T K R COLLEGE OF ENGINEERING &TECHNOLOGY

(Autonomous)

B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING-R17

COURSE STRUCTURE & SYLLABUS

IV YEAR I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	A27PC1	Power Semiconductor Drives	4	1	0	4
2	A27PC2	Power System Operation and control	4	1	0	4
3		Open elective-III	3	0	0	3
4	A27PE4	Professional elective-IV 1.Switch Mode Power Supply **2.** Electrical Distribution System 3. Embeded Systems	3	0	0	3
5	A27PE5	Professional elective-V 1. Special Machines **2.** Advanced Power Electronics 3. Digital Control Systems	3	0	0	3
6	A27PE6	Professional elective-VI 1. VLSI Design **2.** Utilization of Electric Power 3. Programmable Logic Controllers	3	0	0	3
7	A27PC7	Electrical Systems Simulation Lab	0	0	3	2
8	A27PC8	Electrical Workshop	0	0	3	2
9	A27PW9	Industry Oriented Mini project	0	0	0	3
Total Credits						**27**

IV YEAR II SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1		Open elective-IV	3	0	0	3
2	A28PE2	Professional elective-VII 1. Smart Electric Grid **2.** Artificial Neural Networks and Fuzzy Systems 3 Flexible AC Transmission Systems	3	0	0	3
3	A28PE3	Professional elective-VIII 1. Power Quality **2.** Solar Photovoltaic Systems 3. EHV AC Transmission Systems	3	0	0	3
4	A28SC4	Seminar	0	6	0	2
5	A28PW5	Project Work	0	15	0	10
6	A28CV6	Comprehensive Viva Voce	0	0	0	3
Total Credits						**24**

TKR COLLEGE OF ENGINEERING & TECHNOLOGY
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B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING – R17
POWER SEMICONDUCTOR DRIVES- A27PC1

B.Tech. IV year I Semester **L/T/P/C 4/1/0/4**

Prerequisite: Power Electronics & Electrical Machines – I, II

COURSE OBJECTIVES:

1. To introduce the drive system and operating modes of drives and its characteristics
2. To understand Speed – Torque characteristics of different motor drives by various power converter topologies
3. To analyze the motoring and braking operations of drive
4. To differentiate DC and AC drives

COURSE OUTCOMES: After completion of this course the students will be able to

1. Analyze the speed control of DC motors by single phase and three phase converters.
2. Understand the chopper controlled DC drives and four quadrant operation of DC drives.
3. Understand Ac motor drive speed–torque characteristics using different control strategies.
4. Apply suitable method for rotor side speed control of induction motor.
5. Apply different converters for the control of synchronous motor.

UNIT – I:

Control of DC motors by single phase and three phase converters:

Introduction to Thyristor controlled Drives, Single Phase semi and Fully controlled converters connected to separately excited and d.c series motors – continuous current operation – output voltage and current waveforms – Speed and Torque expressions – Speed – Torque Characteristics- Problems on Converter fed d.c motors.

Three phase semi and fully controlled converters connected to d.c separately excited and d.c series motors – output voltage and current waveforms – Speed and Torque expressions – Speed – Torque characteristics – Problems.

UNIT – II:

Four quadrant operation of DC drives: Introduction to Four quadrant operation – Motoring operations, Electric Braking – Plugging, Dynamic, and Regenerative Braking operations. Four quadrant operation of D.C motors by single phase and three phase dual converters – Closed loop operation of DC motor (Block Diagram Only)

Control of DC Motors by Choppers: Single quadrant, Two quadrant and four quadrant chopper fed dc separately excited and series motors – Continuous current operation – Output voltage and current wave forms – Speed and torque expressions – speed-torque characteristics – Problems on Chopper fed D.C Motors – Closed Loop operation (Block Diagram Only)

UNIT – III:

Control of Induction Motor Through Stator Voltage And Stator Frequency: Variable voltage characteristics-Control of Induction Motor by Ac Voltage Controllers – Waveforms – speed torque characteristics.Variable frequency characteristics-Variable frequency control of induction motor by Voltage source and current source inverter and cyclo converters- PWM control – Comparison of VSI and CSI operations – Speed torque characteristics – numerical problems on induction motor drives – Closed loop operation of induction motor drives (Block Diagram Only)

UNIT – IV:

Rotor Side Control of Induction Motor: Static rotor resistance control – Slip power recovery – Static Scherbius drive – Static Kramer Drive – their performance and speed torque characteristics – advantages, applications, problems.

UNIT –V:

Control of Synchronous Motors: Separate control and self control of synchronous motors – Operation of self controlled synchronous motors by VSI, CSI and cyclo converters. Load commutated CSI fed Synchronous Motor – Operation – Waveforms – speed torque characteristics – Applications – Advantages - Numerical Problems – Closed Loop control operation of synchronous motor drives (Block Diagram Only), variable frequency control - Cyclo converter, PWM based VSI & CSI.

TEXT BOOKS

1. "G K Dubey", Fundamentals of Electric Drives, CRC Press, 2002.
2. "Vedam Subramanyam", Thyristor Control of Electric drives, Tata McGraw Hill Publications, 1987.

REFERENCE BOOKS

1. "S K Pillai", A First course on Electrical Drives, New Age International (P) Ltd. 2nd Edition. 1989
2. "P. C. Sen", Thyristor DC Drives, Wiley-Blackwell, 1981
3. "B. K. Bose", Modern Power Electronics, and AC Drives, Pearson 2015.
4. "R. Krishnan", Electric motor drives - modeling, Analysis and control, Prentice Hall PTR, 2001

TKR COLLEGE OF ENGINEERING & TECHNOLOGY
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B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING – R17
POWER SYSTEM OPERATION AND CONTROL - A27PC2

B.Tech. IV year I Semester **L/T/P/C 4/1/0/4**

Prerequisite: Power System Analysis

COURSE OBJECTIVES:

1. To understand real power control and operation
2. To analyze the importance of frequency control
3. To analyze different methods to control reactive power
4. To understand unit commitment problem and importance of economic load dispatch
5. To understand real time control of power systems

COURSE OUTCOMES: After completion of this course, the students will be able to

1. Understand the economic load dispatch
2. Analyze the unit commitment problems, constraints and hydrothermal scheduling of power plants
3. Analyze the load frequency control
4. Understand reactive power and voltage control of a power system
5. Apply the computer control techniques for the power systems.

UNIT – I:

Economic Load Dispatch: Statement of economic dispatch problem – cost of generation – incremental cost curve - co-ordination equations without loss and with loss, solution by suitable method.

UNIT-II:

Unit Commitment: Statement of Unit Commitment problem – constraints; spinning reserve, thermal unit constraints, hydro constraints, fuel constraints and other constraints. Solution methods - Priority-list methods - forward dynamic programming approach.

Hydrothermal scheduling

Optimal scheduling of hydrothermal system, hydroelectric power plant models, scheduling problems-short term hydro scheduling problem

UNIT – III:

Load –Frequency Control: Basics of speed governing mechanism and modeling - speed- load characteristics – load sharing between two synchronous machines in parallel. Control area concept LFC control of a single-area system. Static and dynamic analysis of uncontrolled and controlled cases. Integration of economic dispatch control with LFC. Two- area system – modeling - static analysis of uncontrolled case - tie line with frequency bias control of two-area system

UNIT – IV:

Reactive Power – Voltage Control: Basics of reactive power control. Excitation systems – modeling. Static and dynamic analysis - stability compensation - generation and absorption of reactive power. Relation between voltage, power and reactive power at a node - method of voltage control - tap-changing transformer. System level control using generator voltage magnitude setting, tap setting of OLTC transformer and MVAR injection of switched capacitors to maintain acceptable voltage profile and to minimize transmission loss.

UNIT – V:

Computer Control of Power Systems: Need of computer control of power systems. Concept of energy control centre (or) load dispatch centre and the functions - system monitoring - data acquisition and control. System hardware configuration – SCADA and EMS functions. Network topology – Importance of Load Forecasting and simple techniques of forecasting.

TEXT BOOKS

1. D. P. Kothari and I. J. Nagrath, 'Modern Power System Analysis', Third Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2003.
2. Olle. I. Elgerd, 'Electric Energy Systems Theory – An Introduction', Tata McGraw Hill Publishing Company Ltd, New Delhi, 30th reprint,2007.

REFERENCE BOOKS

1. Chakrabarti&Haldar, "Power System Analysis: Operation and Control", Prentice Hall of India, 2004Edition.
2. C. L. Wadhwa , 'Power System Analysis', New Age International-6th Edition, 2010, ISBN :978-81-224-2839-1
3. Robert Miller, James Malinowski, 'Power System Operation', Tata McGraw Hill Publishing Company Ltd, New Delhi, 3rd Edition2009.
4. P. Kundur, Neal J. Balu, 'Power System Stability & Control', IEEE,1998.

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B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING – R17

1. SWITCH MODE POWER SUPPLY - (A27PE4)

(PROFESSIONAL ELECTIVE-IV)

B.Tech. IV year I Semester **L/T/P/C**
3/0/0/3

Prerequisites: Power Electronics, Electronic devices and circuits

COURSE OBJECTIVES:

1. To understand various modes of operation of DC-DC Converter
2. To analyze control aspects of converter
3. To design various Switched Mode Power Supply components
4. To get awareness on EMI, Protection of converter system

COURSE OUTCOMES: After completion of this course, the students will be able to

1. Analyze various modes of operation of basic Dc-Dc converter circuits.
2. Understand the concept of different isolated SMPS circuits.
3. Analyze different controllers for converter and stability.
4. Apply the selection criteria to design various components of dc-dc converter
5. Analyze dc-dc converter in view of EMI and thermal considerations

UNIT – I:

Basic Converter Circuits: Buck Regulator, Buck- Boost Regulator, Boost Regulator, Cuk Converters and Resonant Converters. Choice of switching frequency.

UNIT – II:

Isolated SMPS: Fly back Converter, Forward Converter, Half-Bridge and Full Bridge Converters, Push-Pull Converter and SMPS with multiple outputs. Choice of switching frequency.

UNIT – III:

Control Aspects: PWM Controllers, Isolation in feedback loop, Power Supplies with multiple output. Stability analysis using Bode Diagrams.

UNIT – IV :

Design Considerations: Selection of output filter capacitor, Selection of energy storage inductor, Design of High Frequency Inductor and High frequency Transformer, Selection of switches. Snubber circuit design, Design of driver circuits

UNIT – V :

Electro Magnetic Interference (EMI): EMI Filter Components, Conducted EMI suppression,Radiated EMI suppression, Measurement. Protection: Over current protection, over voltage protection, Inrush current

protection. Thermal Model: Thermal Resistance, Cooling Considerations, Selection of Heat sinks, Simple Heat sink calculations.

TEXT BOOKS

1. Switched Mode Power Supplies, Design and Construction, H. W. Whittington, B. W. Flynn and D. E. MacPherson, Universities Press, 2009 Edition.
2. Mohan N. Undeland . T & Robbins W., Power Electronics Converters, Application and Design. John Wiley, 3rd edition, 2002
3. Umanand L., Bhat S.R., Design of magnetic components for switched Mode Power Converters. , Wiley Eastern Ltd.,1992
4. Robert. W. Erickson, D. Maksimovic .Fundamentals of Power Electronics., Springer International Edition, 2005
5. Course Material on Switched Mode Power Conversion, V. Ramanarayanan.

REFERENCE BOOKS

1. Krein P.T .Elements of Power Electronics., Oxford University Press
2. M. H. Rashid, Power Electronics. Prentice-Hall of India

TKR COLLEGE OF ENGINEERING & TECHNOLOGY
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B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING – R17
2. ELECTRICAL DISTRIBUTION SYSTEMS - (A27PE4)
(PROFESSIONAL ELECTIVE-IV)

B.Tech. IV year I Semester **L/T/P/C**
3/0/0/3

Prerequisites: Power Systems – I & Power Systems - II

COURSE OBJECTIVES:

1. To distinguish between transmission and distribution systems
2. To understand design considerations of feeders
3. To compute voltage drop and power loss in feeders
4. To understand protection of distribution systems
5. To examine the power factor improvement and voltage control

COURSE OUTCOMES: After completion of this course, the students will be able to

1. Understand the general concepts of distribution system and the design of feeders
2. Analyze the location and different parameters of substations.
3. Understand the distribution system protection and faults.
4. Apply different methods to improve the power factor.
5. Analyze the importance of voltage control and its methods.

UNIT – I:

General Concepts: Introduction to distribution system, Distribution system planning, Factors effecting the Distribution system planning, Load modeling and characteristics. Coincidence factor - contribution factor - Loss factor - Relationship between the load factor and loss factor. Load growth, Classification of loads (Residential, commercial, Agricultural and Industrial) and their characteristics.

Distribution Feeders: Design Considerations of Distribution Feeders: Radial, loop and network types of primary feeders, Factors effecting the feeder voltage level, basic design practice of the secondary distribution system, secondary banking,

UNIT – II:

Substations: Location of Substations: Rating of distribution substation, service area with 'n' primary feeders. Benefits derived through optimal location of substations. Optimal location of Substations (Perpendicular bisector rule and X, Y co-ordinate method).

System Analysis: Voltage drop and power-loss calculations: Derivation for voltage drop and power loss in lines, manual methods of solution for radial networks, three phase balanced primary lines, analysis of non-three phase systems, method to analyze the distribution feeder cost.

UNIT – III:

Protection: Objectives of distribution system protection, types of common faults and procedure for

fault calculations, over current Protective Devices: Principle of operation of Fuses, Auto-Circuit Recloser - and Auto-line sectionalizes, and circuit breakers.

COORDINATION: Coordination of Protective Devices: Objectives of protection co- ordination, general coordination procedure, Types of protection coordination: Fuse to Fuse, Auto-Recloser to Fuse, Circuit breaker to Fuse, Circuit breaker to Auto-Recloser.

UNIT – IV:

Compensation For Power Factor Improvement: Capacitive compensation for power-factor control - Different types of power capacitors, shunt and series capacitors, effect of shunt capacitors (Fixed and switched), effect of series capacitors, difference between shunt and series capacitors, Calculation of Power factor correction, capacitor allocation - Economic justification of capacitors - Procedure to determine the best capacitor location.

UNIT – V:

Voltage Control: Voltage Control: Importance of voltage control, methods of voltage control, Equipment for voltage control, effect of shunt capacitors, effect of series capacitors, effect of AVB/AVR on voltage control, line drop compensation, voltage fluctuations.

TEXT BOOKS

1. TuranGonen, Electric Power Distribution system Engineering, CRC Press, 3rd Edition 2014.
2. V. Kamaraju, Electrical Power Distribution Systems, Tata Mc Graw HillPublishing Company, 2nd edition,2010.

REFERENCE BOOKS

1. G. Ram Murthy, Electrical Power Distribution hand book, 2ndedition, University press2004.
2. A.S. Pabla, Electric Power Distribution, Tata McGraw Hill Publishing company, 6th edition,2013.

TKR COLLEGE OF ENGINEERING & TECHNOLOGY
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B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING – R17
3. EMBEDED SYSTEMS - A27PE4
(PROFESSIONAL ELECTIVE-IV)

B.Tech. IV year I Semester **L/T/P/C**
3/0/0/3

Prerequisite: Microprocessor and Microcontrollers Concepts

COURSE OBJECTIVES:

1. Learn the general embedded system concepts
2. Understand design of embedded hardware and software development tools
3. Learn the basics of OS and RTOS
4. Describe key issues such as CPU scheduling, memory management, task synchronization, and file system in the context of real-time embedded systems.

COURSE OUTCOMES: After Completion of this course, the students will be able to

1. Understand and design real time and non real time embedded systems
2. Define the unique design challenges of real-time systems and program them.
3. Understand unique characteristics of RTOS and use RTOS to build an embedded real- time system

UNIT – I:

Fundamentals Of Embedded Systems: Definition – Classification of Embedded Systems - Processors in the system - Other Hardware units. Software components - Examples for embedded systems, Design issues and trends

UNIT – II:

Embedded Hardware Development Environment: Processor Architecture- Structured units of a processor - Processor selection factors. Common memory devices - Memory selection - Memory map - Internal devices & I/O devices, Serial devices - Parallel port devices, Timer and Counting devices - Direct memory access, Communication Interface Standards,.

UNIT – III:

Embedded Software Development Environment: Embedded System Development Process, Embedded Operating systems, Types of Embedded Operating systems, Host and Target machines, Linkers/Locators for embedded software, getting embedded software into the target system, testing on host machine.

UNIT – IV:

Real Time Operating Systems Concepts – I: Typical OS structure - RTOS structure - The context of its use - Schedule management for multiple tasks - Scheduling in real time - RTOS task scheduling models – Round Robin, Round Robin with Interrupts, Priority driven- Preemptive and Non-preemptive scheduling

UNIT – V:

Real Time Operating Systems Concepts - II: Tasks and Task states, Tasks and Data, Semaphores and shared data, Message queues, Mailboxes and Pipes, Timer functions, events, Memory management, Interrupt routines in an RTOS environment.

Case study of RTOS using MUCOS. Case study for RTOS based programming - Coding for Automatic Chocolate vending machine using MUCOS.

TEXT BOOKS

1. "David E. Simon", an Embedded Software Primer, Pearson Ed., 2005.
2. "Raj Kamal", Embedded systems - architecture, programming and design, Tata McGraw Hill, 2011

REFERENCE BOOKS

1. "J. W. S. Liu", Real time Systems, Pearson, 2000.
2. "Ayala & Gadre", The 8051 Microcontroller & Embedded Systems using Assembly and C, Cengage Publications, 2010.

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B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING – R17

1. SPECIAL MACHINES - A27PE5
(PROFESSIONAL ELECTIVE-V)

B.Tech. IV year I Semester **L/T/P/C**
3/0/0/3

Prerequisite: Electrical Machines - I & Electrical Machines - II

COURSE OBJECTIVES:

1. To understand the working and construction of special machines
2. To analyze the use of special machines in different feed-back systems
3. To understand the use of micro-processors for controlling different machines

COURSE OUTCOMES: After completion of this course, the students will be able to

1. Understand the special type of DC machines.
2. Understand the working of hybrid stepper motor and analyze its configurations.
3. Analyze the working and control of Variable Reluctance Stepping Motors and Switched Reluctance Motor.
4. Understand the working of permanent magnet and brushless dc motor..
5. Analyze the Linear induction motor.

UNIT – I:

Special Types of DC Machines - I: Series booster-Shunt booster-Non-reversible boost- Reversible booster

Special Types of DC Machines – II: Armature excited machines—Rosenberg generator- The Amplidyne and metadyne— Rototrol and Regulex-third brush generator-three-wire generator-dynamometer.

UNIT – II:

Stepper Motors: Introduction-synchronous inductor (or hybrid stepper motor), Hybrid stepping motor, construction, principles of operation, Energisation with two phase at a time- essential conditions for the satisfactory operation of a 2-phase hybrid step motor- very slow- speed synchronous motor for servo control-different configurations for switching the phase windings-control circuits for stepping motors-an open-loop controller for a 2-phase stepping motor.

UNIT – III:

Variable Reluctance Stepping Motors: Variable reluctance (VR) Stepper motors, single- stack VR step motors, Multiple stack VR motors-Open-loop control of 3-phase VR step motor-closed-Loop control of step motor, discriminator (or rotor position sensor) transilator, major loop-characteristics of

step motor in open-loop drive – comparison between open-loop position control with step motor and a position control servo using a conventional (dc or ac)

servo motor- Suitability and areas of application of stepper motors-5- phase hybrid stepping motor-single phase-stepper motor, the construction, operating principle torque developed in the motor.

Switched Reluctance Motor: Introduction – improvements in the design of conventional reluctance motors- Some distinctive differences between SR and conventional reluctance motors-principle of operation of SRM- Some design aspects of stator and rotor pole arcs, design of stator and rotor and pole arcs in SR motor-determination of $L(\theta)$--- θ profile – power converter for SR motor-A numerical example –Rotor sensing mechanism and logic control, drive and power circuits, position sensing of rotor with Hall problems—derivation of torque expression, general linear case.

UNIT – IV:

Permanent Magnet Materials And Motors: Introduction, Hysteresis loops and recoil line- stator frames (pole and yoke - part)of conventional PM dc Motors, Equivalent circuit of a PM-Development of Electronically commutated dc motor from conventional dc motor.

Brushless DC Motor: Types of construction – principle of operation of BLDM- sensing and switching logic scheme, sensing logic controller, lockout pulses –drive and power circuits, Base drive circuits, power converter circuit-Theoretical analysis and performance prediction, modeling and magnet circuit d-q analysis of BLDM -transient analysis formulation in terms of flux linkages as state variables-Approximate solution for current and torque under steady state –Theory of BLDM as variable speed synchronous motor (assuming sinusoidal flux distribution)- Methods or reducing Torque Pulsations, 180 degrees pole arc and 120 degree current sheet.

UNIT – V:

Linear Induction Motor: Development of a double sided LIM from rotary type IM- A schematic of LIM drive for electric traction development of one sided LIM with back iron- field analysis of a DSLIM fundamental assumptions.

TEXT BOOKS

1. K. Venkataratnam, Special electrical machines, university press, 2009.
2. R. K. Rajput - Electrical machines, Laxmi Publications, 5th Edition 2016.
3. V.V. Athani - Stepper motor: Fundamentals, Applications and Design, New age International publishers, 1997.

REFERENCE BOOK

1. “E. G. Janardanan”, Special electrical machines-PHI 2014.

TKR COLLEGE OF ENGINEERING & TECHNOLOGY
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B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING – R17

2. ADVANCED POWER ELECTRONICS - A27PE5
(PROFESSIONAL ELECTIVE-V)

B.Tech. IV year I Semester **L/T/P/C**
3/0/0/3

Prerequisite: Power Electronics

COURSE OBJECTIVES:

1. To understand various Power Electronics devices such as SCR, TRIAC, DIAC, IGBT, GTO etc.
2. To understand application of Power Electronics devices in Choppers, Inverters and Converters etc.
3. To understand control of Electrical Motors through DC-DC converters, AC Converters etc.

COURSE OUTCOMES: After completion of this course, the students will be able to

1. Understand various high power semiconductor devices such as SCR, TRIAC, DIAC, IGBT, GTO etc.
2. Compare different PWM techniques used for inverters.
3. Understand the multilevel inverter circuits.
4. Analyze the switched mode converters and power supplies.
5. Analyze the resonant converters, power conditioners and UPS systems.

UNIT – I:

High-Power Semiconductor Devices: Introduction, High-Power Switching Devices, Diodes, Silicon-Controlled Rectifier (SCR), Gate Turn-Off (GTO) Thyristor, Gate-Commutated Thyristor (GCT), Insulated Gate Bipolar Transistor (IGBT), Other Switching Devices, Operation of Series-Connected Devices, Main Causes of Voltage Unbalance ,Voltage Equalization for GCTs,

UNIT-II:

Cascaded H-Bridge Multilevel Inverters: Introduction, Sinusoidal PWM, Modulation Scheme, Harmonic Content, Over modulation, Third Harmonic Injection PWM, Space Vector Modulation , Switching States, Space Vectors, Dwell Time Calculation, Modulation Index, Switching Sequence, Spectrum Analysis, Even-Order Harmonic Elimination, Discontinuous Space Vector Modulation.

Introduction, H-Bridge Inverter, Bipolar Pulse-Width Modulation, Unipolar Pulse-Width Modulation.

UNIT – III:

Diode-Clamped Multilevel Inverters: Three-Level Inverter, Converter Configuration, Switching State ,Commutation, Space Vector Modulation, Stationary Space Vectors , Dwell Time Calculation, Relationship Between Vref Location and Dwell Times, Switching Sequence Design, Inverter Output Waveforms and Harmonic Content , Even-Order Harmonic Elimination, Neutral-Point Voltage Control, Causes of Neutral-Point Voltage Deviation , Effect of Motoring and Regenerative Operation, Feedback

Control of Neutral-Point Voltage.

UNIT – IV:

DC-DC Switch-Mode Converters & Switching DC Power Supplies: Control of dc-dc converter, Buck converter, boost converter, buck-boost converter, cuk dc-dc converter, full- bridge dc-dc converter, dc-dc converter comparison. Introduction, linear power supplies, overview of switching power supplies, dc-dc converters with electrical isolation, control of switch mode dc power supplies, power supply protection, and electrical isolation in the feedback loop, designing to meet the power supply specifications.

UNIT – V:

Resonant Converters & Power Conditioners And Uninterruptible Power Supplies Classification of resonant converters, basic resonant circuit concepts, load-resonant converters, resonant-switch converters, zero-voltage-switching, resonant-dc-link inverters with zero-voltage switching's, high frequency-link integral-half cycle converters. Power line disturbances, Introduction to Power Quality, power Conditioners, uninterruptible power supplies, Applications.

TEXT BOOKS

1. "M. H. Rashid", Power electronics circuits, Devices and applications, PHI, I edition – 1995.
2. "Ned Mohan, Tore M. Undeland and William P. Robbins, A", "Power Electronics converters, Applications and Design" John Wiley & Sons, Inc., Publication, 3rd Edition 2003

REFERENCE BOOKS

1. "Bin Wu, A", "High-Power Converters and Ac Drives" John Wiley & Sons, Inc., Publication (Free down load from rapidshire.com) 2006.

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B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING – R17

3. DIGITAL CONTROL SYSTEMS -A27PE5
(PROFESSIONAL ELECTIVE-V)

B.Tech. IV year I Semester **L/T/P/C**
3/0/0/3

Prerequisite: Control Systems

COURSE OBJECTIVES:

1. To understand the fundamentals of digital control systems, z-transforms
2. To understand state space representation of the control systems, concepts of controllability and observability
3. To study the estimation of stability in different domains
4. To understand the design of discrete time control systems, compensators, state feedback controllers, state observers through various transformations

COURSE OUTCOMES: After completion of this course, the students will be able to

1. Understand the fundamentals of digital control systems and Z-transform.
2. Understand the Z transform analysis and stability analysis.
3. Analyze the design of controllers for digital control system.
4. Understand state space analysis and concepts of controllability and observability.
5. Analyze digital state observer and stability.

UNIT – I:

Introduction To Digital Control Systems And Z-Transforms: Introduction - Merits and Demerits of Digital Control Systems - Practical aspects of the choice of sampling rate and Multirate sampling - Basic discrete time signals - Quantization – Sampling Theorem - Data Conversions and Quantization - Sampling process - Mathematical Modeling - Data Reconstruction and Filtering of sampled signals - Zero - Order Hold (ZOH).

Z-Transform and Inverse z-Transform, Relationship between s - plane and z - plane - Difference equation - Solution by recursion and z-Transform - Pulse Transfer Functions of the ZOH and relationship between G(s) and G(z) - Bilinear Transformation.

UNIT- II:

Input/output Analysis of Digital Control Systems: Pulse transfer function - z transform analysis of open loop, closed loop systems - Modified z Transform - transfer function - Stability of linear digital control systems - Stability tests – Jury Stability test.

Root loci - Frequency domain analysis - Bode plots - Gain margin and phase margin.

UNIT – III:

Design of Controllers For I/O Model Digital Control Systems: Cascade and Feedback Compensation by continuous data controllers - Digital controllers - Design using Bilinear Transformation - Realization of Digital PID controllers, Design of Digital Control Systems based on Root Locus Technique.

UNIT – IV:

State Space Analysis and State Feedback Control Design of Digital Control Systems: State Equations of discrete data systems, solution of discrete state equations, State Transition Matrix: Computation methods for State Transition Matrix: z - transform method - Relation between State Equations and Pulse Transfer Functions.

Concepts on Controllability and Observability - Pole placement design by state feedback.

UNIT – V:

Digital State Observer and Stability Analysis: Design of the full order and reduced order state observer, Design of Dead beat Controller - some case studies - Stability analysis of discrete time systems based on Lyapunov approach.

TEXT BOOKS

1. K. Ogata, Discrete Time Control Systems, PHI/Addison - Wesley Longman Pte. Ltd., India, Delhi, 1995.
2. B. C Kuo, Digital Control Systems, 2nd Edition, Oxford University Press, Inc., 1992.

REFERENCE BOOKS

1. F. Franklin, J.D. Powell, and M.L. Workman, Digital control of Dynamic Systems, Addison - Wesley Longman, Inc., Menlo Park, CA , 1998.
2. M. Gopal, Digital Control and State Variable Methods, Tata McGraw Hill, India, 1997.
3. C. H. Houpis and G.B. Lamont, Digital Control Systems, McGraw Hill, 1985.
4. John S. Baey, Fundamentals of Linear State Space Systems, McGraw Hill, 1st edition 1999
5. Bernard Fried Land, Control System Design, McGraw Hill, 1st edition 1986.
6. Dorsay, Continuous and Discrete Control Systems, McGraw Hill, 2001.

TKR COLLEGE OF ENGINEERING & TECHNOLOGY
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B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING – R17

1. VLSI DESIGN - A27PE6
(PROFESSIONAL ELECTIVE-VI)

B.Tech. IV year I Semester **L/T/P/C**
3/0/0/3

COURSE OBJECTIVES: The objectives of the course are to:

1. Give exposure to different steps involved in the fabrication of ICs using MOS transistor, CMOS/BICMOS transistors, and passive components.
2. Explain electrical properties of MOS and BiCMOS devices to analyze the behavior of inverters designed with various loads.
3. Give exposure to the design rules to be followed to draw the layout of any logic circuit.
4. Provide concept to design different types of logic gates using CMOS inverter and analyze their transfer characteristics.
5. Provide design concepts to design building blocks of data path of any system using gates.
6. Understand basic programmable logic devices and testing of CMOS circuits.

COURSE OUTCOMES: After completion of this course, the students will be able to

1. Understand the fabrication process of integrated circuit using MOS transistors.
2. Analyze VLSI circuit design processes.
3. Analyze different types of logic gates using CMOS inverter and analyze their transfer characteristics
4. Understand design concepts required to design building blocks of data path and simple memories using MOS transistors
5. Analyze programmable logic devices and CMOS testing.

UNIT – I:

Introduction: Introduction to IC Technology – MOS, PMOS, NMOS, CMOS & BiCMOS **Basic Electrical Properties:** Basic Electrical Properties of MOS and BiCMOS Circuits: I_{ds}- V_{ds} relationships, MOS transistor threshold Voltage, g_m, g_{ds}, Figure of merit ωo; Pass transistor, NMOS Inverter, Various pull ups, CMOS Inverter analysis and design, Bi-CMOS Inverters.

UNIT – II:

VLSI Circuit Design Processes: VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, 2 μm CMOS Design rules for wires, Contacts and Transistors Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits.

UNIT – III:

Gate Level Design: Logic Gates and Other complex gates, Switch logic, Alternate gate circuits, Time delays, Driving large capacitive loads, Wiring capacitance, Fan – in, Fan – out, Choice of layers.

UNIT – IV:

Data Path Subsystems: Subsystem Design, Shifters, Adders, ALUs, Multipliers, Parity generators, Comparators, Zero/One Detectors, Counters.

Array Subsystems: SRAM, DRAM, ROM, Serial Access Memories.

UNIT – V:

Programmable Logic Devices: PLAs, FPGAs, CPLDs, Standard Cells, Programmable Array Logic, Design Approach, Parameters influencing low power design.

CMOS Testing: CMOS Testing, Need for testing, Test Principles, Design Strategies for test, Chip level Test Techniques.

TEXT BOOKS

1. Essentials of VLSI circuits and systems – Kamran Eshraghian, Eshraghian Dougles and A. Pucknell, PHI, 2005 Edition
2. CMOS VLSI Design – A Circuits and Systems Perspective, Neil H. E Weste, David Harris, Ayan Banerjee, 3rd Ed, Pearson, 2009.

REFERENCE BOOKS

1. CMOS logic circuit Design - John .P. Uyemura, Springer, 2007.
2. Modern VLSI Design - Wayne Wolf, Pearson Education, 3rd Edition, 1997.

TKR COLLEGE OF ENGINEERING & TECHNOLOGY
(Autonomous)
B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING – R17

2. UTILIZATION OF ELECTRIC POWER - A27PE6
(PROFESSIONAL ELECTIVE-VI)

B.Tech. IV year I Semester **L/T/P/C**
3/0/0/3

Prerequisite: Electrical Machines-I & Electrical Machines-II

COURSE OBJECTIVES:

1. To understand the fundamentals of illumination and good lighting practices
2. To understand the methods of electric heating and welding.
3. To understand the concepts of electric drives and their application to electrical traction systems.

COURSE OUTCOMES: After completion of this course, the students will be able to

1. Understand the electric drives and types of loads.
2. Understands the concepts and methods of electric heating and welding.
3. Analyze the various illumination methods.
4. Apply the electric drives to electric traction applications.
5. Analyze various calculations involved in electric traction.

UNIT – I:
Electric Drives: Type of electric drives, choice of motor, starting and running characteristics, speed control, temperature rise, particular applications of electric drives, types of industrial loads, continuous, intermittent and variable loads, load equalization.

UNIT – II:
Electric Heating: Advantages and methods of electric heating, resistance heating induction heating and dielectric heating.
Electric Welding: Electric welding, resistance and arc welding, electric welding equipment, comparison between A.C. and D.C. Welding.

UNIT – III:
Illumination: Introduction, terms used in illumination, laws of illumination, polar curves, photometry, integrating sphere, sources of light.
Various Illumination Methods: Discharge lamps, MV and SV lamps – comparison between tungsten filament lamps and fluorescent tubes, Basic principles of light control, Types and design of lighting and flood lighting.

UNIT – IV:

Electric Traction – I: System of electric traction and track electrification. Review of existing electric traction systems in India. Special features of traction motor, methods of electric braking-plugging rheostat braking and regenerative braking.

Mechanics of train movement. Speed-time curves for different services – trapezoidal and quadrilateral speed time curves.

UNIT – V:

Electric Traction-II: Calculations of tractive effort, power, specific energy consumption for given run, effect of varying acceleration and braking retardation, adhesive weight and coefficient of adhesion.

TEXT BOOKS

1. E. Openshaw Taylor, Utilisation of Electric Energy – by University press, 1961.
2. Partab, H., 'Art and Science of Utilisation of Electrical Energy', Dhanpat Rai and Sons, New Delhi, 1986.

REFERENCE BOOKS

1. N. V. Suryanarayana, Utilization of Electrical Power including Electric drives and Electric traction, New Age International (P) Limited, Publishers, 1996.
2. C. L. Wadhwa, Generation, Distribution and Utilization of electrical Energy, New Age International (P) Limited, Publishers, 1997.
3. Tripathy, S.C., 'Electric Energy Utilisation and Conservation', Tata McGraw Hill Publishing Company Ltd. New Delhi, 1991.

TKR COLLEGE OF ENGINEERING & TECHNOLOGY
(Autonomous)
B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING – R17

3. PROGRAMMABLE LOGIC CONTROLLERS - A27PE6
(PROFESSIONAL ELECTIVE-VI)

B.Tech. IV year I Semester **L/T/P/C**
3/0/0/3

Prerequisite: Basic Electrical Course or equivalent.

COURSE OBJECTIVES:

1. To provide knowledge levels needed for PLC programming and operating.
2. To make the students how devices to which PLC input and output modules are connected
3. To train the students to create ladder diagrams from process control descriptions.
4. To make the students understand various types of PLC registers
5. Apply PLC Timers and Counters for the control of industrial processes
6. To make the students understand PLC functions, Data Handling Function

COURSE OUTCOMES: After completion of this course, the students will be able to

1. Understand the purpose, functions, and basic operations of a PLC
2. Apply programming knowledge on Programmable Logic Controllers
3. Understand different types of PLC registers
4. Understand different types of PLC functions, Data Handling Function
5. Analyze analog PLC operation.

UNIT – I:

PLC Basics PLC system, I/O modules and interfacing CPU processor programming equipment programming formats, construction of PLC ladder diagrams, devices connected to I/O modules**.**

UNIT – II:

PLC Programming input instructions, outputs, operational procedures, programming examples using contacts and coils. Drill-press operation. Digital logic gates programming in the Boolean algebra system, conversion examples Ladder diagrams for process control Ladder diagrams and sequence listings, ladder diagram construction and flow chart for spray process system.

UNIT – III:

PLC Registers: Characteristics of Registers module addressing holding registers input registers, output registers. PLC Functions Timer functions and industrial applications counters counter function industrial applications, Architecture functions, Number comparison functions, number conversion functions.

UNIT – IV:

Data handling functions: SKIP, Master control Relay Jump Move FIFO, FAL, ONS, CLR and Sweep functions and their applications. Bit Pattern and changing a bit shift register, sequence functions and applications, controlling of two axes and three axis Robots with PLC, Matrixfunctions.

UNIT – V:

Analog PLC operation: Analog modules and systems Analog signal processing multi bit data processing , analog output application examples, PID principles position indicator with PID control, PID modules, PID tuning, PID functions

TEXT BOOKS

1. "John W Webb and Ronald A Reiss", Programmable Logic Controllers – Principle and Applications, PHI, 5th Edition2003.
2. "JR Hackworth and F. D Hackworth Jr", Programmable Logic Controllers – Programming Method and Applications by - Pearson,2004

REFERENCE BOOKS

1. "W. Bolton", Programmable Logic Controllers, Newnes, 4th Edition 2000.

TKR COLLEGE OF ENGINEERING & TECHNOLOGY
(Autonomous)
B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING – R17
ELECTRICAL SYSTEMS SIMULATION LAB - A27PC7

B.Tech. IV year I Semester **L/T/P/C**
0/0/3/2

Prerequisite: Electrical and Electronic circuits, Power System Analysis & Power Electronics

COURSE OBJECTIVES:

1. To Simulate and analyze electrical and electronic systems**.**
2. To evaluate the performance of transmission lines.
3. To Analyze various Faults in power systems
4. To Model, simulate and analyze the performance of DC Machines and Induction Motors.
5. To Analyze performance of feedback and load frequency control of the systems

COURSE OUTCOMES: After completion of this course, the students will be able to

1. Design and Analyze electrical systems in time and frequency domain
2. Analyze various transmission lines and perform fault analysis
3. Analyze speed control of dc and ac motors
4. Design power electronic converters

Any ten of the following experiments are required to be conducted using suitable software

1. Design of first and second order circuits in time and frequency domain
2. Performance evaluation of medium and long transmission lines
3. Symmetrical component analysis
4. Transmission Line Fault Analysis
5. LG, LL and 3-Φ fault analysis of Transformer
6. Short Circuit Analysis of Power system models
7. Speed Control of DC Motor
8. Speed Control of Induction motor
9. Design and analysis of feedback control system
10. Transient analysis of open ended line and short circuited line
11. Load frequency control of single area and two area power system
12. Economic Dispatch of Thermal Units
13. Design of Single Phase and Three Phase Inverters

14. Design of Single Phase and Three Phase Full Converters

REFERENCE BOOKS

1. C.L. Wadhwa: Electrical Power Systems –Third Edition, New Age International Pub. Co., 2001.
2. Hadi Sadat: Power System Analysis –Tata Mc Graw Hill Pub. Co. 2002.
3. "I. J. Nagrath & M. Gopal", Control Systems Engineering, New Age International Pub. Co., 5th Edition 2009.
4. A.E. Clayton & C.I. Hancock Performance and Design of DC Machines, CBS Publisher, 1st Edition 2004.

TKR COLLEGE OF ENGINEERING & TECHNOLOGY
(Autonomous)
B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING – R17
ELECTRICAL WORKSHOP- A27PC8

B.Tech. IV year I Semester **L/T/P/C**
0/0/3/2

Prerequisite: Basics of Electrical Engineering

COURSE OBJECTIVES:

1. To enhance practical knowledge related to different subjects
2. To develop hardware skills such as soldering, winding etc.
3. To develop debugging skills.
4. To increase ability for analysis and testing of circuits.
5. To give an exposure to market survey for available components
6. To develop an ability for proper documentation of experimentation.
7. To enhance employability of a student.
8. To prepare students for working on different hardware projects.

COURSE OUTCOMES: After completion of course, the students will be able to

1. Apply practical knowledge related to electrical circuits
2. Fabricate basic electrical circuit elements/networks
3. Trouble shoot the electrical circuits
4. Design filter circuit for application
5. Understand hardware skills such as soldering, winding etc and debugging skills.

Group A:

1. Design and fabrication of reactor/ electromagnet for different inductance values.
2. Design and fabrication of single phase Induction/three phase motor stator.
3. Start delta starter wiring for automatic and manual operation.
4. Wiring of distribution box with MCB, ELCB, RCCB and MCCB.
5. Wiring of 40 W tube, T-5, LED, Metal Halide lamps and available latest luminaries.
6. Assembly of various types of contactors with wiring.
7. Assembly of DOL and 3 point starter with NVC connections and overload operatio

Group B: This group consists of electronic circuits which must be assembled and tested on general purpose PCB or bread boards.

1. Design and development of 5 V regulated power supply.
2. Design and development of precision rectifier.
3. Design and development of first order/ second order low pass/high pass filters with an application.
4. Microcontroller Interface circuit for temperature/level/speed/current/voltage measurement.
5. Peak detector using op-amplifiers.
6. Zero crossing detector using op-amplifiers.

TKR COLLEGE OF ENGINEERING & TECHNOLOGY
(Autonomous)
B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING – R17

1. SMART ELECTRIC GRID - A28PE2
(PROFESSIONAL ELECTIVE-VII)

B.Tech. IV year II Semester **L/T/P/C**
3/0/0/3

Prerequisite: Power Systems - II & Electrical Distribution Systems

COURSE OBJECTIVES:

1. To group various aspects of the smart grid
2. To defend smart grid design to meet the needs of a utility
3. To select issues and challenges that remain to be solved
4. To analyze basics of electricity, electricity generation, economics of supply and demand, and the various aspects of electricity market operations in both regulated and deregulated environment.

COURSE OUTCOMES: After completion of this course, the students will be able to

1. Understand the smart grid for the power system.
2. Analyze Intelligrid Architecture of smart grid.
3. Understand the concept of dynamic energy systems.
4. Understand the concept of energy port and market implementation
5. Analyze the development of smart and intelligent electric systems.

UNIT – I:

Introduction: Introduction to smart grid- Electricity network-Local energy networks- Electric transportation- Low carbon central generation-Attributes of the smart grid- Alternate views of a smart grid.

Smart Grid to Evolve a Perfect Power System: Introduction- Overview of the perfect power system configurations- Device level power system- Building integrated power systems- Distributed power systems- Fully integrated power system-Nodes of innovation.

UNIT – II:

DC Distribution and Smart Grid: AC vs DC sources-Benefits of and drives of DC power delivery systems-Powering equipment and appliances with DC-Data centers and information technology loads-Future neighbourhood-Potential future work and research.

Intelligrid Architecture for the Smart grid: Introduction- Launching intelligrid- Intelligrid today- Smart grid vision based on the intelligrid architecture-Barriers and enabling technologies. SCADA, synchro phasors (WAMS)

UNIT – III:

Dynamic Energy Systems Concept: Smart energy efficient end use devices-Smart distributed energy resources-Advanced whole building control systems- Integrated communications architecture-Energy management-Role of technology in demand response- Current limitations to dynamic energy management-Distributed energy resources-Overview of a dynamic energy management-Key characteristics of smart devices- Key characteristics of advanced whole building control systems-Key characteristics of dynamic energy management system.

UNIT – IV:

Energy Port As Part Of The Smart Grid: Concept of energy -Port, generic features of the energy port. **Policies and Programs to Encourage End – Use Energy Efficiency:** Policies and programs in action -multinational - national-state-city and corporate levels.

Market Implementation: Framework-factors influencing customer acceptance and response

- program planning-monitoring and evaluation.

UNIT – V:

Efficient Electric End – Use Technology Alternatives: Existing technologies – lighting - Space conditioning - Indoor air quality - Domestic water heating - hyper efficient appliances - Ductless residential heat pumps and air conditioners - Variable refrigerant flow air conditioning-Heat pump water heating - Hyper efficient residential appliances - Data center energy efficiency- LED street and area lighting - Industrial motors and drives - Equipment retrofit and replacement - Process heating - Cogeneration, Thermal energy storage - Industrial energy management programs - Manufacturing process-Electro-technologies, Residential, Commercial and industrial sectors.

TEXT BOOKS

1. Clark W Gellings, “The Smart Grid, Enabling Energy Efficiency and Demand Side Response”- CRC Press, 2009.
2. Jean Claude Sabonnadiere, Nouredine Hadjsaid, “Smart Grids”, Wiley-ISTE, IEEE Press, May 2012

REFERENCE BOOKS

1. Janaka Ekanayake, Kithsiri Liyanage, Jianzhong. Wu, Akihiko Yokoyama, Nick Jenkins, “Smart Grid: Technology and Applications”- Wiley, 2012.
2. James Momoh, “Smart Grid: Fundamentals of Design and Analysis”-Wiley, IEEE Press, 2012.

TKR COLLEGE OF ENGINEERING & TECHNOLOGY
(Autonomous)
B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING – R17
2. ARTIFICIAL NEURAL NETWORKS AND FUZZY SYSTEMS- A28PE2
(PROFESSIONAL ELECTIVE-VII)

B.Tech. IV year II Semester **L/T/P/C**
3/0/0/3

COURSE OBJECTIVES:

1. To introduce the basics of Neural Networks and its architectures.
2. To introduce the Fuzzy sets and Fuzzy Logic system components
3. To deal with the applications of Neural Networks and Fuzzy systems

COURSE OUTCOMES: After completion of this course, the students will be able to

1. Understand artificial neural network models and their training algorithms
2. Analyze feed forward neural networks.
3. Understand the associative memories
4. Understand the concept of fuzzy logic system components and fuzzy sets.
5. Understand the concept of fuzzification and defuzzification

UNIT – I:

Introduction To Neural Networks: Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Hodgkin-Huxley Neuron Model, Integrate-and-Fire Neuron Model, Spiking Neuron Model, Characteristics of ANN, McCulloch-Pitts Model, Historical Developments, Potential Applications of ANN.

Essentials of Artificial Neural Networks: Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN – Connectivity, Neural Dynamics (Activation and Synaptic), Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules, Types of Application.

UNIT – II:

FeedForward Neural Networks: Single Layer Feed Forward Neural Networks: Introduction, Perceptron Models: Discrete, Continuous and Multi-Category, Training Algorithms: Discrete and Continuous Perceptron Networks, Perceptron Convergence theorem, Limitations of the Perceptron Model, Applications.

Multilayer Feed forward Neural Networks: Credit Assignment Problem, Generalized Delta Rule, Derivation of Backpropagation (BP) Training, Summary of Backpropagation Algorithm, Kolmogorov Theorem, Learning Difficulties and Improvements.

UNIT – III:

Associative Memories: Paradigms of Associative Memory, Pattern Mathematics, Hebbian Learning, General Concepts of Associative Memory (Associative Matrix, Association Rules,

Hamming Distance, The Linear Associator, Matrix Memories, Content Addressable Memory). Bidirectional Associative Memory (BAM) Architecture, BAM Training Algorithms: Storage and

Recall Algorithm, BAM Energy Function, Proof of BAM Stability Theorem. Architecture of Hopfield Network: Discrete and Continuous versions, Storage and Recall Algorithm, Stability Analysis, Capacity of the Hopfield Network.

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: Fuzzification, Membership value assignment, development of rule base and decision making system, Defuzzification to crisp sets, Defuzzification methods.

TEXT BOOKS

1. Rajasekharan and Pai, Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications– PHI Publication, 1st Edition, 1905
2. Satish Kumar, Neural Networks, TMH, 2004.

REFERENCE BOOKS

1. "James A Freeman and Davis Skapura", Neural Networks, Pearson Education, 2002.
2. "Simon Hakins", Neural Networks, Pearson Education, 3rd Edition 2008.
3. C. Eliasmith and Ch. Anderson, Neural Engineering, PHI, 2004.

TKR COLLEGE OF ENGINEERING & TECHNOLOGY
(Autonomous)
B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING – R17
3. FLEXIBLE AC TRANSMISSION SYSTEMS - A28PE2
(PROFESSIONAL ELECTIVE-VII)

B.Tech. IV year II Semester **L/T/P/C**
3/0/0/3

Prerequisite: Power Electronics, Power System Analysis & Power System Operation and Control

COURSE OBJECTIVES:

1. To understand the fundamentals of FACTS Controllers,
2. To know the importance of controllable parameters and types of FACTS controllers & their benefits
3. To understand the objectives of Shunt and Series compensation
4. To Control STATCOM and SVC and their comparison and the regulation of STATCOM, Functioning and control of GCSC, TSSC and TCSC

COURSE OUTCOMES: After completion of this course, the students will be able to

1. Understand the basic concept of FACTs and FACTs controller
2. Understand the working of single phase and three phase voltage source inverter
3. Understand the concept of static shunt compensation.
4. Analyze SVC & STATCOM
5. Understand the Power and control circuits of Series Controllers GCSC, TSSC and TCSC

UNIT – I:

Facts Concepts: Transmission interconnections power flow in an AC system, loading capability limits, Dynamic stability considerations, importance of controllable parameters, basic types of FACTS controllers, and benefits from FACTS controllers.

UNIT – II:

Voltage Source Converters: Single phase, three phase full wave bridge converters transformer connections for 12 pulse operation.

Three level voltage source converter, pulse width modulation converter, basic concept of current source Converters, and comparison of current source converters with voltage source converters.

UNIT – III:

Static Shunt Compensation: Objectives of shunt compensation, midpoint voltage regulation, voltage instability prevention, improvement of transient stability, Power oscillation damping, Methods of controllable var generation, variable impedance type static var generators, switching converter type var generators and hybrid var generators.

UNIT – IV:

SVC and STATCOM: SVC: FC-TCR and TSC-TCR. STATCOM: The regulation and slope. Comparison between SVC and STATCOM

UNIT – V:

Static Series Compensators: Objectives of Series compensation, concept of series capacitive compensation, GTO thyristor controlled series capacitor (GSC), thyristor switched series capacitor (TSSC), and thyristor controlled series capacitor (TCSC) control schemes for GSC TSSC and TCSC.

TEXT BOOKS

1. "N.G. Hingorani and L. Guygi", Understanding FACTS Devices, IEEE Press Publications 2000.
2. "Yong- Hua Song, Allan Johns", Flexible AC Transmission System, IEE Press 1999.

REFERENCE BOOKS

1. "Kalyan K. Sen and Meylingsen", Introduction to FACTS Controllers, John wiley& sons, Inc., Mohamed E.EI – Hawary Series editor, 2009.
2. "K. R Padiyar, Motilal",FACTS controllers in power transmission and distribution UK Books of India 2007.

TKR COLLEGE OF ENGINEERING & TECHNOLOGY
(Autonomous)
B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING – R17
1. POWER QUALITY- A28PE3
(PROFESSIONAL ELECTIVE-VIII)

B.Tech. IV year II Semester **L/T/P/C**
3/0/0/3

Prerequisite: Power Systems - II

COURSE OBJECTIVES:

1. Definition of power quality and different terms of power quality.
2. Study of voltage power quality issue – short and long interruption.
3. Detail study of characterization of voltage sag magnitude and three phase unbalanced voltage sag.
4. Know the behavior of power electronics loads; induction motors, synchronous motor etc by the power quality issues.
5. Overview of mitigation of power quality issues by the VSI converters.

COURSE OUTCOMES: After completion of this course, the students will be able to:

1. Know the severity of power quality problems in distribution system
2. Analyze the long and short interruptions.
3. Understand the concept of voltage sag transformation from up-stream (higher voltages) to down-stream (lower voltage)
4. Analyze the power quality considerations in industrial power systems
5. Analyze the power quality mitigating techniques and standards.

UNIT – I:

Introduction: Introduction of the Power Quality (PQ) problem, Terms used in PQ: Voltage, Sag, Swell, Surges, Harmonics, over voltages, spikes, Voltage fluctuations, Transients, Interruption, overview of power quality phenomenon, Remedies to improve power quality, power quality monitoring.

UNIT – II:

Long & Short Interruptions: Interruptions – Definition – Difference between failures, outage, Interruptions – causes of Long Interruptions – Origin of Interruptions – Limits for the Interruption frequency – Limits for the interruption duration – costs of Interruption – Overview of Reliability evaluation to power quality, comparison of observations and reliability evaluation.

Short interruptions: definition, origin of short interruptions, basic principle, fuse saving, voltage magnitude events due to re-closing, voltage during the interruption, monitoring of short interruptions, difference between medium and low voltage systems. Multiple events,

single phase tripping – voltage and current during fault period, voltage and current at post fault period, stochastic prediction of short interruptions.

UNIT – III:

Single and Three Phase Voltage Sag Characterization: Voltage sag – definition, causes of voltage sag, voltage sag magnitude, and monitoring, theoretical calculation of voltage sag magnitude, voltage sag calculation in non-radial systems, meshed systems, and voltage sag duration. Three phase faults, phase angle jumps, magnitude and phase angle jumps for three phase unbalanced sags, load influence on voltage sags.

UNIT – IV:

Power Quality Considerations In Industrial Power Systems: Voltage sag – equipment behavior of Power electronic loads, induction motors, synchronous motors, computers, consumer electronics, adjustable speed AC drives and its operation. Mitigation of AC Drives, adjustable speed DC drives and its operation, mitigation methods of DC drives.

UNIT – V:

Mitigation of Interruptions & Voltage Sags: Overview of mitigation methods – from fault to trip, reducing the number of faults, reducing the fault clearing time changing the power system, installing mitigation equipment, improving equipment immunity, different events and mitigation methods. System equipment interface – voltage source converter, series voltage controller, shunt controller, combined shunt and series controller.

Power Quality and EMC Standards: Introduction to standardization, IEC Electromagnetic compatibility standards, European voltage characteristics standards, PQ surveys.

TEXT BOOKS

1. "Math H J Bollen", "Understanding Power Quality Problems" , IEEE Press, 2000.
2. "R. Sastry Vedam and Mulukutla S. Sarma", "Power Quality VAR Compensation in Power Systems", CRC Press, 2008.

REFERENCE BOOKS

1. C. Sankaran, Power Quality, CRC Press 2001.
2. Roger C. Dugan , Mark F. Mc Granaghan, Surya Santoso, H. Wayne Beaty, Electrical Power Systems Quality, Tata McGraw Hill Education Private Ltd, 3rd Edition 2012

TKR COLLEGE OF ENGINEERING & TECHNOLOGY
(Autonomous)
B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING – R17
2. SOLAR PHOTOVOLTAIC SYSTEMS - A28PE3
(PROFESSIONAL ELECTIVE-VIII)

B.Tech. IV year II Semester **L/T/P/C**
3/0/0/3

Prerequisite: Engineering Physics – II

COURSE OBJECTIVES:

1.To introduce photovoltaic systems

2.To deal with various technologies of solar PV cells

3.To understand details about manufacture, sizing and operating techniques

4.To have knowledge of design considerations.

COURSE OUTCOMES: After completion of this course, the students will be able to:

1. Understand the basic concept of solar energy.
2. Understand the basic concept of solar cells.
3. Identify photovoltaic system components, performance measurement and design considerations of solar equipment
4. Understand the solar photovoltaic systems.
5. Analyze different MPPT techniques.

UNIT – I:
Solar Energy: Sun and Earth, Solar Spectrum, Solar Geometry, Solar radiation on horizontal and inclined planes, Instruments for measurement of solar radiation ,Solar cell, Equivalent circuit, V-I characteristics, Performance improvement.

UNIT – II:
Solar Cells: Manufacture of Solar Cells-Technologies, Design of Solar cells, Photovoltaic modules, Design requirements, encapsulation systems, manufacture, power rating, hotspot effect, Design qualifications.

UNIT – III:
Protection and Measurements: Flat plate arrays, support structures, module interconnection and cabling, lightning protection, Performance measurement – using natural sun light and simulator, determination of temperature coefficients, internal series resistance, curve correction factor.

UNIT – IV:
Photovoltaic Systems: Photovoltaic systems- types- general design considerations- system sizing- battery sizing- inverter sizing-design examples – Balance of PV systems.

UNIT – V:

Maximum Power Point Trackers: Maximum power point trackers-algorithms- perturb and observe-incremental conductance method, hill climbing method, , hybrid and complex methods, data based and other approximate methods, instrument design, other MPP techniques-Grid interactive PV system.

TEXT BOOKS

1. "F. C. Treble", Generating electricity from the sun, Pergamon Press, 1991.
2. "A. K. Mukherjee, Nivedita Thakur", Photvolatic systems: Analysis and design, PHI 2011
3. "C. S. Solanki", Solar Photovoltaics: Fundamentals, Technologies and applications, PHI, 2009

REFERENCE BOOKS

1. "R.D. Begamudre", Energy Conversion Systems, New Age International 2000.

TKR COLLEGE OF ENGINEERING & TECHNOLOGY
(Autonomous)
B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING – R17
3. EHV AC TRANSMISSION SYSTEMS - A28PE3
(PROFESSIONAL ELECTIVE-VIII)

B.Tech. IV year II Semester **L/T/P/C**
3/0/0/3

Prerequisite: Power systems - II

COURSE OBJECTIVES:

1. To understand the basic concepts of EHV AC transmission.
2. To get the Knowledge on EHV transmission line inductance and capacitance
3. To understand the voltage gradients of conductor and identify corona effects on transmission lines
4. To calculate electrostatic fields of EHV AC lines and its effects
5. To distinguish various compensators for voltage control

COURSE OUTCOMES: After completion of this course, the students will be able to:

1. Understand the basic concepts of EHV AC transmission.
2. Analyze EHV transmission line inductance, capacitance and voltage gradients of conductor
3. Identify corona effects on transmission lines
4. Calculate electrostatic fields of EHVAC lines and its effects and analyze travelling waves
5. Analyze various compensators for voltage control

UNIT – I:

Preliminaries: Necessity of EHV AC transmission – advantages and problems–power handling capacity and line losses- mechanical considerations – resistance of conductors – properties of bundled conductors – bundle spacing and bundle radius- Examples.

UNIT – II:

Line and Ground Reactive Parameters: Line inductance and capacitances – sequence inductances and capacitances – modes of propagation – ground return - Examples

Voltage Gradients of Conductors: Electrostatics – field of sphere gap – field of line changes and properties – charge – potential relations for multi-conductors – surface voltage gradient on conductors – distribution of voltage gradient on sub-conductors of bundle – Exampl

UNIT – III:

Corona Effects – I: Power loss and audible noise (AN) – corona loss formulae – charge voltage diagram – generation, characteristics - limits and measurements of AN – relation between 1-phase and 3-phase AN levels – Examples.

Corona Effects – II: Radio interference (RI) - corona pulses generation, properties, limits – frequency spectrum – modes of propagation – excitation function – measurement of RI, RIV and excitation functions – Examples.

UNIT – IV:

Electro Static Field: Electrostatic field: calculation of electrostatic field of EHV/AC lines – effect on humans, animals and plants – electrostatic induction in unenergised circuit of double-circuit line – electromagnetic interference-Examples.

Traveling Wave Theory: Traveling wave expression and solution- source of excitation- terminal conditions- open circuited and short-circuited end- reflection and refraction coefficients-Lumped parameters of distributed lines-generalized constants-No load voltage conditions and charging current.

UNIT – V:

Line Compensation: Power circle diagram and its use – voltage control using synchronous condensers – cascade connection of shunt and series compensation – sub synchronous resonance in series capacitor – compensated lines – static VAR compensating system.

TEXT BOOKS

1. "R. D. Begamudre", EHVAC Transmission Engineering, New Age International (p) Ltd., 3rd Edition 2006.
2. S. Rao, HVAC and DC Transmission, Khanna Publishers, 3rd Edition 2001.

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1. "E. Kuffel, W. S. Zaengl, J. Kuffel", High Voltage Engineering Fundamentals, Elsevier, 3rd Edition 2016.
2. "Mazen Abdel-salam, Hussein Ains, Abdab EI – Mors hedy and Roshdy Radwan", High Voltage Engineering: Theory and Practice, CRC Press, 2nd Edition 2000.
   "Hugh M. Ryan", High Voltage Engineering and Testing, IEE power and energy

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