EE 642: Computer Oriented Numerical Methods:

L T P
(3-1-3)
Full marks: Theory—100
Sessional---------50
Lab---------50
Time---3 hrs

1. Computer Arithmetic:

Introduction, Floating point representation of numbers and floating point arithmetic, computational errors, Relative and absolute errors, Error propagation, Iterative processes-convergence and acceleration.

2. Iterative methods:

Transcendental equations, Methods of bisection, Method of false position, Newton Raphson method, Complex roots, Synthetic division.

3. Matrices and Linear Systems of Equations:

Matrix inversion, LU decomposition, Solution of linear system of equations by direct methods—Gauss elimination method, ill—conditioned system, Pivotal condensation, Gauss-Siedel iteration method, Gauss-Jordan matrix inversion, Eigen values and Eigen vectors, N—R method for non-linear system of equations.

4. Finite Difference and Interpolation:

Forward difference, Backward difference and central difference, Symbolic relations, Interpolation with equal intervals, Interpolation using forward difference, Newton's and Gauss's formula for interpolation, Interpolation with unequal intervals, Newton's formula, Lagrange's polynomial interpolation.

5. Numerical Differentiation and Integration:

Differentiation by polynomial fit, errors in numerical differentiation, numerical integration—Trapezoidal rule, Simpson's rule, Romberg method.

6. Ordinary Differential Equations:

Taylor's series method, Euler's method, Modified Euler's method, Runga-Kutta method, Predictor-Corrector method.

**Note: Stress should be given on developing algorithms for the numerical methods. Sessional and laboratory work should consist of writing computer programs using these algorithms and running them on the computer.

EE 645: CONTROL SYSTEM- II.

L T P
(3 1 3)
Theory marks = 100
Sessional= 100
Time----- 3 hours.

1. **Compensation techniques**:

Preliminary design specifications in time and frequency domains, gain compensation; load compensation, lag compensation, leg- load compensation.

2. **Describing function analysis of non linear control systems:**

Introduction to nonlinear systems. Describing functions of common non linearities; nonlinear control systems, describing function analysis of nonlinear control systems.

3. **Phase- Plane Analysis:**

Introduction, methods of constructing phase- plane trajectories, time information and solutions from phase- plane trajectories, singular points, phase- plane analysis of linear and nonlinear control systems.

4. **Discrete time systems**:

Introduction to discrete – time systems; Z- transform, inverse Z- transformation; solving difference equation by the Z-transform method; pulse- transfer function; stability analysis in the Z- plane.

5. **State – Space Analysis of control systems:**

Concepts of space, state variables and state models; state – space representation of linear systems; transfer matrix; state- space representation of discrete- time systems. Solution of linear time- invariant and discrete- time state equations.

6. **Stability Analysis by Liapunov's second method**:

Definition of stability in the sense of Liapunov; the second method of Liapunov; Stability analysis of linear systems; estimating the transient response behaviour of dynamic systems; stability analysis of nonlinear systems.

7. **Design of Feedback Control systems**:

Concept of controllability and observality; state feedback and output feedback; a brief idea of pole placement by state feedback and output feedback; optimal control law; cost function or performance index; quadratic performance index; linear quadratic state feedback regulator problem; a brief introduction to model reference systems; adaptive control systems.

IE 651: Electrical Machines

L T P
(3 – 1 – 3)

Theory Marks =100
Sessional Marks = 50
Laboratory Marks = 50

1. **D.C. Machine:**

   Constructional features and principles of operation: shunt series and compound generators and meter. Performances characteristics. Starting, speed control and braking of meters. Choice of D.C. meters for different applications.

2. **Transformers:**
   Constructional features and principles of Operation.

3. **Induction Meters:**

   Principles of operation, equivalent circuit and circle diagram. Torque-speed characteristics. Methods of speed control. Starting and braking of induction motors. Single phase induction meters- methods of starting.

4. **Synchronous Generators and motors**:

   Principles of operation and simple equivalent circuit. Synchronous motors-methods of starting. Synchronization. Typical application of A.C. motors in Industries.

Books:

1. Langsdraf : Theory of Alternating Current Machines(McGraw Hill)
2. Kingsley, Fitzereld : Electric Machinery (McGraw Hill)
3. Say: Performance and Design of Alternating Current Machine.

L T P

EE643: Microprocessors and Applications (EE/IE) (3 1 3)

Full marks: Theory = 100
Sessional =50
Lab=50

1. **Microprocessor Architecture**:

Introduction to the microprocessor. The ALU. Up registers. Basic concepts of programmable device – Bus organization, system components etc. The interface section. The timing and control section. State transition sequence. Block diagram.

2. **Programming Microprocessors**:

Data representation, instruction formats, addressing modes, Instruction set, software design, assembly language programming, program looping, subroutine linkage, position independency, recursion.

3. **Memory Interfacing**:

Main memory types, memory characteristics compatibility between memory and up system bus, address space and its portioning, standard vs. system memories, address decoding, Dynamic RAM interfacing, Quasi- static RAMS, memory mapping and management.

4. **Data transfer**:

Programmed data transfer, DMA mode of data transfer, I/O part, device polling in the interrupt mode, DMA controller, serial mode of data transfer, some standard interfaces.

5. **I/O devices:**

OPAMPS, Opto-couples, DAC, ADC, sample& hold amplifiers, multiplexers, buffers, Timer counter, Data acquisition systems.

6. Support LSIS:

8255, 8155, 8253, 8279 etc

7. **Microprocessor based system design**:

A system of practical relevance to be chosen and described,
e.g- speed controller of de motor,
- A traffic light controller,
- Temperature monitoring & controller,
- ECG data acquisition & monitoring.

EE 646: Signals and Systems.

L	T	P
3	1	0

Max. Marks = 100
Sessional = 50

1. **Introduction:**

   Definitions. Continuous and Discrete-time signals. Systems and their classification.

2. **LTI Systems:**

   Continuous-time LTI systems: the Convolution integral. Discrete-time LTI systems: the Convolution sum. Properties of LTI systems. Systems described by differential and difference equations.

3. **Fourier analysis for continuous-time case:**

   Response of LTI systems to complex exponential. Representation of periodic signals: the Fourier series. Representation of a-periodic signals: the Fourier Transform and its properties. System analysis by Fourier Transforms.

4. **Fourier analysis for Discrete-time case :**

   Response of LTI systems to complex exponential. Discrete-time Fourier series. Discrete-time Fourier Transform and its properties. System analysis.

5. **Sampling :**

   The sampling theorem. Effect of under-sampling. Reconstruction of a signal from its samples using interpolation. Spectrum of sampled signal.

6. **Z-transform :**

   Definitions. The region of convergence. Properties of Z-transform. Inversion of Z-transforms. Application to system analysis.

7. **Digital Filters** :

   Frequency selective filters. FIR and IIR filters.

Books:

1. Oppenheim, Willisky, Nawab: Signals and Systems, PHI (India)
2. Oppenheim, Schafer: Digital Signal Processing, PHI (India)
3. Eugene Xavier: Signals, Systems & Signal Processing, S. Chand & Co.
4. Roberts: Signals and Systems, Tata McGraw Hill.
5. Mastering MATLAB, Pearson Education (for Laboratory use).