EI- 601 – Signals & Systems

Unit I- Introduction to Signal & Systems: Signals, classification of signals, basic continuous time and discrete time signals, continuous LTI, discrete LTI systems , impulse and step functions, impulse response stability, linearity, stability, time invariance, eigen values and eigen functions, discrete convolution ,properties of discrete and continuous LTI systems ,systems described by difference and differential equations.

Unit II- Fourier Analysis of Continuous Time Signals and Systems: Fourier series, fourier series representation of continuous periodic signal & its properties, fourier transform and its properties, parseval's theorem, frequency response of LTI systems.

Unit III- Fourier Analysis of Discrete Time Signals & Systems: Discrete-time fourier series, discrete-time fourier transform (including DFT) and properties, frequency response of discrete time LTI systems, continuous time fourier transform for periodic and non-periodic signals, properties of CTFT.

Unit IV- Laplace & Z-Transform Transform: Laplace transform and its inverse: definition, existence conditions, region of convergence and properties, application of laplace transform for the analysis of continuous time LTI system, Z-Transform, properties of Z-transform inversion of Z-transform, two dimensional Z- transform, convergence of Z-transform, region of convergence and properties, application of Z-transform for the analysis of discrete time LTI systems, solving eq. using Z transform.

Unit V- State Space Analysis: Concept of state, state space representation discrete time LTI systems , state space representation of continuous time LTI systems ,solutions of state equation for discrete time LTI systems , solutions of state equation for continuous time LTI systems ,FFT.

Sampling: Sampling theorem, ideal & real sampling, reconstruction of signal from its samples, aliasing sampling in frequency domain, sampling of discrete-time signals.

References:

1. Alan V. Oppenheim, Alan S. Willsky and H. Nawab, Signals and Systems, Prentice Hall, 1997
2. Simon Haykin, Communication Systems, 3rd Edition, John Wiley, 1995.
3. Signals & Systems, 2nd Edition, by Alan Oppenheim, Alan Wilsky, S. Nawab. Prentice Hall, 1997.
4. Signals and Systems, by Simon Haykin and Barry Van Veen. Wiley, 1999.

EI 602 – Bio Medical Instrumentation

Unit I- Introduction: Origin of Bio electric signals and their characteristics. Noise coupling, powerline and other interfering sources, Artifacts, Analysis of concurrent, coupled and correlated processes.

Unit II -Bioelectric signals: Detection of events in bioelectric signals like ECG, EEG, PCG, detection of waves, correlation & coherence analysis, few case studies.

Unit III-Measurement systems: Specifications of instruments, static & dynamic characteristics, classification of errors, statistical analysis. Introduction to reliability, accuracy, fidelity, speed of response, linearization of technique, data acquisition system.

Unit IV-Bioelectric amplifiers: Special features of bioelectric amplifiers, safety requirements, realization of bioelectric amplifiers, carrier amplifiers, chopper amplifiers, phase sensitive detector, isolation amplifiers, and instrumentation amplifiers.

Unit V-Patient safety and electromedical equipment: Physiological effects of electrical currents, macroshock and microshock, preventive measures to reduce shock hazards, Leakage current, isolation of patient circuits, safety of electrically susceptible patients, radiation hazards and safety, shielding, open ground problem and earthing methods.

References:

1. Human Physiology- The Mechanism of Body Function By Vander, Sherman,TMH Ed.1981
2. Introduction To Biomedical Equipment Technology By Carr & Brown
3. Biomedical Instrumentation and Measurements By Cromwell, 2nd edition, PearsonEducation.
4. Handbook of Biomedical Instrumentation By R. S. Khandpur, TMH
5. Biomedical Digital Signal Processing, Tompkins, PHI
6. Biomedical Instrumentation, Arumugam.

List of Experiments:

1. To Study and Check Specifications of an ECG Recorder.
2. To Measure Blood Pressure Using Sphygmomanometer, Calibration of BP apparatus
3. Study of Audiometer
4. To record/monitor heart sounds using Electronic Stethoscope
5. To Develop a Flow Type Sensor Using Thermistor for Expiratory Volume
6. Measurement
7. To Design and Implement an ECG Amplifier
8. To Study EEG/EMG

EI 603 - Control Systems

Unit I Introduction to Control System and Their Classification : Differential equations of systems, linear approximation, laplace transform and transfer function of linear system, model of physical system (electrical, mechanical and electromechanical), block diagram, signal flow graph, mason's gain formula, return difference and return ratio, error detectors, servomotor, tachogenerator, servo amplifier , magnetic amplifier, rotating amplifier.

Unit II Time Domain Analysis: Representation of deterministic signals, first order system response, s-plane root location and transient response, impulse and step response of second order systems, performance characteristics in the time domain, effects of derivative and integral control, steady state response, error constant, generalized definition of error coefficients, concepts of stability, Routh Hurtwitz criterion.

Unit III Frequency Domain Analysis: Frequency response bode plot, polar plot, nicol's chart, closed loop frequency response, frequency domain performance characteristics, and stability in the frequency domain, nyquist criterion.

Unit IV Root Locus Method: Basis theory and properties of root loci, procedure for the construction of root loci, complete root locus diagram, design and compensation of feed back control system, approaches to compensation, cascade compensation networks and their design in the frequency domain, simple design in s- plane.

Unit V State Variable Methods: Introduction to state variable concepts, state variable description of linear dynamic systems, representation in matrix forms, block diagram and signal flow graph representation of state equations – transfer matrix from state equations, transition matrix, general solution for linear time invariant state equations, basic principles of adaptive control systems.

References:

1. Ogata K, "Modern Control Engineering ", Prentice Hall
2. KUO B.C, "Automatic Control System", Prentice Hall
3. Nagarath & Gopal," Control System Engineering," Wiley Eastern
4. Bakshi & Goyal. Feedback control system, Technical publication.

List of Experiment (Extendable):

1. To determine speed torque characteristics of armature controlled D.C. servomotor.
2. To determine the speed torque characteristics and relationship between torque speed and control windings voltage by AC servomotor.
3. To obtain the step response transient characteristics of first order electric system and to measure system parameters.
4. To plot the nyquist plot of a given transformer function using matlab.
5. To plot the bode plot of a given transformer function using matlab.

EI 604 - Process Instrumentation

Unit I Introduction: Sensors , incentives for process control, process variables types, selection criteria, process degree of freedom, the period of oscillation and damping, characteristics of physical system: resistive, capacitive, elements of process dynamics, types of processes- dead time, single, multicapacity, self-regulating, non self regulating, interacting, non-interacting, linear, non linear, liquid processes, gas processes, flow processes, thermal processes.

Unit II: **Analysis of Control Loop**: Steady state gain, process gain, valve gain, process time constant, variable time constant, transmitter gain, variable pressure drop, analysis of flow control, pressure control, liquid level control, temperature control, SLPC-features, faceplate, functions, MLPC- features, faceplate, functions, SLPC and MLPC comparison.

Unit III Feedback Control: Basic principles, elements of the feedback loop, block diagram, control performance, measures for common input changes, selection of variables for control, approach to process contro, factors in controller tuning, tuning constants for good control performance, correlations for tuning constants, fine tuning of the controller tuning constants, the performance of feedback systems, practical application of feedback control, equipment specification, input processing, feedback control algorithm, output processing.

Unit IV Multivariable Control: Concept of Multivariable Control, modelling and transfer functions, influence of interaction on the possibility of feedback control, important effects on multivariable system behavior relative gain array, effect of interaction on stability and multiloop control system. multiloop control performance through: loop paring, enhancement through decoupling, single loop enhancements.

Unit V Multi loop system: Cascade control, feed forward control, feedback-feed forward control, ratio control, selective control, split range control- basic principles, design criteria, performance, controller algorithm and tuning.

References:

1. Donald Eckman – Automatic Process Control, Wiley Eastern Limited
2. Process control Systems-F.G.Shinskey,TMH
3. Computer Based Industrial Control –Krishna Kant, PHI
4. Handbook of Instrumentation -Process control –B.G.Liptak, Chilton
5. Fundamentals of Process Control - Murrill ISA
6. Applications concepts of Process control- By Murrill ISA

List of Experiments:

1. Finding dynamic elements for any process. (TD, TS)
2. Analysis of Flow loop.
3. Analysis of Level loop.
4. Analysis of Pressure & Temperature loop.
5. Study of Cascade control loop.

6. Study of Ratio control/ Selective control.
7 Study of SLPC for process control.

EI-605 Principles of Management & Managerial Economics

Unit I - Management: Scientific management, principles of management, administration and organization, difference and relationship between organization management and administration, importance of management, characteristics of management.

Unit II – **Management Planning**: Management functions, meaning of planning, advantages of planning, organizing: organizing defined, process of organizing, principles of organizing, organizational structure, staffing process of management, levels of management, project management.

Unit III - Decision Making: Introduction and definition, types of decisions, techniques of decision making, decision making under risk.

Unit IV - Managerial Economics: Introduction, nature & scope of managerial economics application of economics in managerial decision making, micro and macro-economics, theory of the firm, theory of production function.

Unit V - Productivity: Input-Output analysis, micro-economics applied to plants and industrial undertakings, production and production system, productivity, factors affecting productivity, increasing productivity of resources.

References:

1. Peter Dracker, Harper and Row: The Practice of Management.
2. Koontz: Essentials of Management, PHI Learning.
3. Staner: Management, PHI Learning.
4. Daft: Principles of Management, Cengage Learning.
5. T. N. Chhabra: Principle and Practice of Management, Dhanpat Rai, New Delhi.
6. Hirschey: Managerial Economics, Cengage Learning.
7. T. R. Banga and S.C. Sharma: Industrial Organisation and Engineering Economics, Khanna Publishers
8. O.P. Khanna: Industrial Engineering and Management, Dhanpat Rai.
9. Joel Dean: Managerial Economics, PHI learning.
10. V. L. Mote, Samuel Paul and G.S. Gupta: Managerial Economics Concepts & Cases, TMH, New Delhi.
11. V. L. Mote: Managerial Economics, TMH, New Delhi

EI 606 - Minor Project

The selection of topic should be from the subjects the student has studied so far or any topic related to real life problem. He should do the literature survey, analyze the problem and propose some solution for the same. The analysis of the problem may be done with the help of some software or any hardware (which may be made by the student).Following points are important:

1. Presentation of project with the help of power point presentation at the end of the semester is compulsory.
2. A detailed report regarding the topic should be submitted before the internal examination