EI- 801 – OPTICAL INSTRUMENTS AND SENSORS

UNIT-I

Introduction to vector nature of light, Propagation of light, Propagation of light in a cylindrical dielectric rod, ray model, wave model. Theory of image formation, Review of aberration, Comma, acclamation, distortion, Chromative aberration, Osages

UNIT-II

Different types of optical fibers, model analysis of a step index fiber. Signal degradation on optical fiber due to dispersion and attenuation.

UNIT-III

Optical fiber in instrumentation use of optical fibers as sensors, modulation techniques for sensors fiber optic power measurement. Stabilized calibrated light sources end-to-end measurement of fiber losses, optical signal processing.

UNIT-IV

Optical power meters, optical attenuators, optical spectrum analyzer, optical switching & logic gate and measurement techniques like optical time domain reflectometry, (OTDR), attenuation measurements

UNIT-V

Optical Sources & detectors: LED and LASERS, photo detectors, pin detectors detector responsitivity – noise, optical receivers. Integrated optical devices

References:

1. An Introduction to Fiber Optics by Cherin
2. Optical fiber – System Technology, design and applications by C.K. Rao
3. Optical Fiber Sensors, Vol.12 by Culshaw B. and Dakin J. (Ed.), Arctech House
4. Fundamentals of Fiber Optics in Telecommunications and sensor, by B.P. Pal, Wiley Eastern
5. Optical Fiber Communication by G. Kelser, McGraw Hill
6. Liu- Principles & Application of Optical Communication 1st ed., TMH
7. Ghatak- Optics 4th ed., TMH
8. Keiser- Optical Fiber Communication 4th ed., TMH

LIST OF EXPERIMENTS

Optical Instrumentation and Sensors

1. Setting up Fiber Optic Analog Link and Digital Link
2. Study of Intensity Modulation Technique using Analog input signal
3. Pulse Width Modulation in Fiber Optic Link.
4. Measurement of propagation or attenuation loss in optical fiber.
5. Measurement of bending loss in optical fiber.
6. Numerical Aperture (NA) of the fiber.
7. Study of Diffraction gratings.
8. Study of Michelson Interferometer.
9. Study of Reflection Holography.
10. Study of Transmission Holography

EI-802 SAFETY AND RELIABILITY ENGINEERING

UNIT-I

Reliability and safety definitions, Risk factor, Classification of failures and protective measures. Safety measurement, Preliminary hazard analysis, Subsystem fault hazard analysis, Common mode failures, codes and standards for safety.

UNIT-II

Reliability improvement

Redundancy element, Unit, and stand by optimization-cost trade off- Fault tree analysis-Constructions of

Fault tree-Calculations of reliability from fault tree-reliability allocation-evaluation of reliability-test-O.C. curve specifying reliability acceptance test.

UNIT-III

Definition of Quality-Quality control design-Product development cycle-Quality planning of manufacturing process-Process selection and control-Inspection and testing-Quality audit-Organizing for quality-Quality function-Quality engineering and quality control-Typical organization for quality : Small scale, Medium scale and Large scale organization.

UNIT-IV

Distribution, Markov modeling, Stress-strength approach to reliability design, Relationship between MTBF, hazard rate, failure rate, reliability.

UNIT-V

Redundancy techniques, examples from Electrical, Nuclear, Chemical and Process Engineering, Elementary Analysis and Estimation techniques.

References:

Jurian J.M., "Quality V Control Handbook", McGraw Hill.
Grant E.L., & Levenworth, "Statistical Quality Control", McGraw Hill.
Geedenko B.V., "Mathematical Methods of Reliability Theory", Academic.
Mann, Schafer R.E., & Singapurvala N.D., "Mehods for Statistical Analysis of Reliability and Life Date"
Reigenbaum V., "Total Quality Control", McGraw Hill.
Trylot J.R., "Quality Control Systems-Procedures for Planning Quality Programs".

EI- 803A– SIMULATION & MODELING

UNIT-I

Introduction: objectives of modeling, System theory and state variables Type of Model: Analytic, Simulation, Measurement, Analytic Modeling, Probability theory,
Random variables, Poisson process, Markov chains.

UNIT-II

Queuing Theory: Little's Law, M/M/1, M/M/1/k, M/M/C, queuing Models, M/G/1 [Impact variation in service times]

UNIT-III

Petrinets: Stochastic Petrinets[SPN],GSPN.

UNIT-IV

Simulation Modeling: Continuous and discrete event Simulation, Monte carlo Simulation, Pseudo random number generation, Non uniform Random variable Generation, Simulation Languages Features: Simpack, GPSS, GASP IV,CSIM, Estimation of Simulation Outputs/Output Matrix, confidence Intervals, Regenerative Simulation, Method of Batch Means.

UNIT-V

Case Studies: Analytic Vs Simulation Models, Application to Operating Systems, Data bases, Networks Architectures.

References:

P.A. Fishwick Getting started with simulation programming in C & C++. A. Narsingh Deo, Simulation with digi9tal computer.

EI- 803B – EMBEDDED SYSTEMS

UNIT-I

8 Bit Micro controllers: Introduction to MCS-51 family, Peripheral of MCS-51 family, PIC Micro Controller –CPU architecture, registers, instruction sets addressing modes, loop timing, On chip Peripherals of PIC, Motorola MC68H11 Family Architecture Registers, Addressing modes, Interrupts features of interrupts- Interrupt vector and Priority, timing generation and measurements, Input capture, Out capture.

UNIT-II

16 Bit Micro controller: Introduction to MCS-96 family, Peripherals of MCS-96 family, 80196-architecture, CPU operation, memory organization, I/O port, Operand addressing, instruction set, Interrupts, On chip Peripherals-PWM, Timers, HIS/HSO, Serial Port, External memory interfacing.

UNIT-III

32 bit Micro controller: Intel 80960-architecture, memory address space, Salient features of ARM processor family-ARM7 /ARM9/ ARM9E/ ARM10/ ARM11/ SecureCore /Strong ARM, XScale technology, ARM9200 Architecture,Pinouts, Peripheral Identifier, System Interrupts, External Interrupts, Product memory mapping, External memory mapping, Internal memory mapping, On chip Peripherals-Memory controllers, external Bus Interface(EBI), Advanced interrupt controller(AIC), USART, Timer counter.

UNIT-IV

Software development and tools: Embedded system evolution trends. Round- Robin, Roundrobin with Interrupts, function- One- Scheduling Architecture, Algorithms. Introduction toassembler- compiler-cross compilers and Integrated Development Environment (IDE) Object Oriented Interfacing, Recursion, Debugging strategies, Simulators.

UNIT-V

Real Time Operating Systems: Task and Task States, tasks and data, semaphores and shared Data Operating system Services- Message queues- Timer Function- Events- Memory Management, Interrupt Routines in an RTOS environment, basic design Using RTOS.

References:

David E Simon, " An embedded software Primer" Pearson education Asia.
John B Peat man " Design with Micro controller" Pearson education Asia.
Jonartthan W. Valvano Brooks/cole " Embedded Micro Computer Systems. Real time Interfacing", Thomson learning

EI- 803C – INTELLIGENT INSTRUMENTATION

UNIT-I

Intelligent versus Dumb instruments, A historical perspective of instrumentation systems. Review of digital transducers. Interfacing micro computers. Computer ports to high power devices. Optical shaft

encoder communication standards. Concepts of Real Time system and its application.

UNIT-II

Details of Data Acquisition systems (DAS) Logic control systems, Continuous & Batch modes, Single and multi loop controller. Details of Data logger and its application.

UNIT-III

Architecture of Virtual instrument and its relation to operating system. Software overview: LABVIEW, Graphical User Interface (GUI), Control and indicators: G programming- Data type, Data flow programming editing and running a virtual instrument.

UNIT-IV

G Programming details in LABVIEW, G Programming tools and libraries. Programming structure: For loop, While loop. CASE structure, Sequence Structure arrays and clusters. Array operations- Bundle/Unbundled String and file I/O. High level and low level I/Os. Attribute nodes, Local and global variables.

UNIT-V

Software development for Temperature (Low and High), Level, Speed, pressure etc.

References:

 Barney G C, Intelligent Instrumentation : Micro processor application in measurement and control,Prentice Hall, Engle Wood Cliff NJ.
 H S Store, Micro Computer Interfacing, Addison Wesley, Reading, MA
 Rathore T S, Digital Instrumentation, TMH
 Interfacing sensors to the IBM PC, Prentice Hall, Engle Wood Cliff NJ.
 Garry M. Johnson " LAB view Graphical Programming", TMH.
 Lisa K. Wells "Labview for Everyone, PHI.
 Barry Paton, "Sensor, Transducers and Labview", Prentice Hall.

EI- 804A– FUZZY LOGIC & NEURAL NETWORKS

UNIT-I

Fuzzy system introduction, Fuzzy relation, Membership function, Fuzzy matrices and entropy, Fuzzy operation and composition.

UNIT-II

Fuzzy Variables, Linguistic variables, measures of fuzziness, concepts of defuzzification, Fuzzy control applications.

UNIT-III

Fundamentals of Artificial Neural networks- Biological prototype – Artificial neuron, Activation functions, Single layer and multiplayer networks. Training Artificial neural networks, Preceptrons, Exclusive Or Problem – Linear seperability, Storage efficiency, Preceptron learning, perceptron training algorithms. Back propagation, Training algorithm, network configurations, Network paralysis, Local minima, temporal instability.

UNIT-IV

Counter propagation networks, Kohonen layer, Training the kohonen layer, Pre processing the inputted vectors, Initialising the wright vectors, Statistical properties, Training the grosberg layer. Full counter propagation networks, Applications.

Statistical methods, Boltzman training, Cauchy training, Artificial specific heat methods, Applications to

general non-linear optimization problems. Back propagation and cauchy training.

UNIT-V

Hopfield nets, Recurrent networks, Stability, Associative memory, Thermodynamic systems, Statistical Hopfiled networks, Applications. Bi-directional associative memories, Retrieving on stored association, Encoding the associations.

References :

 Laurence Fausett, "Fundamentals of Neural Networks", Prentice Hall.
 Zmmermann H.J., "Fuzzy Set Theory and its Applications", Allied Publishers Ltd.
 Klir G.J., and Folger T., "Fuzzy Sets, Uncertainty and Information", Prentice Hall.
 Limin Fu., "Neural Networks in Computer Intelligence", McGraw Hill.
 Zuroda J.M., "Introduction to Artificial Neural Systems", Jaico Publishing.
 Haykin S., "Artificial Neural Network: A Comprehensive Foundation: Asia Pearson Pub.

EI- 804B – DIGITAL IMAGE PROCESSING

UNIT-I

Digital Image Processing- Elements of a Digital Image Processing system, Structure of the Human eye, Image formation and contrast sensitivity, Sampling and Quantization, Neighbours of a pixel, Distance measures, Photographic file structure and exposure, Filem characteristics, Linear scanner, Video camera, Image processing applications.

UNIT-II

Image Transforms-Introduction to Fourier transform-DFT, Properties of two dimensional FT, Separability, Translation, Periodicity, Rotation, Average value, FFT algorithm, Walsh transform, Hadamard transform, Discrete Cosine transform.

UNIT-III

Image Enhancement- Definition, Spatial domain methods, Frequency domain methods, Histogram modify technique, Neighborhood averaging, Media filtering, Lowpass filtering, Averaging of multiple images, Image sharpening by differentiation and high pass filtering.

UNIT-IV

Image Restoration-Definition, Degradation model, Discrete formulation, Circulant matrices, Block circulant matrices, Effect of diagnolization of circulant and block circulant matrices, Unconstrained and constrained restorations , Inverse filtering, Wiener filter, Restoration in spatial domain.

UNIT-V

Image Encoding-Objective and subjective fidelity criteria, Basic encoding process, The mapping, The quantizer, The coder, Differential encoding, Contour encoding, Run length encoding, Image encoding relative to fidelity criterion, Differential pulse code modulation.

References:

 Rafael, C. Gonzlez., and Paul, Wintz, "Digital Image Processing", Addison-Wesley Publishing Company.
 Jain Anil K., "Fundamentals of Digital Image Processing", Prentice Hall.
 Sosenfeld, and Kak, A.C., "Digital Image Processing", Academic Press.
 William K. Pratt., "Digital Image Processing", John Wiley and Sons.

EI- 804C– ADVANCE INDUSTRIAL ELECTRONICS

UNIT -I

Introduction to modern power conductor devices: Gate turn off thyristor (GTO), Insulated Gate Bipolar

Junction Transistor (IGBT), Power BJT, Power MOSFET, MOS controlled thyristor (MCT), Reverse conducting thyristor (RCT), Smart Power Devices (Power ICs) Rating, Static and dynamic characteristics, Safe operating areas, Protections of devices, Devices selection.

UNIT-II

DC to DC conversion, Buck Boost and Buck Boost converters (Circuit Configuration and analysis with different types of loads) Power factor, Harmonics and effect of source inductance in converter circuits. Resonant DC, DC converters. Switched mode power supply (SMPS).

UNIT-III

Concept of PWM in converters, Unity power factor converters, Voltage source inverters (VSI), Current source inverters (CSI). Application of VSI and CSI in induction motor control.

UNIT-IV

Non Drive applications of power electronics inverters, Uninterrupted power supply (UPS), Induction heating, Metal cutting, Active power line conditioning.

UNIT-V

Vector controlled and slip power controlled induction motor drives, Application of microprocessor, Micro controllers and DSP in Machine drives.

References :

 MH Rashid, Power Elex, PHI
 J.G. Kassakian, MF Schlecht and G.C. Verghese "Principle of Power Electronics", Reading, MA, Addison Wesley.
 Dubey G.K., " Power Semiconductor Controlled Drives", Engle Wood Cliffe NJ, Prentice Hall.
 DC Griffith, " Uninterruptible power supply", Marcell Dekker, NY.
 P. Vas, "Vector control of AC motors", Oxford Press