EI 701
Satellite Communication

Unit-I Satellite Systems: Introduction, frequency allocations for satellite systems. orbits and launching methods: Kepler's three laws of planetary motion, terms used for earth orbiting satellites, orbital elements, apogee and perigee heights, orbit perturbations, inclined orbits, local mean solar point and sun-synchronous orbits, standard time.

Unit-II The Geostationary orbit: Introduction, antenna look angles, polar mount antenna, limits of visibility, near geostationary orbits, earth eclipse of satellite, sun transit outage, launching orbits. polarization: antenna polarization, polarization of satellite signals, cross polarization discrimination. depolarization: ionospheric, rain, ice.

Unit-III The Space segment: Power supply, attitude control, station keeping, thermal control, tt&c subsystem, transponders, antenna subsystem, Morelos and Satmex 5, Anik-satellites, advanced Tiros-n Spacecraft. the earth segment, receive-only home TV systems, master antenna tv system, community antenna TV system, transmit-receive earth station.

Unit-IV The space link: Introduction, equivalent isotropic radiated power, transmission losses, the link power budget equation, system noise, carrier-to-noise ratio (C/N), the uplink, the downlink, effects of rain, combined uplink and downlink C/N ratio, inter modulation noise, inter-satellite links. interference between satellite circuits.

Unit-V Satellite Services VSAT systems: Network architecture, access control protocols, basic techniques, VSAT earth station, calculation of link margins for a VSAT star network. direct broadcast satellite television and radio: digital DBS TV, BDS TV system design and link budget, error control in digital DBS-TV, installation of DBS-TV antennas, satellite radio broadcasting.

References:

1. Roddy: Satellite Communications, TMH.
2. Timothy Prattt: Satellite Communications, Wiley India.
3. Pritchard, Suyderhoud and Nelson: Satellite Communication Systems Engineering, Pearson Education.
4. Agarwal: Satellite Communications, Khanna Publishers.
5. Gangliardi: Satellite Communications, CBS Publishers.
6. Chartrand: Satellite Communication, Cengage Learning.
7. Raja Rao: Fundamentals of Satellite communications, PHI Learning

EI 702
Analytical Instrumentation

Unit I -Molecular Spectro-analytical Methods: Colorimetry and Spectrophotometry: Introduction, theory: molecular energy levels, types of molecular transitions, Lambert-Beer's Law and limitations, types of sources, monochromators and detectors, Instrumentation of single beam and double beam instrument.

Unit II - Infrared Spectroscopy: Theory, diatomic molecules as a simple harmonic oscillator, instrumentation, sample handling techniques, Fourier Transform Infrared Spectroscopy (FTIR): advantages, instrumentation qualitative and quantitative applications, interpretation of Infrared (IR) spectra.

Unit III - Atomic Spectroscopy: Principle, comparison of atomic and molecular spectroscopy, atomic transitions, atomic absorption, atomization process, types of flames, fuel/ oxidant combinations, instrumentation of spectrophotometers, Interferences, spectral, chemical and ionization, applications, Atomic emission spectroscopy (AES), Flame photometer and its instrumentation, analysis using standard addition method, applications.

Unit IV- Separation methods: Theory of chromatography; instrumentation and applications of Thin layer chromatography (TLC). Column chromatography: Principle, process of elution through a column, chromatogram, band broadening, capacity factor, selectivity factor , Column efficiency, number of plates, plate height, column resolution.

Unit V - Gas Chromatography: Carrier gases, different type of injection systems, columns, stationary phases and detectors, isothermal mode, temperature programming mode, analysis by internal standard method, applications, High Performance Liquid Chromatography, mobile phase, isocratic and gradient elution, pumps, injection systems, columns, stationary phases, normal phase and reverse phase chromatography, detectors and their application.

References:

1. Skoog & Lerry, Instrumental Methods of Analysis, Saunders College Publications, New York
2. H.H.Willard, Instrumental Methods of Analysis, CBS Publishers.
3. D.C. Harris, Quantitate Chemical Analysis, W.H.Freeman
4. Christian G.D, Analytical Chemistry, John & Sons, Singapore
5. Skoog, West and Holler, Analytical Chemistry, Saunders College Publications, New York
6. Vogel's Textbook of Qualitative Chemical Analysis, ELBS

7. J.A. Dean, Analytical Chemistry Notebook, McGraw Hill
8. John H. Kennedy, Analytical Chemistry: Principles, Saunders College Publication
9. W. Kemp, Organic Spectroscopy, ELBS
10. Hand book of Instrumental Techniques for Analytical Chemistry, Frank Settle, editor, Prentice Hall

List of Experiments:

1. Determination of pKa value for a dye using double beam spectrophotometer.
2. Spectrometric determination of iron in water sample using double beam spectrophotometer.
3. Determination of concentrations of sodium, calcium, lithium and potassium in sample using flame photometer.
4. Determination of concentration of potassium ions in sample by standard addition method using flame photometer
5. Spectrum interpretation using FT-IR.
6. Analysis of various ions using atomic absorption system.
7. Thin layer chromatographic (TLC) separation of samples from different origin (Biological / Pharmaceutical / Food).
8. Qualitative analysis of samples using Gas chromatography
9. Qualitative analysis of samples using High Performance Liquid Chromatography.

EI 703
Digital Control System

Unit I -Modeling of Digital Control System: Block diagram of sampled data / digital control system, Discrete LTI systems characterized by difference equations Sampling process and its frequency domain analysis, idea sampler, sampling theorem & Nyquist frequency, data conversion techniques uses of A/D, D/A and ZOH elements.

Unit II -Discrete System Modeling: Determination of the Z-plane and Z-transform, mapping between S-plane and Z-plane, Z-transform theorems, inverse Z-transform, Z-transform of system equations, solution of linear difference equations using Z-transform, pulse response, block diagram reduction for systems interconnected through samplers, signal flow graphs for hybrid systems.

Unit III -Discrete Transform Analysis: Transformation methods between planes (s, z and w), folding / aliasing, numerical solution differential, equations, Jordon transformation, backward forward & canonical difference, Pseudo continuous-time (PCT) Control system.

Unit IV -Discrete Control Analysis: Stability studies using Routh's test & Jury's test, Steady state error Analysis for stable systems, Root locus Analysis, Correlation between time Response & frequency response.

Unit V- Discrete state Variable Analysis: State variable representation, time domain state and output equations for sampled data control system, state variable representation of a discrete time SISO system using phase variables - canonical variables - physical variables, State transition equation, State variable representation in the z-domain, system stability, time response between sampling instants.

References:

1. Kuo, “Digital Control System”, Oxford Press.
2. Ogata, “Digital Control System”, PHI.
3. Gopal M., “Digital Control System”, TMH.
4. Santina, Subberud and Hosteller, “Digital Control System Design”, Oxford University Press.
5. Chen, “Analog & Digital Control System Design, Oxford University Press.

List of Experiments:

1. Overview of the MATLAB Environment for control system.
2. Step Response of 1st and 2nd order systems in MATLAB.
3. Analysis and Designing of bode plot using MATLAB.
4. Analysis and Designing of Root locus using MATLAB.
5. Introduction to Simulink for Control System.
6. To study of PID controller with Simulink.
7. Introduction of State Spaces design in MATLAB.
8. Test of Controllability and Observability.
9. Determination of state transition matrix
10. Introduction to LTI viewer.
11. Design of digital compensators, Lag, Lead-Leg.

EI- 704[A]
Digital Image & Video Processing

Unit-I Fundamentals of Image processing and Image Transforms: Basic steps of image processing system sampling and quantization of an image – basic relationship between pixels image transforms, 2 –D Discrete Fourier Transform, Discrete Cosine Transform (DCT), Discrete Wavelet transforms.

Unit-II Image Processing Techniques: Image enhancement: spatial domain methods: histogram processing, fundamentals of spatial filtering, smoothing spatial filters, sharpening spatial filters frequency domain methods: basics of filtering in frequency domain, image smoothing, image sharpening, selective filtering.

Unit-III Image Segmentation & Image Compression: Segmentation concepts, point, line and edge detection, thresholding, region based segmentation, image compression fundamentals, coding redundancy, spatial and temporal redundancy, compression models, lossy and lossless, Hoffmann coding, arithmetic coding, LZW coding, run length coding, bit plane coding, transform coding, predictive coding , wavelet coding, JPEG standards

Unit-IV Basic Steps of Video Processing: Analog video, digital video, time varying image formation models: 3d motion models, geometric image formation, photometric image formation, sampling of video signals, filtering operations.

Unit-V 2-D Motion Estimation: Optical flow, general methodologies, pixel based motion estimation, block matching algorithm, mesh based motion estimation, global motion estimation, region based motion estimation, multi resolution motion estimation, waveform based coding, block based transform coding, predictive coding, application of motion estimation in video coding.

References:

1. M. Tekalp ,"Digital video Processing", Prentice Hall International .
2. Relf, Christopher G.,"Image acquisition and processing with LabVIEW", CRC press.
3. Aner ozdemi R, "Inverse Synthetic Aperture Radar Imaging with MATLAB Algorithms", John Wiley & Sons.
4. Chris Solomon, Toby Breckon ,"Fundamentals of Digital Image Processing A Practical Approach with Examples in Matlab,
5. Gonzaleze and Woods ,"Digital Image Processing ", 3rd edition , Pearson

EI- 704[B]

Data Acquisition System

Unit-I Display System: Seven segment Dot matrix, Multiplexed, Code converter, LCD, construction, working and Programming Hitachi controller), Plasma and vapor displays.

Unit-II Recorders: Galvanometric type, null type, potentiometer type, strip chart and circular chart type, magnetic tape recorder-principle & operation, digital tape recorders.

Unit-III Telemetric Systems: land line & RF telemetry, voltage, current and position telemetry with feedback mechanism, RF telemetry, amplitude modulation , frequency modulation , pulse modulation pulse amplitude modulation, pulse code modulation, wire INE and radio channels, microwave channels, radio ink, transmitting and receiving antenna, telemetry with time and frequency division multiplexing, telemetry hardware, band width and noise reduction(interference, Grounding, shielding, Guarding).

Unit-IV Data transfer techniques: DMA controller and data transfer in DMA mode, serial data transmission method and standards, 4-20 mA current loop, RS-232C, specifications connection and timing , RS- 422, RS-423, GPIB/IEEE-488, standard digital interface, parallel communication, Centronix port, communication protocols, Local Area networks, Firewire, Universal serial bus, HART protocol, foundation, fieldbus, ModBus, TCP/IP, data compression, encryption, error detection & correction techniques, optical disk storage.

Unit-V Data Acquisition System (DAS): single channel and multi channel, data conversion, Supervisory control and data acquisition system (SCADA), data acquisition system around microprocessor, micro controller & PC.

References:

1. Mathivanan N “Microprocessor PC Hardware and interfacing”, PHI, New delhi
2. H S Kalsi “ Electronic Instrumentation” TMH, New delhi
3. Patranabis- Principles of Industrial Instrumentation 3rd Ed., TMH
4. Singh- Industrial Instrumentation & Control 3rd ed., TMH

EI- 705[A]

Nuclear Instrumentation

Unit I- Introduction: Properties of nuclear systems and radiation, interaction of radiation with matter, radioactive sources-choice of isotopes. radiation detectors-ionization chambers, geiger-muller counters, scintillation counters, semiconductor devices, neutron detectors based on recoil, measuring circuits including modulators, converters and stabilizers, synchronous detectors. counting statistics, correlation sets, standard deviation of rate meters, error propagation, effect of background, statistical distribution of pulse height distribution, detector efficiency.

Unit-II Nuclear Reactor Instrumentation: Diffusion, moderation, absorption and delay processes, Neutron flux measurement, Control rod calibration, nuclear fuel inspection and testing including poisoning, Radiation energy measurement, Remote control instrumentation, nuclear instrument maintenance.

Unit-III Application to industrial System: Radioactive tracer technique, gas and liquid flow measurement, leak detection, residence time and its distribution, application to blending corrosion and wear studies thickness and density measurement by beta rays, gamma ray absorption technique, measurement of thickness of surface material by back scattering.

Unit-IV Safety: Hazards of ionization radiation, physiological effect of radiation, dose and risk, radiological protection (Plpha, beta and Gamma, X, Neutron), Shielding material and effectiveness, operational safety instruments, emergency schemes, effluent disposal, application to medical diagnosis and reatment.

Unit-V Radioactive Devices : Level detection by radioactive devices, interface detection by neutron moderation technique, measurement of gas pressure and gas analysers, spectroscopic and frequency methods, void detection, moisture meter, smoke detection, ozonizer, radio chromatography and interferometry, portable instruments, source activity for dynamic properties of instruments.

References:

1. Ed. Noltingk, B.E., "Instrumentation Reference Book, Butterworth Heinemenn.
2. Boltan W., Newness, "Instrumentation and Measurement., Newness.
3. Jones, "Instrumentation Series",

EI- 705[B]
Artificial Intelligence

Unit 01: Introduction: Organization of the brain, biological neuron, biological and artificial neuron models, historical developments, essentials of artificial neural networks, artificial neuron model, operations of artificial neuron, types of neuron activation function, ANN architectures

Unit 02: Classification Taxonomy of ANN: Connectivity, neural dynamics (activation and synaptic), learning strategy (supervised, unsupervised, reinforcement), learning rules, perceptron models: training algorithms: discrete and continuous perceptron networks, perceptron convergence theorem, multilayer feed forward neural networks

Unit 03: Memory: Associative memory, bi-directional associative memory, architecture, BAM training algorithms, storage and recall algorithm, BAM energy function, self-organizing maps (SOM) and adaptive resonance theory (ART).

Unit 04: Fuzzy Logic system: Fuzzy versus crisp, fuzzy sets, membership function, basic fuzzy set operations, properties of fuzzy sets, fuzzy relations, fuzzy control**,** predicate logic (interpretation of predicate logic formula, inference in predicate logic), fuzzy logic (fuzzy quantifiers, fuzzy inference), fuzzy rule based system, defuzzification methods.

Unit 05: Intelligent Tools: Introduction to genetic algorithm, biological background, GA operators, selection, encoding, crossover, mutation, chromosome, expert system, software architecture, rule base system.

References:

1. Simon Haykin, "Neural Networks: A Comprehensive Foundation", 2nd Edition, Pearson Education
2. S. Rajsekaram, G. A. Vijayalaxmi Pai, "Neural Networks, Fuzzy Logic & Genetic Algorithms Synthesis & Applications", Practice Hall India
3. James A. Anderson, "An Introduction to Neural Networks", Practice Hall India Publication
4. Mohamed H. Hassoun, "Fundamentals of Artificial Neural Network", Practice Hall
5. Kelvin Waruicke, Arthur Ekwlle, Raj Agarwal, "AI Techniques in Power System", IEE London U.K.
6. S. N. Sivanandam, S. Sumathi, S. N. Deepa, "Introduction to Neural Network Using MATLAB 6.0", Tata McGraw Hill.

EI-706
Major Project Synopsis-I

The students have to keep in mind that in final semester they would be required to implement whatever has been planned in the **Major Project Synopsis-I** in this semester. It is possible that a work, which involves greater efforts and time may be taken up at this stage and finally completed in final semester, but partial completion report should be submitted in this semester and also evaluated by an external examiner. At the end of semester, all students are required to submit a synopsis.

EI-707
Industrial Training –I

Duration: 2 weeks after the VI semester in the summer break, Assessment in VII semester.

Students must observe following to enrich their learning during industrial training:

- Industrial environment and work culture.
- Organisational structure and inter personal communication.
- Machines/ equipment/ instruments - their working and specifications.
- Product development procedures and phases.
- Project planning, monitoring and control.
- Quality control and assurance.
- Maintenance system.
- Costing system.
- Stores and purchase systems.
- Roles and responsibilities of different categories of personnel.
- Customer services.
-Problems related to various areas of Work etc.
- Layout if any