SEMESTER I

15MECC101  APPLIED MATHEMATICS  3 1 0 4 100

OBJECTIVES:

- To kindle the analyticity of the engineers.
- To develop an appropriate level of mathematical literacy and competency.

INTENDED OUTCOMES

- To teach the fundamental concepts of advanced matrix theory and mathematical modeling of the problems
- To study about Calculus of variations and Random Process
- To teach transforms and its applications

UNIT - I  ADVANCED MATRIX THEORY (9)

UNIT - II  CALCULUS OF VARIATIONS (9)
Variation and its properties – Euler’s equation – Functionals dependent on first and higher order derivatives – Functionals dependent on functions of several independent variables – Some applications – Direct methods: Ritz and Kantorovich methods.

UNIT - III  LINEAR PROGRAMMING (9)
Basic concepts – Graphical and Simplex methods –Transportation problem – Assignment problem.

UNIT – IV  Z – TRANSFORMS (9)

UNIT – V  RANDOM PROCESSES (9)

Total: 45

TEXT BOOKS

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<tr>
<th>S. No.</th>
<th>Author(s) Name</th>
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<tbody>
<tr>
<td>2</td>
<td>Gupta.A.S.</td>
<td>Calculus of Variations with Applications</td>
<td>Prentice Hall of India, New Delhi</td>
<td>1999</td>
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</tbody>
</table>

WEBSITES

1. www.phpsimplex.com
2. www.mathyards.com
3. www.mathworld.com
OBJECTIVES:

- To educate on modeling and representing systems in state variable form.
- To educate on solving linear and non-linear state equations.
- To illustrate the role of controllability and observability.
- To educate on stability analysis of systems using Lyapunov theory.
- To educate on modal concepts and design of state and output feedback controllers and estimators.

INTENDED OUTCOMES:

- To gain the knowledge about linear state equations.
- To gain the knowledge about controllability and observability.
- To gain the knowledge about Lyapunov’s theory

UNIT-I MODERN CONTROL THEORY (9)
Limitations of conventional control theory - Concepts of state, State variables and state model- State model for linear time invariant systems: State space representation using physical-Phase and canonical variables.

UNIT-II SYSTEM RESPONSE (9)
Transfer function from state model - Transfer matrix - Decomposition of transfer functions Direct, cascade and parallel decomposition techniques - Solution of state equation - State transition matrix computation.

UNIT-III DISCRETE SYSTEM (9)
State space representation of discrete system - Decomposition of Transfer functions - Solution of discrete time system - state transition matrix - Discretisation of continuous time state equations.

UNIT-IV SYSTEM MODELS (9)
Characteristic equation - Eigen values and Eigen vectors - Invariance of Eigen values - Diagonalization - Jordan Canonical form - Concepts of controllability and observability - Kalman's and Gilbert's tests - Controllable and observable phase variable forms - Effect of pole-zero cancellation on controllability and observability.

UNIT-V LIAPUNOV STABILITY (9)

Total: 45

REFERENCES

<table>
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<tr>
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<tbody>
<tr>
<td>1</td>
<td>Katsuhiko Ogata</td>
<td>Modern Control Engineering</td>
<td>Prentice Hall of India Private Ltd, New</td>
<td>1998</td>
</tr>
<tr>
<td>2</td>
<td>Nagrath, I.J and Gopal M.</td>
<td>Control Systems Engineering</td>
<td>New Age International Publisher, New Delhi</td>
<td>2005</td>
</tr>
</tbody>
</table>

**WEBSITES**
1. www.microsemi.com
2. www.ece.ncsu.edu
OBJECTIVES:

- To study the internal structure and the switching and operating characteristics of the basic power devices.
- To study the advanced power devices and its working principle.

INTENDED OUTCOMES:

- Ability to determine the suitable device for the application.
- Ability to design of semiconductor device and its parameters.
- Ability to design of protection circuits and control circuits
- Ability to determine the reliability of the system.

UNIT – I  INTRODUCTION


UNIT – II  CURRENT CONTROLLED DEVICES

BJTs – Construction, static characteristics, switching characteristics- Negative temperature coefficient and secondary breakdown – Power Darlington – Thyristors – Physical and electrical principle underlying operating mode – Two transistor analogy – Effect of K and i_c on i_a – concept of latching – Gate and switching characteristics – Converter grade and inverter grade and other types; series and parallel operation – Comparison of BJT and Thyristor – Steady state and dynamic models of BJT and Thyristor.

UNIT – III  VOLTAGE CONTROLLED DEVICES

Power MOSFETs and IGBTs – Principle of voltage controlled devices, construction, types, static and switching characteristics – Steady state and dynamic models of MOSFET and IGBTs; Basics of GTO, MCT, FCT, RCT and IGCT.

UNIT – IV  FIRING AND PROTECTING CIRCUITS

Necessity of isolation – pulse transformer – opto-coupler; Gate drive circuit for SCR, MOSFET, IGBTs and base driving for power BJT – over voltage, over current and gate protections, Design of snubbers.

UNIT – V  THERMAL PROTECTION


Total: 45

REFERENCES
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<tr>
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<tr>
<td>2</td>
<td>Rashid, M.H.</td>
<td>Power Electronics circuits, Devices and Applications</td>
<td>Prentice Hall India, New Delhi</td>
<td>2004</td>
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<tr>
<td>4</td>
<td>Mohan, Undeland and Robins</td>
<td>Power Electronics – Concepts, Applications and Design</td>
<td>John Wiley and Sons, Singapore</td>
<td>2000</td>
</tr>
</tbody>
</table>

**WEBSITES**
1. [www.circuitstoday.com](http://www.circuitstoday.com)
OBJECTIVES:

- To design and analyze the different types of inverters.
- To study the working of advanced types of inverters such as multilevel inverters and resonant inverters.
- Apply switching techniques and basic topologies of DC-AC converters

INTENDED OUTCOMES:

- Ability to design inverters for different applications
- Ability to develop gating circuits for inverters
- Ability to design the filters for harmonics reduction

UNIT-I SINGLE PHASE INVERTERS (9)
Principle of operation of half and full bridge inverters – Performance parameters – Voltage and wave form control of single phase inverters using various PWM techniques – SVM Technique.

UNIT-II THREE PHASE VOLTAGE SOURCE INVERTERS (9)
180 degree and 120 degree conduction mode inverters with star and delta connected loads – voltage and wave form control of three phase inverters – SVM Technique.

UNIT-III CURRENT SOURCE INVERTERS (9)

UNIT-IV MULTILEVEL INVERTERS (9)

UNIT-V RESONANT INVERTERS (9)
Series and parallel resonant inverters - voltage control of resonant inverters – Class E resonant inverter – resonant DC – link inverters.

Total: 45

TEXT BOOKS

<table>
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<tr>
<td>2</td>
<td>Jai P. Agrawal</td>
<td>Power Electronics Systems</td>
<td>Pearson Education, Asia</td>
<td>2002</td>
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# REFERENCES

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OBJECTIVES:

- To obtain the switching characteristic of different types of power semi-conductor devices.
- To determine the operation, characteristics and performance parameters of controlled rectifiers.
- To apply switching techniques and basic topologies of DC-DC switching regulators.

INTENDED OUTCOMES:

- Ability to analyze the characteristics of Power electronics devices.
- Ability to determine the various parameters of single phase and three phase rectifier.
- Ability to demonstrate the response of chopper for a dc load
- Ability to design a PWM converter and an ac voltage regulator.

UNIT- I SINGLE PHASE AC-DC CONVERTER (9)

UNIT- II THREE PHASE AC-DC CONVERTER (9)

UNIT- III DC-DC CONVERTERS (9)

UNIT- IV AC VOLTAGE CONTROLLERS (9)

UNIT -V CYCLOCONVERTERS (9)

Total: 45

TEXT BOOKS

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<tr>
<td>1</td>
<td>Bimbhra, P.S.</td>
<td>Power Electronics</td>
<td>Khanna Publishers, New Delhi</td>
<td>2003</td>
</tr>
<tr>
<td>2</td>
<td>Jagannathan, V</td>
<td>Introduction to Power Electronics</td>
<td>Prentice Hall of India, New Delhi</td>
<td>2006</td>
</tr>
</tbody>
</table>

**REFERENCES**

**WEBSITES**
1. www.powerconversion.com
2. www.vicorpower.com
15MEPE106  MODELING AND ANALYSIS OF ELECTRICAL MACHINES

OBJECTIVES:

- To analyze the various types of machines and model with different transformation techniques.
- To study the special machines and its model.

INTENDED OUTCOMES:

- Ability to understand the various electrical parameters in mathematical form.
- Ability to understand the different types of reference frame theories and transformation relationships.
- Ability to find the electrical machine equivalent circuit parameters and modeling of electrical machines

UNIT – I  ELECTROMECHANICAL ENERGY CONVERSION  (9)
- Introduction – Energy in Magnetic System – Field energy and mechanical force – Multiple excited Magnetic field Systems- Dynamic Equations of Electromechanical Systems-
- Basic concepts of Rotating machines- Elementary machines-Generated emf- MMF of Distributed AC windings- Rotating magnetic field- Torque in round rotor machine – Operation of basic machine types.

UNIT – II  MODELING OF DC MACHINES  (9)

UNIT – III  DYNAMIC MODELING OF INDUCTION MACHINES  (9)

UNIT – IV  BRUSHLESS DC MACHINES  (9)

UNIT – V  SPECIAL MACHINES  (9)
- Permanent magnet and characteristics - Synchronous machines with PMs: Machine configuration-flux density distribution-types of PMSM-Variable Reluctance Machines: Basics-analysis-practical configuration-circuit waveforms for torque production - stepping motors.

Total: 45

TEXT BOOK
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<tr>
<td>1</td>
<td>Paul C. Krause, Oleg Wasynczuk, Scott D. Sudhoff</td>
<td>Analysis of Electric Machinery and Drive Systems</td>
<td>Wiley – Interscience</td>
<td>2004</td>
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<tr>
<td>3</td>
<td>Miller, T.J.E</td>
<td>Brushless Permanent Magnet and Reluctance Motor Drives</td>
<td>Oxford, USA</td>
<td>2005</td>
</tr>
</tbody>
</table>

**REFERENCES**

**WEBSITES**
1. www.cranfieldprecision.com
2. www.mni-group.com
OBJECTIVES:

- To expose the students to various types of scales – measurement and sampling methods.
- To understand the various types of nonparametric tests.
- To study the concerning variance.

INTENDED OUTCOMES:

- To gain the knowledge about hypotheses tests.
- To gain the knowledge about research analysis and report writing.

UNIT-I INTRODUCTION TO RESEARCH METHODOLOGY (9)
Research methodology – definition, mathematical tools for analysis, Types of research, exploratory research, conclusive research, modeling research, algorithmic research, Research process- steps. Data collection methods - Primary data – observation method, personal interview, telephonic interview, mail survey, questionnaire design. Secondary data- internal sources of data, external sources of data.

UNIT-II SCALES – MEASUREMENT AND SAMPLING METHODS (9)
Scales – measurement, Types of scale – Thurstone’s Case V scale model, Osgood’s Semantic Differential scale, Likert scale, Q- sort scale. Sampling methods- Probability sampling methods – simple random sampling with replacement, simple random sampling without replacement, stratified sampling, cluster sampling. Non-probability sampling method – convenience sampling, judgment sampling, quota sampling.

UNIT-III HYPOTHESES TESTS (9)
Hypotheses testing – Testing of hypotheses concerning means (one mean and difference between two means -one tailed and two tailed tests), Concerning variance – one tailed Chi-square test.

UNIT-IV NONPARAMETRIC TESTS (9)
Nonparametric tests- One sample tests – one sample sign test, Kolmogorov-Smirnov test, run test for randomness, Two sample tests – Two sample sign test, Mann-Whitney U test, K-sample test - Kruskal Wallis test (H-Test).

UNIT-V RESEARCH ANALYSIS AND REPORT WRITING (9)
Introduction to Discriminant analysis, Factor analysis, cluster analysis, multidimensional scaling, conjoint analysis. Report writing- Types of report, guidelines to review report, typing instructions, oral presentation.

Total: 45

REFERENCES
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<tr>
<th></th>
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<th>Title</th>
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<th>Edition</th>
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<tbody>
<tr>
<td>2</td>
<td>Panneerselvam, R.</td>
<td>Research Methodology</td>
<td>Prentice-Hall of India</td>
<td>New Delhi, 2004</td>
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</tbody>
</table>

WEBSITES
1. www. Research Methodology.com
OBJECTIVES:

- To learn converter and chopper control of dc drives
- To learn the concept of closed loop control of AC and DC drives
- To learn about digital control of drives

INTENDED OUTCOMES:

- Ability to determine the characteristics of drives
- Ability to design converter fed dc drives and chopper fed dc drives
- Ability to design of closed loop control of drives

UNIT - I  DC MOTORS FUNDAMENTALS AND MECHANICAL SYSTEMS  (9)
DC motor- Types, induced emf, speed-torque relations; Speed control – Armature and field control; Ward-Leonard control – Constant torque and constant horse power operations. Characteristics of mechanical system – dynamic equations, components of torque, types of load; Requirements of drives characteristics – multi-quadrant operation; Drive elements, types of motor duty and selection of motor rating.

UNIT- II  CONVERTER CONTROL  (9)
Principle of phase control – Fundamental relations; Analysis of series and separately excited DC motor with single-phase and three-phase converters – waveforms, performance parameters, performance characteristics. Continuous and discontinuous armature current operations; Current ripple and its effect on performance; Operation with free wheeling diode; Implementation of braking schemes; Drive employing dual converter.

UNIT - III  CHOPPER CONTROL  (9)
Introduction to time ratio control and frequency modulation; Class A, B, C, D and E chopper controlled DC motor – performance analysis, multi-quadrant control - Chopper based implementation of braking schemes; Multi-phase chopper; Related problems.

UNIT - IV  CLOSED LOOP CONTROL  (9)
Modeling of drive elements – Equivalent circuit, transfer function of self, separately excited DC motors; Linear Transfer function model of power converters; Sensing and feedback elements - Closed loop speed control – current, hysteresis, PWM current control and speed loops; P, PI and PID controllers – response comparison. Speed control by symmetric optimum method.

UNIT - V  DIGITAL CONTROL OF DC DRIVE  (9)
Phase Locked Loop and micro-computer control of DC drives – Program flow chart for constant horse power and load disturbed operations; Speed detection and gate firing. Simulation of converter and chopper fed dc drive.

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<tr>
<td>1</td>
<td>Gopal K Dubey</td>
<td>Power Semiconductor Controlled Drives</td>
<td>Prentice Hall Inc, New Jersey</td>
<td>1989</td>
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<tr>
<td>4</td>
<td>Sen, P.C</td>
<td>Thyristor DC Drives</td>
<td>John wiley and Sons, New York</td>
<td>1981</td>
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</tbody>
</table>

**WEBSITES**
1. www.sprint-electric.com
2. www.datasheetcatalog.org
OBJECTIVES:

- To learn converter and chopper control of dc drives
- To learn the concept of closed loop control of AC and DC drives
- To learn about digital control of drives

INTENDED OUTCOMES:

- Ability to determine the characteristics of drives
- Ability to design converter fed dc drives and chopper fed dc drives
- Ability to design of closed loop control of drives

UNIT I CONVENTIONAL CONTROL OF INDUCTION MOTORS (9)
Review of Induction Machine operation – Equivalent circuit – Performance of the machine with variable voltage, rotor resistance variation, pole changing and cascaded induction machines, slip power recovery schemes – Static Kramer Drive.

UNIT II VSI AND CSI FED INDUCTION MOTOR CONTROL (9)

UNIT – III FIELD ORIENTED CONTROL (9)
Field oriented control of induction machines – Theory – DC drive analogy – Direct or Feedback vector control - Indirect or Feed forward vector control – Flux vector estimation - Space Vector Modulation control.

UNIT – IV DIRECT TORQUE CONTROL (9)
Direct torque control of Induction Machines – Torque expression with stator and rotor fluxes, DTC control strategy – optimum switching vector selection – reduction of torque ripple methods.

UNIT -V SYNCHRONOUS MOTOR CONTROL (9)
Synchronous motor control - Brush and Brushless excitation – Load commutated inverter fed drive – Marginal Angle control, Cyclo-converter control, Synchronous and BLDC motor speed control, and Power Factor control.

TEXT BOOK

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<td>Bimal K Bose</td>
<td>Modern Power Electronics and AC Drives,</td>
<td>Pearson Education, Asia</td>
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<td>3</td>
<td>Leonhard, W.</td>
<td>Control of Electrical Drives</td>
<td>Narosa Publishing House</td>
<td>1992</td>
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<td>4</td>
<td>Murphy, J.M.D., and Turnbull,</td>
<td>Thyristor Control of AC Motors</td>
<td>Pergamon Press, Oxford</td>
<td>1988</td>
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<tr>
<td>5</td>
<td>Austin Hughes</td>
<td>Electric Motors and Drives – Fundamentals, Types and Applications</td>
<td>Elsevier – a division of Reed Elsevier India private Limited, New Delhi</td>
<td>2006</td>
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</table>

**WEBSITES**
LIST OF EXPERIMENTS

1. Design, simulation and implementation of Single Phase Semi-converter with R-L-E loads for continuous and discontinuous conduction modes.
2. Design, simulation and implementation of Single phase full-converter with R-L-E loads for continuous and discontinuous conduction modes.
3. Design, simulation and implementation of Three phase full-converter with R-L-E load.
4. Design, simulation and implementation of MOSFET, IGBT based Choppers.
6. Design, simulation and implementation of Single phase AC voltage controller.
7. Design, simulation and implementation of closed loop control of converter fed DC motor drive.
8. Design, simulation and implementation of closed loop control of chopper fed DC motor drive.
III SEMESTER

15MEPE301 FLEXIBLE AC TRANSMISSION SYSTEMS 3 0 0 3 100

OBJECTIVES:

- To emphasis the need for FACTS controllers.
- To learn the characteristics, applications and modeling of series and shunt FACTS controllers.
- To analyze the interaction of different FACTS controller and perform control coordination.

INTENDED OUTCOMES:

- To gain the knowledge about static VAR compensator.
- To gain the knowledge about voltage source converter based facts controllers.
- To gain the knowledge about controllers and their coordination.

UNIT-I INTRODUCTION

Reactive power control in electrical power transmission lines-Uncompensated transmission line-series compensation-Basic concepts of Static Var Compensator(SVC) - Thyristor Controlled Series capacitor(TCSC) - Unified Power Flow Controller(UPFC).

UNIT-II STATIC VAR COMPENSATOR AND ITS APPLICATIONS


UNIT-III THYRISTOR CONTROLLED SERIES CAPACITOR AND ITS APPLICATIONS


UNIT-IV EMERGING FACTS CONTROLLERS


UNIT-V CO-ORDINATION OF FACTS CONTROLLERS


Total: 45

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LIST OF ELECTIVES

15MEPE2E01  NON LINEAR SYSTEMS  3 0 0 3 100

OBJECTIVES:

- To educate on modeling and representing systems in state variable form.
- To educate on solving non-linear state equations.
- To illustrate the role of controllability and observability.
- To educate on stability analysis of systems using Lyapunov's theory.
- To educate on modal concepts and design of state and output feedback controllers and estimators.

INTENDED OUTCOMES:

- To gain the knowledge about phase plane analysis.
- To gain the knowledge about describing function analysis.
- To gain the knowledge about stability analysis.

UNIT-1 INTRODUCTION TO NON LINEAR SYSTEMS  (9)
Introduction, Characteristics of Non linear systems, Jump resonance, Sub-harmonic oscillations, Limit cycles, Frequencyentertainment quenching, Non-linearities - inherent and intentional.

UNIT-1II PHASE PLANE ANALYSIS  (9)
Phase plane analysis, Singular points, sketching of phase portraits, Limit cycles, nonlinear conservative system with nonlinear damping. Effect of non-linearities on the step response of the position control and relay systems.

UNIT-1III DESCRIBING FUNCTION ANALYSIS  (9)
Describing function techniques - Describing functions of nonlinear characteristics, Expression for the functions, Accuracy of describing function methods, Describing functions for multiple non-linearities, Evaluation of the gain function for analytically and graphically defined characteristics.

UNIT-1IV CONCEPTS OF STABILITY  (9)
Experimental determination of gain functions, Condition for stability, stability of oscillations, Stability of systems with multiple non-linearities, Closed loop frequency response, Transient response, Dual input describing functions.

UNIT-1V STABILITY ANALYSIS  (9)
Lyapunov's and Popov’s stability criteria, Linearisation and stability in the small and large sense, Second method of Lyapunov, Variable gradient methods, Lure’s problem, Popov’s stability Theorem.

Total: 45

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<td>Ogata</td>
<td>Modern Control Engineering</td>
<td>Prentice Hall India</td>
<td>1991</td>
</tr>
</tbody>
</table>
15MEPE2E02 HIGH VOLTAGE DIRECT CURRENT TRANSMISSION

OBJECTIVES:

To impart knowledge on operation, modelling and control of HVDC link.
To perform steady state analysis of AC/DC system.
To expose various HVDC simulators.

INTENDED OUTCOMES:

- To gain the knowledge about dc power transmission technology.
- To gain the knowledge about harmonics and filters.
- To gain the knowledge about graetz circuit.

UNIT- I DC POWER TRANSMISSION TECHNOLOGY (9)
Introduction-comparison of AC and DC transmission, Application of DC transmission – description of DC transmission system, planning for HVDC transmission-modern trends in DC transmission.

UNIT- II ANALYSIS OF HVDC CONVERTERS (9)
Pulse number, choice of converter configuration-simplified analysis of Graetz circuit-converter bridge characteristics – characteristics of a twelve pulse converter-detailed analysis of converters.

UNIT-III CONVERTER AND HVDC SYSTEM CONTROL (9)
General principles of DC link control-converter control characteristics-system control hierarchy-firing angle control-current and extinction angle control-starting and stopping of DC link-power control-higher level controllers-telecommunication requirements.

UNIT- IV HARMONICS AND FILTERS (9)
Introduction-generation of harmonics-design of AC filters-DC filters-carrier frequency and RI noise.

UNIT- V SIMULATION OF HVDC SYSTEMS (9)
Introduction-system simulation: Philosophy and tools-HVDC system simulation-modeling of HVDC systems for digital dynamic simulation.

Total: 45

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<tr>
<td>3</td>
<td>Rakosh Das Begamudre</td>
<td>Extra High Voltage AC Transmission</td>
<td>New Age International (P) Ltd.,</td>
<td>1990</td>
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<td>Engineering</td>
<td>New Delhi</td>
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<td>4</td>
<td>Arrillaga, J.</td>
<td>High Voltage</td>
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<td>Peter Pregrinus,</td>
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</table>

**WEBSITES**
1. www.elect.mrt.ac
2. www.energy.siemens.com
OBJECTIVES:

- To understand the various power quality issues.
- To understand the concept of power and power factor in single phase and three phase systems supplying non linear loads
- To understand the conventional compensation techniques used for power factor correction and load voltage regulation.
- To understand the active compensation techniques used for power factor correction.
- To understand the active compensation techniques used for load voltage regulation.

INTENDED OUTCOMES:

- To gain the knowledge about voltage sag, swells and interruptions.
- To gain the knowledge about waveform distortion.

UNIT - I  INTRODUCTION

Importance of power quality, terms and definitions of power quality as per IEEE standard - 1159 such as transients, short and long duration voltage variations, interruptions, short and long voltage fluctuations, imbalance, flickers and transients. Symptoms of poor power quality. Definitions and terminology of grounding. Purpose of grounding. Good grounding practices and problems due to poor grounding.

UNIT- II  FLICKERS AND TRANSIENT VOLTAGES

RMS voltage variations in power system and voltage regulation. Various devices used for voltage regulation and impact of reactive power management. Various causes of voltage flicker and their effects. Short term and long term flickers. Various means to reduce flicker. Transient over voltages, sources, impulsive transients, switching transients, Effect of surge impedance and line termination, control of transient voltages.

UNIT - III  VOLTAGE SAG, SWELLS AND INTERRUPTIONS

Definitions of voltage sag and interruptions. Voltage sags versus interruptions. Economic impact of voltage sag. Major causes and consequences of voltage sags. Voltage sag characteristics. Voltage sag assessment. Influence of fault location and fault level on voltage sag. Areas of vulnerability. Assessment of equipment sensitivity to voltage sags. Voltage sag limits for computer equipment, CBEMA, ITIC, SEMI F 42 curves. Representation of the results of voltage sag analysis. Voltage sag indices. Mitigation measures for voltage sags, such as UPS, DVR, SMEs, CVT etc., utility solutions and end user solutions.

UNIT - IV  WAVEFORM DISTORTION


UNIT- V  POWER QUALITY MONITORING

(9)

Total: 45

TEXT BOOKS

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Author(s) Name</th>
<th>Title of the book</th>
<th>Publisher</th>
<th>Year of Publication</th>
</tr>
</thead>
</table>

WEBSITES
1. www.microdaq.com
2. www.iitk.ac.in
OBJECTIVES:

- To provide knowledge about the stand alone and grid connected renewable energy systems.
- To equip with required skills to derive the criteria for the design of power converters for renewable energy applications.
- To analyse and comprehend the various operating modes of wind electrical generators and solar energy systems.
- To design different power converters namely AC to DC, DC to DC and AC to AC converters for renewable energy systems.
- To develop maximum power point tracking algorithms.

INTENDED OUTCOMES:

- To gain the knowledge about Solar PV, Fuel cells, wind electrical systems-control strategy.
- To gain the knowledge about power converters.
- To gain the knowledge about Grid integrated PMSG and SCIG Based WECS

UNIT I  INTRODUCTION  (9)
Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment (cost-GHG Emission) - Qualitative study of different renewable energy resources ocean, Biomass, Hydrogen energy systems: operating principles and characteristics of: Solar PV, Fuel cells, wind electrical systems-control strategy, operating area.

UNIT II  ELECTRICAL MACHINES FOR RENEWABLE ENERGY CONVERSION  (9)
Review of reference theory fundamentals-principle of operation and analysis: IG, PMSG, SCIG and DFIG.

UNIT III  POWER CONVERTERS  (9)

UNIT IV ANALYSIS OF WIND AND PV SYSTEMS  (9)
Stand alone operation of fixed and variable speed wind energy conversion systems and solar system-Grid connection Issues -Grid integrated PMSG and SCIG Based WECS-Grid Integrated solar system.

UNIT V  HYBRID RENEWABLE ENERGY SYSTEMS  (9)
Need for Hybrid Systems- Range and type of Hybrid systems- Case studies of Wind-PV- Maximum Power Point Tracking (MPPT).

Total: 45
## REFERENCES

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Author(S) Name</th>
<th>Title Of The Book</th>
<th>Publisher</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>S.N.Bhadra, D. Kastha, &amp; S. Banerjee</td>
<td>Wind Electrical Systems</td>
<td>Oxford University Press</td>
<td>2009</td>
</tr>
<tr>
<td>3</td>
<td>Rai. G.D</td>
<td>Non Conventional Energy Sources</td>
<td>Khanna Publishes</td>
<td>1993</td>
</tr>
<tr>
<td>4</td>
<td>Rai. G.D</td>
<td>Solar Energy Utilization</td>
<td>Khanna Publishes</td>
<td>1993</td>
</tr>
</tbody>
</table>
OBJECTIVES:

- To provide knowledge about the single layer, multilayer - feed forward, feedback networks.
- To equip with required skills to derive the fuzzification models.
- To analyses and comprehend the adaptive fuzzy control.

INTENDED OUTCOMES:

- To gain the knowledge about neural networks.
- To gain the knowledge about Fuzzy sets and representations
- To gain the knowledge about Fuzzy Relation and Logic
- To gain the knowledge about Fuzzy systems and Application

UNIT-I NEURAL NETWORK (9)

UNIT-II NEURAL NETWORKS IN CONTROL SYSTEMS (9)
Neural network for non-linear systems - schemes of neuro control - system identification forward model and inverse model - indirect learning - neural network in control systems applications - case studies.

UNIT-III FUZZY LOGIC (9)

UNIT-IV FUZZY LOGIC IN CONTROL SYSTEMS (9)

UNIT-V NON-LINEAR FUZZY CONTROL (9)
Introduction of Non-linear fuzzy control - PID like FLC - Sliding mode FLC - Sugeno FLC - adaptive fuzzy control - fuzzy control applications - case studies.

Total: 45

REFERENCES

<table>
<thead>
<tr>
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<th>Title of the book</th>
<th>Publisher</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Jacek. M. Zurada</td>
<td>Neural Networks and Fuzzy Systems</td>
<td>Prentice-Hall of India Pvt. Ltd., New Delhi</td>
<td>1999</td>
</tr>
<tr>
<td>2</td>
<td>Kosko, B</td>
<td>Neural Networks and Fuzzy Systems</td>
<td>Prentice-Hall of India Pvt. Ltd., New Delhi</td>
<td>1994</td>
</tr>
</tbody>
</table>

**WEBSITES**
1. www.ee.berkeley.edu
2. www.ijicic.org
OBJECTIVES:

- To expose the concepts of feed forward neural networks.
- To provide adequate knowledge about feedback neural networks.
- To teach about the concept of fuzziness involved in various systems.
- To expose the ideas about genetic algorithm.
- To provide adequate knowledge about of FLC and NN toolbox.

INTENDED OUTCOMES:

- To gain the knowledge about Fuzzy modeling.
- To gain the knowledge about genetic algorithm.

UNIT I INTRODUCTION

UNIT II ARTIFICIAL NEURAL NETWORKS

UNIT III FUZZY LOGIC SYSTEM
Introduction to crisp sets and fuzzy sets, basic fuzzy set operation and approximate reasoning. Introduction to fuzzy logic modeling and control. Fuzzification, inferencing and defuzzification. Fuzzy knowledge and rule bases. Fuzzy modeling and control schemes for nonlinear systems. Self-organizing fuzzy logic control. Fuzzy logic control for nonlinear time-delay system.

UNIT IV GENETIC ALGORITHM
Basic concept of Genetic algorithm and detail algorithmic steps, adjustment of free parameters. Solution of typical control problems using genetic algorithm. Concept on some other search techniques like tabu search and and-colony search techniques for solving optimization problems.

UNIT V APPLICATIONS

Total: 45

REFERENCES

<table>
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<tr>
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<tbody>
<tr>
<td>1</td>
<td>Jacek,M.Zurada, House,</td>
<td>&quot;Introduction to Artificial Neural Systems&quot;</td>
<td>Jaico Publishing, Mumbai</td>
<td>1999</td>
</tr>
<tr>
<td>2</td>
<td>Kosko,B.</td>
<td>&quot;Neural Networks And</td>
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</table>

**WEBSITES**
1. www.obitko.com
2. www.doc.ic.ac.uk
OBJECTIVES:

- To design and analyze the various types of PWM converter topologies.
- To study the high frequency power converters and its applications.
- To study and formulate the different types of power factor control strategies.
- To study the different types of filtering techniques and its applications for power converters.

INTENDED OUTCOMES:

- Ability to identify the various types of switched mode inverter topologies.
- Ability to compute the various filtering methods for PWM converters.
- Ability to illustrate the various power factor control techniques.
- Ability to illustrate the various current regulated inverter topologies and special inverter topologies.

UNIT I RESONANT CONVERTERS (9)

UNIT II IMPROVED UTILITY INTERFACE (9)
Generation of current harmonics – Current harmonics and power factor – Harmonics standards and recommended practices – Need for improved utility interface – Improved single phase utility interface – Improved three phase utility interface – Electromagnetic interference.

UNIT III FACTS AND CUSTOM POWER (9)

UNIT IV FACTS ANALYSIS & PROTECTION (9)
Modelling and methods of analysis of SVC and FACTS controllers – System control and protection – Harmonics and filters – Simulation and study of SVC and FACTS under dynamic conditions.

UNIT V EMERGING DEVICES AND CIRCUITS (9)

Total: 45
## REFERENCES

<table>
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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Joseph Vithayathil</td>
<td>Power Electronics - Principles and Applications</td>
<td>Tata McGraw Hill Education India, New Delhi</td>
<td>2010</td>
</tr>
</tbody>
</table>
OBJECTIVES:

- To introduce microprocessors and basics of system design using microprocessors.
- To introduce programming of Embedded C.
- To learn about PIC controller

INTENDED OUTCOMES:

- Ability to learn processor programming
- Ability to learn programming concepts
- Able to understand microcontrollers

UNIT-I  INTRODUCTION  (9)

UNIT-II  MEMORY AND INPUT/OUTPUT SUB SYSTEMS  (9)

UNIT-III  PIPELINING AND VECTOR PROCESSING  (9)

UNIT-IV  ARRAY PROCESSING  (9)

UNIT-V  MULTIPROCESSOR AND RISC ARCHITECTURE  (9)

Total: 45
### TEXT BOOKS

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<tbody>
<tr>
<td>1</td>
<td>Patterson, D A. and Hennessy, J L.</td>
<td>Computer Organisation and Design: The Hardware/Software Interface</td>
<td>Morgan Kaufmann Publishers, San Fransisco, USA</td>
<td>2005</td>
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</tbody>
</table>

### WEBSITES

1. www.ibm.com
2. www.design-reuse.com
OBJECTIVES:

- To study about the VLSI design strategies.
- To study the applications of VLSI for power electronics and power converters.

INTENDED OUTCOMES:

- Ability to apply knowledge of IC fabrication
- Ability to understand the fabrication steps in IC manufacturing
- Ability to monitor the measurement of resistance, capacitance and inductance
- Ability to achieve goals and objectives of various chips designed for engineering applications.

UNIT – I OVERVIEW OF VLSI DESIGN TECHNOLOGY (9)
The VLSI design process – Architectural design – Logical design – physical design – Layout styles – Full custom – Semi custom approaches. Basic electrical properties of MOS and CMOS circuits: \( I_{ds} \) versus \( V_{ds} \) relationships – Transconductance; pass transistor - nMOS inverter – Determination of pull up to pull down ratio for an nMOS Inverter – CMOS inverter – MOS transistor circuit model.

UNIT-II VLSI FABRICATION TECHNOLOGY (9)

UNIT-III MOS AND CMOS CIRCUIT DESIGN PROCESS (9)

UNIT – IV SUBSYSTEM DESIGN (9)

UNIT – V SEQUENTIAL CIRCUITS (9)

Total: 45

REFERENCES
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<td>2</td>
<td>H.E. Weste, David Harris and Ayan Banerjee,</td>
<td>CMOS VLSI Design, A circuits and Systems Perspective</td>
<td>Pearson Education, New Delhi</td>
<td>2006</td>
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</table>

**WEBSITES**
1. www.winecountrysequential.com
2. www.asic-world.com
OBJECTIVES:

- To expose the concepts of feed forward neural networks.
- To provide adequate knowledge about feedback neural networks.
- To teach about the concept of fuzziness involved in various systems.

INTENDED OUTCOMES:

- To gain the knowledge about Fuzzy modeling.
- To gain the knowledge about genetic algorithm.

UNIT – I SEQUENTIAL LOGIC OPTIMIZATION


UNIT – II ASYNCHRONOUS FINITE STATE MACHINES

Scope, Asynchronous Analysis, Design of Asynchronous Machines, Cycle and Races, Plotting and Reading the Excitation Map, Hazards, Essential Hazards Map Entered Variable, MEV Approaches to Asynchronous Design, Hazards in Circuit Developed by MEV Method.

UNIT – III SYSTEM DESIGN USING VHDL

Specification of combinational systems using VHDL, Basic language element of VHDL, Types of Modeling, Design of serial adder with accumulator, State graph for Control network, Design of Binary Multiplier and Binary Divider, Flip-Flops, Registers, Counters, Sequential Machines, Combinational Logic Circuits.

UNIT – IV DIGITAL SYSTEM TESTING


UNIT – V HIGH SPEED DIGITAL DESIGN

Frequency, Time and Distance, Capacitance and Inductance Effects, High Speed Properties of Logical Gates, Speed and Power, measurement techniques, Rise Time and Bandwidth of Oscilloscope probes, Self Inductance, Signal pickup and loading effects of probes, clock distribution, clock skew and methods to reduce skew, Controlling crosstalk on clock lines, Delay adjustments, Clock oscillators and clock jitter.

Total: 45

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<td>1</td>
<td>Fletcher</td>
<td>An Engineering Approach to</td>
<td>PHI, New Delhi</td>
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<td>5</td>
<td>J. Bhaskar</td>
<td>A VHDL Primer</td>
<td>Addison Wesley, United States</td>
<td>1999</td>
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</tbody>
</table>

**WEBSITES**
1. www.calyptech.com
2. www.highfrequencyelectronics.com
OBJECTIVES:

- To expose the students to the concepts of special electrical machines and analyze their performance and to impart knowledge on
- Construction and performance of synchronous reluctance motors.
- Principle of operation and performance of stepping motors.
- Construction, principle of operation and performance of switched reluctance motors
- Construction, principle of operation and performance of permanent magnet synchronous motors

INTENDED OUTCOMES:

- To gain the knowledge about synchronous reluctance motors.
- To gain the knowledge about switched reluctance motors.
- To gain the knowledge about permanent magnet brushless dc motors.

UNIT- I SYNCHRONOUS RELUCTANCE MOTORS (9)
Constructional features: axial and radial air gap Motors. Operating principle, reluctance torque – phasor diagram, motor characteristics.

UNIT -II SWITCHED RELUCTANCE MOTORS (9)
Constructional features, principle of operation. Torque equation, Power controllers, Characteristics and control - Microprocessor based controller.

UNIT- III PERMANENT MAGNET SYNCHRONOUS MOTORS (9)
Principle of operation, EMF, power input and torque expressions, Phasor diagram, Power controllers, Torque-speed characteristics, Self control, Vector control, Current control schemes.

UNIT- IV PERMANENT MAGNET BRUSHLESS DC MOTORS (9)
Commutation in DC motors, Difference between mechanical and electronic commutators, Hall sensors, Optical sensors, Multiphase Brushless motors, Square wave permanent magnet brushless motor drives, Torque and emf equation, Torque-speed characteristics, Controllers-Microprocessor based controller.

UNIT- V STEPPING MOTORS (9)
Constructional features, principle of operation, modes of excitation, torque production in Variable Reluctance (VR) stepping motor, dynamic characteristics, Drive systems and circuit for open loop control, closed loop control of stepping motor.

Total: 45

TEXT BOOKS

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<td>3</td>
<td>Bose, B.K.,</td>
<td>Modern Power Electronics and AC drives</td>
<td>Prentice Hall, New Jersey.</td>
<td>1997</td>
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</tbody>
</table>

**REFERENCES**

**WEB SITES**
1. www.allaboutcircuits.com
2. www.koder.cn
OBJECTIVES:

- To Study about Smart Grid technologies, different smart meters and advanced metering infrastructure.
- To familiarize the power quality management issues in Smart Grid.
- To familiarize the high performance computing for Smart Grid applications.

INTENDED OUTCOMES:

- To gain the knowledge about Distributed Generations.
- To gain the knowledge about Island mode of operation.
- To gain the knowledge about storage devices.

UNIT I  INTRODUCTION : SMART GRID AND EMERGING TECHNOLOGIES  (9)

UNIT II  SMART GRID: MODELS AND OPERATING PRINCIPLES  (9)

UNIT III  SMART GRID: DISTRIBUTED GENERATION SYSTEMS  (9)

UNIT IV  ENERGY STORAGE AND COMMUNICATION  (9)
UNIT V SMART GRID: RELIABILITY, STABILITY AND COMPONENT INTEGRATION


Total: 45

REFERENCES

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<tbody>
<tr>
<td>1</td>
<td>Fox-Penner</td>
<td>Smart Power: Climate Change, the Smart Grid, and the Future of Electric Utilities</td>
<td>Island Press , Washington DC</td>
<td>2010</td>
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<tr>
<td>4</td>
<td>Ryszard Michal Strzelecki, Grzegorz Pawel Benysek</td>
<td>Power Electronics in Smart Electrical Energy Networks</td>
<td>Springer, USA</td>
<td>2008</td>
</tr>
</tbody>
</table>

WEBSITES
1. www.wca.org
2. www.sandc.com
OBJECTIVES:

- To study the Architecture PIC 16C7X.
- To study the addressing modes and instruction set of PIC 16C7X.
- To introduce the need and use of Interrupt structure.
- To develop skill in simple program writing.
- To study simple applications.

INTENDED OUTCOMES:

- To gain the knowledge about PIC 16C7X MICROCONTROLLER.
- To gain the knowledge about PERIPHERALS OF TMSLF2407.
- To gain the knowledge about Programming techniques.

UNIT I  
PIC 16C7X  MICROCONTROLLER  (9)
Architecture - memory organization – Addressing modes – Instruction set – Programming techniques – simple programs

UNIT II  
PERIPHERALS OF PIC 16C7X  (9)
Timers – interrupts – I/O ports – I²C bus for peripheral chip access – A/D converter – UART

UNIT III  
TMSLF2407 DSP CONTROLLER  (9)
Introduction- System configuration registers - Memory Addressing modes - Instruction set – Programming techniques – simple programs

UNIT IV  
PERIPHERALS OF TMSLF2407  (9)
General Purpose Input/Output (GPIO) Functionality- Interrupts - A/D converter-Event Managers (EVA, EVB)- PWM signal generation

UNIT V  
APPLICATIONS OF TMSLF2407  (9)
Voltage regulation of DC-DC converters- Stepper motor and DC motor control- Clarke’s and Park’s transformation-Space vector PWM- Control of Induction Motors and PMSM.

Total: 45

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<tr>
<td>1</td>
<td>John B. Peatman</td>
<td>Design with PIC Microcontrollers</td>
<td>Pearson Education, Asia</td>
<td>2004</td>
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<td>2</td>
<td>Hamid A. Toliyat, Steven Campbell</td>
<td>DSP based Electromechanical Motion Control</td>
<td>CRC Press, USA</td>
<td>2003</td>
</tr>
</tbody>
</table>

WEBSITES

1. www.crcnetbase.com
2. www.smpstech.com
OBJECTIVES:

- To study the architecture of embedded system.
- To study the OS for embedded systems.
- Need of Distributed embedded architecture.

INTENDED OUTCOMES:

- To gain the knowledge about embedded system design processes.
- To gain the knowledge about basic compilation techniques.

UNIT-I INTRODUCTION TO EMBEDDED SYSTEM (9)
An embedded system, functional building block of embedded system, Characteristics of embedded system, applications, Challenges in embedded system design, embedded system design processes.

UNIT-II ARCHITECTURE OF EMBEDDED SYSTEM (9)
Computer architecture taxonomy, CPUs – programming input and output, Supervisor mode, exceptions and traps, Co-processors, memory system mechanisms - CPU bus - memory devices - I/O devices - component interfacing - Assembly and linking - basic compilation techniques.

UNIT-III OS FOR EMBEDDED SYSTEMS (9)
Introduction to RTOS, multiple tasks and multiple processes, context switching, operating system, scheduling policies, inter process communication mechanisms. Introduction to μC/OSII

UNIT-IV PERFORMANCE ISSUES OF EMBEDDED SYSTEMS (9)
CPU Performance, CPU Power consumption, Analysis and optimization of execution time, program size, energy and power, Evaluating operating system performance, power optimization strategies for processes, Hardware accelerators.

UNIT-V DESIGN AND IMPLEMENTATION (9)
Development and debugging, manufacturing, Testing, Program validation and testing, Need of Distributed embedded architecture, I²C Bus, CAN Bus, Design examples: GPS Moving map, Personal Digital Assistant, Elevator controller.

Total: 45
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<tbody>
<tr>
<td>1</td>
<td>David E Simon,</td>
<td>An Embedded software primer</td>
<td>Pearson education India, New Delhi</td>
<td>2004</td>
</tr>
</tbody>
</table>

## WEBSITES

1. www.ece.cmu.edu
2. www.cs.rice.edu
OBJECTIVES:

- To introduce the different optimization problems and techniques
- To study the fundamentals of the linear and non-linear programming problem.
- To understand the concept of dynamic programming and genetic algorithm technique

INTENDED OUTCOMES:

- To gain the knowledge about linear programming.
- To gain the knowledge about Rosenbrock’s method
- To gain the knowledge about Genetic algorithm

UNIT I  INTRODUCTION TO OPTIMIZATION  (9)

UNIT II  LINEAR PROGRAMMING  (9)
Linear programming definition – Pivotal reduction of general system of equation – Simplex algorithms – Two phases of the simplex method – Revised simplex method – Duality in linear programming.

UNIT III  NONLINEAR PROGRAMMING (ONE DIMENSIONAL)  (9)

UNIT IV  NONLINEAR PROGRAMMING (UNCONSTRAINED OPTIMIZATION)  (9)

UNIT V  SPECIAL TECHNIQUES  (9)

Total: 45
# REFERENCES

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<td>Multi-Objective Optimization Using Evolutionary Algorithms</td>
<td>John Wiley and Sons</td>
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<td>4</td>
<td>Ras S.S.</td>
<td>Optimization Theory and Application</td>
<td>Wiley Eastern Limited, NewDelhi</td>
<td>2003</td>
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</tbody>
</table>
OBJECTIVES:

- To introduce the object oriented programming.
- To study the fundamentals of the programming.

INTENDED OUTCOMES:

- To gain the knowledge about Software Development Kit (SDK) tools.
- To gain the knowledge about VC++ components.

UNIT-I HISTORICAL DEVELOPMENT OF PROGRAMMING (9)
Procedural programming - structural programming - object oriented programming - windows programming - Event driven programming - conceptual comparison.

UNIT-II WINDOWS PROGRAMMING (9)
Overview of windows programming - data types - resources - controls -windows messages - device contexts - document interfaces - dynamic link libraries - Software Development Kit (SDK) tools - context help

UNIT-III VISUAL BASIC PROGRAMMING (9)
Form design - overview - programming fundamentals - VBX controls - graphic applications - animation - interfaces - file system control - data control - database application

UNIT-IV VISUAL C++ PROGRAMMING (9)
Frame work classes - VC++ components - resource handling - event handling - message dispatch system - model and model-less system - model and model-less dialogues - importing VBX controls - document – view architecture - sterilization - multiple document - splitter windows - coordination between controls – sub classing.

UNIT-V CASE STUDIES (9)
Application to electrical engineering problems.

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<tr>
<td>1</td>
<td>David Kurlinski, J</td>
<td>Inside Visual C++</td>
<td>Microsoft press, USA</td>
<td>1993</td>
</tr>
</tbody>
</table>

WEBSITES
1. www.codeguru.com
2. www.onesmartclick.com
OBJECTIVES:

- To expose the students to the fundamentals of power system transients.
- To teach the fundamentals of EHV AC transmission system.
- To discuss on EHV and HVDC transmission

INTENDED OUTCOMES:

- To gain the knowledge about EHV and HVDC transmission.

UNIT I INTRODUCTION TO OPTIMIZATION


UNIT II LINEAR PROGRAMMING

Linear programming definition – Pivotal reduction of general system of equation – Simplex algorithms – Two phases of the simplex method – Revised simplex method – Duality in linear programming.

UNIT III NONLINEAR PROGRAMMING (ONE DIMENSIONAL)


UNIT IV NONLINEAR PROGRAMMING (UNCONSTRAINED OPTIMIZATION)


UNIT V SPECIAL TECHNIQUES


Total: 45

REFERENCES

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<td>Optimization Theory and Application</td>
<td>Wiley Eastern Limited, New Delhi</td>
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OBJECTIVES:

To study about the discrete random process and spectral estimation techniques
• To understand the algorithm used in linear estimation and prediction
• To study about various filters and multi rate signal processing

INTENDED OUTCOMES:

• Ability to understand basics of discrete random signal processing
• Ability to estimate the spectrum
• Ability to use the filters for noise cancellation and echo cancellation
• Ability to understand wavelet transforms

UNIT- I  INTRODUCTION  (9)
Algorithms for signal processing – Basic architecture of DSPs.

UNIT- II  TEXAS PROCESSORS  (9)
Architecture – Addressing modes – Instruction set – Programming

UNIT- III  PERIPHERAL INTERFACE OF DSP  (9)
Peripherals – memory – Applications.

UNIT-IV  EXTERNAL INTERFACE  (9)

UNIT-V  SPECIAL PROCESSORS FOR MOTOR CONTROL  (9)
Architecture – Special features – PWM generation – controller implementation

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<tr>
<td>2</td>
<td>Venkataramani B.</td>
<td>Digital Signal Processor – Architecture, Programming and Applications</td>
<td>TMH, New Delhi</td>
<td>2002</td>
</tr>
<tr>
<td>3</td>
<td>Texas groups</td>
<td>Texas Instruments Manuals</td>
<td>Texas Instruments</td>
<td></td>
</tr>
</tbody>
</table>

WEBSITES
1. www.pmdcorp.com
2. www.nexstarsite.com
OBJECTIVES:

- To understand the concept of data communication and modulation techniques.
- To comprehend the use of different types of transmission media and network devices.

INTENDED OUTCOMES:

- Ability To understand the error detection and correction in transmission of data.
- Ability To understand the concept of flow control, error control and LAN protocols

UNIT I  COMPUTER NETWORKS  (9)
Evolution of data networks, Network architecture, ISO Reference model examples of networks, Application of networks, Physical layer, and communication medium characteristics.

UNIT II  MEDIUM ACCESS SUB LAYER AND DATA LINK LAYER  (9)

UNIT III  NETWORK AND TRANSPORT LAYERS  (9)
Network layer design issues Routing algorithm - Congestion control algorithms internetworking. Transport layer design issues – Connection management – A simple transport protocol on top of X.25.

UNIT IV  QUEUING THEORY AND CAPACITY ASSIGNMENT  (9)
M/M/I Queues/G/I Queues, priority queuing capacity assignment for terminal networks and distributed networks, concentration and buffering for finite and infinite buffers and block storage.

UNIT V  PRESENTATION AND APPLICATION LAYERS  (9)

Total: 45

TEXT BOOKS
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<td>Andrew S. Tanenbaum</td>
<td>Computer Networks</td>
<td>Prentice Hall of India, New Delhi.</td>
<td>2003</td>
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<td>2</td>
<td>Bertsekas, D and Gallagher, R</td>
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<td>Tata McGraw Hill, New Delhi</td>
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<td>3</td>
<td>Achyut S Godbole</td>
<td>Data Communications and Networking</td>
<td>Tata McGraw Hill, New Delhi</td>
<td>2002</td>
</tr>
</tbody>
</table>

**WEBSITES**

1. www.tonymarston.net
2. msdn.microsoft.com
**OBJECTIVES:**

- To expose the students to the fundamentals of digital signal processing in frequency domain & its application
- To teach the fundamentals of digital signal processing in time-frequency domain & its application
- To compare Architectures & features of Programmable DS processors
- To discuss on Application development with commercial family of DS Processors
- To design & develop logical functions of DS Processors with Re-Programmable logics & Devices

**INTENDED OUTCOMES:**

- To gain the knowledge about analog and digital control.
- To gain the knowledge about design of filters.
- To gain the knowledge about harmonics.

**UNIT - I**

Review of Transducers - Introduction, measurement of translational and rotational displacement. Resistive potentiometers, strain gauges; differential transformer, synchros, induction potentiometers, piezoelectric transducer; Electro-optical devices, Digital displacement transducers (Translational and rotary encoders). Magnetic and photoelectric pulse counting for speed. Transducers for Torque, voltage, current, power, frequency, power factor, and phase angle measurement.

**UNIT – II**

Signal Conditioning - Necessity, Instrumentation amplifiers, chopper stabilized amplifiers, Impedance converters, Noise problems, shielding and grounding. Concept of filters; Low pass filters; high pass filters; band pass filters; band rejection filters; digital filters. Integration and differentiation of signals, Dynamic compensation, Linearization, Concept of A/D and D/A Converters (voltage to frequency and frequency to voltage converter) sample/hold amplifiers, Microprocessor applications in signal conditioning.

**UNIT – III**

Data Transmission and Recording- Cable transmission of analog voltage and current signals, cable transmission of digital data, Fiber optic data transmission, FM radio telemetry, synchro position repeater systems.

**UNIT – IV**

Measurement and sensing in solid state drives—measurement techniques in DC and AC drives recording of waveforms—Microprocessor based measurement of frequency, phase angle; power factor; voltage; current; reactance; resistance; kVA; kW; kWh and kVAr. Sensing: sensing of voltage, current, Power and speed.
UNIT – V
Computerized Data Acquisition System - Elements of data acquisition systems, data loggers, instrument interconnection systems; Block diagram and details of computerized data acquisition systems, Instrumentation schemes for close loop control of DC and AC drives.

Total: 45

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WEBSITES
1. www.seminarprojects.com
2. electricalpartfinder.com