *To provide the basic concepts of programming in 8051.*
5. *To provide basic knowledge in RISC.*

Module 1

Introduction to microprocessors and microcomputers: Function of microprocessors- architecture of 8085. Intel 8086 Microprocessor - Internal architecture – Block diagram –8086 memory organization – even and odd memory banks – segment registers – logical and physical address.
Minimum and maximum mode operation – Interrupt and Interrupt applications –peripherals– programmable DMA controller-8257 – 8087 math coprocessor-Programmable interrupt controller-8259

Module 2

Addressing modes used in 80x86 family - Data addressing modes, Program memory addressing modes, Stack memory addressing modes. Instruction sets of 8086-programming. Architectures of Intel 80286 Microprocessor, 80386 Microprocessor Advanced Intel Microprocessors – 80486 Pentium.

Module 3

Atmel AT89C51 microcontroller – features - pin configurations - internal block
Schematic. Port structures .Idle & power down mode - power control register - program protection modes – flash programming & verification.
Memory organization - program memory - data memory .Program status word - registers banks. External program & data memory timing diagrams- I/O port timings – and operation –Direct & indirect addressing area - Addressing modes.

Module 4

8051 Programming-Machine cycle-Instruction set – arithmetic - logical and data transfer instructions – Boolean instructions - program branching instructions - Programming examples Timer0 & Timer1 - TMOD SFR - mode0, mode1, mode2, mode3 – TCON-Programming examples.

Module 5

Serial interface - SCON SFR - mode0, mode1, mode2, mode3- block schematics baud

rates- power on reset circuit- ONCE mode- on chip oscillator interrupts - interrupt sources - interrupt enable register -interrupt priority - interrupt control system - interrupt handling ,single step operation. Programming examples
Introduction to RISC processors-Microchip PIC16 family – PIC16F873 processor – features – architecture

References:

1. The 8051 Microcontroller: Muhammad Ali Mazidi, Pearson Education.
2. The 8051 Microcontroller: Kenneth J Ayala, Penram International
3. Microprocessors and Architecture: Ramesh S Goankar
4. Microcomputers and Microprocessors: John Uffenbeck, PHI
5. Web site of Atmel - www.atmel.com
6. The Microprocessors 6th Edition Barry B. Brey Pearson Edu.
7. Microprocessor and Interfacing 2nd Edition Douglous V. Hall TMH
8. The 80x 86 families John Uffenbeck
9. Microchip semiconductor web site – www.microchip.com
10. Design with PIC micro-controllers: John B Peatman, Pearson Education.

EI010 507 Instrumentation lab I

1. Strain gauge & Load cell characteristics.
2. LDR and Opto coupler characteristics.
3. Capacitive & Piezoelectric transducer.
4. Photo electric & Hall effect transducers.
5. LVDT and Tacho generator Characteristics
6. RTD, Thermocouple and Thermistor characteristics
7. Measurement of PH and water conductivity.
8. Characteristics of stepper motor and servo motor. .
9. IC temperature sensor (AD 590)
10. Measurement of Speed-contact and Non-contact Types.
11. Design and testing of Instrumentation amplifier
12. Design and testing of a temperature control
13. Design of RC lead, lag, lead - lag compensator.

EI010 508 Integrated Circuits Lab

Teaching scheme **Credits:** 2

3 hours Practical per week

1. Op-Amp configurations-Inverter, Non inverter
2. Op- Amp applications-Summer, Subtracter, Integrator, Differentiator,Comparator.
3. Design and testing of precision rectifier, V/I and I/V converters.
4. Design and testing of active filters
5. Design and testing of waveform generators using op-amps----square, triangular
6. Design and testing of multivibrators using 555
7. Simplification of a logic function and its realization using (1) AND, OR, NOT gates and (2) Universal gates
8. Design and analysis of Adder & Subtracter
9. Design of code converters a) Binary to Gray b) Binary to excess c) BCD to Decimal
10. Verification of truth tables of JK, RS, D, and T flip flops
11. Study of Digital counters: Ripple counter, Decade counter, Ring counter
12. Shift registers
13. Multiplexer and Demultiplexer

EI 010 601 Process Control Instrumentation

(Common to AI010 601 and IC010 601)

Teaching scheme **Credits**: 4

3 hours lecture and 1 hour tutorial per week

Objectives

1. *To study the basics of process control*
2. *To study about the various controller modes and methods of tuning of controllers*
3. *To give an idea about the construction , characteristics and applications of control valves*
4. *To have a case study of distillation column control.*

Module 1 (12 hours)

Process Control System: Need for process control, classification of process variables, Process characteristics: Process equation, degrees of freedom, modeling of simple systems – thermal, gas, liquid systems. Process lag, load disturbance and their effect on processes. Self-regulating processes, interacting and non interacting processes, Regulator and servo control. Piping and Instrumentation diagram- instrument terms and symbols.

Module 2 (12 hours)

Controller modes: Basic control action, two position (ON-OFF), multi-position, floating control modes. Continuous controller modes: Proportional, Integral, Derivative. Composite controller modes: P-I, P-D, P-I-D. response of controllers for different types of test inputs, electronic controllers to realize various control actions, selection of control mode for different processes, Integral wind-up and prevention. Auto/Manual transfer, Bumpless transfer.

Module 3 (12 hours)

Optimum Controller Settings: Controller tuning Methods- Process reaction curve method, Ziegler Nichols method, damped oscillation method, ¼ decay ratio. Evaluation criteria - IAE, ISE, ITAE. Response of controllers for different test inputs. Selection of control modes for processes like level, pressure, temperature and flow.

Module 4 (12 hours)

Final control elements: I/P and P/I converter, Pneumatic and Electric actuators. Pneumatic control valves, classification, construction details (Globe, butterfly and ball valve types), various plug characteristics. Valve sizing, inherent and installed valve characteristics. Cavitation and flashing in control valves. Valve actuators and positioners. Selection of control valves.

Module 5 (12 hours)

Advanced control schemes: Cascade control, ratio control, feed forward control, Adaptive and Inferential control, split range and averaging control. Multivariable process control, interaction of control loops. Case Studies: Steam boiler – control of heat exchangers, drum level control and combustion. Distillation column – Control of top and bottom product compositions – Reflux ratio, control schemes in distillation column.

Text Books:

1. George Stephenopoulos: *Chemical Process Control,*
2. Donald P. Eckman, *Automatic Process Control*
3. Peter Harriot : *Process Control,*TMH,1985.
4. D R Coughanowr: *Process Systems Analysis and Control*, McGraw Hill.

References:

1. Patranabis D: *Principles of Process Control*, TMH, 1981.
2. B.G Liptak, *Process Control*, Chilton Book Company

EI010 602 DIGITAL SIGNAL PROCESSING

(Common to AI010 602 and EC010 602)

Teaching scheme **Credits**: 4

2 hours lecture and 2 hours tutorial per week

Objectives

- *To study the fundamentals of discrete-time system analysis, digital filter design and the DFT*

Module I (12 hrs)

Advantages of DSP – Review of discrete time signals and systems – Discrete time LTI systems – Review of DTFT – Existence – Symmetry properties – DTFT theorems – Frequency response- Review of Z transform – ROC – Properties

Sampling of Continuous time signals – Frequency domain representation of sampling – Aliasing - Reconstruction of the analog signal from its samples – Discrete time processing of continuous time signals – Impulse invariance – Changing the sampling rate using discrete time processing – Sampling rate reduction by an integer factor – Compressor – Time and frequency domain relations – Sampling rate increase by an integer factor – Expander – Time and frequency domain relations – Changing the sampling rate by a rational factor.

Module II (12 hrs)

Transform analysis of LTI systems – Phase and group delay – Frequency response for rational system functions – Frequency response of a single zero and pole – Multiple poles and zeros - Relationship between magnitude and phase – All pass systems – Minimum phase systems – Linear phase systems – Generalised linear phase – 4 types – Location of zeros.

Module III (12 hrs)

Structures for discrete time systems – IIR and FIR systems – Block diagram and SFG representation of difference equations – Basic structures for IIR systems – Direct form - Cascade form - Parallel form - Transposed forms – Structures for FIR systems – Direct and Cascade forms - Structures for Linear phase systems – Overview of finite precision numerical effects in implementing systems

Analog filter design: Filter specification – Butterworth approximation – Pole locations – Design of analog low pass Butterworth filters – Chebyshev Type 1 approximation – pole locations – Analog to analog transformations for designing high pass, band pass and band stop filters.

Module IV (12 hrs)

Digital filter design: Filter specification – Low pass IIR filter design – Impulse invariant and Bilinear transformation methods – Butterworth and Chebyshev – Design of high pass, band pass and band stop IIR digital filters – Design of FIR filters by windowing – Properties of commonly used windows – Rectangular, Bartlett, Hanning, Hamming and Kaiser.

Module V (12 hrs)

The Discrete Fourier Transform - Relation with DTFT – Properties of DFT – Linearity – Circular shift – Duality – Symmetry properties – Circular convolution – Linear convolution using the DFT – Linear convolution of two finite length sequences – Linear convolution of a finite length sequence with an infinite length sequence – Overlap add and overlap save – Computation of the DFT – Decimation in time and decimation in frequency FFT – Fourier analysis of signals using the DFT – Effect of windowing – Resolution and leakage – Effect of spectral sampling.

References

1. A V Oppenheim, R W Schaffer, *Discrete Time Signal Processing* , 2nd Edition Pearson Education.
2. S K Mitra, *Digital Signal Processing: A Computer Based Approach* ,TMH
3. J G Proakis, D G Manolakis, *Digital Signal Processing: Principles, Algorithms and Applications*, PHI.
4. L C Ludeman, *Fundamentals of Digital Signal Processing*, Wiley
5. J R Johnson, *Introduction to Digital Signal Processing*, PHI

EI 010 603 Industrial Instrumentation I

(Common to AI010 603 and IC010 603)

Teaching scheme **Credits**: 4

3 hours lecture and 1 hour tutorial per week

Objectives

1. *To provide exposure to various measuring techniques for force, torque velocity, acceleration, vibration, density, pressure and temperature.*
2. *At the end of the course the student will have an indepth knowlwdge in units, different techniques, and significance of measuring devices.*

Module 1 (12 hours)

Measurement of Force, Torque, Velocity :-
Basic methods of measurement of force (weight) :scales and balances- mechanical balances- electro magnetic balance – Different types of load cells : hydraulic load cells - pneumatic loadcell - magneto elastic (pressductor)- strain gauge loadcell - proving ring.
Different methods of torque measurement: Strain gauge, Relative regular twist-measurement of torque with spur gears – and proximity sensors.
Speed and velocity measurement: Revelution counter- Capacitive tachometer -Drag cup type tacho meter- D.C and A.C tacho generators – Stroboscope- translational velocity transducers. Velocity measurement using variable reluctance proximity pickup. Calibration methods.

Module 2 (12 hours)

Measurement of acceleration, vibration and density :-
Accelerometers – potentiometric type – LVDT- Piezo-electric, capacitive - Strain gauge and variable reluctance type accelerometers.
Mechanical type vibration instruments – Seismic instrument as an accelerometer and vibrometer – measurement of relative motion - Calibration of vibration pick ups
Units of density, specific gravity and viscosity used in industries – Baume scale API scale – hydro meter- density measurement using LVDT- differential pressure method- pressure head type densitometer – float type densitometer – Ultrasonic densitometer – Bridge type gas densitometer- coriolis densitometer. .

Module 3 (12 hours)

Pressure measurement : - Units of pressure – different types of pressure- Manometers – Different types –errors in manometers- Elastic type pressure gauges – Bourden tube - Bellows – Diaphragms – Electrical methods – Elastic elements with LVDT and strain gauges – potentiometric pressure transducers- Capacitive type pressure gauge –Piezo electric pressure sensor –Resonator pressure sensor – optical pressure transducers- pressure switches- Measurement of vacuum – McLeod gauge – Thermal vacuum gauges – Ionization gauge -Testing and calibration of pressure gauges – Dead weight tester- Bulk gauge(high pressure measurement).

Module 4 (12 hours)

Temperature measurement :- Definitions and standards – Primary and secondary fixed points – Calibration of thermometers - Different types of filled in system thermometer – Sources of errors in filled in systems and their compensation – Bimetallic thermometers – Electrical methods of temperature measurement – resistance thermometers-3 lead and 4 lead RTDs - Thermistors – Linearization techniques.

Module 5 (12 hours)

Thermocouples –thermocouple junctions- Law of thermocouple – Fabrication of industrial thermocouples– Signal conditioning of thermocouple output — Commercial circuits for cold junction compensation — Special techniques for measuring high temperature using thermocouples – Radiation methods of temperature measurement –Radiation fundamentals – Total radiation pyrometers – Optical pyrometer – infra red pyrometers- Two colour radiation pyrometer.- IC temperature sensors- fiber optic temperature measurement- calibration of temperature transducers.

Text Books

1. A.K.Sawhney, A course in mechanical measurements and Instrumentation–Dhanpat Rai and Sons, New Delhi, 1999.
2. R. K. Jain, Mechanical and Industrial Measurements, Khanna Publishers, New Delhi, 1999.

References

1. D.Patranabis, Principles of Industrial Instrumentation, Tata McGraw Hill Publishing Ltd., New Delhi, 1999.
2. B.C.Nakra and K.K.Chaudary, Instrumentation Measurement and Analysis, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1985.
3. S.K.singh, industrial instrumentation and control, Tata McGraw Hill Publishing Ltd., New Delhi, 2006

EI 010 604 Data Acquisition and Communication

Teaching scheme **Credits**: 4

3 hours lecture and 1 hour tutorial per week

Objectives

1. *To get an awareness of modern data acquisition system*
2. *To help students understand different types of data acquisition boards.*
3. *To give an idea about industrial communication systems.*

Module 1 (12 hours)

Fundamentals of data acquisition: Transducers and sensors, Field wiring and communications cabling, Signal conditioning, Data acquisition hardware, Data acquisition software, Host computer.
Data acquisition and control system configuration **:** Computer plug-in I/O, Distributed I/O, Stand-alone or distributed loggers/controllers, IEEE 488 (GPIB) remote programmable instruments
Data acquisition boards: A/D Boards, Single ended vs differential signals, Resolution, dynamic range and accuracy of A/D boards, Sampling techniques, Speed vs throughput, D/A boards, Digital I/O boards, Interfacing digital inputs/outputs, Counter/timer I/O boards.

Module 2

Industrial Communication systems: Introduction, Historical background, standards, OSI Model, Protocols, Physical standards, Modern instrumentation and control systems, Distributed Control systems, PLC, Impact of microprocessor, Smart instrumentation systems.
Basic Principles of Industrial Communication**:** bits, bytes and characters; Communication principles; Communication modes, asynchronous systems, synchronous systems, Error detection, Transmission characteristics, Data coding.

Module 3

Serial Communication**:** UART, Standards organization, serial data communications interface standards, balanced and unbalanced transmission lines, EIA-232 interface standard, Test equipment, Comparison of the EIA interface standards, the 20mA current loop.

Module 4

Modems and Multiplexers**:** Introduction, Modulation techniques, Components of a modem, Radio modem, Modem standards, Multiplexing concepts.

Module 5

Industrial Protocols**:** OSI layers, OSI model for industrial control application, HART protocol, CAN bus, Foundation Field bus.

Text Books

1. John Park, Steve Mackay, Practical Data Acquisition for Instrumentation and Control Systems; Elsevier
2. John Park, Steve Mackay, Practical Data Communication for Instrumentation and Control Elsevier

References:

1. Joseph J. Carr, Data acquisition and control: microcomputer applications for scientists and engineers, Tab Professional and Reference Books.
2. V.U.Bakshi U.A.Bakshi, Measurements And Instrumentation**,** Technical Publications.
3. H. Rosemary Taylor, Data Acquisition for Sensor Systems, Chapman & Hall.

EI 010 605 Control Engineering II

(Common to AI010 605)

Teaching scheme **Credits**: 4

2 hours lecture and 1 hour tutorial per week

Objectives

1. *To study the modeling of the systems using State Space methods*
2. *To learn State variable analysis and design of continuous time systems*
3. *To get an exposure to digital control systems.*
4. *To understand the basic concepts of nonlinear systems*

Module 1 (12 Hours)

System modeling using state variable approach -Limitation of Conventional Control Theory. Concepts of state variables and state model - State model for linear time invariant systems.-State space representation of dynamic systems – Nonuniqueness of state model- Block diagram representations- State diagrams- Lagrange's equations .

Module 2 (12 Hours)

Transformation of state variables- State space representations of transfer functions- Solution of differential equations in state space form- Interpretation and properties of the state transition matrix - Solution by the Laplace transform - The resolvent - Transfer function from state model.

Module 3 (12 Hours)

State variable analysis - controllability and observability. Gilber test and Kalman's tests. Design of regulators for single input single output systems, Bass- gura pole placement formula. Linear observers: Need of observers, Structure and properties of observers, Pole placement for single output systems.

Module 4 (12 Hours)

Discrete time systems- Introduction to digital control system –Review of Z-transform and properties.- inverse z transform- z transform method for solving difference equations- Impulse sampling and data hold circuits -Zero order and First order hold – signal reconstruction –Practical aspects of the choice of sampling rate-Pulse transfer function - The Z and S domain relationships -Stability analysis - Jury's test-Bilinear transformation .

Module 5 (12 Hours)

Nonlinear systems- Behaviour of nonlinear systems-Common physical nonlinearities-The phase plane method- basic concepts- Singular points- Describing function method – Basic concepts-- Describing functions of saturation and dead zone nonlinearities. – Stability of nonlinear systems- limit cycles.
(Detailed analysis not required).

Text Books

1. K. Ogata , Modern Control Engineering , Prentice Hall of India

2. K. Ogata , Discrete Time Control Systems ,Prentice Hall Of India.
3. M. Gopal , Digital Controls and State Variable Methods ,TMH Pub. Com.
4. B. C. Kuo , Automatic Control Systems, Prentice Hall of India.
5. J. Nagrath & M. Gopal ,Control System Engineering , New Age Int. (P) Ltd
6. B.Friedland, Control System Design- An Introduction to state space methods- Mc Graw Hill, Inc.N Y.

EI 010 606 L01 Digital System Design

Teaching Scheme **Credits:4**
3 hours lecture and 1 hour tutorial per week

Objectives

1. *To design and implement combinational circuits using basic programmable blocks*
2. *To design and implement synchronous sequential circuits*
3. *To study the fundamentals of Verilog HDL*
4. *Ability to simulate and debug a digital system described in Verilog HDL*

Module 1 (12hours)

Introduction to Verilog HDL: Design units, Data objects, Signal drivers, Delays , Data types, language elements, operators, user defined primitives, modeling-data flow, behavioral, structural, Verilog implementation of simple combinational circuits: adder, code converter, decoder, encoder, multiplexer, demultiplexer.

Module 2 (12 hours)

Combinational circuit implementation using Quine–McCluskey algorithm, Decoders, Multiplexers, ROM and PLA, Implementation of multi output gate implementations

Module 3 (12 hours)

Finite State Machines: State diagram, State table, State assignments, State graphs, Capabilities and limitations of FSM, Meta stability, Clock skew, Mealy and Moore machines, Modelling of clocked synchronous circuits as mealy and Moore machines: serial binary adder, Sequence detector, design examples.

Module 4 (12 hours)

Digital System Design Hierarchy: State assignments, Reduction of state tables, Equivalent states, Determination of state equivalence using implication table, Algorithmic State Machine, ASM charts, Design example.

Module 5 (12 hours)

Verilog HDL implementation of binary multiplier, divider, barrel shifter, FSM, Linear feedback shift register, Simple test bench for combinational circuits.

References:

1. Michael D.Ciletti, *Advanced Digital design with Verilog HDL*, Pearson Education, 2005.
2. S. Brown & Z. Vranestic, *Fundamentals of Digital Logic with Verilog HDL*, Tata McGraw Hill, 2002.

3. Samir Palitkar, *Verilog HDL A Guide To Digital Design And Synthesis*, Pearson, 2nd edition, 2003.
4. Peter J Ashenden “Digital Design, an embedded system approach using Verilog” Elsevier, 2008
5. Frank Vahid, *Digital Design*, Wiley Publishers.
6. T R Padmanabhan, Design through Verilog HDL, IEEE press, Wiley Inter science, 2002.
7. Donald D Givone, *Digital Principles and Design*, Tata McGraw Hill, 2003.
8. Wakerly J F, *Digital Design Principles and Practices*, PHI, 2008.
9. Nazeih M Botros, *HDL programming VHDL and Verilog*, Dreamtech press, 2009
10. David J. Comer, *Digital Logic and State Machine Design*, Oxford university press, 3rd edition, 1995.

EI010 606 L602: Database Management Systems
(Common to EC010 606 L02)

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

- *To impart an introduction to the theory and practice of database systems.*
- *To develop basic knowledge on data modelling and design of efficient relations.*
- *To provide exposure to oracle database programming.*

Module I (10 hours)

Basic Concepts - Purpose of Database Systems- 3 Schema Architecture and Data Independence- Components of DBMS –Data Models, Schemas and Instances-Data Modeling using the Entity Relationship Model-Entity types, Relationship Types, Weak Entity Types .

Module II (14 hours)

Relational Model Concepts –Constraints – Entity Integrity and Referential Integrity, Relational Algebra -Select, Project, Operations from Set Theory, Join, OuterJoin and Division - Tuple Relational Calculus.

SQL- Data Definition with SQL - Insert, Delete and Update Statements in SQL, Defining Domains, Schemas and Constraints, Constraint Violations - Basic Queries in SQL - Select Statement, Use of Aggregate functions and Group Retrieval, Nested Queries, Correlated Queries – Views.

Module III (12 hours)

Oracle Case Study : The Basic Structure of the Oracle System – Database Structure and its Manipulation in Oracle- Storage Organization in Oracle.- Programming in PL/SQL- Cursor in PL/SQL - Assertions – Triggers.

Indexing and Hashing Concepts -: Ordered Indices, Hash Indices, Dense and Sparse Indices, Multi Level Indices, Cluster Index, Dynamic Hashing.

Module IV (11 hours)

Database Design– Design Guidelines– Relational Database Design – Functional Dependency- Determination of Candidate Keys, Super Key, Foreign Key, Normalization using Functional Dependencies, Normal Forms based on Primary keys- General Definitions of First, Second and Third Normal Forms. Boyce Codd Normal Form– Multi-valued Dependencies and Forth Normal Form – Join Dependencies and Fifth Normal Form – Pitfalls in Relational Database Design.

Module V (13 hours)

Introduction to Transaction Processing- Transactions- ACID Properties of Transactions- Schedules- Serializability of Schedules- Precedence Graph- Concurrency Control – Locks and Timestamps-Database Recovery

Query processing and Optimization- Translating SQL Queries into a Relational Algebra Computing Select, Project and Join

Object Relational Databases-Distributed Databases-Different Types-Fragmentation and Replication Techniques-Functions of DDBMS.

Reference Books

1. Elmsari and Navathe, *Fundamentals of Database System,* Pearson Education Asia, 5th Edition, New Delhi, 2008.
2. Henry F Korth, Abraham Silbershatz , *Database System Concepts*, Mc Graw Hill 6td Edition, Singapore, 2011.
3. Elmsari and Navathe, *Fundamentals of Database System,* Pearson Education Asia, 3rd Edition, New Delhi, 2005, for oracle
4. Alexis Leon and Mathews Leon, *Database Management Systems*, Leon vikas Publishers, New Delhi.
5. Narayanan S, Umanath and Richard W.Scamell, *Data Modelling and Database Design,Ce*ngage Learning, New Delhi, 2009.
6. S.K Singh,*Database Systems Concepts,Design and Applications*, Pearson Education Asia, New Delhi, 2006.
7. Pranab Kumar Das Gupta, *Database management System Oracle SQL And PL/SQL*, Easter Economy Edition, New Delhi, 2009
8. C.J.Date , *An Introduction to Database Systems,* Pearson Education Asia, 7th Edition, New Delhi.
9. Rajesh Narang, *Database Management Systems*, Asoke K ghosh , PHI Learning, New Delhi, 2009.
10. Ramakrishnan and Gehrke, *Database Management Systems*, Mc Graw Hill, 3rd Edition , 2003.

EI 010 606 L03 Computer networks

Teaching scheme **Credits**: 4

3 hours lecture and 1 hour tutorial per week

Objectives

1) To understand the concepts of computer networks
2) To study the functions of different layers.
3) To introduce IEEE standards employed in computer networking.
4) To make the students to get familiarized with different protocols and network components.

Module 1 (12 hours)

Network goals -topologies- configurations-concept of internet- ISO-OSI 7 Layer Standard -peer processes-Functions of each layer-TCP/IP reference model - Transmission media -description and characteristics - base band and broad band transmission-synchronous and asynchronous -full duplex, half duplex links- Concepts of WAP technology.

Module 2 (12 hours)

MODEMS-serial communication standards - X-21 digital interface- Need for data link layer-stop and wait and sliding window protocol-HDLC-terminal handling- polling-multiplexing- concentration-virtual circuit and data-grams - routing -congestion control.

Module 3 (12 hours)

LAN- base band and broad band Lan's - carrier sense networks-CSMA/CD -ring network- shared memory -IEEE802 standards-introduction to X-25. Transport layer- design issues- establishing and releasing connection - flow control – buffering - crash recovery - a simple transport protocol on X-25.

Module 4 (12 hours)

Session layer- design issues -data exchange - dialogue management - synchronization- remote procedure call-client server model - Presentation layer-data presentation-compression- network security-privacy- cryptography- presentation layer in ARPANET.

Module 5 (12 hours)

Application layer - virtual terminal - file transfer protocol-E-mail-introduction to distributed system - ATM-protocol architecture -ATM logical connections -ATM cells -cell transmission- ATM adaptation layer -AAL protocols -basic principles of SDH and SONET.

References

1. Computer Networks: Andrew S Tannenbaum, Pearson Education.
2. An Engineering Approach to Computer Networking: Keshav, Pearson Education.
3. Computer Networking: A Top Down Approach: Kurose Pearson Education.
4. Computer Network & Internet: Comer, Pearson Education.
5. Data communication: Hausly
6. Computer Networks, protocols standards & interfaces, Uyless Balack
7. Local Area Networks: William Stallings, Pearson Education.
8. Understanding Data Communication and networks- 2nd ed-William A Shay (Vikas Thomson Learning)

EI 010 606 L04 Micro-controller Based System Design

Teaching scheme **Credits**: 4

3 hours lecture and 1 hour tutorial per week

Objectives

1. *To give an idea about micro controllers and its interfacing techniques.*
2. *To get an exposure in microcontroller programming*

Module 1

Various logic families – features – comparison – PLA – PAL- GAL -comparison – combinational PAL – PAL with flip-flops – study of 16L8, 22V10 GAL – dual port RAM – FIFO – FPGA – gate arrays.

Module 2

Embedded C compiler – advantages – memory models – interrupt functions – code optimization – 89C2051 micro-controller- architecture-comparison with 89C51- design of a simple trainer circuit using 89C51/89C2051 µC. Introduction to latest micro controllers (ARM Processor/ PIC microcontrollers) - introduction, architecture (block diagram explanation only), Memory organization etc.

Module 3

Analog to digital converters- single slope, dual slope, successive approximation, sigma delta, flash – comparison – typical ICs – A/D interface – digital to analog converters – different types – D/A interface – optically isolated triac interface- design of a temperature control system- sensors - opto isolator -interfacing programs using C and assembly language-.

Module 4

Serial Communication :Serial bus standards – I2C bus, SPI bus – operation – timing diagrams – 2 wire serial EEPROM – 24C04 – 3wire serial EEPROM – 93C46 – interfacing – serial communication standards – RS232, RS422, RS485 – comparison – MAX232 line driver/ receiver – interfacing — universal serial bus – PCI bus - interfacing programs using C and assembly language – low voltage differential signaling – PC printer port – registers – interfacing.

Module 5

Real World Interfacing**:** Matrix key board interface – AT keyboard – commands – keyboard response codes – watch dog timers – DS1232 watch dog timer – real time clocks – DS1302 RTC – interfacing – measurement of frequency – phase angle – power factor – stepper motor interface – dc motor speed control – L293 motor driver – design of a position control system — interfacing of DIP switch, LED, 7 segment display, alphanumeric LCD – relay interface – design of a traffic light control system – interfacing programs using C and assembly language.

References

1. The 8051 Microcontroller: Muhammad Ali Mazidi, Pearson Education.
2. The 8051 Microcontroller: Kenneth J Ayala, Penram International.
3. Digital fundamentals: Floyd, Pearson Education.
4. Programming and customizing the 8051 µC: Myke Predko, TMH
5. Programming with ANSI C and turbo C: Kamthane, Pearson Education.
6. Microcomputers and Microprocessors: John Uffenbeck, PHI.
7. Web site of Atmel semiconductors – www.atmel.com
8. PIC 16F877 data book

EI 010 606 L05 Telemetry and Remote Control

Teaching scheme **Credits**: 4

3 hours lecture and 1 hour tutorial per week

Objectives

1. *To study the concepts of classical telemetry systems*
2. *To get an exposure to radio and satellite telemetry systems.*
3. *To learn the fundamentals of optical telemetering systems.*
4. *To understand the essential principles of telecontrol systems and installation*

Module 1

Fundamental concepts – functional blocks of telemetry and telecontrol systems -Telemetry methods- Classical ones- Pneumatic and electrical telemetry- Electrical telemetry systems-Voltage, current, position telemetry- Principles of optical telemetry.

Module 2

Radio telemetry: RF modulation methods- Multiplexing techniques- TDM, FDM –comparison- Transmission channels in landline and Radio telemetry.- Methods of data transmission in telemetry- FM/FM, PCM/FM and PAM/AM techniques. Radio receiving techniques. Introduction to telemetry standards- Antennas for telemetry.

Module 3

The complete telemetry package. Special telemetry problems- Telemetry hardware and applications- bandwidth and noise restrictions.
Introduction to satellite telemetry- TT and C services, Digital Transmission system in satellite telemetry. Multiple access Techniques.

Module 4

Optical telemetry-optical fibres for signal transmission-source for fibre optic transmission-optical detectors-trends in fibre optic device development-examples of optical telemetry systems

Module 5

Analog and digital techniques in telecontrol-remote transmission-signaling-adjustment-guidance and regulation-reliability of telecontrol installations-design of telecontrol-Installations

References

1. A.K. Sawhney, ’A course in electrical and electronic measurements and instrumentation ‘
2. Patranabis ‘Telemetry Principles ‘References:
3. D. Rodyy, J. Coolen, electronics communications, 4th edition, PH
4. O.J. Strock, Introduction to Telemetry, ISA
5. Grenburg E I-Handbook of Telemetry and Remote Control-McGraw Hill
6. Swoboda G-Telecontrol methods and applications of Telemetry and Remote Control-Reinhold Publishing Company

EI 010 606 L06 Robotics and Automation

Teaching scheme **Credits**: 4

3 hours lecture and 1 hour tutorial per week

Objectives

1. *To give a basic knowledge of robots and their types.*
2. *To study in detail the power sources, sensors, manipulators, actuators, grippers involved with robots and kinematics.*
3. *To learn about robot programming techniques.*

Module 1

Basic concepts : - Definition and origin of robotics – Different types of robotics –Various generations of robots – Degrees of freedom – Asimov's laws of robotics – Dynamic stabilization of robots.

Module 2

Power sources and sensors : - Hydraulic, Pneumatic and Electric drives. Sensors: Sensors in Robotics- Tactile Sensors- Proximity and Range Sensors-Uses – Machine vision – Ranging – Laser – Acoustic – Magnetic and Fiber optic.

Module 3

Manipulators, actuators and grippers : - Construction of manipulators – Manipulator dynamics and force control – Electronic and pneumatic manipulator control circuits – End effectors – U various types of grippers – Design considerations.

Module 4

Robot Programming: Types of programming- Leadthrough programming-A Robot Program as a Path in Space- Motion Interpolation- Capabilities and Limitations of Leadthrough Methods. Robotic languages- The textual Robot Languages- Generations-Structure-Motion Commands-workcell control.

Module 5

Case studies :- Mutiple robots – Machine interface – Robots in manufacturing and non-manufacturing applications – Robot cell design – Selection of robot**.**

Text Books

1. Mikell P. Weiss G.M., Nagel R.N., Odraj N.G., Industrial Robotics, McGraw Hill Singapore, 1996.
2. Ghosh, Control in Robotics and Automation: Sensor Based Integration, Allied Publishers, Chennai, 1998.

References

1. Deb.S.R., Robotics technology and flexible Automation, John Wiley, USA 1992.
2. Asfahl C.R., Robots and manufacturing Automation, John Wiley, USA 1992.
3. Klafter R.D., Chimielewski T.A., Negin M., Robotic Engineering – An integrated approach, Prentice Hall of India, New Delhi, 1994.

4. Mc Kerrow P.J. Introduction to Robotics, Addison Wesley, USA, 1991.
5. Issac Asimov I Robot, Ballantine Books, New York, 1986.

EI010 607 Microprocessor & Microcontroller Lab

(Common to AI010 607)

Teaching scheme **Credits: 2**

3 hours practical per week

Objectives

1. *To provide experience on programming and testing of few electronic circuits using 8086*
2. *To provide experience on programming and testing of few electronic circuits using 8051simulator.*
3. *To understand basic interfacing concepts between trainer kit and personal computers.*

A. Programming experiments using 8086 (MASM)

1. Sum of N Numbers.
2. Display message on screen using code and data segment.
3. Sorting, factorial of a number
4. Addition /Subtraction of 32 bit numbers.
5. Concatenation of two strings.
6. Square, Square root, & Fibonacci series.

B. Programming experiments using 8051 simulator (KEIL).

1. Addition and subtraction.
2. Multiplication and division.
3. Sorting, Factorial of a number.
4. Multiplication by shift and add method.
5. Matrix addition.
6. Square, Square root, & Fibonacci series.

C. Interface experiments using Trainer kit / Direct down loading the programs from Personal computer.

1. ADC / DAC interface.
2. Stepper motor interface.
3. Display (LED, Seven segments, LCD) interface.
4. Frequency measurement.
5. Wave form generation.
6. Relay interface.

EI 010 608 Mini Project
(Common to AI010 608)

Teaching Scheme
3 hours practical per week **2 credits**

The mini project will involve the design, construction, and debugging of an electronic system product approved by the department. The schematic and PCB design should be done using any of the standard schematic capture & PCB design software. Each student may choose to buy, for his convenience, his own components and accessories. Each student must keep a project notebook. The notebooks will be checked periodically throughout the semester, as part of the project grade. The student should submit the report at the end of the semester. A demonstration and oral examination on the mini project also should be done at the end of the semester.

EI010 701 FIBER OPTICS & LASER INSTRUMENTATION

Teaching scheme **Credits:** 4
2 hours lecture and 2 hour tutorial per week

Objectives

1. *To impart in students the basic concepts of Fiber optics and laser instrumentation.*
2. *To give a basic introduction to different types of optical fibers, their production and characteristics.*
3. *To provide adequate knowledge in Fiber-optic communication system and the light sources and detectors used.*
4. *To give an idea about different types of modulators and sensors.*
5. *To create a strong base in the fundamental principles of Lasers and its applications in industrial and medical fields.*

Module 1

Optic fiber and its properties: Introduction- Principle of light propagation through a fiber- Types of optical fibers (material, refractive index, mode) – Properties – Transmission characteristics of optical fiber- Combined fiber lossess- Dispersion . Optical fiber production and fabrication – Fiber drawing .

Module 2

Fiber optical communication system (Block diagram) – Advantages – Applications - Limitations- Light sources for fiber optics : LED – LASER diodes – Detectors for fiber optics: Photodetectors- PN , PIN, APD .
Source coupling - Fiber connection - Splicing techniques.

Module 3

Fiber optic modulators — Fiber optic sensors- Application in instrumentation – Pressure, Temperature , Displacement, Force, Acceleration, Torque, Strain, Fluid level , flow and viscosity

Module 4

Laser fundamentals- Laser rate equation – Three level system –Four level system. Properties of laser beams – Laser modes – Resonator configuration – Q switching – Types of lasers: Solid lasers – Liquid lasers – Semiconductor lasers .

Module 5

Laser applications: Laser for measurement of distance, length, atmospheric effect and pollutants – Laser Doppler anemometry (LDA) - Material processing : Laser heating, Melting, Scribing, Trimming, Welding.

Medical application of lasers – Laser and tissue interaction – Laser diagnosis - Laser instruments for microsurgery, Removal of tumors of vocal chords, Brain surgery, Dermatology, Oncology and Ophthalmology.

TEXT BOOKS

1. Keiser : Optical Fiber Communication systems, McGraw Hill Ltd, 1983.
2. D.C. Oshca and W. Rusel Callen: introduction to lasers and Applications, Addision Wesley, 1978.
3. A.K. Ghatak and K. Thaiagarajan: Optical Electronics, Foundation Books 1991.
4. C.K. Sarkar,D.C. Sarkar: Optoelectronics and Fiber Optics Communication, New Age International Limited, 2001.
5. Joseph C Palais: Fiber Optic Communications-Pearson education ,1998.
6. John M. Senior: Optical Fiber Communications- Principles and Practice, Pearson Education Limited.
7. A.K. Ghatak and K. Thaiagarajan: Lasers: Theory and Applications , Macmillian India Limited,1981.
8. William T Silfvast: Laser fundamentals, Cambridge University Press, 1996.

EI010 702 COMPUTERISED PROCESS CONTROL (Common to AI010 702)

Teaching scheme **Credits:** 4
2 hours lecture and 2 hour tutorial per week

Objective

a) *To provide a detailed view of the implementation of SCADA in process industry.*
b) *To give an insight about Instrumented Safety Systems and Programmable Logic controllers with applications using ladder programming.*
c) *To teach about different digital controllers using z transforms.*
d) *To impart knowledge about Distributed Control System and its architecture.*
e) *To have an insight into Electrical Safety and Process Safety Management.*

Module 1

Introduction to computer control of process- need for computers in control system –block diagram of a computer control system- multi channel data acquisition system(DAS)
Supervisory Control and Data Acquisition System (SCADA) :Concepts- SCADA development from Telemetry, SCADA System Hardware, Remote Terminal Units (RTUs), Master Terminal Units, Communication philosophies, Communication Interface and Communication Protocols, Configuring Simple applications, Operator Interfacing and Applications of SCADA.

Module 2

Programmable Logic Controllers: Introduction to Instrumented Safety Systems and Safety Integrity Levels, Sequential and Combinational Control, Microprocessor Based Programmable Logic Controllers - Architecture, I/O Modules, Isolators, PLC Programming Languages, PLC ladder programming : Programming On-Off inputs to produce on – off outputs, Concept of Redundancy and Triple Modular Redundant PLCs, PLC Installation and Testing.

Module 3

Digital controllers: Design of Control algorithms using Z transforms – Dead beat algorithm – Dahlin's method –Ringing – Kalman's approach – Digital PID algorithms – Position and velocity form . Modified Z transforms to system with dead time –Smith predictor algorithm. Internal model control using Z transform.

Module 4

DCS Basic Packages: Introduction to Centralized & De-centralized Control, Direct Digital Control and Distributed Process Control, DCS Architecture, Local Control Units, DCS Configuration with associated accessories, I/O Hardware, Multiplexers, A/D and D/A Converters, Set Point Stations, DCS Flow sheet Symbols. Redundancy Concepts, Data Highways,Field Buses, CRT Displays, Man Machine Interface, Operator Stations, Engineer' Stations, System Integration with PLC, SCADA and Computers, OPC Connectivity.

Module 5

Electrical safety: NEMA standards, grounding and shielding – standards , power grounding, concept of shielding, electro static instrument shielding . Process safety management: elements of process safety management- process safety information – process hazard analysis .

Reference Books

1. Stuart A.Boyer "Supervisory **Control and Data Acquisition**
2. Jeff Weigunt. "Creating HMI/ SCADA Industrial Applications using Microsoft Access", ISA.
3. RJ.Willam, "Hand book of SCADA System for the Oil and Gas Industry", Mold Clwyd.
4. Considine, Applications of Computers in Process Control
5. Krishnakanth, Computerised Based Industrial Controls
6. B.G Liptak - Handbook of Process Control - 1996
7. Jon Stenerson "Fundamentals of Programmable Logic Controllers, Sensors and Communications", Prentice Hall of India.
8. John webb: Programmable logic controllers, PHI
9. Deshpande, P.B. and Ash R.H., Elements of Computer Process Control, Instruments Society of America, 1981
10. C.L.Smith, Digital Computer Process Control, Intext Educational Publications 1972
11. M.P.Lukas, Distributed Control System, Van Nostrand Rainhold Compony 1986.
12. Frank D Petruzella, Programmable Logic Controllers (Mc Graw Hill)
13. Dobrivoje Popovic and Vijay P. Bhatkar - Distributed Computer Control for Industrial Automation - Marcel Dekker, INC, 1990.
14. LIPTAK, Instrument engineers hand book: Process software and digital networks , third edition.
15. LIPTAK, Instrument engineers hand book: Process measurement and analysis, fourth edition.
16. www.fieldbusfoundation.org

EI 010 703 BIOMEDICAL INSRTUMENTATION
(common to AI010 703 and IC010 703)

Teaching scheme **Credits:** 3
2 hours lecture and 1 hour tutorial per week

Course objectives:

1. To help students learn the basics of instrumentation related to biomedical systems.
2. To help students get overall knowledge of the medical equipments for diagnosis and therapy.
3. To help students understand the relative electrical safety measures and standards.
4. To help students know general concepts of imaging system.

Module 1

Introduction to BMI: general perspective including objectives– an overview of safety requirements, biometrics, biomedical instruments, parameters, man-machine interface and components.
Bioelectric potentials: human cell- action potential, generation and propagation of bio electric action potential, resting potential- relative refractory period, absolute refractory period.
Electrodes: electrode theory- types of electrodes- biopotential electrodes- polarizable and nonpolarizable electrodes- equivalent circuit of electrode-skin interface.
Transducers: transducers for biological applications: pressure, flow, pulse, respiration; chemical sensor- implantable transducer.

Module 2

Cardio vascular system: electrical activity of heart- ECG- typical ECG and characteristics- ECG as a diagnostic tool- monitoring scheme- lead system- introduction to ECG machine.
Phonocardiography- principle and clinical applications.
Biopotential Recording- noise, motion artifacts and other considerations.

Module 3

Nervous system: EEG- typical EEG and characteristics- significance- lead system, clinical applications, evoked potentials, introduction to EEG machine.
Respiratory system: respiratory measurements - lung volume and capacities- spirometer
EMG-working principle and clinical applications.

Module 4

Electrical safety– physiological effects of electricity, micro and macro shock hazards, electrical safety codes and standards- patient safety considerations in power distribution and equipment design.

Therapeutic Equipment: pacemaker, defibrillator, dialysis machine, ventilators.
Operation theatre equipment: surgical diathermy equipment- diathermic equipment using microwaves, short waves and ultra sound.

Module 5

Medical Imaging: computed tomography- basic principle- data accumulation scanning motions– X ray tubes- collimators- detectors- image reconstruction algorithms- display.
Nuclear Magnetic Resonance: nuclear structure and angular momentum- magnetic dipole moment- resonance- RF magnetic field- Larmor frequency- free induction decay- an overview of NMR instrumentation and imaging system.

Text Books

1. Leslie Cromwell, Fred J. Weibell and Erich A Pferffer - Biomedical Instrumentation and Measurements - Prentice Hall of India, 1990
2. R.S Khandpur - Handbook of Biomedical Instrumentation - Tata Mc Graw – Hill

References

1. John G. Webster - Medical Instrumentation - Application and Design - Houghton mifflin company, Boston
2. John C. Cobbold - Tranducers for Biomedical measurements - John wiley & Sons
3. Jacob Kline- Hand book of Biomedical Engineering - Academic Press INC

EI 010 704 ANALYTICAL INSRTUMENTATION
(Common to AI010 704 and IC010 704)

Teaching scheme **Credits:** 3
2 hours lecture and 1 hour tutorial per week

Objectives

a. *To impart a basic knowledge about analytical instruments, its concepts, and its technique.*
b. *To give a vast knowledge about different types of spectroscopic analysis.*
c. *To study about different types of chromatographic analysis.*

Module 1

Introduction to Analytical Instrumentation: Fundamentals of analytical instruments: Elements of an analytical instrument – PC based analytical instruments –Classification of instrumental techniques . Electro magnetic radiation- Electromagnetic spectrum- Laws relating to absorption of radiation. Absorption spectroscopy: Absorption instruments – Radiation sources- Optical filters- Monochromators- Detectors.

Ultra violet and visible absorption spectroscopy- Colorimeters/ photometers: Single beam and double beam filter photometer – Spectro photometers: Single beam and double beam spectro photo meters- Infra red spectroscopy: Basic components- Radiation sources- Monochromators- Detectors.

Module 2

Flame Photometry: Principle and constructional details of flame photometer- Emission system – Optical system – Detectors . Atomic absorption spectrophotometers: Theoretical concepts, Instrumentation: Radiation sources - Burners and flames - Plasma excitation sources - Optical and electronic system .

Fluorescence spectroscopy: Principle of fluorescence – Measurement of fluorescence – Single beam and double beam filter fluorimeter- Ratio fluorimeter. Spectro fluorimeters.

Raman spectrometer- Basic theory-Photo acoustic spectroscopy- Photo thermal spectroscopy .

Module 3

Mass spectrometer: Principle of operation- Magnetic deflection mass spectrometers- Components of a mass spectrometer – Inductively coupled plasma mass spectrometer.

Nuclear Magnetic Resonance spectroscopy: Basic principle – Constructional details of NMR spectrometer – Nuclear radiation detectors .

Electron Spin Resonance spectrometer: Basic ESR spectrometer – Electron spectroscopy: Instrumentation for electron spectroscopy.. X- Ray spectrometers: X – ray spectrum –Instrumentation for x –ray spectrometry. X-ray diffractometers- X-ray absorption meters- X- ray fluorescence spectrometry.

Module 4

Industrial Gas analyzers- pH meters- Conductivity meters - Dissolved oxygen meters- Sodium analyser – Gas analysers- Paramagnetic oxygen analyser – CO analysers – Flue gas analysers- Blood PH measurement – Thin film technology for gas sensors- Basic concepts. Measurement techniques and application of gas sensors. Thermal Sensors:- Radiation Sensors, Mechanical Sensors and Bio-Chemical Sensors.

Module 5

Chromatography: Chromatographic process – Classification- Terms in chromatography- Gas chromatography: Block diagram- Principle - Constructional details – Column details- GC detectors.

Liquid Chromatography: Types of liquid chromatography- High pressure Liquid Chromatography (HPLC): Principle- Constructional details.

Textbooks:

1. Instrumental Methods of Analysis, Willard, Merritt, Dean, Settle, CBS Publishers & Distributors, New Delhi, Seventh edition.
2. Handbook of Analytical Instruments, R. S. Khandpur, Tata McGraw–Hill Publications, 3rd edition
3. Principles of Instrumental Analysis, Skoog, Holler, Nieman, Thomson books-cole publications, 5th edition.

Reference books:

2. Instrumental Methods of Chemical Analysis, Galen W. Ewing, McGraw-Hill Book Company, Fifth edition.
3. Introduction to Instrumental Analysis, Robert D. Braun, McGraw-Hill Book Company

EI 010 705 INDUSTRIAL INSRTUMENTATION II
(common to AI010 705 and IC010 705)

Teaching scheme **Credits:** 3
2 hours lecture and 1 hour tutorial per week

Objectives

a. *To provide exposure to various measuring techniques for flow, level, ph, humidity, viscosity, moisture , dimension, sound and thermal conductivity.*
b. *At the end of the course the student will have an indepth knowlwdge in units, different techniques, and significance of measuring devices.*

Module 1

Measurement of flow: Flow characteristics- Flow measuring techniques - Classification of flow meters- Variable head flow meters for incompressible fluids- : Venturi tubes- Square root relationship - Flow nozzle- Orifice plates - Dall tube – Wiers and flumes - Pitot tube. Variable meters for compressible fluids. Installation of flow meters. Quantity flow meters: Positive displacement flow meters- Nutating disc, Rotary vane, Reciprocating piston, Oval gear, Helix type. Mass flow meters: Angular momentum type, Impeller turbine, Twin turbine, Coriollis , Thermal , Radiation type mass flow meters.

Module 2

Inferential type : Variable area flow meters (Rotameters) – Turbine flow meters - Target flow meters- Electrical type flow meters- Electro magnetic type- Comparison of DC and AC excitations- Ultrasonic flow meters - Laser Doppler Anemometer (LDA) - Hot wire anemometer - Other flow meters: Purge flow regulators- Flow meters for solid flow – Vortex flow meters – Calibration of flow meters. Dynamic weighing method – Master meter method- Bell prover system . Factors to be considered for flow meter selection.

Module 3

Level measurement :- Methods of liquid level measurement –Classification of liquid level detectors – Direct method- Hook type, Sight glass technique– Float type level indication — Float level switches - Rope method- Level measurement using displacer and torque tube – Indirect methods : Hydrostatic pressure type- Pressure gauge method- Air bellows- Air purge system. Boiler drum level measurement – Thermal level sensors – Differential pressure method –Electrical types of level gauges using Resistance, Capacitance, Nuclear radiation and Ultrasonic sensors – Laser level sensors- Microwave level switches – Fibre optic level detectors- Calibration of level detectors.

Module 4

Measurement of pH, Viscosity, Humidity and Moisture : - Need for pH measurement - pH electrodes- Viscosity terms – Capillary viscometer- Say bolt viscometer – Rotameter type viscometer- red wood type viscometer. – Humidity terms – Dry and wet bulb psychrometers – Hot wire electrode type hygrometer – Dew cell – Electrolysis type hygrometer – Commercial type dew point meter –Different methods of moisture measurement –Application of moisture measurement.

Smart sensors: block diagram- Smart transmitter. Recent trends in sensor technology – Semiconductor sensors–Film sensors – MEMS - Nanosensors.

Module 5

Measurement of Dimension, Sound and Thermal conductivity : Thickness measurement- Contact type thickness gauge- Inductive methods , Capacitive methods . Non contact type - Radiation type- Laser based thickness gauges- Measurement of coating thickness- Laser based length measurement- Width measurement – Diameter measurement. Measurement of sound using microphones, Measurement of thermal conductivity of solids, liquids and gases.

TEXT BOOKS

1. D. Patranabis, Principles of Industrial Instrumentation Tata McGraw Hill Publishing Co., New Delhi, 1999

2. R.K.Jain, Mechanical and Industrial Measurements, Khanna Publishers, New Delhi 1999.

3. A.K.Sawhney, A course in Mechanical Measurements and Instrumentation – Dhanpat Rai and Sons, New Delhi, 1999.

REFERENCES

1. Ernest O. Doebelin, Measurement systems application and design international student Edition, Tata McGraw Hill Publishing Co., New Delhi, 1999.
2. Eckman D.P.Industrial Instrumentation – Wiley Eastern Limited, 1990.
3. Liptak B.G. Instrument Engineers Handbook (Measurement), Chilton Book Co., 1994.
4. Padmanabhan T R, Industrial Instrumentation Principles and Design, Springer International

EI010 706 L01 Optimization Techniques
(Common to EC010 706L01 and AI010 706L03)

Teaching Schemes **Credits: 4**

2 hours lecture and 1 hour tutorial per week.

Objectives:

Understand the need and origin of the optimization methods. Get a broad picture of the various applications of optimization methods used in engineering. Define an optimization problem and its various components.

Module I (12 hrs)

One Dimensional Unconstrained Minimization techniques, single variable minimization, unimodality, bracketing the minimum, necessary and sufficient conditions for optimality, convexity, steepest descent method.

Module II (12hrs)

Linear programming, introduction, linear programming problem, linear programming problems involving LE (≤) constraints, simplex method, optimality conditions, artificial starting solutions, the M method.

Module III (12hrs)

Transportation models, definition, non traditional models, transportation algorithm, East West corner method, Vogel approximation method. Assignment model, Introduction, Hungarian method.

Module IV (12hrs)

Forecasting Models, moving average technique, regression method, exponential smoothing. Game Theory, two persons zero sum games, mixed strategy games- graphical method.

Module V (12hrs)

Queuing models, elements of queuing model, pure birth and death model, specialized Poisson queues, single server models. Multiple server models, self service model.

References:

1. Ashok D Belegundu, Tirupathi R Chandrupatla, “Optimization concepts and Application in Engineering”, Pearson Education.
2. Kalynamoy Deb, “Optimization for Engineering Design, Alogorithms and Examples”, Prentice Hall,
3. Hamdy A Taha, “Operations Research – An introduction”, Pearson Education,
4. Hillier / Lieberman, “Introduction to Operations Research”, Tata McGraw Hill Publishing company Ltd,
5. Singiresu S Rao, “Engineering optimization Theory and Practice”, New Age International,
6. Mik Misniewski, “Quantitative Methods for Decision makers”, MacMillian Press Ltd.,

EI010 706 L02 VLSI Technology

Teaching scheme **Credits:** 4

2 hours lecture and 2 hour tutorial per week

Objectives

1) To study the concepts of IC fabrication.
2) To get an idea about different types of monolitihic components..
3) To familiarize with different CMOS technologies.

Module 1

Process steps in IC fabrication: Crystal growth and wafer preparation- Czochralski process- apparatus- silicon shaping, slicing and polishing- Diffusion of impurities- physical mechanism- Ion implantation- Annealing process- Oxidation process- Lithography- Photolithography, Fine line lithography, electron beam and x-ray lithography- Chemical vapour deposition (CVD)- epitaxial growth- reactors- metallisation- patterning- wire bonding and packaging.

Module 2

Monolithic components: Isolation of components- junction isolation and dielectric isolation- Transistor fabrication- buried layer- impurity profile- parasitic effects- monolithic diodes- schottky diodes and transistors- FET structures- JFET- MOSFET- PMOS and NMOS, control of threshold voltage (V_{th})- silicon gate technology- Monolithic resistors- sheet resistance and resistor design- resistors in diffused regions- MOS resistors- monolithic capacitors- junction and MOS structures- IC crossovers and vias.

Module 3

CMOS technology: Metal gate and silicon gate- oxide isolation- Twin well process- Latch up- BiCMOS technology- fabrication, circuit design, stick diagrams- design rules- Capacitance of layers- Delay- Driving large capacitance loads- Wiring capacitance- Basic circuit concepts- scaling of MOS structures- scaling factors- effects of miniaturization. – CMOS design style – Design rules and layout – Lambda based design rules – Contact cuts – Double metal MOS process rules – CMOS lambda based design rules- stick diagram .

Module 4

Subsystem design and layout- Simple logic circuits- inverter, NAND gates, BiCMOS circuit, NOR gates, CMOS logic systems – bus lines- arrangements- power dissipation- power supply rail distribution- subsystem design process, Two phase clocking – Charge storage – Dynamic shift register – precharged bus –General arrangement of a 4 bit arithmetic processor – Design of a 4 bit shifter –FPGA- block diagram and PLDs (PROM,PAL,PLA).

Module 5

Gallium Arsenide Technology: Sub-micro CMOS technology- Crystal structure- Doping process- Channeling effect- MESFET- GaAs fabrication- Device modeling.

References

1. Modern VLSI design: Wolf, Pearson Education.
2. VLSI technology: S M Sze, Mc Graw Hill pub.
3. Basic VLSI design: Douglas Pucknell, PHI.
4. Principles of CMOS VLSI Design: H E Weste, Pearson Edn.
5. Integrated Circuits: K R Botkar, Khanna Pub.
6. CMOS circuit design layout and simulation: Barter, IEEE press.
7. Introduction to VLSI: Conway, Addison weslay.
8. Neil H.E. Weste, David Harris and Ayan Banerjee, “CMOS VLSI Design, A circuits and Systems Perspective”, (3/e), Pearson, 2006

EI 010 706 L03 DIGITAL IMAGE PROCESSING
(common with AI010 706 L05)

Teaching scheme **Credits:** 4
2 hours lecture and 2 hour tutorial per week

Objectives

- *To study the fundamentals of image processing*
- *To study various transforms*
- *To get an exposure to image enhancement and restoration*
- *To learn the details of coding techniques*
- *To understand the concept of segmentation*

Module 1

Digital image fundamentals: Two dimensional systems and mathematical preliminaries-Elements of digital image processing system- Structure of the human eye - Image formation and contrast sensitivity – Gray scale and Colour Images-Sampling and Quantization -Image processing applications

Module 2

Image Transforms: Introduction to Fourier transform - Discrete Fourier transform - Properties of two dimensional FT – Separability, Translation, Periodicity, Rotation, Average Value – DFT,FFT,DCT, DST, Walsh, Hadamard, KL transforms and their properties.

Module 3

Image Enhancement: Point Operations - Spatial domain methods - Frequency domain methods - Histogram Equalization technique - Neighbourhood averaging Median filtering - Low pass filtering Averaging of multiple Images - Image sharpening by differentiation - High pass filtering.
Image Restoration: Degradation model for continuous functions - Discrete formulation - Diagonalization of circulant and Block-circulant matrices - Effects of Diagonalization - Unconstrained and constrained Restorations - Inverse Filtering - Wiener Filter - Constrained least - square Restoration.

Module 4

Image Compression: Coding and Inter-pixel redundancies - Fidelity criteria - Image Compressions Models - Elements of Information theory - Variable length coding - Bit plane coding - Lossless Predictive coding - Lossy predictive coding - Transform coding techniques.

Module 5

Image Segmentation and Representation: The detection of discontinuities - Point, Line and Edge

detections - Gradient operators - combined detection - Thresholding - Representation schemes: chain codes - Polygon approximation - Boundary descriptors: Simple descriptors - Shape numbers Fourier descriptor's - Introduction to recognition and Interpretation.

Text books:

1. Rafael C Gonzalez and Richard E.woods, ―Digital Image Processing‖,3/e,Addition – Wesley.
2. Anil K Jain, ―Fundamentals of Digital Image Processing‖, PHI, New Delhi, 1995
3. S Jayaraman,S Esakkirajan,T Veerakumar,‖Digital Image Processing‖,TMH,2009

References:

1. Kenneth R Castleman, ―Digital Image Processing‖, PHI, 1995.
2. William K Pratt, ―Digital Image Processing‖, Wiley India 2/e.
3. Sid Ahmed M A, ―Image Processing Theory, Algorithm and Architectures‖, McGraw-Hill, 1995.
4. Rafael C Gonzalez and Richard E.woods, ―Digital Image Processing Using MATLAB‖, Addition - Wesley, 2004.
5. R.M. Haralick, and L.G. Shapiro, Computer and Robot Vision, Vol-1, Addison

EI 010 706 L 04 Applied soft computing

Teaching scheme **Credits:** 4
2 hours lecture and 2 hour tutorial per week

OBJECTIVE

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

Module 1

INTRODUCTION AND DIFFERENT ARCHITECTURES OF NEURAL NETWORKS

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

Module 2

NEURAL NETWORKS FOR CONTROL

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

Module 3

INTRODUCTION TO FUZZY LOGIC

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

Module 4

FUZZY LOGIC CONTROL SYSTEM

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

Module 5

HYBRID CONTROL SCHEMES

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

TEXT BOOKS

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

REFERENCE BOOKS

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

EI 010 706 L05 Instrumentation in petrochemical industries

Teaching scheme **Credits:** 4
2 hours lecture and 2 hour tutorial per week

Objectives

1. *To give an idea about the process. Products, and instrumentation applications in a petrochemical industry.*
2. *To get an exposure of various controllers used in petrochemical industries.*

Module 1

Introduction: Petroleum Exploration, production and Refining – Sub process- final product -by-products - constituents of Crude Oil.

Module 2

P & I diagram of petroleum refinery – Atmospheric Distillation of Crude oil – Vacuum Distillation process – Thermal Conversion process – Control of Distillation Column – Temperature Control – Process control – Feed control – Reflux Control – Reboiler Control

Module 3

Controls of chemical Reactors: Temperature Control, Pressure Control – Control of Dryers – Batch Dryers – Atmospheric and Vacuum; Continuous Dryers

Module 4

Control Heat Exchangers and Evaporators – variables and Degrees of freedom – Liquid to Liquid Heat Exchangers – Steam Heaters – Condensers – Reboilers and Vaporizers – Cascade Control – Feed forward Control. Evaporators: Types of Evaporators

Module5

Control of Pumps: Centrifugal pump: On-Off level control – Pressure control – Flow control – Throttling control. Rotary pumps: On-Off pressure control. Reciprocating Pumps: On-Off control and Throttling control. Effluent and Water Treatment Control: Chemical Oxidation – chemical Reduction – Naturalization – Precipitation – Biological control.

TEXT BOOKS

1. Dr. Ram Prasad, "Petroleum Refining Technology", Khanna Publisher, 1st Edition,2000.
2. Liptak B.G., "Instrumentation in Process Industries", Chilton Book Company,1973.

REFERENCE BOOKS

1. Considine M. and Ross S.D., "Handbook of Applied Instrumentation", McGraw Hill,1962.
2. Liptak B.G., "Instrument Engineers Handbook", Volume II.,1989.

EI 010 706 L06 Reliability and Safety engineering

Teaching scheme **Credits:** 4
2 hours lecture and 2 hour tutorial per week

OBJECTIVES

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

Module 1

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

Module 2

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

Module 3

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

Module 4

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

Module 5
SAFETY MANAGEMENT
Safety Management: visible and latent hazards - human factors and safety - OSHA- safety audit - industrial fatigue- role of industrial psychology- risk analysis - safety training - accident and near miss investigations- promotional measures to avoid accidents - safety management characteristics-industrial safety policies and implementation.

TEXT BOOKS

1. Govil, A.K., “Reliability Engineering”, Tata McGraw -Hill, New Delhi, 1983.
2. L.S sreenath, “ reliability engineering, east west press publisher, 2002.
3. Sinha and Kale, “Introduction to Life-Testing”, Wiley Eastern, New Delhi, 1992.
4. L.M. Deshmukh, Industrial Safety Management, Tata McGrawHill.
5. Wisley, “Human Engineering - Guide for Equipment Designers”, University of California Press, California, 1973.
6. Jain R K, Industrial Safety Health And Environment Management Systems ,Khanna.

EI010707 INSTRUMENTATION LAB II

Teaching Scheme

3 hours practical per week **2 credits**

1. Design and testing of ON-OFF controller using Op-amp
2. Design and testing of PI controller using op-amp.
3. Calibration of pressure gauge using Dead weight tester.
4. Heart rate measurement using ElectroCardioGraph.
5. Study of Audiometer and Spirometer
6. Study of recorders
7. Design and testing of band pass filter using op-amp
8. Flame photometers
9. Digital Spectro photometer
10. Photo colorimeter
11. Humidity measurement using hygrometer and psychrometer
12. Chemical analysis using Chtromatographic method.
13. Dissolved oxygen analyser
14. Flue- Gas analysers
15. Determination of Transfer function model of Temperature transducers.

EI 010 708 SYSTEM SIMULATION LAB

Teaching Scheme
3 hours practical per week **2 credits**

Using Matlab and Scilab

Part A – Control Systems

1. Study of Matlab general functions and tool boxes, and programming.
2. Study of first order and second order system responses in time and frequency domain.
3. Check the stability of a system. Report whether the system is stable, unstable, or marginally stable. Given the transfer function of the system.
4. State-space analysis of continuous/discrete open-loop system. Study of controllability and observability.
5. Design of state feedback and state observer.
6. Design of lead, lag and lag-lead compensator in frequency domain.
7. Design of lead, lag and lag-lead compensator in time domain.

Using Blocksets

1. Simulation of Mass Spring Dashpot system, DC Motor Control.
2. Design of Deadbeat Control Algorithm and simulation using Matlab.
3. Design of Dalhin's Control Algorithm and simulation using Matlab.
4. Design of Kalman's Control Algorithm and simulation using Matlab.
5. Design of Cascade Control and simulation. Given the transfer function of the system.

Part B – Digital Signal Processing

1. Generation of basic discrete and continuous signals –impulse, step, ramp, exponential, sine, cosine.
2. Program for Arithmetic Operations using DSP kit.
3. Program for Different types of Wave generation using DSP kit.
4. Linear convolution and circular convolution.
5. Proof of convolution in time domain is multiplication in frequency domain.
6. FIR filter design using window techniques.
7. FFT using DIT Algorithm.
8. Computation of DFT and IDFT using functions.

EI 010 709 Seminar

Teaching scheme **credits: 2**

2 hours practical per week

The seminar power point presentation shall be fundamentals oriented and advanced topics in the appropriate branch of engineering with references of minimum seven latest international journal papers having high impact factor.

Each presentation is to be planned for duration of 25 minutes including a question answer session of five to ten minutes.

The student's internal marks for seminar will be out of 50. The marks will be awarded based on the presentation of the seminar by the students before an evaluation committee consists of a minimum of 4 faculty members. Apportioning of the marks towards various aspects of seminar (extent of literature survey, presentation skill, communication skill, etc.) may be decided by the seminar evaluation committee.

A bona fide report on seminar shall be submitted at the end of the semester. This report shall include, in addition to the presentation materials, all relevant supplementary materials along with detailed answers to all the questions asked/clarifications sought during presentation. All references must be given toward the end of the report. The seminar report should also be submitted for the viva-voce examination at the end of eighth semester.

For Seminar, the minimum for a pass shall be 50% of the total marks assigned to the seminar.

EI 010 710 Project Work

Teaching scheme **credits: 1**

1 hour practical per week

Project work, in general, means design and development of a system with clearly specified objectives. The project is intended to be a challenge to intellectual and innovative abilities and to give students the opportunity to synthesize and apply the knowledge and analytical skills learned in the different disciplines.

The project shall be a prototype; backed by analysis and simulation etc. No project can be deemed to be complete without having an assessment of the extent to which the objectives are met. This is to be done through proper test and evaluation, in the case of developmental work, or through proper reviews in the case of experimental investigations.

- The project work has to be started in the seventh semester and to be continued on to eighth semester.
- Project work is to be done by student groups. Maximum of four students only are permitted in any one group.
- Projects are expected to be proposed by the students. They may also be proposed by faculty member (Guide) or jointly by student and faculty member.
- Students are expected to finalise project themes/titles with the assistance of an identified faculty member as project guide during the first week of the seventh semester.

The progress from concept to final implementation and testing, through problem definition and the selection of alternative solutions is monitored. Students build self confidence, demonstrate independence, and develop professionalism by successfully completing the project.

Each student shall maintain a project work book. At the beginning of the project, students are required to submit a project plan in the project book. The plan should not exceed 600 words but should cover the following matters.

- ❖ Relevance of the project proposed
- ❖ Literature survey
- ❖ Objectives
- ❖ Statement of how the objectives are to be tackled

- Time schedule
- Cost estimate

These proposals are to be screened by the evaluation committee (EC- minimum of 3 faculty members including the guide) constituted by the head of department, which will include a Chairman and the EC will evaluates the suitability and feasibility of the project proposal. The EC can accept, accept with modification, request a resubmission, or reject a project proposal.

Every activity done as part of project work is to be recorded in the project book, as and when it is done. Project guide shall go through these records periodically, and give suggestions/comments in writing in the same book.

The students have to submit an interim report, along with project work book showing details of the work carried out by him/her and a power point presentation at the end of the 7^{th} semester to EC. The EC can accept, accept with modification, request a resubmission, or extension of the project.

The student's internal marks for project will be out of 50, in which 30 marks will be based on day to day performance assessed by the guide. Balance 20 marks will be awarded based on the presentation of the project by the students before an evaluation committee consists of a minimum of 3 faculty members including the guide.

For Project, the minimum for a pass shall be 50% of the total marks assigned to the Project work.

EI 010 801 INSTRUMENTATION SYSTEM DESIGN (common to AI010 801 and IC 010 801)

Teaching scheme **Credits:** 4

3 hours lecture and 2 hours tutorial per week

Objective

To help the students get basic understanding of the following:

- *Design of instrumentation systems for various applications.*
- *Design of electronic and pneumatic controllers.*
- *Piping and instrumentation diagrams.*
- *Procedures for the preparation of an instrumentation project.*
- *Noise and noise reduction techniques in measurement.*

Module 1

Sensing element : Elastic sensing elements - Cantilever and torque elements, Pillar load cell, Strain gauge accelerometer- Inductive push pull displacement sensor -Capacitive level sensor .

Signal conditioning element :Design of resistive and reactive bridges for sensors. Design of the bridge Circuit for RTD- Design of reference junction compensation for thermocouple.- Linearising techniques for thermocouple and thermistor- Design of charge amplifier- Instrumentation amplifier. A.C. carrier systems.- Lock in amplifier.

Module 2

Current transmitters-Concept of 2 and 4 wire transmitters with 4-20mA output- Open loop and closed loop current transmitters. Smart transmitters- Future trends in intelligent devices- Design of pneumatic and electronic PID controllers-Design of ON-OFF controllers with neutral zone - Design of instrumentation servo mechanism- Design of annunciators - Low level and high level annunciators.- Enunciators

Module 3

Orifice meter- Design of orifice for a given flow condition for compressible and incompressible fluids -Design of rotameter- Design of venturi meter- Bourdon gauges-Factors affecting sensitivity- Design of bourdon tubes- Design of square root extractors for variable head flow meters.

Module 4

Piping and instrumentation diagrams – ISA symbols – Process and instrumentation (PI)diagram of typical process plant – Preparation of instrumentation project – Documents to be produced- Process flow sheet – mechanical flow sheets- Instrument index sheet – Instrument specification sheet – Process information required- process information – Bid documents – project procedures – Project schedule – Vendor drawings – Work coordination – Project manager – process engineer – Equipment engineer – Job execution – planning hints- scheduling- Project checklist – equipment delivery - Conclusion Instrument specification sheet for pressure – Choice of temperature – flow – level – analytical instruments and control panels.

Module 5

Signals and noise in instrument systems – Statistical representation – pdf – psd – Auto correlation function – Effects of noise and interference – Series and common mode – Noise sources and

coupling mechanisms – Multiple earths – Methods of reduction of noise – Shielding – Screening – Filtering – Modulation – Averaging – Auto correlation .

Text Books

1. John P. Bentley : Principles of measurement systems, Longman 1983
2. Johnson C.D: Process control instrumentation technology, 4/e, PHI, 1995
3. D.Patranabis : Principles of Industrial Instrumentation, Tata McGraw Hill Publishing Ltd. New Delhi, 1999
4. Sheingold D. H.: Transducer interfacing hand book – a guide to analog signal conditioning, analog devices Inc masschusetts, 1980.
5. Anderson N A : Instrumentation for process measurement and control :Chilton book company 1980.
6. Andrew w: Applied Instrumentation in process Industries; Vol. II. Gulf publications, 1990.
7. Doebelin.E.O. Measurement systems applications and design, McGraw Hill, 1975.
8. Tattamangalam R. Padmanabhan : Industrial Instrumentation Principles and Design, Springer International
9. E. Radhakrishnan : Instrumentation, measurements and Experiments in Fluids, Boca Raton, FL : CRC Press

EI 010 802 INSTRUMENTATION IN PROCESS INDUSTRIES
(common to AI010 802)

Teaching scheme **Credits:** 4

2 hours lecture and 2 hours tutorial per week

Objectives

a. *To give a basic knowledge about unit operations.*
b. *To provide exposure to the process and instrumentation applications in different industries.*

MODULE 1

Basic concepts and principles of commonly used unit operations – Reactors – batch reactors – distillation towers – refrigeration units – steam boilers – furnaces – dryers – crystallizers – centrifuges – heat exchangers – pumps – compressors – evaporators – extruders.

MODULE 2

Instrumentaion in the Food industry : Description of the process – Measurment hardware in the food industries – Analyzers in the food industry – Valves and feeders in the food industry – Controllers and displays in the food industry – Computer applications in the food industry – Typical control systems in the food industry

MODULE 3

Instrumentation in the iron and steel industry: Description of the process – Measurment hardware – analyzers – valves - Controllers and displays in the iron and steel industry – Computer applications in the iron and steel industry – Typical control systems in the iron and steel industry

MODULE 4

Instrumentaion in the Paper industry : Description of the process – Measurment hardware in the Paper industry – Analyzers in the Paper industry – Valves and feeders in the Paper industry – Controllers and displays in the Paper industry – Computer applications in the Paper industry – Typical control systems in the Paper industry.

Instrumentation in the Nuclear industy: Description of the process- Measurement hardware in the nuclear industry – Analysers in the nuclear industry – Valves and control rodes in the nuclear industry – Control panels and displays – Computer applications – Typical control system.

MODULE 5

Instrumentaion in the pharmaceutical industry : Description of the process – Measurment hardware in the pharmaceutical industry – Analyzers in the pharmaceutical industry – Valves and feeders in the pharmaceutical industry – Controllers and displays in the pharmaceutical industry – Computer applications in the pharmaceutical industry – Typical control systems in the pharmaceutical industry.

Text Book:

1. Instrumentation in the Processing Industries , Bela G Liptak (ed.), Chilton Book Company

Reference Books:

1. Unit operation in chemical ENgg. McCabe Smith 4/e Mcgrans Hill
2. Outline Chemical Technology M Gopal Rao &M Sitting 3/E East West 1973
3. Chemical Engineering Hand book Peiry,McGrans Hill
4. Chemical reaction Engineering O leven spielJ.Wiley & sons

EI 010803 - ADVANCED INSTRUMENTATION AND APPLICATIONS

Teaching scheme **Credits:** 4

2 hours lecture and 2 hours tutorial per week

Objective

- *To know about virtual instrumentation and its application using LabVIEW*
- *To discuss different applications of ultrasonic instrumentation*
- *To study the application of fuzzy logic and neural network in instrumentation and control.*

Module 1: Intelligent and Virtual Instrumentation

Virtual Instrumentation- Definition to Virtual Instrumentation (VI) – Block diagram and Architecture of Virtual Instruments – Virtual Instruments versus Traditional Instruments – LabVIEW based virtual instrumentation – Organization of the DAQ VI system - Application. **Sensor fusion and estimation in instrumentation –** Sensor validation using artificial neural networks – Sensor data fusion to improve measurement accuracy in presence of noise– Sensor fusion in robotic environment.

Module 2: Biochemical and microwave sensors

Biochemical sensors – Introduction – measuring principles in biochemical sensor design-application – some biochemical sensors – current trends in biochemical sensor research.

Microwave sensors – Basics of microwave propagation – classification of Microwave sensors – Active sensors – Principle of Pulsed Radar – CW Radar sensor – Altimeter – Rate of climb meter. Applications: Industrial / Commercial Application – Biomedical Application.

Module 3: Ultrasonic Instrumentation

Ultrasonic test methods: Pulse echo, transit time, direct contact, immersion type and ultrasonic methods of flaw detection. Ultrasonic measurement: Ultrasonic method of measuring thickness, depth and flow, variables affecting ultrasonic testing in various applications. Ultrasonic applications: Ultrasonic applications in medical diagnosis and therapy, acoustical holography.

Module 4: Fuzzy based Instrumentation and Control

Introduction to Fuzzy sets and systems. Basics of fuzzy sets membership function, support of a fuzzy set, height - normalised fuzzy set, α - cuts (decomposition of a fuzzy set), set theoretic definitions on fuzzy sets, complement, intersection and union equality, - fuzzy engineering - applications of fuzzy controls, case studies.

Module 5: Application of Neural Network in Instrumentation

Introduction - Principles - artificial neuron - activation functions - Single layer & multi-layer networks - Training artificial neural networks - Perception - Representation - Linear separability - Learning - Back Propagation - Training algorithm – Applications.

Text Books

1. M.K Ghosh, S. Sen, S. Mukhopadhyay, 'Measurement and Instrumentation – Trends and Application', Ane's Student Edition, 2009 Paperback Edition.
2. Bitter, R., Mohiuddin, T. and Nawrocki, M., "LabVIEW Advanced Programming Techniques", CRC Press, 2nd Edition, 2007.
3. Science And Technology Of Ultrasonics- Baldev Raj, V.Rajendran, P.Palanichamy, Narosa Publishing House, First Edition 2004.
4. Alan E Crawford, 'Ultrasonic Engineering', Academic Press Inc, Second Edition.
5. Timothy J Ross,"Fuzzy logic with Engineering Applications", Wiley Publications,1997.
6. Fausett, L., "Fundamentals of Neural Networks", Prentice Hall, Englewood Cliffs, N.J., 1994.
7. Jacek M. Zurada, 'Introduction to Artificial Neural Systems', Jaico Publication House,1995.
8. Wasserman P.D, Neural Computing Theory & Practice ,Van Nortland Reinhold,1997.

EI 010 804 L01 NANO ELECTRONICS

Teaching Schemes **Credits: 4**

2 hours lecture and 2 hours tutorial per week.

Objectives

- *To introduce students to the nano electronics and the systems.*
- *To understand the basic principles of carbon nano tubes.*

Module I (12hrs)

Challenges going to sub-100 nm MOSFETs Oxide layer thickness, tunnelling, power density, non-uniform dopant concentration, threshold voltage scaling, lithography, hot electron effects, sub-threshold current, velocity saturation, interconnect issues, fundamental limits for MOS operation.

Module II (12 hrs)

Novel MOS-based devices Multiple gate MOSFETs, Silicon-on-insulator, Silicon- on-nothing, Fin FETs, vertical MOSFETs, strained Si devices.

Module III (12 hrs)

Quantum structures quantum wells, quantum wires and quantum dots, Single electron devices charge quantization, energy quantization, Coulomb blockade, Coulomb staircase, Bloch oscillations.

Module IV (12 hrs)

Hetero structure based devices Type I, II and III hetero junctions, Si-Ge hetero structure, hetero structures of III-V and II-VI compounds - resonant tunnelling devices.

Module V (12 hrs)

Carbon nanotubes based devices CNFET, characteristics; Spin-based devices spin FET, characteristics.

Reference Books:

1. Mircea Dragoman and Daniela Dragoman, " Nano electronics Principles & devices", Artech House Publishers, 2005.
2. Karl Goser, "Nanoelectronics and Nanosystems: From Transistors to Molecular and Quantum Devices", Springer 2005.
3. Mark Lundstrom and Jing Guo, "Nanoscale Transistors: Device Physics Modelling and Simulation", Springer, 2005.
4. Vladimir V Mitin, Viatcheslav A Kochelap and Michael A Stroscio, "Quantum hetero structures", Cambridge University Press, 1999.
5. S M Sze (Ed), " High speed semiconductor devices", Wiley, 1990

EI 010 804 L02 MICRO ELECTRO MECHANICAL SYSTEMS

Teaching Schemes **Credits: 4**

2hours lecture and 2 hours tutorial per week

Objectives

- *To introduce students to the MEMS systems, its hardware.*
- *To introduce devices and their working principles..*

Module I (12hrs)

Overview of MEMS and Microsystems –Typical MEMS product – Evolution of Microfabrication – Multidisciplinary nature of MEMS – Applications.

Module II (12 hrs)

Working Principle of Microsystems – Microsensors – Microactuation – Microaccelerometers - Microfluidics

Module III (12 hrs)

Engineering Science for Microsystem Design - Atomic Structure of Matter – Ions –Molecular Theory – Intermolecular Force – Doping of Semiconductors – Diffusion Process – Electrochemistry – Quantum Physics – Materials for MEMS and Microsystems – Substrate and Wafer – Silicon as Substrate Material – Silicon compounds – Silicon Piezoresistors – Gallium Arsenide – Quartz – Piezoelectric Crystals – Polymers.

Module IV (12 hrs)

Micro system Fabrication Process – Photolithography – Ion implantation – Diffusion – Oxidation – Chemical Vapour Deposition – Physical Vapour Depostion – Deposition of Epitaxy - Etching

Module V (12 hrs)

Overview of Micromanufacturing – Bulk Micromanufacturing – Surface Micromachining – The LIGA Process.

Reference Books:

1. Tai-Ran Hsu , “MEMS & Microsystems Design and Manufacture”, Mc Graw Hill.
2. Nitaigur Premchand Mahalik , “MEMS”, Tata Mc Graw Hill
3. James D. Plummer, Michael D.Deal, Peter B. Griffin, “Silicon VLSI Technology’, Pearson Education.

EI 010 804 L03 BIOMEDICAL SIGNAL PROCESSING

Teaching scheme **Credits:** 4
2 hours lecture and 2 hours tutorial per week

OBJECTIVES:

- *To give an introduction about biomedical signals*
- *To give an idea about neurological and cardiological signal processing*
- *To study the different data reduction techniques*
- *To give an introduction about the matlab for biomedical signal processing*.

Module 1

Introduction to Bio-Medical Signals: The nature of Bio-Medical Signals, objectives of Bio-Medical signal analysis,
artifacts encountered and difficulties in Bio-Medical signal analysis, computer aided diagnosis.

Module 2

Neurological Signal Processing: EEG signal and its characteristics, linear prediction theory, autoregressive
method, Recursive estimation of AR parameters, Spectral error measure, adaptive segmentation, transient detection and elimination – a case of epileptic patients. Markov model, marko chain, dynamics of sleep wave transitions, hipnogram model parameters.

Module 3

Cardiological Signal Processing : ECG parameters and its estimation, the review of Wiener filtering problem,
principle of adaptive filter, adaptive noise canceller, cancellation of 60Hz , interference in ECG, cancellation of ECG signal from the EMG of chest, muscle, cancellation of maternal ECG in fetal ECG, cancellation of high frequency noise in electro surgery.

Module 4

Data Reduction Techniques : Need for data reduction, turning point algorithm, AZTEC algorithm,CORTES algorithm, FAN algorithm, Huffman coding technique and data compression techniques comparison.

Module5

Mat lab for biomedical signal processing : MATLAB Basics: Input Outputs, arithmetic Algebra, Managing Variables- Variables and assignments, vectors and matrices, functions, built in functions, user define functions and graphics.
Branching, looping, programming commands and interacting operating systems, filter design (Lowpass and Band pass FIR filters) and applications in Bio-Medical signal processing.

References:

1. Biomedical Signal Processing principles and techniques – D C Reddy, TMH Publication 2005
2. Biomedical signal analysis – A case study approach by Rangraj M, Rangayyan, John Wiley publications
3. Biomedical Digital Signal Processing – Willis J Tomkins, The PHI Publications
4. Handbook of Biomedical Instrumentation – R S Khandpur, TMH Publications, 2nd Edition.
1. A guide to MAT LAB – Ronald Lipsman, Brain Hunt, Jonnathan Rosen Berg, Cambridge University Press 2005
2. MATLAB Primer – Marcel CRC Press

EI 010 804 L04 REAL TIME EMBEDDED SYSTEMS

Teaching scheme **Credits:** 4

2 hours lecture and 2 hours tutorial per week

Objectives

- *To study various embedded systems and peripherals*
- *To understand the concept of embedded programming*
- *To get an exposure to various operating systems services*
- *To learn the basics of scheduler*
- *To study various RTOS*

Module I

Introduction to Embedded Systems - Definition and Classification – Overview of Processors and hardware units in an embedded system – Software embedded into the system – Exemplary Embedded Systems – Embedded Systems on a Chip (SoC)
I/O Devices - Device I/O Types and Examples – Synchronous and Asynchronous Communications from Serial Devices - Examples of Internal Serial-Communication Devices - UART and HDLC - Parallel Port Devices - Sophisticated interfacing features in Devices/Ports- Timer and Counting Devices - I2C, USB, CAN.

Module-II

Programming concepts of embedded programming in C Program Elements, Macros and functions - Use of Pointers - NULL Pointers - Use of Function Calls – Multiple function calls in a Cyclic Order in the Main Function Pointers – Function Queues and Interrupt Service Routines Queues Pointers – Concepts of embedded programming in C++-,Cross compiler – Optimization of memory codes.

Module-III

Real time operating systems Definitions of process, tasks and threads – Clear cut distinction between functions – ISRs and tasks by their characteristics – Operating System Services- Goals – Structures- Kernel - Process Management – Memory Management – Device Management – File System Organisation and Implementation

Module-IV

I/O Subsystems – Interrupt Routines Handling in RTOS, RTOS Task scheduling models - Handling of task scheduling and latency and deadlines as performance metrics – Co-operative Round Robin Scheduling – Cyclic Scheduling with Time Slicing (Rate Monotonic Co-operative Scheduling) – Pre-emptive Scheduling Model strategy by a Scheduler - Inter Process Communication and Synchronisation – Shared data problem – Use of Semaphore(s) – Priority Inversion Problem and Deadlock Situations – Inter Process Communications using Signals – Semaphore Flag or mutex as Resource key – Message Queues – Mailboxes – Pipes.

Module-V

Study of Micro C/OS-II or Vx Works or Any other popular RTOS – RTOS System Level Functions – Task Service Functions – Time Delay Functions – Memory Allocation Related Functions – Semaphore Related Functions

TEXT BOOKS

1. Rajkamal, *Embedded Systems Architecture, Programming and Design*, TATA McGraw-Hill, First reprint Oct. 2003
2.Steve Heath, *Embedded Systems Design*, Second Edition-2003, Newnes,
3.David E.Simon, An *Embedded Software Primer*, Pearson Education Asia, First Indian Reprint 2000.

REFERENCES

4.Wayne Wolf, *Computers as Components: Principles of Embedded Computing System Design – Harcourt India*, Morgan Kaufman Publishers, First Indian Reprint 2001
5.Frank Vahid and Tony Givargis, *Embedded Systems Design – A unified Hardware / Software Introduction*, John Wiley, 2002

EI 010 804 L05 ENVIORNMENTAL MONITORING INSTRUMENTS

Teaching scheme **Credits:** 4

2 hours lecture and 2 hours tutorial per week

Objectives

- *To give an idea about concept of eco system and need for environmental monitoring*
- *To study the different measurement techniques for environmental parameters*

Module 1

Concept of ecosystem: Structure and function of an ecosystem, producers, consumers and decomposers, energy flow in ecosystem, ecological succession, food chains and ecological pyramids, biodiversity and its conservation. Introductory lessons on environmental pollution: greenhouse gases and global warming

Need for environmental monitoring-Indian standards for population levels (concentrations) in respect of air quality and water quality. Noise levels, impact of pollution on human health, vegetation, animals and property value. Biological quality of water-bacteria and virus-applications of sophisticated microprocessor including electron microscope for identification of microbial organism.

Module 2

Water quality parameter-PH-conductivity-temperature-turbidity-chemical pollutants chlorides, sulphides-Nitrates and nitrites-phosphate-flouride, phenolic compounds measurement techniques for these parameters.

Module 3

Elemental concentration in Water-Mercury, Lead, chromium, Arsenic, Zinc, Cadmium, Copper, Selenium, Nickel, Sodium, Potassium, Lithium-measurement techniques for these parameters.

Air pollution: Overview of emissions– criteria pollutants – toxic air pollutants –motor vehicle emission Measurement techniques for particulate matter in air-oxides of sulpher, nitrogen, unburnt hydrocarbons, carbon dioxide ,carbon monoxide, ozone.

Module 4

Noise pollution-desirable levels of sound. Measurement of sound level. Soil pollution insecticides, pesticides, fertilizers measurement techniques for these pollutants.

Concepts of solid waste management: source reduction – recycling – disposal.

Concepts of waste water treatment methods: physical treatments – biological treatments - reuse and recycle of water and waste water.

Module 5

Pollution monitoring devices: paper tape sampler - bubbler systems - gas analysers
Basics of methods of measuring pollution:
principle of sampling air /water/soil for pollution measurement; ambient air sampling: collection of gaseous air pollutants, collection of particulate air pollutants; stack sampling: sampling system, particulate sampling, and gaseous sampling.

References:

1. S.P. Mahajan, Pollution control in process industries, Tata McGraw Hill, 1985.
2. G.N. Pandey and G.C. Carney, environmental engineering, Tata McGraw Hill, 1989.
3. . R. Rajagopalan, Environmental Studies, Oxford IBH Pub.
4. Benny Joseph, Environmental Studies, McGraw Hill Pub.
5. Erach Bharucha, Text Book for Environmental Studies, Pub., UGC.
6. Masters, Gilbert M. Introduction to Environmental Engineering and Sciences, PHI.

India Environmental Port, http://www.indiaenvironmentportal.org.in

EI010 804 L06 AIRCRAFT INSTRUMENTATION

Teaching scheme **Credits:** 4

2 hours lecture and 2 hours tutorial per week

OBJECTIVE

To describe the principle and working of aircraft systems and instruments

MODULE 1 :--AIRPLANE CONTROL SYSTEMS

Conventional Systems - Power assisted and fully powered flight controls - Power actuated systems – Engine control systems - Push pull rod system, flexible push full rod system - Components - Modern control systems - Digital fly by wire systems - Auto pilot system active control Technology, Communication and Navigation systems Instrument landing systems, VOR - CCV case studies.

MODULE 2:-- AIRCRAFT SYSTEMS

Hydraulic systems - Study of typical workable system - components - Hydraulic system controllers - Modes of operation - Pneumatic systems - Advantages - Working principles - Typical Air pressure system – Brake system - Typical Pneumatic power system - Components, Landing Gear systems - Classification – Shock absorbers - Retractive mechanism.

MODULE 3:-- ENGINE SYSTEMS

Fuel systems for Piston and jet engines, - Components of multi engines. lubricating systems for piston and jet engines - Starting and Ignition systems - Typical examples for piston and jet engines.

MODULE 4:-- AUXILLIARY SYSTEM

Basic Air cycle systems - Vapour Cycle systems, Boost-Strap air cycle system - Evaporative vapour cycle systems - Evaporative air cycle systems - Oxygen systems - Fire protection systems, De icing and anti icing systems.

MODULE 5 :--. AIRCRAFT INSTRUMENTS

Flight Instruments and Navigation Instruments – Gyroscope - Accelerometers, Air speed Indicators – TAS, EAS- Mach Meters - Altimeters - Principles and operation - Study of various types of engine instruments - Tachometers - Temperature gauges - Pressure gauges - Operation and Principles.

TEXT BOOKS

1. McKinley, J.L., and Bent, R.D., “Aircraft Maintenance & Repair”, McGraw-Hill, 1993.
2. “General Hand Books of Airframe and Powerplant Mechanics”, U.S. Dept. of Transportation, Federal Aviation Administation, The English Book Store, New Delhi1995.

REFERENCES

1. Mekinley, J.L. and Bent, R.D., “Aircraft Power Plants”, McGraw-Hill, 1993.
2. Pallet, E.H.J., “Aircraft Instruments & Principles”, Pitman & Co., 1993.

3. Treager, S., “Gas Turbine Technology”, McGraw-Hill, 1997.

EI 010 805 G01 TEST ENGINEERING

Teaching Schemes **Credits : 4**

2 hrs lecture and 2 hrs tutorial per week

Objectives

1. *To provide an insight into multi-disciplinary approach to test engineering including test economics and management.*
2. *To understand practical, concise descriptions of the methods and technologies in modern mechanical, electronics and software testing.*
3. *To provide an insight into the developing interface between modern design analysis methods and testing practice.*
4. *To understand why products and systems fail, which testing methods are appropriate to each stage of the product life cycle and how testing can reduce failures.*
5. *To provide an overview of international testing regulations and standards.*

Module 1 (12 hrs)

Introduction: need for test, analysis and simulation, good and bad testing, test economics, managing the test programme

Stress, Strength and Failure of Materials: mechanical stress and fracture, temperature effects, wear corrosion, humidity and condensation, materials and component selection

Electrical and Electronics Stress, Strength and Failure: stress effects, component types and failure mechanisms, circuit and system aspects

Module 2 (12 hrs)

Variation and Reliability: variation in engineering, load-strength interference, time-dependent variation, multiple variations and statistical experiments, discrete variations, confidence and significance, reliability

Design Analysis: Quality Function Deployment, design analysis methods, analysis methods for reliability and safety, design analysis for processes, software for design analysis, limitations of design analysis, using analysis results for test planning

Module 3 (12 hrs)

Development Testing Principles: functional testing, testing for reliability and durability, testing for variation, process testing, 'Beta' testing

Materials and Systems Testing: materials, assemblies and systems, system aspects, data collection and analysis, standard test methods, test centres

Testing Electronics: circuit test principles, test equipment, test data acquisition, design for test, electronic component test, EMI / EMC testing

Module 4 (12 hrs)

Software: software in engineering systems, software errors, preventing errors, analysis of software system design, data reliability, managing software testing

Manufacturing Test: manufacturing test principles, manufacturing test economics, inspection and measurement, test methods, stress screening, electronics manufacturing test options and economics, testing electronic components, statistical process control and acceptance sampling

Testing in Service: in-service test economics, test schedules, mechanical and systems, electronic and electrical, sotaftware, reliability centred maintenance, stress screening of repaired items, calibration

Module 5 (12 hrs)

Data Collection and Analysis: FRACAS, acceptance sampling, probability and hazard plotting, time series analysis, software for data collection and analysis, reliability demonstration and growth measurement, sources of data

Laws, Regulations and Standards: safety and product liability, main regulatory agencies in USA, Europe and Asia, International standards, BIS, ISO standards, industry / technology standards

Management: organization and responsibilities, procedures for test, development test programme, project test plan, training and education for test, future of test.

References:

1. Patrick D. T. O'connor, "A Concise Guide to Cost-effective Design, Development and Manufacture", John Wiley & Sons, 2001
2. Patrick D. T. O'connor, "Practical Reliability Engineering", Wiley India, 2008
3. Naikan V. N. A., "Reliabilty Engineering and Life Testing", PHI Learning, 2008
4. Kapur K. C., Lamberson L. R., "Reliability in Engineering Design", Wiley India, 2009
5. Srinath L. S., "Reliability Engineering", East West Press, 2005

EI010 805 G02 Total quality management
(Common to AI 010 805 G01 and IC 010 805 G03)

Teaching scheme **Credits**: 4
2 hours lecture and 2 hour tutorial per week

OBJECTIVE

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

Module 1. INTRODUCTION

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

Module2 . TQM PRINCIPLES

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure.

Module3. STATISTICAL PROCESS CONTROL (SPC)

The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

Module4 TQM TOOLS

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA.

Module5. QUALITY SYSTEMS

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, QS 9000, ISO 14000 – Concept, Requirements and Benefits.

TEXT BOOK

1. Dale H.Besterfiled, et al., Total Quality Management, Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6.

REFERENCE BOOKS

1. James R.Evans & William M.Lidsay, The Management and Control of Quality, (5th Edition), South-Western (Thomson Learning), 2002 (ISBN 0-324-06680-5).
2. Feigenbaum.A.V. “Total Quality Management, McGraw Hill, 1991.
3. Oakland.J.S. “Total Quality Management Butterworth – Hcinemann Ltd., Oxford. 1989.
4. Narayana V. and Sreenivasan, N.S. Quality Management – Concepts and Tasks, New Age International 1996.
5. Zeiri. “Total Quality Management for Engineers Wood Head Publishers, 1991.

EI 010 805 G03 Human factors engineering
(common to AI010 805G02)

Teaching scheme **Credits**: 4
2 hours lecture and 2 hour tutorial per week

OBJECTIVES

1. Appreciate the importance of the human factors discipline.
2. Apply human factors (HF) methods and principles to the evaluation and design of systems in the world around you.
3. Understand human limitations and capabilities and how they impact the design of controls, displays, and related devices.
4. Appreciate how human factors can influence the effectiveness of human-system interactions.

Module 1:

Introduction to the subject: common examples of human machine interactions/systems – need for engineering approach and attention to human machine systems through simple common place examples like handle positioning on doors, positioning of bath room fittings, stair case dimensions, heights of table and chair in relation, placing of alphabet keys on computer key board; definition of HF.

Module 2:

Human machine systems/interfaces, HFE at work place through examples from mechanical fitting shop, electrical machine shop, assembly lines in manufacturing shops, front panels of electronic instruments.

Module 3:

Anthropometric Principles: Bertillon's observations - Bergmann's rule - Allen's rule; anthropometric division of body types - anthropometric data.

Module 4:

Applied anthropometry and work space design & seating: positive and adverse effects related to work design issues – impact on worker performance and fatigue - illustration through simple examples including dimensions: safe clearances or heights, such as for doorways or walkways, safe reach distances, such as for safety cords or equipment controls, safety features including machine guards and protective shields.

Module 5:

Work related health issues, safety aspects and legal aspects: work related musculoskeletal disorders, visual environment, thermal environment, auditory environment, vibrations.

Text Books:

1. McCormick, E.J., Human Factors in Engineering and Design, McGraw-Hill Book Company.

2. Eggleton, E.M. (Ed.), Ergonomic Design for People at Work: Volume 1 and 2, Van Nostrand Reinhold.

References:

1. ILO, Introduction to Work study

2. M. S. Sanders and Ernest J. McCormick, Human Factors Engineering and Design. McGraw Hill Inc.

3. Kroemer, K., H. Kroemer, and Kroemer-Elbert, K., Ergonomics: How to Design for Ease and Efficiency, Prentice Hall
4. Meister, D., Conceptual Aspects of Human Factors. Baltimore, MD, The Johns Hopkins University Press

5. Burgess, J.H., Designing for Humans: The Human Factors in Engineering, Petrocelli Books.

EI010 805 G 04 BIO INFORMATICS

(common to IC010 805G04)

Teaching Schemes **Credits: 4**

2 hours lecture and 2 hours tutorial per week.

Objective: To cater the needs of students who want a comprehensive study of the principle and techniques of bioinformatics..

Module 1 (12 hrs)

Nature and scope of life science, Various branches of life sciences, Organization of life at various levels, Overview of molecular biology, The cell as basic unit of life-Prokaryotic cell and Eukaryotic cell - Central Dogma: DNA-RNA-Protein, Introduction to DNA and Protein sequencing, Human Genome Project, SNP, **Bioinformatics databases**, - Nucleotide sequence databases, Primary nucleotide sequence databases-EMBL, GeneBank, DDBJ; Secondary nucleotide sequence databases Protein sequence databases- SwissProt. Protein Data Bank

Module 2 (12 hrs)

Basic concepts of sequence similarity, identity and homology, definitions of homologues, orthologues, paralogues. Scoring matrices- PAM and BLOSUM matrices, Pairwise sequence alignments: Needleman & Wuncsh, Smith & Waterman algorithms for pairwise alignments. BLAST and FASTA. Multiple sequence alignments (MSA)- CLUSTALW.

Module 3 (12 hrs)

Phylogeny: Basic concepts of phylogeny; molecular evolution; Definition and description of phylogenetic trees. Phylogenetic analysis algorithms - Maximum Parsimony, UPGMA and Neighbour-Joining. Evaluation of phylogenetic trees-reliability and significance; Boot strapping; Jackknifing

Module 4 (12 hrs)

Computational approaches for bio-sequence analysis - Mapping bio-sequences to digital signals – various approaches – indicator sequences – distance signals – use of clustering to reduce symbols in amino acid sequences - analysis of bio-sequence signals – case study of spectral analysis for exon location.

Module 5 (12 hrs)

Systems Biology: System Concept- Properties of Biological systems, Self organization, emergence, chaos in dynamical systems, linear stability, bifurcation analysis, limit cycles, attractors, stochastic and deterministic processes, continuous and discrete systems, modularity and abstraction, feedback, control analysis, Mathematical modeling; Biological

Networks- Signaling pathway, GRN, PPIN, Flux Balance Analysis, Systems biology v/s synthetic biology

References.

1. Claverie & Notredame, “Bioinformatics - A Beginners Guide”, Wiley-Dreamtech India Pvt.
2. Uri Alon, “An Introduction to Systems Biology Design Principles of Biological Circuits”, Chapman & Hall/CRC.
3. Marketa Zvelebil and Jeremy O. Baum, “Understanding Bioinformatics”, Garland Science.
4. Bryan Bergeron, “Bioinformatics Computing, Pearson Education”, Inc., Publication.
5. D. Mount, “Bioinformatics: Sequence & Genome Analysis”, Cold spring Harbor press.
6. Charles Semple, Richard A. Caplan and Mike Steel, “Phylogenetics”, Oxford University Press.
7. C. A. Orengo, D.T. Jones and J. M. Thornton, “Bioinformatics- Genes, Proteins and Computers”, Taylor & Francis Publishers.
8. Achuthsankar S. Nair et al. “Applying DSP to Genome Sequence Analysis: The State of the Art, CSI Communications”, vol. 30, no. 10, pp. 26-29, Jan. 2007.
9. Resources at web sites of NCBI, EBI, SANGER, PDB etc

EI010805 G05 Intellectual Property Rights
(common to IC 010 805 G05)

Teaching scheme **Credits:4**

2 hour lecture and 2 hour tutorial

Objectives

1. *To appreciate the concept of Intellectual Property and recognize different kinds of Intellectual Property*
2. *To appreciate the rationale behind IP and underlying premises*
3. *To know the position of IP under the constitution of India*

Module 1(12 Hours)

Concept of intellectual property – different types of IP-Rationale behind Intellectual property-Balancing the rights of the owner of the IP and the society – Enforcement of IPRs – IP and constitution of India.

Module 2 (12 Hours)

World intellectual Property Organization (WIPO) – WTO/TRIPS Agreement – India and the TRIPS Agreement – Patent law in India –Interpretation and implementations – Transitional period.

Module 3 (12 Hours)

Patent system – Patentable Invention – Procedure for obtaining patent – Rights of a patentee – Limitations on Particular's Rights – Revocation of patent for Non – working Transfer of patent – Infringement of patent.

Module 4 (12 Hours)

Indian Designs Law – Meaning of Design Registration and Prohibitions – Copyright in Designs – Piraiy of Design and Penalities – Steps for foling an Application – Copyright law in India – Owner of the copyright – Rights of Broad Casters and Performers – Registration of Copyright – Assignment, Licensing and Transmission – Infringement – International Copyright and Copyright Societies

Module 5 (12 Hours)

Trade Mark Law in India – Functions of a Trade Mark – Registration of Trade Mark Exploiting Trade Mark – Infringement –Offenses and Penalties – Indian Trade Mark Act 1999; salient features. Geographical Indications – Registration of Geographical Indication – Term and Implication of Registration – Reciprocity and Prohibition on Registration.

Text books

1. Jayasree Watal -**Intellectual Property Rights:** In the WTO and Developing Countries - Oxford University Press
2. V.Sarkar-Intellectual Property Rights and Copyright- ESS publications

References

1. R..Anita Rao and Bhanoji Rao - Intellectual Property Rights –Eastern Book Company

2. Arthur R Miller and Michael H Davis – Intellectual Property in a Nutshell: marks patents, Trade and Copy Right

3. Richard Stim - Intellectual Property marks patents, Trade and Copy Right – Cangage Learning
4. Christopher May and Susan K Sell - Intellectual Property Rights –A critical History - Viva Books

EI 010 805 G 06 Professional Ethics
(common to AI 010805 G04 and IC 010 805 G06)

Teaching Schemes **Credit: 4**

2 hours lecture and 2 hours tutorial per week.

Objectives:

- *To create awareness on professional ethics for engineers*
- *To instil human values and integrity*
- *To respect the rights of others and develop a global perspective*

Module 1 (12 hrs)

Understanding Professional Ethics and Human Values Current scenario – contradictions – dilemmas – need for value education and self esteem – Human values – morals – values – integrity – civic virtues - work ethics – respect for others – living peacefully – caring – honesty – courage – valuing time – co operation – commitment – empathy – self confidence - character

Module 2 (12 hrs)

Ethics for Engineers Ethics – its importance – code of ethics – person and virtues – habits and morals – 4 main virtues – ethical theories – Kohlberg's theory – Gilligan's theory – towards a comprehensive approach to moral behaviour – truth – approach to knowledge in technology

Module 3 (12 hrs)

Environmental Ethics and sustainability problems of environmental ethics in engineering - engineering as people serving profession – engineer's responsibility to environment – principles of sustainability - industrial, economic, environmental, agricultural and urban sustainability - Sustainable development.

Module 4 (12 hrs)

Social Experimentation, Responsibility and Rights Engineers as responsible experiments – safety and risk – confidentiality – knowledge gained confidentiality – experimental nature of engineering – Intellectual Property Rights – professional rights – employee rights – occupational crime

Module 5 (12 hrs)

Global Issues Globalisation – unethical behaviour – computer ethics – weapons development – engineers as expert witness and advisors – moral leadership

Reference

1. Mike W Martin, Roland Schinzinger, " Ethics in Engineering", Tata McGraw -Hill, 2003
2. Govindarajan M, Natarajan S, Senthil Kumar V S, "Engineering Ethics" PHI India, 2004
3. P Aarne Vesblind, Alastair S Gunn, " Engineering Ethics and the Enviornment"

4. Edmund G Seebauer, Robert L Barry, " Fundamentals of Ethics for scientists and engineers" Oxford University Press 2001
5. R RGaur, R Sangal, G P Bagaria, " A foundation course in value education and professional ethics"

EI010 806 PROCESS CONTROL LAB

Teaching Scheme

3 hours practical per week **2 credits**

1. Electronic PID controller and implementation of PID algorithm using high level language
2. Performance Evaluation of Temperature process control station.
3. Performance Evaluation of Pressure process control station
4. Performance Evaluation of Flow process control station
5. Performance Evaluation of Level process control station
6. Characteristics of Differential Pressure Transmitter and Rotameter
7. Characteristics of control valve, with and without positioner
8. Characteristics of I/P and P/I converter
9. Study of process control simulator
10. Study of PLC
11. PLC programming and implementation
12. Control of bottle filling system using PLC
13. Speed controller of a DC motor using PLC
14. Liquid level control using PLC
15. Study of Distributed Control System

MATLAB

1) Experiments using MATLAB SIMULINK package for level control in realtime.
2) Experiments using MATLAB SIMULINK package for pressure control in realtime.
3) Controller tuning for a process– using Ziegler-Nichols and Cohen – Coon rule

LABVIEW

1) LabVIEW Fundamentals I – Data types, Loops, Shift Registers, Case Structures, Sequence Structures, Formula Node.
2) LabVIEW Fundamentals II – Arithmetic Operations, Arrays, Sub-VI, Boolean Operations, Comparison.
3) Development of VI for temperature measurement-with display, and visual and sound alarms
4) Development of VI for level measurement-with display, and visual and sound alarms

EI010 807 Project Work

Teaching scheme **credits: 4**

6 hours practical per week

The progress in the project work is to be presented by the middle of eighth semester before the evaluation committee. By this time, the students will be in a position to publish a paper in international/ national journals/conferences. The EC can accept, accept with modification, and request a resubmission.

The progress of project work is found unsatisfactory by the EC during the middle of the eighth semester presentation, such students has to present again to the EC at the end of the semester and if it is also found unsatisfactory an extension of the project work can be given to the students.

Project report: To be prepared in proper format decided by the concerned department. The report shall record all aspects of the work, highlighting all the problems faced and the approach/method employed to solve such problems. Members of a project group shall prepare and submit **separate** reports. Report of each member shall give details of the work carried out by him/her, and only summarise other members' work.

The student's sessional marks for project will be out of 100, in which 60 marks will be based on day to day performance assessed by the guide. Balance 40 marks will be awarded based on the presentation of the project by the students before an evaluation committee.

For Project, the minimum for a pass shall be 50% of the total marks assigned to the Project work.

EI010 808 Viva -Voce

Teaching scheme **credits: 2**

A comprehensive oral Viva-voce examination will be conducted to assess the student's intellectual achievement, depth of understanding in the specified field of engineering and papers published / accepted for publication etc. At the time of viva-voce, certified bound reports of seminar and project work are to be presented for evaluation. The certified bound report(s) of educational tour/industrial training/ industrial visit shall also be brought during the final Viva-Voce.

An internal and external examiner is appointed by the University for the Conduct of viva voce University examination.

For Viva-voce, the minimum for a pass shall be 50% of the total marks assigned to the Viva-voce.

Note: If a candidate has passed all examinations of B.Tech. course (at the time of publication of results of eighth semester) except Viva-Voce in the eighth semester, a re-examination for the Viva-Voce should be conducted within one month after the publication of results. Each candidate should apply for this 'Save a Semester examination' within one week after the publication of eighth semester results.