IV Year – II SEMESTER	T	P	C
	3+1	0	3

DIGITAL CONTROL SYSTEMS

Preamble:

In recent years digital controllers have become popular due to their capability of accurately performing complex computations at high speeds and versatility in leading non linear control systems. In this context, this course focuses on the analysis and design of digital control systems.

Learning objectives:

- To understand the concepts of digital control systems and assemble various components associated with it. Advantages compared to the analog type.
- The theory of z–transformations and application for the mathematical analysis of digital control systems.
- To represent the discrete–time systems in state–space model and evaluation of state transition matrix.
- To examine the stability of the system using different tests.
- To study the conventional method of analyzing digital control systems in the w–plane.
- To study the design of state feedback control by "the pole placement method."

UNIT – I:

Introduction and signal processing

Introduction to analog and digital control systems – Advantages of digital systems – Typical examples – Signals and processing – Sample and hold devices – Sampling theorem and data reconstruction – Frequency domain characteristics of zero order hold.

UNIT–II:

Z–transformations

Z–Transforms – Theorems – Finding inverse z–transforms – Formulation of difference equations and solving – Block diagram representation – Pulse transfer functions and finding open loop and closed loop responses.

UNIT–III:

State space analysis and the concepts of Controllability and observability

State Space Representation of discrete time systems – State transition matrix and

methods of evaluation – Discretization of continuous – Time state equations – Concepts of controllability and observability – Tests (without proof).

UNIT – IV:

Stability analysis

Mapping between the S–Plane and the Z–Plane – Primary strips and Complementary Strips – Stability criterion – Modified routh's stability criterion and jury's stability test.

UNIT – V:

Design of discrete–time control systems by conventional methods

Transient and steady state specifications – Design using frequency response in the w–plane for lag and led compensators – Root locus technique in the z–plane.

UNIT – VI:

State feedback controllers:

Design of state feedback controller through pole placement – Necessary and sufficient conditions – Ackerman's formula.

Learning outcomes:

- The students learn the advantages of discrete time control systems and the "know how" of various associated accessories.
- The learner understand z–transformations and their role in the mathematical analysis of different systems(like laplace transforms in analog systems).
- The stability criterion for digital systems and methods adopted for testing the same are explained.
- Finally, the conventional and state–space methods of design are also introduced.

Text Book:

1. Discrete–Time Control systems – K. Ogata, Pearson Education/PHI, 2nd Edition

Reference Books:

1. Digital Control Systems, Kuo, Oxford University Press, 2nd Edition, 2003.
2. Digital Control and State Variable Methods by M.Gopal, TMH

IV Year – II SEMESTER

T	P	C
3+1	0	3

ELECTIVE – II

ADVANCED CONTROL SYSTEMS

Preamble:

This subject aims to study state space, describing function, phase plane and stability analysis including controllability and observability. It also deals with modern control and optimal control systems.

Learning Objectives:

- Review of the state space representation of a control system**:** Formulation of different models from the signal flow graph, diagonalization.
- To introduce the concept of controllability and observability. Design by pole placement technique.
- Analysis of a nonlinear system using Describing function approach and Phase plane analysis.
- The Lypanov's method of stability analysis of a system.
- Formulation of Euler Laugrange equation for the optimization of typical functionals and solutions.
- Formulation of linear quadratic optimal regulator (LQR) problem by parameter adjustment and solving riccatti equation.

UNIT – I:

State space analysis

State Space Representation – Solution of state equation – State transition matrix, –Canonical forms – Controllable canonical form – Observable canonical form, Jordan Canonical Form.

UNIT – II:

Controllability, observability and design of pole placement

Tests for controllability and observability for continuous time systems – Time varying case – Minimum energy control – Time invariant case – Principle of duality – Controllability and observability form Jordan canonical form and other canonical forms – Effect of state feedback on controllability and observability – Design of state feedback control through pole placement.

UNIT – III:

Describing function analysis

Introduction to nonlinear systems, Types of nonlinearities, describing functions, Introduction to phase–plane analysis.

UNIT–IV:

Stability analysis

Stability in the sense of Lyapunov – Lyapunov's stability and Lypanov's instability theorems – Direct method of Lypanov for the linear and nonlinear continuous time autonomous systems.

UNIT–V:

Calculus of variations

Minimization of functional of single function – Constrained minimization – Minimum principle – Control variable inequality constraints – Control and state variable inequality constraints – Euler lagrangine equation.

UNIT –VI:

Optimal control

Linear quadratic optimal regulator (LQR) problem formulation – Optimal regulator design by parameter adjustment (Lyapunov method) – Optimal regulator design by continuous time algebraic riccatti equation (CARE) - Optimal controller design using LQG framework.

Learning Outcomes:

- State space representation of control system and formulation of different state models are reviewed.
- Able to design of control system using the pole placement technique is given after introducing the concept of controllability and observability.
- Able to analyse of nonlinear system using the describing function technique and phase plane analysis.
- Able to analyse the stability analysis using lypnov method.
- Minimization of functionals using calculus of variation studied.
- Able to formulate andsolve the LQR problem and riccatti equation.

Text Books:

- Modern Control Engineering – by K. Ogata, Prentice Hall of India, 3rd edition, 1998
- Automatic Control Systems by B.C. Kuo, Prentice Hall Publication

Reference Books:

1. Modern Control System Theory – by M. Gopal, New Age International Publishers, 2nd edition, 1996
2. Control Systems Engineering by I.J. Nagarath and M.Gopal, New Age International (P) Ltd.
3. Digital Control and State Variable Methods – by M. Gopal, Tata Mc Graw– Hill Companies, 1997.
4. Systems and Control by Stainslaw H. Zak , Oxford Press, 2003.
5. Optimal control theory: an Introduction by Donald E.Kirk by Dover publications.

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HIGH VOLTAGE ENGINEERING
(ELECTIVE – II)

Preamble:

With the growth of power, HV power transmission has become an important subject. The performance of generating equipment requires knowledge of different phenomena occurring at higher voltage. Thus evaluations of various insulating materials are required for protection of HV equipments. Keeping this in view the course is designed to understand various phenomena related to breakdown study and withstand characteristics of insulating materials. The course also describes the generation and measurement of DC, AC and Impulse voltages as well various testing techniques.

Learning Objectives:

- To understand electric field distribution and computation in different configuration of electrode systems.
- To understand HV breakdown phenomena in gases, liquids and solids dielectric materials.
- To acquaint with the generating principle of operation and design of HVDC, AC and Impulse voltages and impulse currents.
- To understand various techniques of AC, DC and Impulse measurement of high voltages and currents.
- To understand the insulating characteristics of dielectric materials.
- To understand the various testing techniques of HV equipments.

UNIT–I:

Introduction to High Voltage Technology

Electric Field Stresses – Uniform and non–uniform field configuration of electrodes – Estimation and control of electric Stress – Numerical methods for electric field computation.

UNIT–II:

Break down phenomenon in gaseous, liquid and solid insulation

Gases as insulating media – Collision process – Ionization process – Townsend's criteria of breakdown in gases – Paschen's law – Liquid as Insulator – Pure and commercial liquids – Breakdown in pure and commercial liquid – Intrinsic breakdown – Electromechanical breakdown – Thermal breakdown –Breakdown of solid dielectrics in practice – Breakdown in composite dielectrics used in practice.

UNIT–III:

Generation of High voltages and High currents

Generation of high DC voltages – Generation of high alternating voltages – Generation of impulse voltages – Generation of impulse currents – Tripping and control of impulse generators.

UNIT–IV:

Measurement of high voltages and High currents

Measurement of high AC, DC and Impulse voltages – Voltages and measurement of high currents – Direct, alternating and Impulse.

UNIT–V:

Non–destructive testing of material and electrical apparatus

Measurement of DC resistivity – Measurement of dielectric constant and loss factor – Partial discharge measurements.

UNIT–VI:

High voltage testing of electrical apparatus

Testing of insulators and bushings – Testing of isolators and circuit breakers – Testing of cables – Testing of transformers – Testing of surge arresters – Radio interference measurements.

Learning Outcomes:

- To be acquainted with the performance of high voltages with regard to different configurations of electrode systems.
- To be able to understand theory of breakdown and withstand phenomena of all types of dielectric materials.
- To acquaint with the techniques of generation of AC,DC and Impulse voltages.
- To be able to apply knowledge for measurement of high voltage and high current AC,DC and Impulse.
- To be in a position to measure dielectric property of material used for HV equipment.
- To know the techniques of testing various equipment's used in HV engineering.

Text Books:

1. High Voltage Engineering by M.S.Naidu and V. Kamaraju – TMH Publications, 3rd Edition.

2. High Voltage Engineering : Fundamentals by E.Kuffel, W.S. Zaengl, J. Kuffel by Elsevier, 2nd Edition.
3. High Voltage Engineering and Technology by Ryan, IET Publishers.

Reference Books:

1. High Voltage Engineering by C.L.Wadhwa, New Age Internationals (P) Limited, 1997.
2. High Voltage Insulation Engineering by Ravindra Arora, Wolfgang Mosch, New.

Age International (P) Limited, 1995.

SPECIAL ELECTRICAL MACHINES
(Elective – II)

Preamble:

This is an advanced course on electrical machines. Students will be exposed to various special machines which are gaining importance in industry. This course covers topics related to principles, performance and applications of these special machines including switched reluctance motors, stepper motors, permanent magnet dc motors, linear motors and electric motors for traction drives.

Learning Objective:

- To explain theory of operation and control of switched reluctance motor.
- To explain the performance and control of stepper motors, and their applications.
- To describe the operation and characteristics of permanent magnet dc motor.
- To distinguish between brush dc motor and brush less dc motor**.**
- To explain the theory of travelling magnetic field and applications of linear motors.
- To understand the significance of electrical motors for traction drives.

UNIT I:

Switched Reluctance Motor

Principle of operation – Design of stator and rotor pole arc – Power converter for switched reluctance motor – Control of switched reluctance motor.

UNIT II:

Stepper Motors

Construction – Principle of operation – Theory of torque production – Hybrid stepping motor – Variable reluctance stepping motor – Open loop and closed loop control.

UNIT III:

Permanent Magnet DC Motors

Construction – Principle of working – Torque equation and equivalent circuits – Performance characteristics – Moving coil motors.

UNIT IV:

Permanent Magnet Brushless DC Motor

Construction – Principle of operation – Theory of brushless DC motor as variable speed synchronous motor – Sensor less and sensor based control of BLDC motors.

UNIT V:

Linear motors

Linear induction motor: Construction– principle of operation– applications. Linear synchronous motor: Construction – principle of operation– applications.

UNIT VI:

Electric Motors for traction drives

AC motors– DC motors –Single sided linear induction motor for traction drives – Comparison of AC and DC traction.

Learning Outcomes:

The student should be able to

- Explain theory of operation and control of switched reluctance motor.
- Explain the performance and control of stepper motors, and their applications.
- Describe the operation and characteristics of permanent magnet dc motor.
- Distinguish between brush dc motor and brush less dc motor**.**
- Explain the theory of travelling magnetic field and applications of linear motors.
- Understand the significance of electrical motors for traction drives.

Text Books:

1. Special electrical Machines, K.Venkata Ratnam, University press, 2009, New Delhi.
2. Brushless Permanent magnet and reluctance motor drives, Clarenden press, T.J.E. Miller, 1989, Oxford.
3. Special electrical machines, E.G. Janardhanan, PHI learning private limited, 2014.

IV Year – II SEMESTER

T	P	C
3+1	0	3

ELECTIVE – III

ELECTRIC POWER QUALITY

Preamble:

Power quality is a major problem for utilities and customers. Customers using sensitive critical loads need quality power for proper operation of the electrical equipment. It is important for the student to learn the power quality issues and improvement measures provided by the utility companies. This course covers the topics on voltage and current imperfections, harmonics, voltage regulation, power factor improvement, distributed generation, power quality monitoring and measurement equipment.

Learning Objectives:

- To learn different types of power quality phenomena.
- To identify sources for voltage sag, voltage swell, interruptions, transients, long duration over voltages and harmonics in a power system.
- To describe power quality terms and study power quality standards.
- To learn the principle of voltage regulation and power factor improvement methods.
- To explain the relationship between distributed generation and power quality.
- To understand the power quality monitoring concepts and the usage of measuring instruments.

UNIT–I:

Introduction

Overview of power quality – Concern about the power quality – General classes of power quality and voltage quality problems – Transients – Long–duration voltage variations – Short–duration voltage variations – Voltage unbalance – Waveform distortion – Voltage fluctuation – Power frequency variations.

UNIT–II:

Voltage imperfections in power systems

Power quality terms – Voltage sags – Voltage swells and interruptions –

Sources of voltage sag, swell and interruptions – Nonlinear loads – IEEE and IEC standards. Source of transient over voltages – Principles of over voltage protection – Devices for over voltage protection – Utility capacitor switching transients.

UNIT–III

Voltage Regulation and power factor improvement:

Principles of regulating the voltage – Device for voltage regulation – Utility voltage regulator application – Capacitor for voltage regulation – End–user capacitor application – Regulating utility voltage with distributed resources – Flicker – Power factor penalty – Static VAR compensations for power factor improvement.

UNIT– IV

Harmonic distortion and solutions

Voltage distortion vs. Current distortion – Harmonics vs. Transients – Harmonic indices – Sources of harmonics – Effect of harmonic distortion – Impact of capacitors, transformers, motors and meters – Point of common coupling – Passive and active filtering – Numerical problems.

UNIT–V

Distributed Generation and Power Quality

Resurgence of distributed generation – DG technologies – Interface to the utility system – Power quality issues and operating conflicts – DG on low voltage distribution networks.

UNIT–VI

Monitoring and Instrumentation

Power quality monitoring and considerations – Historical perspective of PQ measuring instruments – PQ measurement equipment – Assessment of PQ measuring data – Application of intelligent systems – PQ monitoring standards.

Learning Outcomes:

At the end of this course the student should be able to

- Differentiate between different types of power quality problems.
- Explain the sources of voltage sag, voltage swell, interruptions, transients, long duration over voltages and harmonics in a power system.
- Analyze power quality terms and power quality standards.

- Explain the principle of voltage regulation and power factor improvement methods.
- Demonstrate the relationship between distributed generation and power quality.
- Explain the power quality monitoring concepts and the usage of measuring instruments.

Textbooks:

1. Electrical Power Systems Quality, Dugan R C, McGranaghan M F, Santoso S, and Beaty H W, Second Edition, McGraw–Hill, 2012, 3rd edition.
2. Electric power quality problems –M.H.J. Bollen IEEE series-Wiley india publications, 2011.
3. Power Quality Primer, Kennedy B W, First Edition, McGraw–Hill, 2000.

Reference Books:

1. Understanding Power Quality Problems: Voltage Sags and Interruptions, Bollen M HJ, First Edition, IEEE Press; 2000.
2. Power System Harmonics, Arrillaga J and Watson N R, Second Edition, John Wiley & Sons, 2003.
3. Electric Power Quality control Techniques, W. E. Kazibwe and M. H. Sendaula, Van Nostrad Reinhold, New York.
4. Power Quality c.shankaran, CRC Press, 2001
5. Harmonics and Power Systems –Franciso C.DE LA Rosa–CRC Press (Taylor & Francis).
6. Power Quality in Power systems and Electrical Machines–EwaldF. fuchs, Mohammad A.S. Masoum–Elsevier.

DIGITAL SIGNAL PROCESSING
(Elective – III)

Preamble:

Signals analysis is very important in daily life. Hence it is required to study the different signals (continuous and discrete) and their properties. The behavior of the signals in time and frequency domain are important in analyzing the response of the network. The tools like FFT, DFT, Z–transforms may be used in the analysis of the signals. Filters must be required to eliminate the unwanted signals. Hence digital filter design also required to be studied. Sampling of signals are required to convert continuous to discrete signals. To have knowledge on the implementation signals, DSP processors must be studied.

Learning Objectives:

- To study different types of signals and properties of systems.
- To study the application of Fourier transform to discrete time systems.
- To study the FFT and inverse FFT and its applications to discrete sequences.
- To study the realization of digital filters and their design.
- To study the multi–rate signal processing.
- To study the architecture of digital signal processors.

UNIT–I:

Introduction

Introduction to Digital Signal Processing**:** Discrete time signals & sequences – Linear shift invariant systems – Stability and causality – Linear constant coefficient difference equations.

UNIT–II:

Discrete Fourier Series

Properties of discrete Fourier series, DFS representation of periodic sequences, Discrete Fourier transforms: Properties of DFT, linear convolution of sequences using DFT, Computation of DFT. Relation between Z–transform and DFS.

UNIT–III:

Fast Fourier Transforms

Frequency domain representation of discrete time signals and systems – Fast

Fourier transforms (FFT) – Radix–2 decimation in time and decimation in frequency FFT Algorithms – Inverse FFT – and FFT for composite N.

UNIT–IV:

Realization of Digital Filters

Solution of difference equations of digital filters – Block diagram representation of linear constant – Coefficient difference equations – Basic structures of IIR systems – Transposed forms – Basic structures of FIR systems – System function.

IIR Digital Filters

Analog filter approximations – Butter worth and Chebyshev – Design of IIR Digital filters from analog filters – Design Examples**:** Analog–Digital transformations.

FIR Digital Filters

Characteristics of FIR Digital Filters – Frequency response – Design of FIR Digital Filters using Window Techniques – Frequency Sampling technique – Comparison of IIR & FIR filters.

UNIT–V:

Multirate Digital Signal Processing:

Decimation – Interpolation – Down sampling – Up sampling rate – Conversion – Implementation of sampling rate conversion.

UNIT–VI:

Introduction to Digital Signal Processors(DSP):

Introduction to programmable DSPs**:** Multiplier and Multiplier Accumulator (MAC) – Modified bus structures and memory access schemes in DSPs – Multiple access memory – Multiport memory – VLSI architecture – Pipelining – Special addressing modes – On–chip peripherals – Architecture of TMS 320C5X – Introduction – Bus structure – Central arithmetic logic unit – Auxiliary registrar – Index registrar – Auxiliary register compare register – Block move address register – Parallel logic unit – Memory mapped registers – Program controller – Some flags in the status registers – On–chip registers, On–chip peripherals.

Learning outcomes:

- Able to study different types of signals and properties of systems.
- Able to apply of Fourier transform to discrete time systems.
- Able to apply the FFT and inverse FFT to discrete sequences.

- Able to realize and design digital filters.
- Able to understand the multi–rate signal processing.
- Able to understand architecture of digital signal processors.

Text Books:

1. Digital Signal Processing – Alan V. Oppenheim, Ronald W. Schafer, PHI Ed., 2006
2. Digital Signal Processing, Principles, Algorithms, and Applications: John G. Proakis, Dimitris G. Manolakis, Pearson Education / PHI, 2007

Reference Books:

1. Digital Signal Processing: Andreas Antoniou, TATA McGraw Hill , 2006
2. Digital Signal Processing: MH Hayes, Schaum's Outlines, TATA Mc–Graw Hill, 2007.
3. DSP Primer – C. Britton Rorabaugh, Tata Mc Graw Hill, 2005.
4. Fundamentals of Digital Signal Processing using Matlab – Robert J. Schilling, Sandra L. Harris, Thomson, 2007.
5. Digital Signal Processors – Architecture, Programming and Applications, B.Venkataramani, M.Bhaskar, TATA McGraw Hill, 2002.

FLEXIBLE ALTERNATING CURRENT TRANSMISSION SYSTEMS (FACTS)

(Elective – III)

Preamble:

Flexible Alternating Current Transmission System controllers have become a part of modern power system. It is important for the student to understand the principle of operation of series and shunt compensators by using power electronics. As the heart of many power electronic controllers is a voltage source converter (VSC), the student should be acquainted with the operation and control of VSC. Two modern power electronic controllers are also introduced.

Learning Objectives:

- To learn the basics of power flow control in transmission lines by using FACTS controllers
- To explain the operation and control of voltage source converter.
- To discuss compensation methods to improve stability and reduce power oscillations in the transmission lines.
- To learn the method of shunt compensation by using static VAR compensators.
- To learn the methods of compensation by using series compensators
- To explain the operation of two modern power electronic controllers (Unified Power Quality Conditioner and Interline Power Flow Controller).

UNIT–I:

Introduction to FACTS

Power flow in an AC System – Loading capability limits – Dynamic stability considerations – Importance of controllable parameters – Basic types of FACTS controllers – Benefits from FACTS controllers – Requirements and characteristics of high power devices – Voltage and current rating – Losses and speed of switching – Parameter trade–off devices.

UNIT–II:

Voltage source and Current source converters

Concept of voltage source converter(VSC) – Single phase bridge converter – Square–wave voltage harmonics for a single–phase bridge converter – Three–phase full wave bridge converte r– Three–phase current source

converter – Comparison of current source converter with voltage source converter.

UNIT–III:

Shunt Compensators–1

Objectives of shunt compensation – Mid–point voltage regulation for line segmentation – End of line voltage support to prevent voltage instability – Improvement of transient stability – Power oscillation damping.

Methods of controllable VAR generation

Variable impedance type static VAR generators – Thyristor Controlled Reactor (TCR) and Thyristor Switched Reactor (TSR).

UNIT–IV:

Shunt Compensators–2

Thyristor Switched Capacitor(TSC)– Thyristor Switched Capacitor – Thyristor Switched Reactor (TSC–TCR). Static VAR compensator(SVC) and Static Compensator(STATCOM)**:** The regulation and slope transfer function and dynamic performance – Transient stability enhancement and power oscillation damping– Operating point control and summary of compensation control.

UNIT V:

Series Compensators

Static series compensators**:** Concept of series capacitive compensation – Improvement of transient stability – Power oscillation damping – Functional requirements. GTO thyristor controlled Series Capacitor (GSC) – Thyristor Switched Series Capacitor (TSSC) and Thyristor Controlled Series Capacitor (TCSC).

UNIT–VI:

Combined Controllers

Schematic and basic operating principles of unified power flow controller(UPFC) and Interline power flow controller(IPFC) – Application of these controllers on transmission lines.

Learning Outcomes:

The student should be able to

- Determine power flow control in transmission lines by using FACTS controllers.
- Explain operation and control of voltage source converter.

- Discuss compensation methods to improve stability and reduce power oscillations in the transmission lines.
- Explain the method of shunt compensation by using static VAR compensators.
- Appreciate the methods of compensations by using series compensators.
- Explain the operation of modern power electronic controllers (Unified Power Quality Conditioner and Interline Power Flow Controller).

Text Books:

1. "Understanding FACTS" N.G.Hingorani and L.Guygi, IEEE Press.Indian Edition is available:—Standard Publications, 2001.
2. "Flexible ac transmission system (FACTS)" Edited by Yong Hue Song and Allan T Johns, Institution of Electrical Engineers, London.
3. Thyristor-based FACTS Controllers for Electrical Transmission Systems, by R.Mohan Mathur and Rajiv K.Varma, Wiley.

IV Year – II SEMESTER	T	P	C
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ELECTIVE – IV

OOPS THROUGH JAVA

Preamble:

This course teaches students how to develop Java applications. Topics covered include the Java programming language syntax, OO programming using Java, exception handling, file input/output, threads, collection classes, and networking.

Learning Objectives:

- Focus on object oriented concepts and java program structure and its installation.
- Comprehension of java programming constructs, control structures in Java.
- Implementing Object oriented constructs such as various class hierarchies, interfaces and exception handling.
- Understanding of Thread concepts and I/O in Java.
- Being able to build dynamic user interfaces using applets and Event handling in java.
- Understanding of various components of Java AWT and Swing and writing code snippets using them.

UNIT I:

Introduction to OOP

Introduction, Need of Object Oriented Programming, Principles of Object Oriented Languages, Procedural languages Vs OOP, Applications of OOP, History of JAVA, Java Virtual Machine, Java Features, Program structures, Installation of JDK1.6

UNIT II:

Programming Constructs

Variables, Primitive Datatypes, Identifiers- Naming Coventions, Keywords, Literals, Operators-Binary, Unary and ternary, Expressions, Precedence rules

and Associativity, Primitive TypeConversion and Casting, Flow of control-Branching, Conditional, loops.

Classes and Objects- classes, Objects, Creating Objects, Methods, constructors-Constructor overloading, cleaning up unused objects-Garbage collector, Class variable and Methods-Static keyword, this keyword, Arrays, Command line arguments.

UNIT III:

Inheritance: Types of Inheritance, Deriving classes using extends keyword, Method overloading, super keyword, final keyword, Abstract class.

Interfaces, Packages and Enumeration: Interface-Extending interface, Interface Vs Abstract classes, Packages-Creating packages, using Packages, Access protection, java. lang package.

Exceptions & Assertions - Introduction, Exception handling techniques-try... catch, throw, throws, finally block, user defined exception, Exception Encapsulation and Enrichment, Assertions.

UNIT IV:

MultiThreading : java.lang.Thread, The main Thread, Creation of new threads, Thread priority, Multithreading- Using isAlive () and join (), Syncronization, suspending and Resuming threads, Communication between Threads

Input/Output: reading and writing data, java.io package

UNIT V:

Applets- Applet class, Applet structure, An Example Applet Program, Applet Life Cycle, paint (), update () and repaint ()

Event Handling -Introduction, Event Delegation Model, java.awt.event Description, Sources of Events, Event Listeners, Adapter classes, Inner classes.

UNIT VI:

Abstract Window Toolkit

Why AWT?, java.awt package, Components and Containers, Button, Label, Checkbox, Radio buttons, List boxes, Choice boxes, Text field and Text area, container classes, Layouts, Menu, Scroll bar

Swing:

Introduction, JFrame, JApplet, JPanel, Components in swings, Layout Managers, JList and JScroll Pane, Split Pane, JTabbedPane, Dialog Box

Pluggable Look and Feel.

Learning Outcomes:

- Understand the format and use of objects.
- Understand basic input/output methods and their use.
- Understand object inheritance and its use.
- Understand development of JAVA applets vs. JAVA applications.
- Understand the use of various system libraries.

Text Books:

1. The Complete Refernce Java, 8ed, Herbert Schildt, TMH
2. Programming in JAVA, Sachin Malhotra, Saurabh choudhary, Oxford.
3. JAVA for Beginners, 4e, Joyce Farrell, Ankit R. Bhavsar, Cengage Learning.
4. Object oriented programming with JAVA, Essentials and Applications, Raj Kumar Bhuyya, Selvi, Chu TMH.
5. Introduction to Java rogramming, 7th ed, Y Daniel Liang, Pearson.

Reference Books:

1. JAVA Programming, K. Rajkumar. Pearson.
2. Core JAVA, Black Book, Nageswara Rao, Wiley, Dream Tech
3. Core JAVA for Beginners, Rashmi Kanta Das, Vikas.
4. Object Oriented Programming through JAVA , P Radha Krishna, University Press.

UNIX AND SHELL PROGRAMMING
(Elective – IV)

Learning Objectives:

- to provide a comprehensive introduction to Shell Programming.
- have the fundamental skills required to write simple and complex Shell scripts to automate jobs and processes in the Unix environment.

UNIT I:

Introduction to Unix:- Architecture of Unix, Features of Unix, Unix Commands – PATH, man, echo, printf, script, passwd, uname, who, date, stty, pwd, cd, mkdir, rmdir, ls, cp, mv, rm, cat, more, wc, lp, od, tar, gzip.

UNIT II :

Unix Utilities:- Introduction to unix file system, vi editor, file handling utilities, security by file permissions, process utilities, disk utilities, networking commands, unlink, du, df, mount, umount, find, unmask, ulimit, ps, w, finger, arp, ftp, telnet, rlogin.Text processing utilities and backup utilities, detailed commands to be covered are tail, head, sort, nl, uniq, grep, egrep, fgrep, cut, paste, join, tee, pg, comm, cmp, diff, tr, awk, cpio.

UNIT III :

File Management : File Structures, System Calls for File Management – create, open, close, read, write, lseek, link, symlink, unlink, stat, fstat, lstat, chmod, chown, Directory API – opendir, readdir, closedir, mkdir, rmdir, umask.

Introduction to Shells : Unix Session, Standard Streams, Redirection, Pipes, Tee Command, Command Execution, Command- Line Editing, Quotes, Command Substitution, Job Control, Aliases, Variables, Predefined Variables, Options, Shell/Environment Customization.

Filters : Filters and Pipes, Concatenating files, Display Beginning and End of files, Cut and Paste, Sorting, Translating Characters, Files with Duplicate Lines, Count characters, Words or Lines, Comparing Files.

UNIT IV :

Grep : Operation, grep Family, Searching for File Content.

Sed : Scripts, Operation, Addresses, commands, Applications, grep and sed.

awk: Execution, Fields and Records, Scripts, Operations, Patterns, Actions, Associative Arrays, String.

Functions, String Functions, Mathematical Functions, User – Defined Functions, Using System commands, in awk, Applications, awk and grep, sed and awk.

UNIT V :

Interactive Korn Shell : Korn Shell Features, Two Special Files, Variables, Output, Input, Exit Status of a Command, eval Command, Environmental Variables, Options, Startup Scripts, Command History, Command Execution Process.

Korn Shell Programming : Basic Script concepts, Expressions, Decisions: Making Selections, Repetition, special Parameters and Variables, changing Positional Parameters, Argument Validation, Debugging Scripts, Script Examples.

UNIT VI :

Interactive C Shell : C shell features, Two Special Files, Variables, Output, Input, Exit Status of a Command, eval Command, Environmental Variables, On-Off Variables, Startup and Shutdown Scripts, Command History, Command Execution Scripts.

C Shell Programming : Basic Script concepts, Expressions, Decisions: Making Selections, Repetition, special Parameters and Variables, changing Positional Parameters, Argument Validation, Debugging Scripts, Script Examples.

Learning Outcomes:

Upon completing this course students will have skills in:

1. Use UNIX shells and commands to create powerful data processing applications.
2. Build UNIX applications using the shell command interpreter and UNIX commands.
3. Use UNIX at the command line to manage data, files, and programs.
4. Use UNIX editors and tools to create and modify data files and documents.

Text Books :

1. Unix and shell Programming Behrouz A. Forouzan, Richard F. Gilberg. Thomson.

2. Your Unix the ultimate guide, Sumitabha Das, TMH. 2nd Edition. 2007-2008 Page 34 of 95.

References Books:

1. Unix for programmers and users, 3rd edition, Graham Glass, King Ables, Pearson Education.
2. Unix programming environment, Kernighan and Pike, PHI. / Pearson Education.
3. The Complete Reference Unix, Rosen, Host, Klee, Farber, Rosinski, Second Edition, TMH.

AI TECHNIQUES
(Elective IV)

Preamble:

The aim of this course is to study the AI techniques such as neural networks and fuzzy systems. The course focuses on the application of AI techniques to electrical engineering.

Learning Objectives:

- To study various methods of AI
- To study the models and architecture of artificial neural networks.
- To study the ANN paradigms**.**
- To study the fuzzy sets and operations.
- To study the fuzzy logic systems.
- To study the applications of AI.

UNIT–I:

Introduction to AI techniques

Introduction to artificial intelligence systems– Humans and Computers – Knowledge representation – Learning process – Learning tasks – Methods of AI techniques.

UNIT–II:

Neural Networks

Organization of the Brain – Biological Neuron – Biological and Artificial neuron Models, MC Culloch-pitts neuron model, Activation functions, Learning rules, neural network architectures- Single-layer feed-forward networks: – Perceptron, Learning algorithm for perceptron- limitations of Perceptron model

UNIT–III:

ANN paradigm

Multi-layer feed-forward network (based on Back propagation algorithm)– Radial-basisn function networks- Recurrent networks (Hopfield networks).

UNIT – IV:

Classical and Fuzzy Sets

Introduction to classical sets – properties – Operations and relations – Fuzzy sets – Membership – Uncertainty – Operations – Properties – Fuzzy relations – Cardinalities – Membership functions.

UNIT–V:

Fuzzy Logic System Components

Fuzzification – Membership value assignmen – Development of rule base and decision making system – Defuzzification to crisp sets – Defuzzification methods – Basic hybrid system.

UNIT–VI:

Application of AI techniques

Load forecasting – Load flow studies – Economic load dispatch – Load frequency control – Reactive power control – Speed control of dc and ac motors.

Text Books:

1. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications by S.Rajasekaran and G.A. Vijayalakshmi Pai – PHI Publication.
2. Fuzzy logic with fuzzy applications- by T.J. Ross, TMH.

Reference Books:

1. Introduction to Artificial Neural Systems – Jacek M. Zurada, Jaico Publishing House, 1997.
2. Fundamentals of Neural Networks Architectures, Algorithms and Applications - by laurene Fausett, Pearson.
3. Neural Networks, Algorithms, Applications and programming Techniques by James A. Freeman, David M. Skapura.
4. Introduction to Neural Networks using MATLAB 6.0 by S N Sivanandam, S Sumathi, S N Deepa TMGH

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POWER SYSTEM REFORMS
(Elective IV)

Preamble:

This course introduces the concepts and issues of power system reforms and aims at computation of Available Transfer Capability (ATC), Congestion Management, Electricity Pricing, Ancillary services Management and Power system operation in competitive environment.

Learning Objectives:

- To study fundamentals of power system deregulation and restructuring.
- To study available transfer capability.
- To study congestion management
- To study various electricity pricing.
- To study operation of power system in deregulated environment.
- To study importance of Ancillary services management.

UNIT–I

Over view of key issues in electric utilities

Introduction – Restructuring models – Independent system operator (ISO) – Power Exchange – Market operations – Market Power – Standard cost – Transmission Pricing – Congestion Pricing – Management of Inter zonal/Intra zonal Congestion.

UNIT–II

OASIS: Open Access Same–Time Information System

Structure of OASIS – Processing of Information – Transfer capability on OASIS – Definitions Transfer Capability Issues – ATC – TTC – TRM – CBM calculations – Methodologies to calculate ATC.

UNIT–III

Congestion Management

Introduction to congestion management – Methods to relieve congestion

UNIT–IV

Electricity Pricing:

Introduction – Electricity price volatility electricity price indexes –

Challenges to electricity pricing – Construction of forward price curves – Short–time price forecasting.

UNIT–V

Power system operation in competitive environment:

Introduction – Operational planning activities of ISO – The ISO in pool markets – The ISO in bilateral markets – Operational planning activities of a Genco.

UNIT–VI

Ancillary Services Management:

Introduction – Reactive power as an ancillary service – A review – Synchronous generators as ancillary service providers.

Learning Outcomes:

- Will understand importance of power system deregulation and restructuring.
- Able to compute ATC.
- Will understand transmission congestion management.
- Able to compute electricity pricing in deregulated environment.
- Will be able to understand power system operation in deregulated environment.
- Will understand importance of ancillary services.

Text Books:

1. Kankar Bhattacharya, Math H.J. Boller, Jaap E.Daalder, 'Operation of Restructured Power System' Klum,er Academic Publisher – 2001
2. Mohammad Shahidehpour, and Muwaffaq alomoush, – "Restructured electrical Power systems" Marcel Dekker, Inc. 2001
3. Loi Lei Lai; "Power system Restructuring and Deregulation", Jhon Wiley & Sons Ltd., England.
4. Electrical Power Distribution Case studies from Distribution reform, upgrades and Management (DRUM) Program, by USAID/India, TMH.

SYSTEMS ENGINEERING
(Elective IV)

Preamble:

This course is intended to introduce the student to the systems engineering process used to create multidisciplinary solutions to complex problems which have multiple, often conflicting objectives. The course will provide an overview of systems engineering in the context of large developmental programs. By focusing on the objectives, principles and practices of systems engineering, the course will enable the student to better understand the functions, capabilities and limitations of systems engineering.

Learning Objectives:

- To understand the foundations of systems Engineering.
- To understand the process of engineering systems systematically
- To understand how to deploy (put to use) the systems engineered.
- To understand the supporting systems during systems life cycle.
- To understand the application of systems engineering in product and service space.
- To understand systems engineering in perspective of related disciplines project management and software engineering.

UNIT–I:

Introduction to Systems**:** Systems Fundamentals – Systems Science – Systems Thinking – Modeling Systems.

UNIT –II:

Systems Engineering and Management: System life cycle models – System vision and mission – Stakeholder needs and requirements – System requirements – Logical architecture design – Physical architecture design – System analysis – System realization – System implementation – System integration – System verification – System validation.

UNIT – III:

System deployment and use – System deployment – Operation of the system – System maintenance – Logistics.

UNIT – IV:

Systems engineering management – Planning – Assessment and Control –

Risk Management – Measurement – Decision Management – Configuration Management – Information Management – Quality Management.

UNIT – V:
Applications of systems engineering **–** Product systems engineering **–** Services Systems engineering **–** Enterprise systems engineering

UNIT – VI:
Enabling systems engineering – People**:** Enabling teams and individuals – Software engineering, Project management – Case studies.

Learning Outcomes:

- To be able to appreciate and evaluate systems in general and apply to specific systems.
- Should engineer successful systems fit for intended purpose. Right from concept to development.
- Should be able to successfully deploy the new systems developed.
- Should be able to leverage the support systems for success of systems from womb to tomb.
- Should be able to apply systems engineering in engineering product and services.
- Should be able to relate systems engineering with project management and software engineering.

Text books:

1. SEBOK Guide to the Systems Engineering Body of Knowledge (SEBoK), version 1.2 – INCOSEwww.sebowiki.org/wiki/incose systems engineering Hand Book.

Reference Books:

1. Systems engineering principles and practice second edition John wiley Alexander Kossiakoff etal.
2. Systems engineering with Economics, Probability and Statistics Khisty C.Jotin. 2nd edition, 2nd edition J Ross publications.

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