5EIC1 SIGNALS & SYSTEMS

L:-3 T:-1 M.M.-100

Introduction: Continuous time and discrete time signals and systems, Properties of systems.

Linear time invariant systems- continuous time and discrete time, Properties of LTI systems and their block diagrams.

Convolution, Discrete time systems described by difference equations.

Fourier series representation of signals: Fourier series representation of continuous periodic signal & its properties. Fourier series representation of Discrete periodic signal & its properties. Continuous time filters & Discrete time filters described by Diff. equation.

Fourier transform: The continuous time Fourier transform for periodic and non-periodic signals, Properties of CTFT.

Discrete time Fourier transform for periodic and non-periodic signals, Properties of DTFT.

Z-transform & Laplace transform: The region of convergence for the Z-transform, The Inverse Z-transform, Two dimensional Z transform, Properties of Z transform.

Laplace transform: Properties of Laplace Transform, Application of Laplace transform to system analysis.

Sampling: Mathematical theory of sampling, Sampling theorem, Ideal & Real sampling, Interpolation technique for the reconstruction of a signal from its samples, Aliasing, Sampling in freq. domain, Sampling of discrete time signals.

SUGGESTED READINGS

1. Signals And Systems, Oppenheim, Willsky, Nawab, PHI.(1992)
2. Signals And Systems M J Roberts, Mc-Graw Hill.(2004)
3. Principles of Linear Systems And Signals, 2e (Intl. Version), Lathi 2nd, Oxford (2002)
4. Signal & Systems 3e, Chen 3rd, Oxford (2004)
5. Fundamentals of Signals And Systems, Wiley (2009)
6. Signals And Systems, P Rao, Mc-Graw Hill (2011)
7. Signals And Systems: A Simplified Approach, Ganesh Rao, 4e, Pearson (2012)
8. Signals And Systems: Continuous And Discrete, Roger E Ziemer, 4e, PHI (1998)
9. Signals And Systems, Ravi Kumar, PHI (2009)
10. Signals & Systems, Iyer, Cengage Learning (2009)

5EIC2 LINEAR INTEGRATED CIRCUITS

L:-3 T:-1 M.M.-100

OPERATIONAL AMPLIFIERS: Basic differential amplifier analysis, Basic structure and principle of operation, Single ended and double ended configurations, calculation of differential gain, common mode gain, Op-amp configurations with feedback, Op-amp parameters, Inverting and Non-Inverting configuration, Comparators, Adder.

OPERATIONAL AMPLIFIER APPLICATIONS: Integrator, Differentiator, Voltage to frequency & Frequency to voltage converters. Oscillators: Phase shift, Wien bridge,

Quadrature, precision rectifier, half and full wave rectifiers, square wave, triangular wave, sawtooth oscillators. Voltage controlled oscillators.

ACTIVE FILTERS: Low pass, high pass, band pass and band reject filters, All pass filter, Switched capacitor filter, Butterworth filter design, Chebyshev Filter design.

LINEAR ICs: Four quadrant multiplier & its applications, Basic blocks of linear IC voltage regulators, Three terminal voltage regulators, Positive and negative voltage regulators, A/D and D/A converters, analog switches, The 555 timer as astable and monostable multivibrators. Zero crossing detector, Schmitt trigger and its applications. **NON- LINEAR APPLICATIONS OF OP-AMP:** log and antilog amplifiers, and multipliers. Solution of differential equation and analog computer.

PHASE-LOCKED LOOPS: Operating Principles of PLL, Linear Model of PLL, Lock range, Capture range, Applications of PLL as FM detector, signal synchronizer, Building blocks of PLL, LM 565 PLL.

Suggested Readings:

1. OP-AMP and linear integrated circuits 2nd edition, PLHI by Ramakant A. Gayakwad. (1992)
2. Design with operation amplifiers and Analog Integrated circuits by Sergei Franco. (2007)
3. Integrated Electronics: Analog and Digital circuits & system by Millman & Halkias. (1972)
4. Linear Integrated Circuits by D.R.Chaudhary (WEL). 2007
5. Operational amplifier with linear integrated circuits, 4thedition, W.D. Stanley, Pearson.(2002)
6. Op Amps and Linear Integrated Circuits: Concepts and Applications, Fiore, Cengage learning. (2010)

5EIC3 CONTROL SYSTEM II

L:-3 T:-0 M.M.-100

State space Model- Review of vectors and matrices, Canonical Model from Differential Equations and Transfer Fucnctions, Interconnection of Subsystems.

Analysis of Linear State Equations- First order Scaler Differential Equation, System modes and modal decomposition, State Transition Matrix, Time –varying matrix case, Solution of state equations. Pole placement by state feedback, Ackermann's Formula.

Lyapunov's stability theory for Linear System- Equalibrium points and stability concepts, Stability Definations, Linear system stability, The Direct method of Lyapunov, Use of Lyapunov's method in feedback design.

Controllability & Observability- Definitions, Contrallabilty/Observability Criteria, Design of state feedback control systems, Full-order and Reduced-order observer Design, Stabilizability and Detectability.

Suggested Readings:

1. Modern Control Engineering, Ogata K, Prentice Hall, New Delhi. (2010).
2. Linear System Theory, Hespanha, J.P., Princeton University Press.

3. Mathematical Control Theory, Sontag, E.D., second edition, Springer Verlag, 2014.
4. Ogata K, Discrete Time Control Systems PHI Learning. (2010).
5. Richard Dorf & Robert Bishop,Modern Control Systems, Pearson Education. (2011).
6. M .Gopal, Control Systems: Principles and Design, Mc Graw Hill Publications. (2008).
7. Franklin Powell , Feedback Control Of Dynamical Systems, Pearson Education. (2008).
8. Singh & Janardhanan - Modern control engineering, Cengage learning. (2010).

5EIC4 ELECTRONIC MEASUREMENT & INSTRUMENTATION

L:-3 T:-0 M.M.-100

SIGNAL GENERATION: Sine wave generators, Frequency synthesized signal generators, Sweep frequency generators.

SIGNAL ANALYSIS: Measurement Technique, Wave Analyzers, Frequency - selective wave analyzer, Heterodyne wave analyzer, Harmonic distortion analyzer, Spectrum analyzer.

SIGNAL CONVERSION: Types of Conversions, SAC, Flash type converter, A/D and D/A converters, comparators, F/V and V/F converters, Fundamentals of optical and magnetic isolators, Data Acquisition Systems, Sample and Hold circuits. Sampling Theory.

ELECTRONIC INSTRUMENTS FOR MEASURING BASIC PARAMETERS: Electronic Voltmeter, Electronic Multimeters, Digital Voltmeter, Q meter, Vector Impedance meter, Vector Voltmeter, RF Power & Voltage Measurements, Digital Storage Oscilloscope, Powerscope, Hall Effect transducers.

TIME MEASUREMENT TECHNIQUES: Time standards; Measurement of time interval between events, order of events, Very low time, period, phase, time constant measurements.

FREQUENCY MEASUREMENT TECHNIQUES: Frequency, ratio and product, high and low frequency measurements, Gating error, Time base error, Trigger level error, High frequency measurements.

INSTRUMENT CALIBRATION & MAINTENANCE: Process instrument calibration, Standards, Laboratories, Validation of standards laboratories, Primary reference standards, Procedure for calibration of plant instruments and master instruments, Types and procedure of maintenance.

Suggested Readings:

1. Electronic Instrumentation and Measurement, Bell, Oxford. (2007).
2. Electronic Instrumentation, H S Kalsi, TMH. (2012).
3. Electronic Measurements and Instrumentation, Lal Kishore, Pearson. (2010).
4. Elements of Electronic Instrumentation and Measurement, Carr, Pearson. (1996).
5. Instrumentation for Engineering Measurements, Dally, Pearson. (2003).

6. Digital Measurement Techniques, T. S. Rathore, Narosa Publishing House. (2003).
7. Monographs on System Design using Integrated Circuits, B. S. Sonde, Tata Mc-Graw Hill. (1992).
8. Digital Signal Processing, D. J. DeFatta, J. G. Lucas and W., J Wiley and Sons. (1987).
9. Student reference manual for Electronic and Instrumentation measurement, Wolf &Smith, PHI Publication. (2003).
10. Principles of measurement and instrumentation, Alan Morris, PHI. (1989).
11. Industrial instruments and control, S.K.Singh , TMH. (2008).
12. Instrumentation Devices and Systems, Rangan C. S., Sarma G. R. and Mani V. S. V., Tata McGraw-Hill Publishing Company Limited. (1997).
13. Measurement Systems, Doebelin E. O. and Manik D. N., Tata McGraw-Hill Publishing Company Limited. (1959).
14. Process Control Instrumentation Technology, Johnson C. D., Prentice Hall of India Private Limited. (2010).
15. Applied Instrumentation, W. G. Andrews- Vol II, Applied Instrumentation, W. G. Andrews- Vol III (1982).
16. Principles of Industrial Instrumentation and Control Systems, Cengage learning. (2011).

5EIC5 MICROPROCESSORS

L:-3 T:-0 M.M.-100

Introduction to computer architecture and organization, Architecture of 8-bit and 16-bit microprocessors, Bus configurations, CPU module.

Introduction to Assembly language and machine language programming, Instruction set of typical 8-bit and 16-bit microprocessor, subroutines and stacks programming exercise.

Timing diagrams, Memory families, Memory Interfacing, programmable peripheral interface chips.

Interfacing of input-output ports, programmable interval timer. Serial and parallel data transfer schemes, interrupts and interrupts service procedure.

Programmable interrupt controller. Programmed and interrupt driven data transfer.

Programmable DMA controller, UART. Programming the ports, Timers, serial interface, ADC interface, interrupt programming, programming exercise, Application.

Suggested Readings:

1. Microprocessors Architecture, Programming & Application, Ramesh S. Gaonkar, 5th Edition Penram International Publishing House (2009).
2. Microprocessors and Interfacing –Douglas V' Hall Tata McGraw Hill. (1974).
3. Advanced Microprocessors & Peripherals A K Ray & KM Bhurchandi.(2006).
4. The 8086 Microprocessor Programming & Interfacing the PC, Kenneth J. Ayala, Delman Publishers (2007).
5. The 8086 Family John Uffenbeck Pearson Edu. (2002).

5EIC6.1 OPTIMIZATION TECHNIQUES

L:-3 T:-0 M.M.-100

Introduction: Historical development, Engineering Application of optimization. Formulation of Design problems as a Mathematical Programming Problems, Classification of Optimization problems.

Classical Optimization using Differential Calculus: Single Variable and Multivariable Optimization with & without Constraints. Langrangian theory, Kuhn Tucker conditions.

Linear Programming: Simplex method, Two phase Method and Duality in Linear Programming.

Application of Linear Programming: Transportation and Assignment problems.

Non-linear Programming: Unconstrained Minimization: Unimodal function, Fibonacci, Golden Section and Quadratic Interpolation Methods, Univariate, Steepest Descent and Conjugate Gradient Method, Constrained Optimization: Penalty Function Methods.

Suggested Readings:

1. Engineering optimization: Theory and practice, Singiresu S Rao, New Age International Publishers.
2. Hiller and Lieberman, Introduction to operation Research (seventh Editionl), TMH 2010.
3. Prasad - Operations Research, Cengage learning 2011.
4. Ravindren Philips and Solberg, operation Research principles and Practice (Second Edition), Wiley 2007
5. Anderson - An introduction to management science, quantitative approaches to decision making, Cengage learning2012.

5EIC6.2 COMPUTER ORIENTED NUMERICAL & STATISTICAL METHODS

L:-3 T:-0 M.M.-100

Introduction: Historical development, Engineering Application of optimization. Formulation of Design Problem as a Mathematical Programming Problems, Classification of Optimization problems.

Classical Optimization using Differential Calculus: Single Variable and Multivariable Optimization with & without Constraints. Langrangian theory, Kuhn Tucker conditions.

Linear Programming: Simplex method, Two phase Method and Duality in Linear Programming.

Application of Linear Programming: Transportation and Assignment problem.

Non-linear Programming: Unconstrained Minimization: Unimodal function, Fibonacci, Golden Section and Quadratic Interpolation Methods, Univariat, Steepest Descent and Conjugate Gradient Method, Constrained Optimization: Penalty Function Methods.

Suggested Readings:

1. Numerical methods for Scientific and Engineering Computation by M.K.Jain, S.R.K.Iyengar, R.K. Jain. (2003)
2. Computer based numerical algorithms by E.V. Krishnamoorthy.(2004)
3. Introduction to Numerical Analysis by E. Atkinson. (1984).
4. Peebles, P. Probability, random variables and random signal principles. Mc Graw Hill. (2007).
5. Computer Oriented Numerical & Statistical Methods by Dr. Gokhroo & Others. (2012).
6. Elementary Numerical Analysis by Samuel D.Conte and Cart de Boor, McGraw Hill International Edition. (1910).
7. Numerical methods for Science and Engineering, PHI by R.G.Stanton. (1963).
8. Papoulis, A. Probability, random variables and stochastic processes. Mc Graw Hill (international Students' edition), Singapore. (2012).
9. Childers, D. G. Probability and random processes using MATLAB. Mc Graw Hill. (1997).
10. Smith, G. D. Numerical Solution of PDE, Oxford Uni. Press. (2002).
11. Numerical Analysis, Burden, Cengage learning. (2004).
12. Numerical Mathematics and Computing, Cheney, Cengage learning.(2005).

5EIC6.3 DIGITAL COMMUNICATION

L:-3 T:-0 M.M.-100

Digital Transmission of Analog Signals: Uniform and Non-uniform quantization. PCM and delta modulation, Signal to quantization noise ratio in PCM and delta modulation. DPCM, ADM, T1 Carrier System, Error probability in PCM system.

Base Band Transmission: Line coding (RZ, NRZ): Polar, Bipolar, Manchester, AMI. Inter symbol interference, Pulse shaping, Nyquist criterion, Raised cosine spectrum. Optimum transmit and receive filters. Matched filter detection.

Digital Modulation Techniques: Geometric interpretation of signals and Orthogonalization. ASK, BPSK, BFSK, QPSK, M-ary PSK, MSK and GMSK modulation techniques and Coherent detection of these techniques. Signal constellation and calculation of error probabilities.

Information Theory: Measure of Information, Average Information, Entropy, Information rate, Increase in Average information per bit by coding, Shannon's Theorem and Shannon's bound, Capacity of a Gaussian Channel, BW-S/N trade off.

Source & Error Control Coding: Coding and decoding of Information Source coding, Entropy coding, Hamming code, Single Parity- Bit Code, Linear Block code, Cyclic code & Convolutional code.

Suggested Readings:

1. Lathi, Modern Digital And Analog Communication Systems, Oxford Publication.(2002)
2. Taub & Schilling, Principles of Communication Systems, TMH.

3. Simon Haykin, An Introduction to Analog & Digital Communication System, Wiley. (2013).
4. Hwei Hsu, Schaums Outline Analog And Digital Communication, TMH. (2006).
5. Kennedy, Electronic Communication Systems, TMH. (2013).
6. K.Sam Shanmugam, Digital & Analog Communication Systems, Wiley. (2012).
7. Sklar, Digital Communication, Pearson Education. (2010).
8. J.G.Proakis, Digital Communication, McGraw –Hill. (2004).
9. Simon Haykin, Digital Communications, Wiley. (2008).
10. Ranjan Bose, Information Theory & Coding, TMH. (2011).

5EIC11 COMPUTER PROGRAMMING LAB-II

P:-3 **M.M.-75**

1. **Programs in C++**
   i) Palindrome Number. Also Generate prime numbers between 1 & given number.
   ii) Pyramid of stars using nested for loops. Also Reversed pyramid using for loops & decrement operator.
   iii) Write a program to find sum of all integers greater than 100 and less than 200 that are divisible by 7.
   iv) Write a program to perform the matrix operations. (Transpose, addition, subtraction, multiplication, Test of symmetry).
   v) To implement tower of Hanoi problem. Also Implement morse code to text conversion and vice-versa.
2. **Program in Java**
   i) Write a program to display a greet message according to Marks obtained by student.
   ii) Write a program to generate 5 Random nos. between 1 to 100, and it should not follow with decimal point.
   iii) Write a program to convert given no. of days into months and days.(Assume that each month is of 30 days)
   iv) Write a program to Display Invert Triangle using while loop.
   v) Implement spell checker using dictionary.

5EIC12 CONTROL LAB

P:-3 **M.M.-75**

1. To design I order system on R-C circuit and observe its response with the following inputs and trace the curve. (a) Step (b) Ramp (c) Impulse.
2. To design II order electrical network and study its transient response for step input and following cases:- (a) Under damped System (b) Over damped System (c) Critically damped System.
3. To Study the frequency response of following compensating networks, plot the graph and find out corner frequencies: - (a) Lag Network (b) Lead Network (c) Lag-lead Network.
4. To perform experiment on stepper motor (finding step angle and frequency response etc.)
5. To perform experiment on Potentiometer error detector.
6. To perform experiments on Position control system using dc servomotor.

7. a) To draw the error Vs angle characteristics of Synchro transmitter.
   b) To draw the characteristics of Synchro transmitter and control transformer.
8. To perform experiments on relay control system.
9. a) To find Transfer Function of a.c. servo motor.
   b) To draw Torque Speed Characteristics of a.c. servo motor.
10. a) To find Transfer Function of d.c. servo motor.
    b) To draw Torque Speed Characteristics of armature controlled d.c. servo motor.
11. To identify a system T.F. using its frequency response.
12. To perform experiments on magnetic levitation systems.

5EIC13 MICROPROCESSOR LAB

P:-2 **M.M.-75**

Following exercises are to be done in 8085 assembly language.

1. Arranging a set of data in Ascending order.
2. Arranging a set of data in Descending order.
3. Finding out number of Positive, Negative and Zeros from a Data Set.
4. Searching the Existence of a certain data in a given data.
5. BCD to Binary conversion.
6. Binary to BCD conversion.
7. Design a Up/Down Counter.
8. Multiply Two 8 Bit Numbers using Successive Addition and Shifting method.
9. Find Factorial of a number.
10. Solve the given Algebraic Equation.
11. Generate a Software Delay.
12. Division of 8 bit Unsigned Numbers.
13. A program to display real time clock. Assume a periodic signal is interrupting RST 7.5 signal after every 0.5 seconds.
14. Generate a square wave and rectangular wave of given frequency at the Output pin of 8255 chip.

5EIC14 TRANSDUCER LAB

P:-2 **M.M.-75**

1. To draw the characteristics of following temperature transducers: -
   (a)PT 100 (b) Thermistor (c) K Type Thermocouple
2. To perform experiment on ultrasonic depth meter.
3. Water level measurement kit:

a) To draw I/P vs O/P characteristics.
b) Study of water level indication.
c) To plot the curve between error and different measured water level.

4. Load Cell Kit:

a) To perform experiment and plot curve between load and strain.
b) To study about excitation.
c) To plot error curve at different loads.

5. To study Piezo electric vibration pickup.
6. LVDT Kit:

a) To study excitation and balancing network.
b) To study phase difference.
c) To plot curve between displacement and output voltage.

7. Torque measurement Kit:
a) To study about unbalanced strain.
b) To plot the curve between torque vs strain.

8. To draw characteristics of LDR.
9. To draw Characteristics of Hall effect sensor.
10. Design of Opto-coupler using photoelectric transducers.
11. To study various pressure sensors like Bourdon tube, Diaphragms, Pressure switches, Bellows etc.

5EIC15 PERSONALITY DEVELOPMENT AND GENERAL APTITUDE

P:-2 **M.M.-50**

1. To make students appreciate the notion and components of personality, thereby to apply the acquired information to themselves and to march towards brilliance in their respective academic and professional careers.
2. To enable students to keep themselves abreast of general knowledge and current affairs.
3. To bring out creativity and other latent talents with right goal setting so that self-esteem gets enhanced.
4. To sharpen memory skills and other study skills vital for academic and professional excellence.
5. To give training for positive thinking to keep the students in a good stead at the time of crisis.

1. Introduction

- Meaning of Personality
- Determinants of Personality- biological, psychological and socio-cultural factors.
- Misconceptions and clarifications
- Need for personality development

2. Self-Awareness and Self Motivation

- Self analysis through SWOT and Johari window
- Elements of motivation
- Seven rules of motivation
- Techniques and strategies for self motivation
- Motivation checklist and Goal setting based on principle of SMART
- Self motivation and life

3. Memory and Study Skills

- Definition and importance of memory
- Causes of forgetting
- How to forget (thought stopping), how to remember (techniques for improving memory)

- The technique of passing exams-management of examination fear.

4. Power of positive thinking

- Nurturing creativity, decision-making and problem solving.
- Thinking power- seven steps for dealing with doubt.
- Traits of positive thinkers and high achievers.
- Goals and techniques for positive thinking
- Enhancement of concentration through positive thinking
- Practicing a positive life style.

5. General Knowledge and Current Affairs

- Regional, national and international events
- Geographical, political and historical facts
- Information on sports and other recreational activities
- Basic knowledge with regard to health and health promotion

PRACTICAL TRAINING

The course would include the following practical exercises:

Brainstorming and simulation exercise.

Thought stopping.

Memory and study skill training.

Suggested Readings

1. Hurlock, E.B, Personality Development, 28th Reprint. New Delhi: Tata Mc Graw Hill. (2006).
2. Mikew, Martin, schinzinger, Ethics in engineering, TMH. (2010)

6EIC1 PROCESS CONTROL SYSTEM

L:-3 T:-1 M.M.-100

GENERAL CONCEPTS: General Concepts and terminology, Piping and Instrumentation diagram.

TYPES OF DYNAMIC PROCESS: Instantaneous, Integral, First and second order, self-regulating, interacting and non-interacting processes. Dead time elements.

MATHEMATICAL MODELING OF SYSTEMS: Liquid Systems (Level and flow), perturbation variable and linearization methods. Response of a thermometer bulb, Concentration response of a stirred tank. Temperature response of a stirred tank, Process lag, load disturbance and their effect on processes.

BASIC CONTROL ACTION: Basic control action, two position, multi position, continuous controller modes: proportional, integral and Derivative, Composite Controller modes PI, PD, PID, Integral wind up and anti-wind up.

Response of controllers for different test Input. Selection of control modes for processes like level, temperature and flow.

CONTROLLER TUNING METHODS: Evaluation criteria IAE, ISE, ITAE etc. process reaction curve method, continuous oscillation method, damped oscillation method, auto tuning.

FINAL CONTROL ELEMENTS: Pneumatic control value, construction details and types, value sizing, selection of control valves, Inherent and Installed characteristics valve actuators and positioners.

ADVANCED CONTROL SYSTEM: Cascade control, ratio control, feed forward control. Over-ride, split range and selective control. Multivariable process control, Interaction of control loops.

CASE STUDY: Distillation column, Basic features of composition control schemes. Control of overhead composition, Bottom composition and both product compositions, Location of sensing element, Control of columns with varying feed rates, Pressure control, Control of feed temperature and internal reflux control, boiler drum level control.

Suggested Readings:

1. Peter Harriott, "*Process Control*", Tata McGraw Hill, New Delhi, (1985).
2. Surekha Bhanot "Process control principals and applications", Oxford University press. (2007).
3. Principles of Industrial Instrumentation and Control Systems, Alavala, Cengage Learning (2004).
4. Process dynamics and Control, Sundaram, Cengage Learning (2005).

6EIC2 FIBER OPTICS & INSTRUMENTATION

L:-3 T:-1 M.M.-100

OPTICAL FIBER OVERVIEW: Introduction, Ray theory, Optical fibers: multimode, single mode, step index, graded index, plastic & glass fibers. Transmission Characteristics of Optical Fibers - Introduction, Attenuation, Material absorption loss, Fiber bend loss, scattering, Dispersion (intermodal & intramodal), Dispersion Shifted Fibers, Dispersion Compensating Fibers. Manufacturing of optical Fibers – preparation of optical fiber, Liquid phase techniques, Vapour phase depositions techniques.

OPTICAL FIBER SOURCES: Laser- Emission and absorption of radiation, Einstein relation, Absorption of radiation, Population inversion, Optical feedback, Threshold condition. Population inversion and threshold, working of three levels & four level laser. Basic idea of solid state, semiconductors, gas & liquid laser. Basic concept of Q-switching and mode locking. Light Emitting Diode - Structure, Material, Characteristics, Power & Efficiency.

OPTICAL DETECTORS & CONNECTION: Optical detection principles, quantum efficiency, Responsivity, PIN photo diode, Avalanche photo diodes, Noise in Detectors, Photo Diode Materials. Fiber Alignment, fiber splices, fiber connectors, expanded beam connectors, fiber couplers.

OPTICAL FIBER MEASUREMENTS: Measurements of Fiber Attenuation, Dispersion, Refractive Index Profile, Cut off Wave Length, Numerical Aperture & Diameter. Field measurement through optical time domain reflectometry (OTDR), Laser based systems for measurement of distance, Velocity, Holography.

OPTICAL FIBER APPLICATIONS: Wavelength division multiplexing, DWDM, active and passive components, optical sensors, optical amplifiers, public network applications, military, civil and industrial applications.

Suggested Readings:

1. J.M. Senior, Optical Fiber Communication: Principles and Practice, Pearson Education. (2013)
2. R.P. Khare, Fiber Optics & Optoelectronics, Oxford Publications. (2014)
3. Keiser G.: Optical Fiber Communication, TMH (2004)
4. J. Grovar Optical Communication System PHI (1999)
5. A.Ghatak & K.Thygarajan, Introduction to Fiber Optics, Cambridge University Press. (2006)
6. Joseph C Palais, Fiber Optics Communication, PHI. (2010)
7. Harold Kolimbris, Fiber Optics Communication, Pearson Education. (2009)
8. D. Anuradha, Optical Fiber and Laser, Principles and Applications, New Age. (2008)

6EIC3 INDUSTRIAL MEASUREMENTS

L:-3 T:-0 M.M.-100

TEMPERATURE MEASUREMENTS: Thermocouples, Resistance Temperature detectors, Thermistors, Radiation and optical pyrometers, Infrared pyrometers, Calibration of temperature sensors.

PRESSURE MEASUREMENTS: Electric pressure transducers: LVDT, strain guage, Capacitive pressure transducers, Piezo electric pressure transducers, Potentiometric pressure transducer, Low pressure measurement: McLeod gauge, Thermal conductivity: Thermocouple type, Differential pressure transmitters, Calibration of pressure gauge: Dead weight tester.

FLOW MEASUREMENTS: Orifice, Venturi, Flow nozzles and pitot tubes, Rotameters, Vortex flowmeters, Electromagnetic flow meters, Ultrasonic flow meter, thermal flow meter, Mass flow type meters, Shunt flow meters.

LEVEL MEASUREMENTS: Hydrostatic pressure type in open vessels and closed vessels, Differential pressure method, Electrical conductivity method, Capacitance type, Radioactive type, Ultrasonic type.

DENSITY MEASUREMENTS: Ultrasonic densitometer, radiation densitometer, Impulse wheel methods.

STRAIN MEASUREMENTS: Electrical strain gauges Wire & foil type materials, Adhesives configuration, Protective coatings, Bonding, Temp. compensation, Calibration, Rosette gauges.

RECORDER: Operating mechanism, Chart drive mechanism, Strip chart recorders, Circular chart recorders, X-Y type recorders, Magnetic tape recorders.

Suggested Readings:

1. Industrial Instrumentation, S K Singh, New Age. (2003).
2. Transducer and Instrumentation DVS Murty PHI Publication. (2004)
3. Electronic Measurements & Instrumentation, Oliver & Cage, TMH. 1971
4. Instruments Transducers, Neubert, Oxford. (1986)

5. Elements of Electronic Instrumentation & Measurements, Joseph J. Carr, Pearson. (2002)
6. Fundamentals of Instrumentation and Measurements, Dominique Placko, Wiley. (2013)
7. Instrumentation Devices & Systems. Rangan, Sarma & Mani, MVGraw Hill. (1997)
8. Industrial Instrumentation, Krishnaswamy .K,New Age. (2005)

6EIC4 BIOMEDICAL INSTRUMENTATION

L:-3 T:-0 M.M.-100

HUMAN BODY SUBSYSTEMS: Brief description of neural, muscular, cardiovascular and respiratory systems; their electrical, mechanical and chemical activities.

TRANSDUCERS AND ELECTRODES: Principles and classification of transducers for Bio-medical applications, Electrode theory, different types of electrodes, Selection criteria for transducers and electrodes.

BIOPOTENTIALS: Electrical activity of excitable cells, ENG, EMG, ECG, ERG, ECG. Neuron potential.

CARDIOVASCULAR SYSTEM MEASUREMENTS: Measurement of blood pressure, blood flow, cardiac output, cardiac rate, heart sounds, Electrocardiograph, phonocardiograph, Plethysmograph, Echocardiograph.

INSTRUMENTATION FOR CLINICAL LABORATORY: Measurement of pH value of blood, ESR measurement, hemoglobin measurement, O2 and CO2 concentration in blood, GSR measurement. Spectrophotomentry, chromatography, Hematology.

MEDICAL IMAGING: Diagnostic X-rays, CAT, MRI, thermography, ultrasonography, medical use of isotopes, endoscopy.

PATIENT CARE, BIOTELEMETRY AND SAFETY MEASURES: Elements of Intensive care monitoring basic hospital systems and components, physiological effects of electric current shock hazards from electrical equipment, safety measures, Standards & practices. Biomedical Telemetry: Introduction, block diagram and description of single channel/multi channel telemetry systems.

THERAPEUTIC AND PROSTHETIC DEVICES: Introduction to cardiac pacemakers, defibrillators, ventilators, muscle stimulators, diathermy, heart lung machine, Hemodialysis, Applications of Laser.

APPLICATIONS OF BIOPOTENTIALS: Electrocardiographic diagnostic criteria for Identification of cardiac disorders, Electrocardiographic pattern of ischemia, Atrial abnormalities, Ventricular enlargement, Abnormal ECG patterns, Clinical applications of EEG, EMG, ERG.

COMPUTER APPLICATIONS: data acquisition and processing, remote data recording and management. Real time computer applications.

Suggested Readings:

1. L. Cromwell, F. J. Weibell, and L. A. Pfeiffer, Biomedical Instrumentation and Measurements, Pearson Education, Delhi, (1990)
2. J. J. Carr and J. M. Brown, Introduction to Biomedical Equipment Technology, 4th ed., Pearson Education, Delhi, (2001)

1. Biomedical Instrumentation Systems, Chatterjee, Cengage learning 2011
2. Aston, "Principles of Biomedical Instrumentation and measurements", McGraw Hill publishing Co, 1990
3. L.A. Geddes and L.E. Baker, Principles of Applied Biomedical Instrumentation, John Wiley & Sons, Inc, 1989
4. Richard Aston, Principles of Biomedical Instrumentation and Measurement, Merrill Publishing Company,. 1990
5. Jacobson B. and Webster J.G., Medical Clinical Engineers, Prentice Hall Inc.,. 1979
6. J. G. Webster, Medical Instrumentation Application and Design, 3rd ed., John Wiley & Sons, N.Y., 1998
7. R. S. Khandpur, Handbook of Biomedical Instrumentation, 2nd ed., Tata McGraw Hill, 2003
8. R. Anandanatarajan, "Biomedical Instrumentation", PHI Learning, 2009

6EIC5 MICROCONTROLLERS & EMBEDDED SYSTEMS

L:-3 T:-0 M.M.-100

THE 8051 MICROCONTROLLER: Introduction, The 8051 microcontroller hardware, I/O pins, Ports, External memory, Counters and Timers, Serial data.

8051 ASSEMBLY LANGUAGE PROGRAMMING: Addressing modes, External data moves, Stack, Push and Pop opcodes, Logical operations, Byte level and bit level logical operations. Arithmetic operations, Jump and call instructions, Interrupts & returns.

REAL TIME CONTROL: Interrupts, Multiple sources of interrupts, Non maskable sources of interrupts, Interrupt structure in 8051, Timers, Free running counter & Real Time control.

SYSTEM DESIGN: Serial I/O interface, Parallel I/O ports interface, Digital and Analog interfacing methods, LED array, keyboard, Printer, Flash memory interfacing.

INTRODUCTION TO EMBEDED SYSTEM: Application of Microcontrollers in interfacing, MCU based measuring instruments. Real Time Operating System for System Design, Multitasking System, Task Definition in a Multitasking System, Round Robin Scheduling, Full Preemptive Scheduling, Basic study and Features of Commercial RTOS WINCE and Embedded Linux.

Suggested Readings:

1. Kenneth J.Ayala, "*The 8051 Micro controller*", Penram Interfacing Publishing, (1996)
2. Myke Predko, "Programming and Customizing the 8051 micro controller", Tata-McGraw Hill, 3rd reprint. (2002)
3. Rajkamal, "Embedded Systems" TMH (2004)
4. The 8051 Microcontrollers & Embedded Systems,Mazidi, ,PHI (2004)
5. David E. Simon, "An Embedded Software Primer", Pearson Education (1999)
6. The 8051 Microcontroller w/CD,_Ayala, Cengage learning (1999)
7. The 8051 Microcontroller & Embedded Systems using Assembly and C w/CD Ayala/Gadre, Cengage learning (2007)

8. Embedded Systems & Robots: Projects Using the 8051 Microcontroller, Ghoshal, Cengage learnin (2011)

6EIC6.1 CONTROL SYSTEM COMPONENTS

L:-3 T:-0 M.M.-100

Motors: Types, working principle, characteristic, and mathematical model of following: Motors AC/DC motors, stepper, servo, linear, Synchronous, Generators, and Alternator.

Types, working principle, characteristics, and symbolic representation of following: Switches: Toggle, Slide, DIP, Rotary, Thumbwheel, Selector, Limit, Proximity, Combinational switches, zero speed, belt sway, pull cord. Relays: Electromechanical, Solid state relays, relay packages Contactors: Comparison between relay & contactor, contactor size and ratings Timers: On Delay, Off delay and Retentive.

Sequencing & Interlocking for motors: Concept of sequencing & Interlocking, Standard symbols used for Electrical Wiring Diagram, Electrical Wiring diagrams for Starting, Stopping, Emergency shutdown, (Direct on line, star delta, soft starter) Protection devices for motors: Short circuit protection, Over load Protection, Over/ under voltage protection, Phase reversal Protection, high temperature and high current Protection, over speed, Reversing direction of rotation, Braking, Starting with variable speeds, Jogging/Inching Motor Control Center: Concept and wiring diagrams.

Pneumatic components: Pneumatic Power Supply and its components: Pneumatic relay (Bleed & Non bleed, Reverse & direct), Single acting & Double acting cylinder, Special cylinders: Cushion, Double rod, Tandem, Multiple position, Rotary Filter Regulator Lubricator (FRL), Pneumatic valves (direction controlled valves, flow control etc), Special types of valves like relief valve, pressure reducing etc. Hydraulic components: Hydraulic supply, Hydraulic pumps, Actuator (cylinder & motor), Hydraulic valves.

Suggested Readings:

1. B. L. Theraja, “A text book of Electrical Technology”, S. Chand & Company Ltd., IE - 09005 Control System Components Vol II First ed. 1959.
2. S. R. Majumdhar, “Pneumatic Systems”, Tata McGraw-Hill Publisher, 2009.
3. Meixner H and Sauer E, “Intro to Electro-Pneumatics”, Festo didactic, First ed. 1989.
4. Hasebrink J P and Kobler R, “Fundamentals of Pneumatic Control Engineering”, FestoDidactic: Esslinger(W Germany),1989.
5. Petruzella, “Industrial Electronics”, McGraw-Hill International First ed., 1996.

6EIC6.2 ROBOTICS

L:-3 T:-0 M.M.-100

Introduction: Basic concepts, definition and origin of robotics, different types of robots, robot classification, applications, robot specifications.

Introduction to automation: Components and subsystems, basic building block of automation, manipulator arms, wrists and end-effectors. Transmission elements: Hydraulic, pneumatic and electric drives. Gears, sensors, materials, user interface, machine vision, implications for robot design, controllers.

Kinematics, dynamics and control: Object location, three dimensional transformation matrices, inverse transformation, kinematics and path planning, Jacobian work envelope, manipulator dynamics, dynamic stabilization, position control and force control, present industrial robot control schemes.

Robot programming: Robot programming languages and systems, levels of programming robots, problems peculiar to robot programming, control of industrial robots using PLCs.

Automation and robots: Case studies, multiple robots, machine interface, robots in manufacturing and non-manufacturing applications, robot cell design, selection of a robot.

Suggested Readings:

1. Spong, M.W., Hutchinson, H., & Vidyasagar, M., "Robot Modeling and Control", John Wiley (Wiley India Ed.), (2006).
2. Asfahl C.R, "Robots and Manufacturing Automation", John Wiley & Sons, New York, (1992).
3. Klafter R.P, Chmiclewski T.A, Negin M, "Robotics Engineering: Integrated approach", Prentice Hall, New Jersey, (1994)
4. Mikell P, Weiss G.M, Nagel R.N and Odrey N.G, "Industrial Robotics", McGraw Hill, New York, (1986).
5. Deb S.R, Robotics Technology and Flexible Automation, Tata McGraw Hill, New Delhi, (1994).

6EIC6.3 RANDOM VARIABLES & STOCHASTIC PROCESSES

L:-3 T:-0 M.M.-100

PROBABILITY: Axioms of probability theory. Probability spaces. Joint and conditional probabilities. Bayes' Theorem-Independent events.

RANDOM VARIABLES: Introduction, Distribution and density functions, Discrete and continuous random variables, (Gaussian), Exponential, Rayleigh, Uniform, Bernoulli, Binominal, Poisson, discrete Uniform and conditional distributions.

MULTIPLE RANDOM VARIABLES: Distributions and densities. Functions of one and two random variables. Conditional distributions, conditional expected values, statistical independence. Independent random variables. Moments and characteristic functions. Inequalities of Chebyshev and Schwartz. Convergence concepts. Jointly Gaussian random variables, sums of random variable, Central limit theorem.

STOCHASTIC PROCESSES: Definitions, Random process concept, Statistics of stochastic processes: mean, autocorrelation, strict and wide sense stationary, random processes and Linear Systems.

STOCHASTIC PROCESSES IN FREQUENCY DOMAIN: Power spectrum of stochastic processes, Transmission over LTI systems, Gaussian and White processes, Properties of power spectral density.

Suggested Readings:

1. Probability, Random Variables And Stochastic Processes, Veerarajan, TMH (2002)
2. Stochastic Processes, 2ed, Ross, Wiley. (1996)
3. Devore – Probability and statistics for engineering and sciences, Cengage learning. (2011)
4. Mendenhall – Introduction to probability and statistics, Cengage learning. (2012)
5. Probability, Random Variables And Random Signal Principles, Peebles, TMH. (2002)
6. Probability Theory and Stochastic Processes for Engineers, Bhat, Pearson. (2011)
7. Probability and Random Processes with Application to Signal Processing, 3/e, Stark, Pearson. (2002)
8. Probability, Random Variables And Stochastic Processes, TMH (2002).
9. Random Processes: Filtering, Estimation and Detection, Ludeman, Wiley (2002).
10. An Introduction to Probability Theory & Its App., Feller, Wiley (1969).

6EIC11 MICROPROCESSOR & MICROCONTROLLER LAB

P:-3 **M.M.-75**

Following exercises are to be done in 8051 Assembly Language.

Simple programs

1. Add 'N' 8 Bit Numbers
2. Transfer Data from Code Memory to Internal Memory
3. Convert a given Hex number to BCD
4. Implement a Four Variable Boolean Function using K-Map Minimization.
5. Convert deg. Centigrade to deg. Fahrenheit

Complex programs

6. 16 bit Multiplication (use add and shift method)
7. Find Largest and Smallest Numbers among 10 Numbers.
8. Using Look up Table and DPTR as the Base find Square of a Number in the Accumulator
9. Implement a Mathematical Calculator which executes various Arithmetic operations based on the choice entered in register R4.

8051 Interfacing Programs

10. Interface LED Bank with 8051 to flash LED's using timer.
11. Interface Seven Segment Display with 8051.
12. Interface Stepper Motor with 8051 in Continuous and Step mode
13. Interface D/A converter with 8051.
14. Interface A/D converter MCP3204 with 8051 using SPI.

6EIC12 ELECTRONIC INSTRUMENTATION LAB

P:-3 **M.M.-75**

1. Measurement of following parameters of op-amp :
   a) Input impedance.
   b) Output impedance.
   c) Input & Output offset voltage.
   d) Input bias currents.
   e) Slew rate.
   f) Supply voltage rejection ratio (SVRR).
   g) Common mode rejection ratio (CMRR).
   h) Gain Bandwidth product.
   i) Power consumption.
   j) Transient response.

Study & make the following circuits on breadboard using op-amplifiers.

2. (a) Differentiator (b) Integrator
3. (a) Wein's Bridge Oscillator (b) RC Phase shift Oscillator
4. Following filters for first order response.
   a) High pass filter
   b) Low pass filter
   c) Notch filter
5. Wave generators
   a) Square wave generator
   b) Saw tooth Generator
6. Instrumentation amplifier.
7. A Comparator.
8. (a) Voltage to current converter. (b) Current to voltage converter.
9. Frequency divider
10. Study and make the following circuits on bread board using 555 timer & determine the o/p frequency and Duty cycle:
    a) Astable multivibrator
    b) Monostable multivibrator
    c) Bistable multivibrator

6EIC13 CONTROL SYSTEM SIMULATION LAB-I

P:-2 **M.M.-75**

1. Introduction to `MATLAB'. Computing control software, defining systems in TF, ZPK form.
2. Use of for, while loops in MATLAB programming.
3. (a). Plot step response a given TF and system in state-space. Take different valves of damping ratio and natural undamped frequency and observe the difference.
   (b). Plot ramp and impulse response for the same.
4. For a given 2nd order system write a program to obtain time response specifications maximum overshoot, peak time, settling time etc.
5. Write a program to check for the stability of a given closed loop system by
   a. Finding close loop poles
   b. using Routh's stability criterion.

6. Sketch the root locus for a given system and determine the system gain. Also simulate the same using MATLAB.
7. Sketch the Bode plot (actual and asymptotic) for a given system and analyze the stability. Also simulate the same using MATLAB and find the values of GM and PM for different values of gain.
8. Design of lead controller to satisfy given specifications using bode plot.
9. Use MATLAB to plot Nyquist plot for a given system and comment upon stability.
10. To design a PID controller for the given system to meet desired specifications. Observe the response using MATLAB.

6EIC14 PROCESS CONTROL LAB

P:-2 **M.M.-75**

1. To perform experiments on Linear system simulator.
2. To draw response of temperature controlled process for On/Off, P, PI, PID Controller.
3. Tuning of controllers on a pressure loop.
4. To study the design and application of Lag compensator circuits.
5. To study the design and application of Lead compensator circuit.
6. To study process simulator.
   (a) To perform experiments on P, PI, PD, PID controller with Process simulation.
   (b) To study the effect of loading the process.
7. To study the operation of linear & equal percentage type control valves and determine the Following: -
   a) Valve flow coefficient
   b) characteristics of control valve

c) Rangeability of control valves.

8. To perform experiments on Ratio Control Scheme and Cascade Control Scheme on liquid level and flow system.
9. To plot and analyze step/impulse response of a first order system in
   a) Non interacting mode
   b) Interacting mode.
10. (a) Study of basic logic operations, timer, counter, arithmetic operations in PLC.
    (b) Problem solving In PLC.
    (c) To perform experiments on PLC controlled process.

6EIC15 PROFESSIONAL ETHICS AND DISASTER MANAGEMENT

P:-2 **M.M.-50**

1. **Issues on ethics and values:**
   Moral and ethical values, classification of values, value system, deterioration of social values, social norms & social control.
2. **Profession, professionalism & ethics:**
   Professional responsibilities, competencies and expectations. Role of a professional, person, professional accountability and professional ethics.
3. **Ethics in engineering and disaster management:**
   Engineering professionals, role of engineers, technology & society, engineering as social experimentation, engineering ethics.

4. **Types of disasters:**
   Environmental, economic & social disasters; causes, impact and prevention, Case studies.
5. **Thoughts of ethics**

Suggested Readings:

1. Engineering Ethics: Concepts & Cases by Harris, Cengage Learning (2013)

7EIC1 NEURAL NETWORKS AND FUZZY LOGIC CONTROL

L:-3 T:-1 M.M.-100

NEUROPHYSIOLOGY: Introduction: Elementary neurophysiology - From neurons to ANNs - Neuron model McCulloch-Pitts model, Hebbian Hypothesis; limitations of single-layered neural networks.

APPLICATIONS OF NEURAL NETWORKS: Pattern classification, Associative memories, Optimization, Applications in Image Processing-Iris, finger print & face, Applications in decision making

THE PERCEPTRON: The Perceptron and its learning law. Classification of linearly separable patterns.

LINEAR NETWORKS: Adaline - the adaptive linear element. Linear regression. The Wiener-Hopf equation. The Least-Mean-Square (Widrow-Hoff) learning algorithm. Method of steepest descent. Adaline as a linear adaptive filter. A sequential regression algorithm.

MULTI-LAYER FEEDFORWARD NEURAL NETWORKS: Multi-Layer Perceptrons. Supervised Learning. Approximation and interpolation of functions. Back-Propagation Learning law. Fast training algorithms. Applications of multilayer perceptrons: Image coding, Paint-quality inspection, Nettalk.

FUZZY LOGIC- Introduction -Uncertainty & precision, Statistics and random process, Uncertainty in information, Fuzzy sets and membership. 3 MEMBERSHIP FUNCTIONS: Features of membership function. Standard forms and boundaries, Fuzzification, Membership value assignment – Intuition, Inference, Neural networks.

FUZZY TO CRISP CONVERSIONS: Maximum membership principle. **DEFUZZIFICATION METHODS**- Centroid method, Weighted average method, Meanmax membership.

FUZZY RULE BASED SYSTEMS: Natural language, linguistic hedges, Rule based system –Canonical rule forms, Decomposition of compound rules, Likelihood and truth qualification Aggregation of Fuzzy rules. Graphical techniques of reference.

FUZZY CONTROL SYSTEM- Simple Fuzzy Logic controller, General FLC, Control System Design Problem Control (Decision) Surface, Assumptions in a Fuzzy Control System Design ,Special forms of FLC system models, Industrial application: Aircraft Landing Control Problem

FUZZY ENGINEERING PROCESS CONTROL: Classical Feedback Control, Classical PID Control, Multi-input, Multi-output (MIMO) Control Systems, Fuzzy Statistical Process Control

Suggested Readings:

1. S.N. Sivanandam, S. Sumathi and S.N. Deepa -Introduction to Neural Networks using MATLAB 6.0, Tata McGraw-Hill, (2006)

2. Timothy J. Ross -Fuzzy Logic with Engineering Applications, Third Edition, (1995)
3. Artificial Neural Network,Robert Schalloff,TMH 1997
4. Fundamental Of Neural Network Architecture And Application,Laurene V. Fausett,Pearson 1993
5. Neural Network Algorithm And Programing Tech,James A Freeman,Pearson 1991
6. Neural N/W For Pattern Recognition,Cristopher, M.Bhishop,Oxford 1995
7. Fuzzy Neuro Approach To Agent Application,Lee ,Raymond S.T.,New Age 2008 6 Fuzzy Logic and Neural Networks: Basic Concept And Application,A Lavala, Chemakesava R.,New Age 2012

7EIC2 DIGITAL SIGNAL PROCESSING

L:-3 T:-1 M.M.-100

SAMPLING - Discrete time processing of Continuous-time signals, continuous time processing of discrete-time signals, 5 Changing the sampling rate using discrete-time processing.

TRANSFORM ANALYSIS OF LTI SYSTEMS - Introduction, The frequency response of LTI systems, System functions for systems characterized by LCCD (Linear Constant Coefficient Difference) equations, All-pass system, Minimum-Phase systems, Linear systems with linear phase.

STRUCTURES FOR DISCRETE-TIME SYSTEMS- Block diagram and signal flow graph representation of LCCD equations, 2 Basic structures for IIR and FIR systems, Transposed forms.

FILTER DESIGN TECHNIQUES - Introduction, Analog filter Design: Butterworth & Chebyshev, 3 IIR filter design by impulse invariance & Bilinear transformation, 2 Design of FIR filters by Windowing: Rectangular, Hanning, Hamming & Kaiser.

DFT, FFT- The Discrete Fourier transform (DFT), Properties of the DFT, Linear Convolution using DFT, 5 Efficient computation of the DFT: Decimation–in-Time and Decimation-in frequency FFT Algorithms.

Suggested Readings:

1. Proakis, Manolakis, “Digital Signal Processing: Principals, Algorithms And Applications”, 4th ed., Pearson Education. (2006)
2. Oppenheim, Schafer, “Discrete Time Signal Processing”, 3rd ed. , PHI (2010)
3. Digital Signal Processing: A Modern Introduction, Ambardar, cengage learning 2011
4. Introduction to Digital Signal Processing using MATLAB, Schilling 2011
5. Sanjit K Mitra, “Digital Signal Processing”, 4th ed., TMH 2013
6. Tan, Jiang, “Digital Signal Processing: Fundamentals and Applications”,2nd ed., Elsevier 2008
7. Ifeachor, Jervis, “Digital Signal Processing”, 2nd ed., Pearson Education 2009

7EIC3 DIGITAL IMAGE PROCESSING

L:-3 T:-0 M.M.-100

DIGITAL IMAGE FUNDAMENTALS: Image sensing and acquisition, Image sampling and quantization, Representing digital images, Spatial and gray-level resolution,

Spatial operations, Vector & matrix operations, Zooming and Shrinking of digital images. RGB and HSI Color models

BASIC IMAGE OPERATIONS: Intensity transformation functions, Histogram equalization, Spatial filtering for image smoothing, Image sharpening by first and second order derivatives, Image smoothing and sharpening using frequency domain filters

IMAGE RESTORATION: Image restoration model, Noise Models, Spatial and frequency properties of noise, noise probability density functions, Noise only- spatial filter, Mean, order Statistic and adaptive filters, Concepts of inverse and Wiener filtering

MORPHOLOGICAL IMAGE PROCESSING: Erosion and Dilation, Opening and closing, morphological algorithms for Boundary extraction, thinning, pruning, smoothing and thickening

IMAGE SEGMENTATION AND COMPRESSION: Edge based segmentation, Edge detection masks, Gradient operators, Thresholding, Region growing, Watershed transform, Fundamentals of image compression; Loss-less compression techniques; Lossy compression techniques, compression standards

Suggested Readings:

1. Gonzalez, Woods and Eddins, "Digital Image Processing", 3rd ed. , Pearson Education (2010)
2. Anil K Jain, "Fundamentals of Digital Image Processing", 4th ed., Prentice Hall (2010)
3. Tamal Bose, "Digital Signal and Image Processing", 3 rd ed. , John Wiley 2005
4. Sonaka, Hlavac and Boyle, "Image Processing, Analysis and Machine Vision", 3rd ed. , Cengage Learning 2013
5. Pratt, "Digital Image Processing", 4 th ed. , John Wiley 2001
6. Image Processing, Analysis, and Machine Vision, Sonka, cengage learning 2006

7EIC4 ANALYTICAL & ENVIRONMENTAL INSTRUMENTATION

L:-3 T:-0 M.M.-100

SPECTROSCOPIC ANALYSIS- Absorption and reflection techniques, Atomic techniques emission, absorption and fluorescence, X-ray spectroscopy, Photo acoustic spectroscopy, Microwave spectroscopy, Mass spectrometers.

GAS ANALYSIS - Infrared and ultraviolet absorption analyzers, Paramagnetic oxygen analyzers, Thermal conductivity analyzers and Chemiluminescence analyzers.

CHROMATOGRAPHY- Paper and thin layer chromatography. Basic parts of gas chromatography, Types of columns, Detection systems- thermal conductivity, Flame ionization, Electron capture detector. Types of liquid chromatography, Liquid chromatography, Column and detection systems.

ENVIRONMENTAL POLLUTION MONITORING- Air pollutants, Air pollution monitoring instruments- carbon mono oxide, sulpher dioxide, nitrogen oxide, hydro carbon & ozone. Smoke monitor, Dust monitor, Visible emission monitoring system.

LIQUID ANALYSIS- PH meter, Conductivity meter, Analyzers for measurement of ammonia, silica, sodium and dissolved oxygen.

Suggested Readings:

1. Instrumentation technology, Jones E.B., Newnes-Butterworths. 1974
2. Instrument Engineer's Hand Book, Process Meas. & Analysis, Bela G. Liptak, Butterworth-Heinemann Ltd. 1995
3. Mechanical & Industrial Measurements, Jain R.K., Khanna Publications 1988
4. Handbook of Analytical Instruments, Khandpur R.S., Tata McGraw Hill. 2006
5. Principles of instrumental Analysis, Douglas A Skoog, Cengage Leaning. 1998

7EIC5.1 INSTRUMENTATION IN INDUSTRIES

L:-3 T:-0 M.M.-100

PROCESS INDUSTRIES INSTRUMENTATION – Organisation for Instrument Engineering, Instrument department functions & responsibilities, Process industries instrumentation, Man power classifications, Power plant training in instrumentation, Standardisation of instrumentation, Specialised process plant instrumentation.

C&I IN CHEMICAL REACTORS – Classifications, Temperature Control Schemes, Reactor Temperature Control, Reactor Temperature Control with recirculation. Cascade Temperature Control with heating & cooling capability. Pressure Control Schemes – Reactor Pressure Control by modulating gas make up, Reactor Pressure Control by throttling flow of vent gas, Continuous Control of Reactor Pressure

C& I IN HEAT EXCHANGERS – Classifications. **Steam Heaters Control Schemes** – Feedback control of steam heated exchanger, Control valve in condensate line, Pumping traps, Steam trap replaced by level control, By pass control.

Condensers Control Schemes– Condenser on temperature control, Condenser on Pressure Control, Condenser control by changing the wetted surface area, Hot gas by-pass control.

Reboilers & Vaporizers Control Schemes – Temperature – Pressure cascade control loop on steam heater, Temperature- Flow cascade control loop on steam reboiler.

C&I IN EVAPORATORS, DRYERS AND PUMPS – Principles & Classifications, Control Schemes of Evaporators- Horizontal tube, Forced circulation, Short tube vertical, Falling film, Long tube vertical, Agitated film evaporators. **DRYERS**- Principles & classifications of dryers, Control of batch and continuous dryers,

PUMPS - Classification & Control schemes for pumps.

STEAM POWER PLANT INSTRUMENTATION – Selection of instrumentation, Power plant measurement (primary & secondary), Automatic control systems : Feed water control, Steam temperature control, Auxiliary control systems, Interlocks, Data logging & Computing equipments.

Suggested Readings

1. Instrument Engineer's Hand Book: Process Control, Bela G. Liptak, Chilton Book Co. Radnor, Pennsylvania. (1995)
2. Industrial Instrumentation, Krishnaswamy. K, New Age 2005
3. Fundaments Of Industrial Instrumentation And Process Control, Willium Dunn,TMH 2009
4. Process Systems Analysis and Control, Donald Coughanowr, TMH 2010
5. Process/Industrial Instruments and Control Hand Book, Gregory Mcmillan, TMH 2009
6. Process Control - Principles and Applications, Bhanot, Oxford 2008
7. Process Dynamics Control, Dale E. Seborg, Oxford 2010
8. Advanced Process Control: Beyond Single Loop Control, Cecil Smith, Oxford 2010
9. Instrument Engineer's Hand Book: Process Measurement & Analysis, Bela G. Liptak, Butterworth-Heinemann Ltd. 1995
10. Industrial Instrumentation, S K Singh, New Age 2010

7EIC6.1 MICROWAVE ENGINEERING

L:-3 T:-0 M.M.-100

INTRODUCTION - Introduction to Microwaves and their applications, Transit time effect. Rectangular Wave-guides: Solution of Wave equation modes in rectangular waveguides, Basic idea of TE and TM modes, TEM mode of propagation

MICROWAVE COMPONENTS - Theory and application of cavity resonators. Coupling to cavity, Q of Cavity resonators, Attenuators, Tees, Hybrid rings, Wave guide corners, Bends and twists, phase shifters, directional couplers, isolators, circulators.

MICROWAVE GENERATORS AND AMPLIFIERS - Theory of Velocity Modulation. Operation And Characteristics of Two-Cavity Klystron Amplifier, Reflex Klystron, TWT, Magnetrons.

MICROWAVE SOLID STATE DEVICES - Principle of working and applications of IMPATT diode; hot Carrier Diode, PIN Diode, Tunnel diode, Gun Diode, MASER amplifiers, CCD.

MICROWAVE MEASUREMENTS - Detection of Microwaves, Basic Methods of Measurement of Frequency, Power, Scattering Parameters, VSWR, Impedance.

Suggested Readings:

1. Microwave Engineering, Annapurna Das, Sisir Das, TMH. (2009) 2. Microwave Devices And Circuits, 3, Samuel Y. Liao,Pearson. (2006)
2. Foundations For Microwave Engineering – R.E. Collin, R.E. Collin, Wiley 2001
3. Microwave Engineering By, Pozar, Wiley 2009
4. Microwave Devices And Circuit Design, Ganesh Prasad Srivastava, Vijay Laxmi Gupta, PHI 2006
5. Microwave Semiconductor Devices, Roy Mitra, PHI 2003
6. Microwave Engineering, Raghuvanshi, cengage learning

7EIC6.2 ADVANCED MICROPROCESSORS

L:-3 T:-0 M.M.-100

The 8086 Microprocessor Family: 8086 ARCHITECTURE- Hardware specifications, Pins and signals, Internal data operations and Registers, Minimum and maximum mode, System Bus Timing, Linking and execution of Programs.

Software & Instruction Set: Assembly language programming: addressing mode and instructions of 8086, Strings, Procedures and Macros, 8086 interrupts. Assembler Directives and operators.

Analog Interfacing: A/D and D/A converter interfacing, keyboard and display interfacing, RS 232 & IEEE 488 communication standards. An 8086 based Process Control Systems

Digital Interfacing: Programmable parallel ports, Interfacing microprocessor to keyboard and alphanumeric displays, Memory interfacing and Decoding, DMA controller.

Multiprocessor Configurations: - Multiuser / Multi tasking operating system concepts, 8086 based Multiprocessor systems. Introduction and basic features of 286, 386, 486 & Pentium processors.

Suggested Readings:

1. A Nagoor Kani "Microprocessors and Microcontrollers" Mc Graw Hill Education 2ed. (2012)
2. Douglas V. Hall "Microprocessors and Interfacing Programming and Hardware" Tata Mc Graw Hill.(2000)
3. Ray & K. Bhurchandi. "Advanced Microprocessors and Peripherals. Tata Mc Graw Hill, 2012
4. A Nagoor Kani "Microprocessors and Microcontrollers" Mc Graw Hill Education 2ed. 2012
5. Introduction to Microprocessors, A. P. Mathur Mc Graw Hill 2011
6. The Intel Family of Microprocessors: Hardware and Software Principles and Applications, Antonakos, cengage learning 2012
7. The 8086 Microprocessor: Programming & Interfacing the PC, Ayala, cengage learning2007

7EI6.3A ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS

L:-3 T:-0 M.M.-100

Introduction to Artificial Intelligence: Intelligent Agents, State Space Search, Uninformed Search, Informed Search, Two Players Games, Constraint Satisfaction Problems.

Knowledge Representation: Knowledge Representation And Logic, Interface in Propositional Logic, First Order Logic, Reasoning Using First Order Logic, Resolution in FOPL

KNOWLEDGE ORGANIZATION: Rule based System, Semantic Net, Reasoning in Semantic Net Frames, Planning

KNOWLEDGE SYSTEMS: Rule Based Expert System, Reasoning with Uncertainty, Fuzzy Reasoning

KNOWLEDGE ACQUISITION: Introduction to Learning, Rule Induction and Decision Trees, Learning Using neural Networks, Probabilistic Learning Natural Language Processing

Suggested Readings:

1. Elaine Rich and Kevin Knight, Artificial Intelligence 3/e, TMH (1991)
2. Padhy: Artificial Intelligence & Intelligent Systems, Oxford (2005)
3. 1 James A Anderson, An introduction to Neural Networks. Bradford Books 1995
4. Dan. W Patterson, Artificial Intelligence and Expert Systems, PHI 1990
5. Kumar Satish, "Neural Networks" Tata Mc Graw Hill 2004
6. S. Rajsekaran & G.A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications" Prentice Hall of India. 2006
7. Siman Haykin,"Neural Netowrks" Prentice Hall of India 1990
8. Artificial Intelligence, Kaushik, cengage learning

7EIC11 CONTROL SYSTEMS SIMULATION LAB II

P:-3 **M.M.-75**

The Lab work includes exercises based on following in MATLAB

1. Representation of a system in State Space, Conversion from TF to State Space, Discretizing the given Continuous Time System.
1 Representing the System in various Canonical Forms,
2 Diagonalization, Finding Eigen values, Eigenvectors
3 Computation of State Transition Matrix
4 Plotting State Responses for given inputs.
5 Check for Controllability, Observability of the System.
6 Pole placement design using state feedback.
7 Design Full Order Observer to Estimate States for the given System
8 Design Reduced Order Observer for the given System
9 Using Combined Estimator and Control Law Plot the Response for the given System
10 Simulate different systems for plotting responses in SIMULINK.

7EIC12 ANALYTICAL INSTRUMENTATION LAB

P:-2 **M.M.-75**

1. To measure pH value of given solution using pH meter.
2. To determine suspended particular matter using right volume air samples.
2. Find out concentration of (Na or K) by flame photo meter in the given sample.
3. To measure transmittance and absorption of a solution using Single beam spectro photo meter.
4. To study water analysis kit & measure pH, temperature, conductivity, dissolved O2 of a given solution.
5. To measure the conductivity of solution indicator controller.
6. To study the analysis of flue gases.

7. To study ion selective electrode.
8. To study pH monitor and controller.
9. To study silica analyzer and zirconia based oxygen analyzer.
10. To study gas/ liquid chromatograph.

7EIC13 INDUSTRIAL ECONOMICS & MANAGEMENT

P:-2 **M.M.-50**

1. Framework of industrial economics – organizational forms and alternative motives of the firm, industrial efficiency, theory of profitability, market structure, principles of costing.
2. Approaches to industrial location analysis, Productivity analysis, Input-Output analysis, Concentration of economic power. New Industrial Policy – Critical analysis, Role of technology and entrepreneurship in industrial development.
3. Industrial project appraisal- classification of industries, industrial legislations in India, recent trends in MNCs, LPG, FDI &joint ventures, methods of project evaluation-NPV,CBA,IRR, break-even analysis.
4. Management – Principles of management, functions of management planning, organizing, staffing, directing, controlling, co-ordinating, decision making
5. Emerging issues – Total quality management, JIT, quality circle, KANBAN, benchmarking, six sigma, quality management, ,ISO 9000, ISO 14000 , Customer relationship management(CRM) .

Suggested Readings:

1. Subburay, Total quality management, TMH. (2011)
2. Barthwal R.R- industrial economics. wiley eastern limited
3. Tirole jean – the theory of industrial organization. MIT PRESS
4. Ahluwalia I.J – industrial growth in india . Oxford university press
5. Divine P.J and R.M jones et Al- an introduction In industrial economics .George allen &Unwin limited London.
6. Peter F. drucker – principles and practice of management. Prentice hall ltd .

7EIC14 Practical Training

P:-3 **M.M.-150**

8EIC1.1 INDUSTRIAL ELECTRONICS

L:-3 T:-0 **M.M.-100**

SEMICONDUCTOR POWER DEVICES - Basic characteristics & working of Power Diodes, Diac, SCR, Triac, Power Transistor, MOSFETs, IGBT, and GTO

RECTIFIERS & INVERTERS - Working principles of single and three phase bridge rectifiers, Voltage and current source inverters

POWER SUPPLIES: Principle of operation of choppers. Step up, Step down and reversible choppers. High frequency electronic ballast, Switch Mode Power Supply: Fly

back converter, forward/buck converter, Boost converter and buck-boost converter. Uninterruptible Power Supply.

MOTOR CONTROL: Introduction to speed control of DC motors using phase controlled converters and choppers, Basic idea of speed control of three phase induction motors using voltage and frequency control methods.

Stepper Motors: Variable reluctance, Permanent magnet and hybrid stepper motors. Induction and dielectric heating control.

Suggested Readings:

1. Power Electronics Principles & Applications, Joseph Vithayathil, TMH , (2010).
2. Power Electronics, Ravish Singh, TMH, (2012).
3. Industrial Electronics and Control, Ttti, TMH 2001
4. Power Electronics: Converters Applications., Mohan, Robbins, Wiley 1995
5. Power Electronics, Moorthi, Oxford 2005
6. Elements of Power Electronics, Krein, Oxford 1998
7. Power Electronics, R.S.Murthy, Pearson 2012
8. Power Electronics: Circuits, Devices and Applications

8EIC2.1 NONLINEAR CONTROL SYSTEMS

L:-3 T:-0 M.M.-100

Introduction: Nonlinear Control, Common Nonlinearities in Control systems, Points of Differences in Linear and Nonlinear System Behavior,

Phase Plane Analysis: Phase Portraits, Singular Points, Construction of Phase Portraits, Method of Isoclines, Symmetry in Phase Portraits, Jump Resonance, Limit Cycles, Existence of Limit Cycles, Poincare-Bendixson Theorem

Describing Function Fundamentals: Describing Functions of Common Nonlinearities-computing describing functions, describing functions of common nonlinearities- describing functions analysis of non linear systems-stability analysis.

Fundamentals of Lyapunov Theory: Nonlinear Systems and Equilibrium Points, Concepts of Stability, Linearization and Local Stability, Lyapunov's Direct Method, Equilibrium Point Theorems, Krasovskii's method- variable gradient method

Nonlinear Control System Design: Feedback Linearization and the Canonical Form, Input State Linearization, Input-Output Linearization, Gain Scheduling, Sliding Control, Model Reference Adaptive Control.

Suggested Readings:

1. Jean-Jacques E. Slotine, "Applied Nonlinear Control", Prentice Hall Englewood Cliffs, New Jersey, (1991).
2. Vidyasagar. M, "Nonlinear System Analysis", Prentice Hall Englewood Cliffs, New Jersy, 1978
3. M. Gopal "Digital Control & State variable Methods", Tata-Mc-Grew hills 2003

8EIC3.1 DISTRIBUTED CONTROL SYSTEM

L:-3 T:-0 M.M.-100

INTRODUCTION- Hierarchical organization for a process computer control and computer system structure for a manufacturing complex. Centralized and distributed control concept. Lower level and higher level computer tasks and duties. Functional requirement of DPCS. Aims of plant automation and distributed computer control systems and subsystems. DPCS system configuration and integration with PLCs and computers.

ARCHITECTURE- Overviews of DPCS, systems architectures, data base organization. DPCS elements, comparison of different DPCS systems, state of the art in DPCS, configuration of control unit, different cards (I/O, O/P , Memory , PLC etc) system implementation concepts, work stations and its key – functions and function chart.

DCS DISPLAYS- Standard and user defined displays, continuous process display, Ground display, overview display, detail display, graphic display, trend display, loop display, alarm summary display, annunciator display, batch/ sequence display, tuning display, tuning panel, instrument faceplate.

DATA COMMUNICATIONS LINKS AND PROTOCOL - Communication Hierarchy (point to point to field bus) Network requirements, ISO reference model. Transmission media, network topologies, internetworking, data transmission, bus access methods, error handling Field buses, MAP and TOP Protocols. Features and capabilities of various field buses. FB standardization, comparison of MODBUS, PROFIBUS and FIPBUS, HART protocol, IEEE project 1002 on LAN implementation.

DCS CONTROL FUNCTIONS- control unit, sequential control, system maintenances, utility, switch instrument, batch system builder, graphic builder, feedback control builder, security, and process reporting function.

Suggested Readings:

1. John.W. Webb Ronald A Reis, “Programmable Logic Controllers - Principles and Applications”, 4th Edition, Prentice Hall Inc., New Jersey. 1998
2. Lukcas M.P, “Distributed Control Systems”, Van Nostrand Reinhold Co., New York. 1986
3. 1 Frank D. Petruzella, “Programmable Logic Controllers”, 2nd Edition, McGraw Hill, New York. 1997
4. 2 Deshpande P.B and Ash R.H, “Elements of Process Control Applications”, ISA Press, New York. 1995
5. 3 Curtis D. Johnson, “Process Control Instrumentation Technology”, 7th Edition, Prentice Hall, New Delhi, 2002
6. 4 Krishna Kant, “Computer-based Industrial Control”, Prentice Hall, New Delhi, 1997
7. Process/Industrial Instruments and Control Hand Book, Gregory Mcmillan, TMH. 2009
8. Process Control - Principles And Applications, Bhanot, Oxford. 2008
9. Process Dynamics Control ,Dale E. Seborg, Oxford. 1994
10. Advanced Process Control: Beyond Single Loop Control, Cecil Smith, Oxford. 2010

8EIC4.1 WIRELESS COMMUNICATION

L:-3 T:-0 M.M.-100

Radar Fundamentals - Basic Radar System, Accuracy & Resolution, Radar Range Equitation, Radar Display, Radar Classifications, Basic Block Diagram of CW Radar, FM CW Radar, Moving Target Indicator Radar, Pulse Doppler Radar & Tracking Radar, Range & Velocity Resolution of Radar

Propagation Phenomena - Fundamentals of fading, Multipath channels, Fresnel zone clearance, bending of radio beam, Effective earth radius, Spread Spectrum signals: Direct-sequence spread spectrum signals, p-n sequences, Frequency hopped spread spectrum signals, Code-division multiplexing.

Multiple Access Techniques - FDMA, TDMA and CDMA with reference to mobile radio and satellite systems. TDMA based networks, OFDM and its characteristics, Packet radio multiple access techniques. CDMA based networks: Architecture, Air interface, Call processing, power control, Rake receiver concept and performance of CDMA system.

Cellular Wireless Networks-, GSM: Introduction, overview of the GSM systems, GSM codec, channel coding and interleaving, radio like control. Cordless systems and WLL, Mobile IP, Wireless access protocol. Wireless LAN's: Technology, IEEE 1002.11 standards, Broadband Wireless 1002.16, Blue tooth, Wi-Fi, WiMax, Zigbee & RFID technology.

Satellite Communication - Elements of satellite communication: Frequency bands, Transmission and Multiple access. Satellite orbit and description- orbital period and velocity, effects of orbital inclination, Azimuth and elevation, Coverage angle and slant range, Satellite Link: basic link analysis, Geostationary orbit, Satellite description. Earth Station antenna, high-power amplifier, low-noise amplifier, up converter, down converter, monitoring and control, reliability.

Suggested Readings:

1. William Stallings, Wireless Communication and Networks, Pearson Education (2013)
2. Rappaport, T.S., Wireless Communications, Pearson Education (2013)

REFERENCE Books:

1. Gottapu Sasibhushana Rao, Mobile Cellular Communications, Pearson Education 2013
2. Singal, T.L, Wireless Communication, Tata McGraw Hill 2011
3. Vijay Kr. Garg, Wireless Communications and Networking, Morgan Kaufmann, Elsevier 2013
4. Blake, Wireless Communication Technology, Cengage Learning 2013
5. W.C.Y. Lee , Mobile Cellular Telecommunications , Tata McGraw Hill 2011
6. Wireless Communications and Networking, Price, TMH 2014
7. Pratt, Bostain, Satellite Communications, Wiley India 2011
8. Mark Zhuang, Wireless Communications and Networking, Prentice Hall of India 2003

9. Simon Haykin, Modern Wireless Communications, Pearson Education 2005
10. Price, Fundamentals of Wireless Networking, Tata McGraw Hill 2012

8EIC4.2 MEMS and Nano Technology

L:-3 T:-0 M.M.-100

Introduction to Nanoelectronics: Top Down and Bottom UP Approach, Nanotechnology Potentials, Idea of band structure – Metals, Insulators and Semiconductors. Effect of crystal size on density of states and band gap, Electronic structure of nanoparticles. Nanostructured crystals, Size and dimensionality effects – Single electron tunneling – Applications – Superconductivity, Graphenes and CNT.

Nano Fabrication and Patterning Techniques: Si processing methods, Cleaning/etching, Oxidation, Gettering, doping, Epitaxy. CVD & MOCVD, Physical Vapor Deposition (PVD), Liquid Phase Techniques, Self assembly and catalysis. Etching: Wet and Dry, Nanolithography, Nanoimprinting, XRay Lithography(XRL), Particle beam lithography(e-beam, FIB, shadow mask evaporation),

General Characterization Techniques: X- Ray Diffraction studies – Bragg's law – particle size – Scherrer's equation, Infrared Spectroscopy of Semiconductors, Raman Spectroscopy, Dynamic Light Scattering (DLS), NMR Spectroscopy, ESR Spectroscopy. photo electron spectroscopy(XPS)- SEM, TEM, STM, Atomic force microscopy(AFM).

Electrical, Magnetic, Mechanical and Optical Properties and Applications: Electronic and electrical properties -One dimensional systems-Metallic nanowires, Quantum dots -Two dimensional systems - Quantum wells. Magnetic properties - Transport in a magnetic field. Mechanical properties, Optical properties, Evolving interfaces of Nano in NanoBiology, Nano Sensors and Nanomedicines

MEMS and Microsystems: Evolution of Micro Fabrication – Micro Systems and Microelectronics. Application of MEMS in Various Fields. Introduction – Substrate and Wafer, Active Substrate Material. Silicon as a substrate material, MEMS packaging. Case study on pressure sensor with packaging.

Suggested Readings

1. Nano Essentials, T Pradeep, Mc Graw Hill, (2008).
2. Nanotechnology-Enabled Sensors, Kourosh Kalantar-zadehand Benjamin Fry, Springer, (2007).

REFERENCE BOOKs

1. 1 Fundamental of Nanoelectronics, George W. Hanson, Pearson 2009
2. 2 Principal of Nanotechnology, G. A. Mansoori, Wiley 2005
3. 3 Mems and Micro Systems, Mahalik, TMH 2007
4. 4 MEMS, Gabriel, Wiley 2006
5. 5 MEMS, A.R. Jha, CRC 2008
6. Nano Fabrication, CRC 2012
7. MEMS & Microsystems, Design and Manufacture, Tai-Ran HSU, TMH 2013

8EIC4.3 COMPUTER NETWORKS

L:-3 T:-0 M.M.-100

Queuing Theory- Pure birth, Pure death & Birth-death processes, Mathematical models for M/M/1, M/M/∞, M/M/m, M/M/1/K and M/M/m/m queues. Little's formula.

Physical and Data link layer – OSI model & TCP/IP reference models, Line coding schemes, Packet & Circuit switching, Virtual circuit network, Framing, Simplex protocol, Simplex stop & wait protocol, Sliding window protocol, Go back N protocol, selective repeat, HDLC, PPP

MAC Sublayer- Static & dynamic channel allocation, Multiple Access Protocols: ALOHA, slotted ALOHA, CSMA, Token Bus, Token Ring, FDDI. IEEE standards 1002.3 & 1002.5, Virtual circuit network: frame relay & ATM frame and protocol architecture, Network connection devices: Hubs, Bridges, switches, Routers and Gateways

Network Layer- IPv4 & IPv6 addressing and datagram, Internetworking, Non-adaptive & Adaptive routing algorithms, Distance vector routing and Link state routing algorithms, OSPF and BGP

Transport and Application Layer- Client server paradigm, TCP frame format, Data traffic descriptors, QoS, Congestion and its control algorithms, Improving QoS by different queuing schemes, leaky bucket and token bucket implementation, Domain name, DNS in the internet, SMTP, FTP, WWW, HTTP

Text Book:

1. Forouzan, "Data Communications and Networks", 5th ed., Mcgraw-Hill, (2006).

REFERENCE BOOKS:

1. Tanenbaum, "Computer Network", 5th ed., Pearson Education 2012
2. Leon Garcia, Widjaja, "Communication Networks', 2nd ed., Mcgraw-Hill 2003
3. Stallings, "Data and Computer Communications", 10th ed., Pearson Education 2013 4 Bertsekas, Gallager, "Data Networks", 2nd ed., PHI 1992
4. Computer Networks, Dave, cengage learning 2003
5. Fundamentals of Networking and Data Communications, White, cengage learning 2013

8EC5A INDUSTRIAL ELECTRONICS LAB

1. Study the characteristics of SCR and observe the terminal configuration, Measure the breakdown voltage, latching and holding current. Plot V-I characteristics.
2. Perform experiment on triggering circuits for SCR. i.e. R-triggering, R-C triggering and UJT triggering circuit.
3. Study and test AC voltage regulators using triac, antiparallel thyristors and triac & diac.
4. Study and obtain the waveforms for single-phase bridge converter.
5. Perform experiment on single phase PWM inverter.

6. Perform experiment on buck, boost and buck-boost regulators.
7. Control speed of a dc motor using a chopper and plot armature voltage versus speed characteristic.
8. Control speed of a single-phase induction motor using single phase AC voltage regulator.
9. i) Study single-phase dual converter. ii) (ii) Study speed control of dc motor using single-phase dual converter.
10. Study single-phase cycloconverter.
11. Perform experiment on Motor control – open loop & closed loop.
12. Design, observe and perform experiment on various type of pulse generation from DSP/ FPGA Platform. Perform experiment for PWM inverters and choppers.

8EI6A REAL TIME CONTROL SYSTEM LAB

1 Characteristics of control valve

2 Closed loop response of flow control loop.

3 Closed loop response of level control loop

4 Closed loop response of temperature control loop

5 Operation of on-off controlled thermal process. Response of on-off controller

6 Response of P+I+D controller. Tuning of PID controller

7 Measurement & Control of level using PID.

8 Measurement & Control of flow using PID

9 Measurement & Control of pressure using PID.

10 Measurement & Control of flow using PLC.

11 Measurement & Control of level using PLC.

12 Measurement & Control of pressure using PLC.

13 Measurement & Control of temperature using PLC.

14 Using SCADA for process control:

• preparation of process graphics

• tagging trends

• reporting

• Process monitoring and control.

15 Study of Communication and Configuration of HART Field Devices:

• Communicate with HART device

• Re-ranging of HART Field Devices

• Basic setup of HART Device

• Detailed setup of HART Device

16 Study of Process Calibrator:

• Test & Calibration of Process Indicators & Controllers using

• Resistance, RTD, Thermocouple

• mili Volts, 4-20 mA,

• Frequency & Volt

• Error calculation.

17 Study of Thermal Imager: Non-contact type temperature measurement of Process, Machines, Material etc.

18 Study of Vibration Analyzer: Measurement and Analysis of vibration in electrical and mechanical machines.

19 Familiarization with the Instrumentation and Process Control Training System (IAFLTP):Process Workstation, Instrumentation Workstation, PID Controller, ON/OFF Controller, Programmable Logic Controller, Signal Isolator, Flow Meter, Level Transmitter, Temperature Sensor, Emergency Push-Button, Pneumatic Unit, Trend Recorder, Pressure Gauge, Pressure Transmitter, Pneumatic Control Valve, Accessories, Basic Setup.

20 I.S.A. Standard and Instrument Symbols. Introduction to Measurement, Measuring Instruments.

21 Study of Interacting systems and Non-interacting systems.

8EI7A APPLIED INSTRUMENTATION LAB

1. Measurement of optical power attenuation and numerical aperture in a plastic optical fiber.

2. Study and measurement of losses in optical fiber.

3. Measurements of various amplitudes and time intervals between each segment of ECG, Measurement of R-R interval and calculation of Heart Rate.

4. Determination of Heart Axis by measuring QRS amplitude in the different leads (Lead I, Lead II and Lead III) and Plotting Einthoven Triangle.

5. Measurement of Heart rate variability (HRV) and analysis using time and frequency based approach.

6. Recording of blood pressure using sphygmomanometer & stethoscope and relate with heart rate.

7 Recording of the EMG Signal for different stress on the muscle.

8 To find out various lung capacity measurements using pneumotachograph.

9 Study of EEG Signal, to measure the amplitude, frequency & nature of EEG.

10 Design of an instrumentation amplifier for amplification of the low level ECG signals for gain 1000 and CMRR >100 dB and flat frequency response from 4 to 40 Hz.