TKR COLLEGE OF ENGINEERING AND TECHNOLOGY
AN AUTONOMOUS INSTITUTION
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Medbowli, Meerpet, Balapur, Hyderabad, Telangana – 500 097
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B.TECH–ELECTRICAL&ELECTRONICS ENGINEERING (R22)

Course Structure R-22

SEMESTER VII

S.No.	Class	Course Code	Name of the Subject	L	T	P	Credits
1	**HS**	D7HSFM	Fundamentals of Management	3	0	0	3
2	**PE**	D27PE3	**Professional Elective-III** 1.Mobile Application development 2. Modern Control Theory 3. Electric and Hybrid Vehicles	3	0	0	3
3	**PE**	D27PE4	**Professional Elective-IV** 1. Power quality & FACTS 2. Power System Reliability 3. Embedded systems applications	3	0	0	3
4	**OE**	D27OE3	**Open Elective-III** 1. Design Estimation and Costing of Electrical Systems 2. Energy Storage Systems 3. Reliability Engineering	3	0	0	3
5	**PC**	D27PC26	Electric Drives	3	0	0	3
6	**PC**	D27PC27	Electrical & Electronics Design Lab	0	0	2	1
7	**PW**	D27PW1	Major Project Phase-I	0	0	8	4
8	**MC**						
		Total Credits					20

Major Project Phase I: Students can form a group of minimum of two or maximum of four under the allocated guide, students group should choose a project title, for the chosen project title carryout a detailed literaturesurvey,problemformulation,planninghigherleveldesign.Theprojectevaluationwillbe Continuous Internal Evaluation will be made by the PRC Committee. The PRC committee consists of Head, Project Coordinator, One Senior Professor, One Associate Professor, and guide.

Mandatory Course: Competitive Exams:

For completion of this course the student can submit the proof of appearing the competitive exams like,GATE,IELTES,GRE,TOEFL,CDAC,CDS,CAT,oranyexaminationorganizedbyNATIONALTESTING AGENCY (NTA), or college in the level of NTA.

or

The student should request for the provision of conducting Technical Seminar by the department. The topic of seminar should be the current technology of respective Engineering Branch. The evaluation will be done by the Departmental Academic Committee (DAC) based on rubrics framed.

Professional Elective-III

1. Mobile Application development
2. Modern Control Theory
3. Electric and Hybrid Vehicles

Professional Elective-IV

1. Power quality & FACTS
2. Power System Reliability
3. Embedded systems applications

Open Elective–III

1. Design Estimation and Costing of Electrical Systems
2. Energy Storage Systems
3. Reliability Engineering

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B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING (R22)

FUNDAMENTALS OF MANAGEMENT (D7HSFM)

B. Tech. VII Sem **L/T/P/C**
3/0/0/3

COURSE OBJECTIVES

1. To make the students to understand the management concepts
2. To analyze the managerial skills.
3. To know the applications of management concepts in practical aspects of business.
4. To interpret, understand and develop the management principles in organizations.
5. To learn the basic concepts of organization its principles and functions**.**

Course Outcomes

Upon completion, of course the student will be able to

1. To infer the basic knowledge of management functions , levels and evolution of Management.
2. To ensure the students in decision making problem solving for the issues in corporate in the organization.
3. To acquire the knowledge of entire organization design and structure.
4. To perceive the strategically decision in selection, requirement training and development.
5. To enact and impose the qualities of a leader, mentor and coach.

UNIT - I

Introduction to Management: Definition, Nature and Scope, Functions, Managerial Roles, Levels of Management, Managerial Skills, Challenges of Management; Evolution of Management- Classical Approach- Scientific and Administrative Management; The Behavioral approach

UNIT – II

Planning and Decision Making: General Framework for Planning - Planning Process, Types of Plans. Decision making and Problem solving - Programmed and Non Programmed Decisions, Steps in Problem Solving and Decision Making.

UNIT - III

Organization and HRM: Principles of Organization: Organizational Design & Organizational Structures; Departmentalization, Delegation; Empowerment, Centralization, Decentralization, Recentralization;

Human Resource Management & Business Strategy: Talent Management, Talent Management Models and Strategic Human Resource Planning; Recruitment and Selection; Training and Development; Performance Appraisal.

UNIT - IV

Leading and Motivation: Leadership, Power and Authority, Leadership Styles; Behavioral Leadership, Situational Leadership, Leadership Skills, Leader as Mentor and Coach, Leadership during adversity and Crisis.

Motivation - Types of Motivation; Motivational Theories - Needs Hierarchy Theory, Two Factor Theory, Theory X and Theory Y.

UNIT - V

Controlling: Control, Types and Strategies for Control, Steps in Control Process, Budgetary and Non- Budgetary Controls. Characteristics of Effective Controls

TEXTBOOKS:

1. Management Fundamentals, Robert N Lussier, 5e, Cengage Learning, 2013.
2. Fundamentals of Management, Stephen P. Robbins, Pearson Education, 2009.

REFERENCES:

1. Essentials of Management, Koontz Kleihrich, Tata Mc - Graw Hill.
2. Management Essentials, Andrew DuBrin, 9e, Cengage Learning, 2012.
3. Harold Koontz and Heinz Weihrich, 2010, Essentials of Management, TMH

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B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING (R22)
MOBILE APPLICATION DEVELOPMENT (D27PE3)
(Professional Elective-III)

B. Tech. VII Semester **L/T/P/C**
3/0/0/3

Course Objective:

1. To demonstrate their understanding of the fundamentals of Android operating systems
2. To improves their skills of using Android software development tools
3. To demonstrate their ability to develop software with reasonable complexity on mobile platform
4. To demonstrate their ability to deploy software to mobile devices
5. To demonstrate their ability to debug programs running on mobile devices

Course Outcomes:

Upon completion, of course the student will be able to
1. Understand the fundamentals of android operating system and application Lifecycle
2. Understand the features of android user interface and event handling.
3. Analyze different intents, broad cast receivers and notifications.
4. Understand the concepts of Persistent storage and retrieving data using shared preference.
5. Understand SQLite database and using content Providers

UNIT I

Introduction to Android Operating System: Android OS design and Features – Android development framework, SDK features, Installing and running applications on Android Studio, Creating AVDs, Types of Android applications, Best practices in Android programming, Android tools Android application components – Android Manifest file, Externalizing resources like values, themes, layouts, Menus etc, Resources for different devices and languages, Runtime Configuration Changes Android Application Lifecycle – Activities, Activity lifecycle, activity states, monitoring state changes

UNIT II

Android User Interface: Measurements – Device and pixel density independent measuring unit - s Layouts – Linear, Relative, Grid and Table Layouts
User Interface (UI) Components –Editable and non-editable Text Views, Buttons, Radio and Toggle Buttons, Checkboxes, Spinners, Dialog and pickers
Event Handling – Handling clicks or changes of various UI components
Fragments – Creating fragments, Lifecycle of fragments, Fragment states, Adding fragments to Activity, adding, removing and replacing fragments with fragment transactions, interfacing between fragments and Activities, Multi-screen Activities

UNIT III

Intents and Broadcasts: Intent – Using intents to launch Activities, Explicitly starting new Activity, Implicit Intents, Passing data to Intents, Getting results from Activities, Native Actions, using Intent to dial a number or to send SMS

Broadcast Receivers – Using Intent filters to service implicit Intents, Resolving Intent filters, finding and using Intents received within an Activity

Notifications – Creating and Displaying notifications, Displaying Toasts

UNIT IV

Persistent Storage: Files – Using application specific folders and files, creating files, reading data from files, listing contents of a directory Shared Preferences – Creating shared preferences, saving and retrieving data using Shared Preference

UNIT V

Database – Introduction to SQLite database, creating and opening a database, creating tables, inserting retrieving and etindelg data, Registering Content Providers, Using content Providers (insert, delete, retrieve and update)

TEXT BOOK:

1. Professional Android 4 Application Development, Reto Meier, Wiley India, (Wrox), 2012.

REFERENCE BOOKS:

1. Android Application Development for Java Programmers, James C Sheusi, Cengage Learning, 2013.

2. Beginning Android 4 Application Development, Wei-Meng Lee, Wiley India (Wrox), 2013.

WEB LINK:

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B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING (R22)
MODERN CONTROL THEORY (D27PE3)
(Professional Elective-III)

B. Tech. VII Sem **L/T/P/C**
3/0/0/3

Course Objectives:
The objective of the course is to

1. Understand state space representation of systems and study controllability and observability tests for continuous time-invariant systems.
2. Understand the problem formulation of nonlinear systems and study the performance.
3. Understand different types of optimal control techniques and its applications

Course Outcomes: After completion of the course, the student acquires knowledge to

1. Understand mathematical preliminaries of vectors and vector Spaces
2. Model linear Continuous time physical systems and non-linear systems
3. Describing function analysis of nonlinear systems and stability analysis of non-linear systems
4. Describe Phase-plane analysis of nonlinear control systems.
5. Stability analysis of the linear continuous time invariant systems by Lyapunov method

UNIT I
Mathematical Preliminaries: Fields, Vectors and Vector Spaces – Linear combinations and Bases–Linear Transformations and Matrices – Scalar Product and Norms – Eigen-values, Eigen Vectors and a Canonical form representation of Linear operators – The concept of state – State Equations for Dynamic systems – Time invariance and Linearity – Non-uniqueness of state model – State diagrams for Continuous-Time State models.

UNIT II
State Variable Analysis: Linear Continuous time models for Physical systems– Non Linear Models- Existence and Uniqueness of Solutions to Continuous-Time State Equations – Solutions of Linear Time Invariant Continuous-Time State Equations – State transition matrix and its properties. General concept of controllability – General concept of Observability – Controllability tests for Continuous-Time Invariant Systems – Observability tests for Continuous-Time Invariant Systems –Controllability and Observability of State Model in Jordan Canonical form – Controllability and Observability Canonical forms of State model

UNIT-III:

Non Linear Systems: Introduction – Non Linear Systems - Types of Non-Linearities – Saturation–Dead- Zone - Backlash – Jump Phenomenon etc;– Singular Points – Introduction to Linearization of nonlinear systems, Properties of Non-Linear systems – Describing function–describing function analysis of nonlinear systems – Stability analysis of Non-Linear systems through describing functions.

UNIT-IV:

Phase-Plane Analysis: Introduction to phase-plane analysis, Method of Isoclines for Constructing Trajectories, singular points phase-plane analysis of nonlinear control systems

UNIT-V:

Stability Analysis: Stability in the sense of Lyapunov, Lyapunov's stability and Lypanov'sinstability theorems - Stability Analysis of the Linear continuous time invariant systems by Lyapunov second method – Generation of Lyapunov functions – Variable gradient method –Krasooviski's method. State feedback controller design through Pole Assignment – State observers:Full order and Reduced order.

TEXT BOOKS:

1. Modern Control System Theory by M.Gopal – New Age International-1984
2. Modern Control Engineering by Ogata.K Prentice Hall – 1997 N.K.Sinha, control systems,New Age International, 3rd edition.

REFERENCES:

1. Optimal control by kircks

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B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING (R22)
ELECTRIC AND HYBRID VEHICLES
(PROFESSIONALELECTIVE-III) (D27PE3)

B. Tech. VII Sem **L/T/P/C**
3/0/0/3

Course Objectives:

1. Classification of different electrical vehicles concepts
2. Apply drives for Electric Train system
3. Illustrate energy storage devices for vehicle application

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand the basics of conventional vehicles
2. Analyze various hybrid drive-train topologies and power flow control in hybrid drive-train topologies
3. Analyze power flow control in electric drive-train topologies
4. Analyze battery-based energy storage, super capacitor-based energy storage, and Flywheel based energy storage in hybrid and electric vehicles
5. Understand and analyze energy management strategies used in hybrid and electric vehicles

UNIT I

Introduction Conventional Vehicles: Basics of vehicle performance, IC engines, parts, vehicle power source characterization, transmission characteristics, and mathematical models to describe vehicle performance.

UNIT II

Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive- trains on energy supplies.

Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.

UNIT III

Electric Trains

Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis.

Electric Propulsion unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

UNIT IV

Energy Storage

Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices. Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Communications, supporting subsystems.

UNIT V

Energy Management Strategies:

Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies. Case Studies: Design of a Hybrid Electric Vehicle (HEV), Design of a Battery Electric Vehicle (BEV).

TEXT BOOKS:

1. C. Mi, M. A. Masrur and D. W. Gao, "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", John Wiley & Sons, 2011.
2. Onori,L. Serraoand G.Rizzoni,"HybridElectricVehicles:Energy Management Strategies",Springer,2015.

REFERENCE BOOKS:

1. M. Ehsani, Y. Gao, S. E. Gay and A. Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design", CRC Press, 2004.
2. T.Denton,"ElectricandHybridVehicles",Routledge,2016.

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B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING (R22)
POWER QUALITY & FACTS (D27PE4)
(Professional Elective-IV)

B. Tech. VII Sem **L/T/P/C**
3/0/03

Course Objectives:

1. Define power quality and explore various terms associated with it. Study voltage-related power quality issues, focusing on short and long interruptions.
2. Conduct a detailed study on characterizing voltage sags, with a specific emphasis on magnitude and three-phase unbalanced voltage sags. Understand how power quality issues affect the behaviour of power electronics loads and rotating machinery
3. Gain an understanding of FACTS controllers, their controllable parameters, and types. Explore the importance of shunt and series compensation, focusing on the control and comparison of TATCOM and SVC, and the functioning and regulation of other FACTS devices like GCSC, TSSC, and TCSC.

Course Outcomes: At the end of this course, students will be able to:

1. Develop an awareness of the severity of power quality issues in distribution systems, focusing on their impact and challenges.
2. Understand the concept of transforming voltage sags from upstream (higher voltages) to downstream (lower voltage) in the distribution system.
3. Understand transmission lines and series/shunt reactive power compensation.
4. Demonstrate competence in selecting controllers based on specific applications and system requirements.
5. Thoroughly understand various systems and their requirements, including the control circuits of shunt controllers (SVC & STATCOM) and series controllers (GCSC, TSSC, and TCSC) for enhancing transient stability, preventing voltage instability, and damping power oscillations.

UNIT I

Power Quality Problems in Distribution Systems: Power Quality problems in distribution systems: Transient and Steady state variations in voltage and frequency. Unbalance, Sags, Swells, Interruptions, Wave-form Distortions: harmonics, noise, notching, dc-offsets, fluctuations. Flicker and its measurement.

UNIT II

Transmission Lines and Series/Shunt Reactive Power Compensation: Basics of AC Transmission. Analysis of uncompensated AC transmission lines. Passive Reactive Power Compensation. Shunt and series compensation at the mid-point of an AC line. Comparison of Series and Shunt Compensation.

UNIT III

Static Shunt Compensators: Objectives of shunt compensation, Methods of controllable VAR generation, Static VAR Compensator, its characteristics, TCR, TSC, FC-TCR configurations, STATCOM, basic operating principle, control approaches and characteristics

UNIT IV

Static Series Compensators: Objectives of series compensator, variable impedance type of series compensators, TCSC, TSSC-operating principles and control schemes, SSSC, Power Angle characteristics, Control range and VAR rating, Capability to provide reactive power compensation, external control

UNIT V

Combined Compensators: Introduction to Unified Power Flow Controller, Basic operating principles, Conventional control capabilities, independent control of real and reactive power.

TEXT BOOKS:

1. Electrical Power Systems Quality, Dugan Roger C, Santoso Surya, Mc Granaghan, Marks F. Beaty and H. Wayre, Mc Graw Hill
2. Power Systems Quality Assessment, J. Arillaga, N.R. Watson, S.Clon, John Wiley.

REFERENCE BOOKS:

1. Power Quality, C.Sankaran, CRC Press 4. Understanding power quality problems, Math H. Bollen, IEEE press.
2. "Understanding FACTS –Concepts and Technology of Flexible AC Transmission Systems"Narain G. Honorani, Laszlo Gyugy

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B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING (R22)
POWER SYSTEM RELIABILITY (D27PE4)
(Professional Elective-IV)

B.Tech. VII Sem **L/T/P/C**
3/0/0/3

Course Objectives:

1. To describe the generation system model and recursive relation for capacitive model building
2. To explain the equivalent transitional rates, cumulative probability and cumulative frequency
3. To develop the understanding of risk, system and load point reliability indices
4. To explain the basic and performance reliability indices

Course Outcomes: Upon the completion of this course, the student will be able to

1. Understand basic probability theory and reliability
2. Analyse generating system reliability
3. Apply operating reserve and bulk power system reliability evaluation approach
4. Apply distribution system reliability analysis
5. Analyse substations and switching stations

UNIT I

Basic Probability Theory: Elements of probability, probability distributions, Random variables, Density and Distribution functions- Binomial distribution- Expected value and standard deviation – Binomial distribution, Poisson distribution, normal distribution, exponential distribution, Weibull distribution.

Definition of Reliability: Definition of terms used in reliability, Component reliability, Hazard rate, derivation of the reliability function in terms of the hazard rate. Hazard models - Bath tub curve, Effect of preventive maintenance. Measures of reliability: Mean Time to Failure and Mean Time between Failures.

UNIT II

Generating System Reliability Analysis: Generation system model – capacity outage probability tables – Recursive relation for capacitive model building – sequential addition method – unit removal –Evaluation of loss of load and energy indices – Examples. Frequency and Duration methods –Evaluation of equivalent transitional rates of identical and non-identical units – Evaluation of cumulative probability and cumulative frequency of non-identical generating units – 2-level daily load representation- merging generation and load models – Examples.

UNIT III

Operating Reserve Evaluation: Basic concepts - risk indices – PJM methods – security function approach – rapid start and hot reserve units – Modeling using STPM approach.

Bulk Power System Reliability Evaluation: Basic configuration – conditional Probability approach –system and load point reliability indices – weather effects on transmission lines – Weighted average rate and Markov model – Common mode failures.

Inter Connected System Reliability Analysis: Probability array method – Two inter connected systems with independent loads – effects of limited and unlimited tie capacity - imperfect tie – Two connected Systems with correlated loads – Expression for cumulative probability and cumulative frequency.

UNIT IV

Distribution System Reliability Analysis: Basic Techniques – Radial networks – Evaluation of Basic reliability indices, performance indices – load point and system reliability indices – customer oriented, loss and energy-oriented indices – Examples. Basic concepts of parallel distribution system reliability

UNIT V

Substations and Switching Stations: Effects of short-circuits - breaker operation – Open and Short circuit failures – Active and Passive failures – switching after faults – circuit breaker model – preventive maintenance – exponential maintenance times.

TEXT BOOKS:

1. Reliability Evaluation of Power systems by R. Billinton, R.N. Allan, BS Publications, 2007.
2. Reliability Modeling in Electric Power Systems by J. Endrenyi, John Wiley and Sons, 1978

REFERENCE BOOKS:

1. Reliability Engineering: Theory and Practice by Alessandro Birolini, Springer Publications.
2. An Introduction to Reliability and Maintainability Engineering by Charles Ebeling, TMH Publications.
3. Reliability Engineering by E. Balaguruswamy, TMH Publications.
4. Reliability Engineering by Elsayed A. Elsayed, Prentice Hall Publications.

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B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING (R22)
EMBEDED SYSTEMS APPLICATIONS (D27PE4)
(Professional Elective-IV)

B.Tech. VII Semester **L/T/P/C**
3/0/0/3

Course Objectives:

1. To equip with the basic concepts of embedded system, applications in which they are used,
2. To describe tools and methodologies needed for embedded system design.
3. To know RTOS concepts and familiar with the characteristics of latency in real-time systems.

Course Outcomes: Upon completing this course, the student will be able to

1. Understand the microprocessor architecture and its components used in embedded systems
2. Write the 8051-assembly language code and Embedded 'C' code for interfacing various devices.
3. Develop simple embedded systems for real time operations
4. To understand the selection procedure of Processors in the embedded domain.
5. Design Procedure for Embedded Firmware.

UNIT I

Embedded Systems Basics:

Introduction to Embedded systems, Examples of embedded systems, Typical Hardware, Gates, Timing Diagrams, Memory, Microprocessors, Buses, Direct Memory Access, Interrupts, Microprocessor Architecture, and Interrupt Basics.

UNIT II

The 8051 Architecture: Introduction, 8051 Micro controller Hardware, Input/output Pin Ports and Circuits, External Memory, Serial data Input/output, Interrupts.

UNIT III

Embedded C Programming: Overview of the C standard library, Embedded System Oriented Topics, MISRA C — Designing Safer C Programs, Basics of event driven programming.

Basic Assembly Language Programming Concepts: The Assembly Language Programming Process, Programming Tools and Techniques, Programming the 8051.

UNIT IV

Moving Data: Introduction, Addressing Modes, External Data Moves, Code Memory Read Only Data Moves, Push and Pop Opcodes, Data Exchanges.

Basic Design Using a Real-Time Operating System: Message Queues, Mailboxes and Pipes, Timer Functions, Events, Memory Management, Interrupt Routines in an RTOS Environment

UNIT V

Applications: Introduction, keyboards, Human Factor, Key Switch Factors, Keyboard Configurations, Displays, Seven-Segment Numeric Display, D/A and A/D Conversions.

Embedded Software Development Tools: Host and Target machines, Linker/Locators for Embedded Software, Getting Embedded Software into the Target System; Debugging Techniques: Testing on Host Machine, Using Laboratory Tools, An Example System.

TEXT BOOKS:

1. An Embedded Software Primer, David E. Simon, Pearson Education.
2. The 8051 Microcontroller, Third Edition, Kenneth J.Ayala, Thomson.

REFERENCE BOOKS:

1. Embedded Microcomputer Systems Real Time Interfacing, Jonathan W.Valvano, Cengage Learning.
2. 8051 Microcontrollers, Satish Shah, Oxford Higher Education.
3. Micro Controllers, Ajay V Deshmukhi, TMH.
4. Embedded System Design, Frank Vahid, Tony Givargis, John Wiley.
5. Microcontrollers, Raj kamal, Pearson Education.

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B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING (R22)
DESIGN ESTIMATION AND COSTING OF ELECTRICAL SYSTEMS
(Open Elective–III)

B.Tech. VII Sem **L/T/P/C**
3/0/0/3

Prerequisite: Power systems –I & Power Systems-II

Course Objectives:

1. To emphasize the estimation and costing aspects of all electrical equipment, installation and designs on the cost viability.
2. To design and estimation of wiring
3. To design overhead and underground distribution lines, substations and illumination

Course Outcomes: After Completion of this course, student will be able to

1. Understand the design considerations of electrical installations.
2. Design electrical installation for buildings and small industries.
3. Identify and design the various types of light sources for different applications.

UNIT– I

Design Considerations of Electrical Installations: Electric Supply System, Three phase four wire distribution system, Protection of Electric Installation against overload, short circuit and Earth fault, Earthing, General requirements of electrical installations, testing of installations, Indian Electricity rules, Neutral and Earth wire, Types of loads, Systems of wiring, Service connections , Service Mains, Sub-Circuits, Location of Outlets, Location of Control Switches, Location of Main Board and Distribution board, Guide lines for Installation of Fittings, Load Assessment, Permissible voltage drops and sizes of wires, estimating and costing of Electric installations.

UNIT– II

Electrical Installation for Different Types of Buildings and Small Industries: Electrical installations for residential buildings – estimating and costing of material, Electrical installations for commercial buildings, Electrical installations for small industries.

UNIT– III

Overhead and Underground Transmission and Distribution Lines: Introduction, Supports for transmission lines, Distribution lines – Materials used, Underground cables, Mechanical Design of overhead lines, Design of under ground cables.

UNIT– IV

Substations: Introduction, Types of substations, Outdoor substation – Pole mounted type, Indoor substations – Floor mounted type.

UNIT– V

Design of Illumination Schemes: Introduction, Terminology in illumination, laws of illumination, various types of light sources, Practical lighting schemes LED, CFL and OCFL differences.

TEXTBOOKS:

1. "K. B. Raina, S. K. Bhattacharya","Electrical Design Estimating and Costing", NewAge International Publisher, 2010.
2. "Er. V. K. Jain, Er. AmitabhBajaj", "DesignofElectricalInstallations", UniversityScience Press.

REFERENCEBOOKS:

1. Code of practice for Electrical wiring installations,(System voltage not exceeding 650volts), Indian Standard Institution, IS:732-1983.
2. Guide for Electrical layout in residential buildings, Indian StandardInstitution,IS:4648-1968.
3 .Electrical Installation buildings Indian Standard Institution, I S:2032.
4 .Code of Practice for selection, Installation of Maintenance of fuse (voltage not exceeding650V), Indian Standard Institution, IS:3106-1966.
5. Code of Practice for earthling, Indian Standard Institution,IS:3043-1966.
6. Code of Practice for Installation and Maintenance of induction motors, Indian Standard Institution, IS: 900-1965.
7. Code of Practice for electrical wiring, Installations(system voltage not exceeding 650Volts), Indian Standard Institution, IS: 2274-1963.
8. Gupta J.B.,Katson, Ludhiana","Electrical Installation, estimating and costing",S.K.Kataria and sons, 2013.

WEB LINK:

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B.TECH. ELECTRICAL & ELECTRONICS ENGINEERING (R22)
ENERGY STORAGE SYSTEMS
(Open Elective–III)

B. Tech VII Sem **L/T/P/C**
3/0/0/3

Prerequisite: Electrochemistry

Course Objective:

- To enable the student to understand the need for energy storage, devices and technologies available and their applications

Course Outcomes: After completion of this course, the student will be able to

1. analyzethecharacteristicsofenergyfromvarioussourcesandneedforstorage
2. classifyvarioustypesofenergystorageandvariousdevicesusedforthepurpose
3. Identify various real time applications.

UNIT - I

Electrical Energy Storage Technologies: Characteristics of electricity, Electricity andthe roles of EES, High generation cost during peak-demand periods, Need for continuous and flexible supply,Long distance between generation and consumption, Congestion in power grids, Transmission by cable.

UNIT - II

Needs for Electrical Energy Storage: Emerging needs for EES, More renewable energy, less fossil fuel, Smart Grid uses, The roles of electrical energy storage technologies, The roles from the viewpoint of a utility, The roles from the viewpoint of consumers, The roles from the viewpoint of generators of renewable energy

UNIT - III

Features of Energy Storage Systems: Classification of EES systems , Mechanical storage systems, Pumped hydro storage (PHS), Compressed air energy storage (CAES), Flywheel energy storage (FES),Electrochemical storage systems, Secondary batteries, Flow batteries, Chemical energy storage, Hydrogen (H2),Synthetic natural gas (SNG).

UNIT - IV

Types of Electrical Energy Storage systems: Electrical storage systems ,Double-layer capacitors(DLC), Superconducting magnetic energy storage(SMES),Thermal storage systems, Standards for EES, Technical comparison of EES technologies.

UNIT - V

Applications: Present status of applications, Utility use (conventional power generation, grid operation & service), Consumer use (uninterruptablepowersupplyforlargeconsumers), Newtrendsinapplications
,Renewable energy generation, Smart Grid, Smart Microgrid, Smart House, Electric vehicles, Management and control hierarchy of storage systems, Internal configuration of battery storage systems, External connection of EES systems , Aggregating EES systems and distributed generation (Virtual Power Plant), Battery SCADA– aggregation of many dispersed batteries.

TEXT BOOKS:

1. "James M. Eyer, JosephJ. Iannucci and Garth P.Corey", "Energy Storage Benefits and Market Analysis", Sandia National Laboratories,2004.
2. The Electrical Energy Storage by IECMarket Strategy Board

REFERENCEBOOK:

1."Jim Eyer, Garth Corey", Energy Storage fortheElectricityGrid:Benefits andMarketPotentialAssessmentGuide,Report,SandiaNationalLaboratories, Feb 2010

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B.TECH. ELECTRICAL&ELECTRONICSENGINEERING (R22)
RELIABILITY ENGINEERING (D27OE3)
(Open Elective – III)

B. Tech. VII Sem **L/T/P/C**
3/0/0/3

Prerequisite: Mathematics-III (Laplace Transforms, Numerical Methods and Complex variables)

Course Objectives:

- To introduce the basic concepts of reliability, various models of reliability
- To analyze reliability of various systems
- To introduce techniques of frequency and duration for reliability evaluation of repairable

systems

Course Outcomes: At the end of this course, students will be able to:

1. Model various systems applying reliability networks and evaluation of the same
2. Estimate the limiting state probabilities of repairable systems
3. Apply various mathematical models for evaluating reliability of irreparable systems

UNIT I

Basic Probability Theory: Elements of probability, probability distributions, Random variables, Density and Distribution functions- Mathematical expected – variance and standard deviation – binomial distribution: Concepts, properties, engineering applications.

UNIT II

Network Modeling And Evaluation Of Simple Systems: Basic concepts- Evaluation of network Reliability / Unreliability - Series systems, Parallel systems - Series-Parallel systems- Partially redundant systems- Examples.

Network Modeling And Evaluation Of Complex Systems: Conditional probability method- tie set, Cut-set approach- Event tree and reduced event tree methods- Relationships between tie and cut-setsExamples.

UNIT III

Probability Distributions In Reliability Evaluation: Distribution concepts, Terminology of distributions, General reliability functions, Evaluation of the reliability functions, shape of reliability functions –Poisson distribution – normal distribution, exponential distribution, Weibull distribution.

Network Reliability Evaluation Using

Probability Distributions: Reliability Evaluation of Series systems, Parallel systems – Partially redundant systems- determination of reliability measure- MTTF for series and parallel systems – Examples.

UNIT IV

Discrete Markov Chains: Basic concepts- Stochastic transitional probability matrix- time dependent probability evaluation- Limiting State Probability evaluation- Absorbing states – Application. **Continuous Markov Processes**: Modeling concepts- State space diagrams- Unreliability evaluation of single and two component repairable systems.

UNIT V

Frequency And Duration Techniques: Frequency and duration concepts, application to multi state problems, Frequency balance approach.

Approximate System Reliability Evaluation: Series systems – Parallel systems- Network reduction techniques- Cut set approach- Common mode failures modeling and evaluation techniques- Examples.

TEXT BOOKS:

1. Roy Billinton and Ronald N Allan, Reliability Evaluation of Engineering Systems, Plenum Press.
2. E. Balagurusamy, Reliability Engineering by Tata McGraw-Hill Publishing Company Limited

REFERENCE BOOKS:

1. Reliability Engineering: Theory and Practice by Alessandro Birolini, Springer Publications.
2. An Introduction to Reliability and Maintainability Engineering by Charles Ebeling, TMH Publications.
3. Reliability Engineering by Elsayed A. Elsayed, Prentice Hall Publications.

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B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING (R22)

ELECTRIC DRIVES (D27PC26)

B. Tech. VII Sem **L/T/P/C**
3/0/0/3

Course Objectives:

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

Course Outcomes: At the end of the course the student will be able to:

1. Understand control of dc motors through phase-controlled rectifiers
2. Analyse four quadrant operations of dc drives through dual converters
3. Analyse control of dc motors by choppers
4. Analyse control of induction motor by ac voltage controllers and variable frequency control.
5. Understand and analyse control of synchronous motors

UNIT I

Control of DC Motors

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

Three phase semi and fully controlled converters connected to DC separately excited and DC 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

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 and 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 - modelling, Analysis and control, Prentice Hall PTR, 2001

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B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING (R22)

Electrical & Electronics Design Lab (D27PC27)

B. Tech. VII Sem **L/T/P/C**
0/0/2/1

PREREQUISITE: Basics of Electrical Engineering

COURSEOBJECTIVES:

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 prepar students for working on different hardware projects.

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

1. Get practical knowledge generated to electrical
2. Fabricate basic electrical circuit elements/networks
3. Trouble shoot the electrical circuits
4. Design filter circuit for application
5. Get hard ware skills such as soldering, winding etc.
6. Get debugging kills.

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. Star delta starter wiring for automatic and manual operation.
4. Wiring of distribution box with MCB,ELCB,RCCB and MCCB.
5. Wiring of 40Wtube,T-5,LED,Metal Halidel amps and available latestl uminaries.
6. Assembly of various types of contactors with wiring.
7. Assembly of DOL and 3 point starter with NVC connections and overload operation.
   GroupB:This group consists of electronic circuits which must be assembled and tested on general purpose PCB or bread boards.
8. Design and development of 5V regulated power supply.
9. Design and development of precision rectifier.
10. Design and development of first order/second order low pass/ high pass filters with an application.
11. Microcontroller Interface circuit for temperature/level/speed/current/voltage measurement.
12. Peak detector using op-amplifiers.
13. Zero crossing detector using op-amplifiers
14. Power quality comparison of CFL, LED, and Incandescent and fluorescent lamps.

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B.TECH–ELECTRICAL&ELECTRONICS ENGINEERING (R22)

SEMESTERVIII

S.No.	Class	Course Code	Name of the Subject	L	T	P	C
1	**OE**	D28OE4	Open Elective-IV	3	0	0	3
2	**PE**	D28PE5	Professional Elective-V	3	0	0	3
3	**PE**	D28PE6	Professional Elective-VI	3	0	0	3
4	**PW**	D28PW3	Comprehensive Viva/Test	0	0	2	1
5	**PW**	D28PW2	Major Project Phase II	0	0	20	10
		Total Credits					20

Major Project Phase II: The approved project in Major Project Phase I should be implemented, student should submit the progress of his implementation work in 2 phases, to the PRC (Project Review Committee). The PRC consists of Head, Project Coordinator, One Senior Professor, One Associate Professor, and guide. Upon approval in both the phases, the student is eligible to submit the final project report by completing proper documentation to the external viva voce.

Professional Elective-V
HVDC Transmission
Solar Power batteries
AI Techniques in Electrical Engineering

Professional Elective-VI
Smart Grid Technologies
Electrical Distribution Systems
Machines Learning Applications to Electrical Engineering

Open Elective–IV
Power system Reforms
Programmable Logic Controllers & SCADA
Energy from Waste

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B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING (R22)
HVDC Transmission (D28OE4)
(Professional Elective-V)

B. Tech. VIII Sem **L/T/P/C 3/0/0/3**

Course Objectives:

- To compare EHV AC and HVDC and understand Graetz circuit with 6 and 12 pulse operation
- To control HVDC systems with various methods and to perform power flow analysis in AC/DC systems
- To describe various protection methods for HVDC systems and Harmonics

.**Course Outcomes:** Upon the completion of this course, the student will be able to

1. Understand the importance of Transmission power through HVDC.
2. Describe the converter control and HVDC control systems.
3. Analyse power flow in AC-DC systems using simultaneous and sequential methods.
4. Analyse converter Faults and Protection
5. Analyse the Harmonics and use of filters to minimize the harmonics

UNIT- I

Basic Concepts Necessity of HVDC systems, Economics and Terminal equipment of HVDC transmission systems, Types of HVDC Links, Apparatus required for HVDC Systems, Comparison of AC and DC Transmission, Application of DC Transmission System, Planning and Modern trends in D.C. Transmission.

Analysis of HVDC Converters: Choice of Converter Configuration, Analysis of Graetz circuit, Characteristics of 6 Pulse and 12 Pulse converters, Cases of two 3 phase converters in Y/Y mode – their performance.

UNIT- II

Converter and HVDC System Control: Principle of DC Link Control, Converters Control Characteristics, Firing angle control, Current and extinction angle control, Effect of source inductance on the system, Starting and stopping of DC link, Power Control.

Reactive Power Control in HVDC: Introduction, Reactive Power Requirements in steady state, sources of reactive power- Static VAR Compensators, Reactive power control during transients.

UNIT- III

Power Flow Analysis in AC/DC Systems: Modelling of DC Links, DC Network, DC Converter, Controller Equations, Solution of DC load flow, P.U. System for DC quantities, solution of AC-DC Power flow-Simultaneous Method-Sequential method.

UNIT- IV

Converter Faults and Protection: Converter faults, protection against over current and over voltage in converter station, surge arresters, smoothing reactors, DC breakers, Audible noise, space charge field, corona effects on DC lines, Radio interference.

UNIT-V:

Harmonics: Generation of Harmonics, Characteristics harmonics, calculation of AC Harmonics, NonCharacteristics harmonics, adverse effects of harmonics, Calculation of voltage and Current harmonics, Effect of Pulse number on harmonics

Filters: Types of AC filters, Design of Single tuned filters –Design of High pass filters.

TEXT BOOKS:

1. "K. R. Padiyar", HVDC Power Transmission Systems: Technology and system Interactions, New Age International (P) Limited, and Publishers, 1990.
2. "S K Kamakshaiah, V Kamaraju", HVDC Transmission, TMH Publishers, 2011

REFERENCE BOOKS:

1. "S. Rao", EHVAC and HVDC Transmission Engineering and Practice, Khanna publications, 3rd Edition 1999.
2. "Jos Arrillaga", HVDC Transmission, The institution of electrical engineers, IEE power & energy series 29, 2nd edition 1998.
3. "E. W. Kimbark", Direct Current Transmission, John Wiley and Sons, volume 1, 1971.
4. "E. Uhlmann", Power Transmission by Direct Current, B. S. Publications, 2009

Web Link: https://nptel.ac.in/courses/108104013

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B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING (R22)
SOLAR POWER BATTERIES
(Professional Elective-V)

B. Tech. VIII Sem **L/T/P/C**
3/0/0/3

Course Objectives:

- To understand the PV systems and the solar power batteries operation
- To analyze the solar PV system storage with batteries.
- To understand Grid Tie vs. Off-Grid Solar Battery System

Course Outcomes: At the end of this course, students will be able to:

1. Know operating principles of different types of solar power batteries
2. Use the batteries for effective storage of solar PV.
3. Gain the knowledge on environmental impacts of solar power batteries

UNIT I

Introduction to solar PV systems, basics of Storage for solar PV systems, Storage for solar PV systems: the batteries, Introduction to Solar Power Batteries, terminology associated, understanding Solar Battery Specifications, working principle, Series Vs. Parallel, Charging parameters, cycle life, Temperature effects, Battery Design and Construction, Important components in battery construction.

UNIT II

Primary and Secondary batteries, Classification of Secondary batteries, i.e Lead-Acid, Lead-Antimony, Lead- Calcium, Lead-Acid Battery Chemistry, Nickel-Cadmium Batteries and their types.

UNIT III

AC Coupled Storage vs. DC Coupled Storage, working of Solar Batteries with a Solar Power System and Hybrid Inverter, Main Degradation mechanisms of Solar Batteries, Battery Strengths and Weaknesses, Battery System Design and Selection Criteria, Life Expectancy, Battery standards, Safety precautions,

UNIT IV

Solar Battery Costs, Declining Cost, factors contribute to the performance of solar battery, selection of suitable batteries based on the application, Grid Tie vs. Off-Grid Solar Battery System, Benefits and disadvantages of using solar batteries,

UNIT V

The environmental impacts of batteries: Introduction, Service life of the components, Energy requirements for production and transport of the PV-battery system components, Contributing components, Influence of different user conditions, Uncertainties, Future research, Energy return factor, The overall battery efficiency, Different efficiency measures and battery design, The Future of Solar Battery Storage.

TEXT BOOKS:

1. S. Sumathi and L. Ashok Kumar, Solar PV and Wind Energy Conversion Systems: An Introduction to Theory, Modeling with MATLAB/SIMULINK, and the Role Of Soft Computing Techniques, Springer 2011
2. H.A. Kiehne, "Battery Technology Handbook" by Publisher: CRC Press 2003
3. https://core.ac.uk/download/pdf/30044842.pdf
4. Handbook on Battery Energy Storage System
5. https://www.adb.org/sites/default/files/publication/479891/handbook-battery-energy-storage

REFERENCE BOOKS:

1.Cristina Archer and S. Lovejoy, Battery Technology for Electric Vehicles: Public Science and Private Innovation, Springer 2015

2. Soteris A. Kalogirou, "Solar Energy Engineering: Processes and Systems" by, Academic Press, Year: 2009

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B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING (R22)
AI TECHNIQUES IN ELECTRICAL ENGINEERING (D28PE5)
(Professional Elective-V)

B. Tech. VIII Sem **L/T/P/C**
3/0/0/3

Course Objectives:

- To locate soft commanding methodologies, such as artificial neural networks, Fuzzy logic and genetic Algorithms.
- To observe the concepts of FFN and concept of fuzziness involved in various systems and comprehensive knowledge of fuzzy logic control and to design the fuzzy control
- To analyze genetic algorithm, genetic operations and genetic mutations.

Course Outcomes: At the end of this course, students will be able to:

1. Understand feed forward neural networks, feedback neural networks and learning techniques.
2. Understand fuzziness involved in various systems and fuzzy set theory.
3. Develop fuzzy logic control and genetic algorithm for applications in electrical engineering.

UNIT I

Artificial Neural Networks: Introduction, Models of Neuron Network-Architectures –Knowledge representation, Artificial Intelligence and Neural networks–Learning process-Error correction learning, Hebbian learning –Competitive learning-Boltzmann learning, supervised learning-Unsupervised learning–Reinforcement Learning-Learning tasks.

UNIT II

ANN Paradigms: Multi-layer perceptron using Back propagation Algorithm (BPA), Self –Organizing Map (SOM), Radial Basis Function Network-Functional Link Network (FLN), Hopfield Network.

UNIT III

Fuzzy Logic: Introduction –Fuzzy versus crisp, Fuzzy Sets-Membership function –Basic Fuzzy set operations, Properties of Fuzzy sets –Fuzzy Cartesian Product, Operations on Fuzzy relations –Fuzzy logic–Fuzzy Quantifiers, Fuzzy Inference-Fuzzy Rule based system, Defuzzification methods.

UNIT IV

Genetic Algorithms: Introduction-Encoding –Fitness Function-Reproduction operators, Genetic Modeling –Genetic Operators-Cross over-Single site cross over, two points cross over –Multi point cross over Uniform cross over, Matrix cross over-Cross over Rate-Inversion & Deletion, Mutation operator –Mutation –Mutation Rate-Bit-wise operators, Generational cycle-convergence of Genetic Algorithm.

UNIT V

Applications Of AI Techniques: Load forecasting, Load flow studies, Economic load dispatch, Load frequency control, Single area system and two area system, Reactive power control, Speed control of DC and AC Motors.

TEXT BOOKS:

1. S. Rajasekaran and G.A.V.Pai Neural Networks, Fuzzy Logic & Genetic Algorithms, PHI, New Delhi, 2003.
2. Rober J. Schalkoff, Artificial Neural Networks, Tata McGraw Hill Edition, 2011.

REFERENCE BOOKS:

1. P. D. Wasserman; Neural Computing Theory & Practice, Van Nostrand Reinhold, New York,1989.
2. Bart Kosko; Neural Network & Fuzzy System, Prentice Hall, 1992
3. D. E. Goldberg, Genetic Algorithms, Addison-Wesley 1999

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B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING (R22)
SMART GRID TECHNOLOGIES (D28PE6)
(Professional Elective-VI)

B. Tech. VIII Sem **L/T/P/C**
3/0/0/3

Course Objectives:

- To defend smart grid design to meet the needs of a utility
- To select issues and challenges that remain to be solved
- 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: At the end of the course the student will be able to:

1. Understand the features of small grid in the context of Indian grid.
2. Understand the role of automation in transmission and distribution.
3. Apply evolutionary algorithms for smart grid and understand operation, maintenance of PMUs, PDCs, WAMs, and voltage and frequency control in micro grid

UNIT-I:

Introduction To Smart Grid: What is Smart Grid? Working definitions of Smart Grid and Associated Concepts –Smart grid Functions-Traditional Power Grid and Smart Grid –New Technologies for Smart Grid – Advantages –Indian Smart Grid –Key Challenges for Smart Grid.

UNIT- II:

Smart Grid Architecture: Components and Architecture of Smart Grid Design –Review of the proposed architectures for Smart Grid. The fundamental components of Smart Grid designs – Transmission Automation – Distribution Automation –Renewable Integration

UNIT- III:

Tools And Techniques For Smart Grid: Computational Techniques –Static and Dynamic Optimization Techniques –Computational Intelligence Techniques –Evolutionary Algorithms – Artificial Intelligence techniques.

UNIT-IV:

Distribution Generation Technologies: Introduction to Renewable Energy Technologies – Micro grids –Storage Technologies –Electric Vehicles and plug –in hybrids –Environmental impact and Climate Change –Economic Issues.

Communication Technologies And Smart Grid: Introduction to Communication Technology – Synchro-Phasor Measurement Units (PMUs) –Wide Area Measurement Systems (WAMS).

UNIT-V:

Control Of Smart Power Grid System

Load Frequency Control (LFC) in Micro Grid System –Voltage Control in Micro Grid System – Reactive Power Control in Smart Grid. Case Studies and Test beds for the Smart Grids.

TEXT BOOKS:

1. Stuart Borlase, Smart Grids, Infrastructure, Technology and Solutions, CRC Press, 2013
2. Gil Masters, Renewable and Efficient Electric Power System, Wiley-IEEE Press, 2004.

REFERENCE BOOKS:

1. A.G. Phadke and J.S. Thorp, “Synchronized Phasor Measurements and their Applications”, Springer Edition, 2010.
2. T. Ackermann, Wind Power in Power Systems, Hoboken, NJ, USA, John Wiley, 2005.

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B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING (R22)
ELECTRICAL DISTRIBUTION SYSTEMS (D28PE6)
(Professional Elective-VI)

B. Tech VIII Sem **L T P C**
3 0 0 3

Prerequisites: Power Systems–I & Power Systems- II

Course Objectives:

1. To understand design considerations of feeders
2. To compute voltage, drop and power loss in feeders
3. To understand protection, PF 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 toFuse, 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 shuntcapacitors(Fixedandswitched),effectofseriescapacitors,differencebetweenshunt 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. Turan Gonen, Electric Power Distribution system Engineering,CRCPress,3rd Edition 2014.
2. V.Kamaraju,ElectricalPowerDistributionSystems,TataMcGraw 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.
3. CLWadhwa,ElectricalPowerSystemby,6thEdition

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B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING (R22)

MACHINE LEARNING APPLICATIONS TO ELECTRICAL ENGINEERING ((D28PE6)

(Professional Elective-VI)

B. Tech. VIII Sem **L T P C**
3 0 0 3

Prerequisites: Power Systems–I & Power Systems- II

Course Objectives:

1. To develop a foundational understanding of machine learning principles and techniques.
2. To explore and understand how machine learning can be integrated into various electrical Engineering applications.
1. To gain hands-on experience in implementing machine learning algorithms to solve real-world electrical engineering problems.

Course Outcomes: At the end of this course, students will be able to:

1. Demonstrate proficiency in applying machine learning algorithms to solve real-world problems in electrical engineering
2. Integrate machine learning principles effectively into electrical engineering applications,
3. Enhance problem-solving skills by successfully addressing complex issues in electrical Engineering through machine learning.

UNIT I

Introduction to Machine Learning:

Definition and types of machine learning, Historical perspective, Basic concepts: supervised learning, unsupervised learning, reinforcement learning

UNIT II

Fundamentals of Electrical Engineering Relevant to ML:

Overview of electrical circuits and systems, Signal processing basics, Introduction to control systems

UNIT III

Data Preprocessing and Feature Engineering:

Data cleaning and handling missing values, Feature scaling and normalization, Feature extraction and selection

UNIT IV

Machine Learning Algorithms for Electrical Engineering Applications

Regression and classification algorithms, Decision trees and ensemble methods, Neural networks and deep learning, Support vector machines, Clustering algorithms for pattern recognition

UNIT V

Case Studies and Applications in Electrical Engineering

Power system optimization using ML, Fault detection and diagnostics in electrical systems, Smart grid applications, Signal processing with ML, Control system optimization and adaptive control using ML

TEXT BOOKS:

1. C. Aldrin Renold and Sumathi S., Pattern Recognition and Machine Learning, Wiley India, 2015.
2. S. Rajasekaran and G. Aghila, Machine Learning: An Algorithmic Perspective, Chapman and Hall/CRC,2018
3. Chandra Shekhar Yadav, S. Ramakrishnan, and U. Rajendra Acharya, Machine Learning: Concepts, Methodologies, Tools and Applications, Springer 2018.

REFERENCE BOOKS:

1. Ethem Alpaydin, Introduction to Machine Learning, MIT Press 2010
2. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.
3. Kevin P. Murphy, Machine Learning: A Probabilistic Perspective, MIT Press 2012

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B.TECH.ELECTRICAL AND ELECTRONICS ENGINEERING (R22)

POWER SYSTEM REFORMS (D28OE4)
(Open Elective – IV)

B. Tech VIII Sem **L T P C**
3 0 0 3

Course Objectives:

1. To study fundamentals of power system deregulation and restructuring.
2. To study available transfer capability.
3. To study congestion management
4. To study various electricity pricing.
5. To study operation of power system in deregulated environment.
6. To study importance of Ancillary services management.

Course Outcomes:

1. Will understand importance of power system deregulation and restructuring.
2. Able to compute ATC.
3. Will understand transmission congestion management.
4. Able to compute electricity pricing in deregulated environment.
5. Will be able to understand power system operation in deregulated environment.
6. Will understand importance of ancillary services.

UNIT–I : Over view of key issues in electric utilities : Introduction – Restructuring models – Independent system operator (ISO) – Power Exchange – Market operations – Market Power – Standard cost – Transmission Pricing – Congestion Pricing – Management of Inter zonal/Intra zonal Congestion.

UNIT–II : **OASIS:** Open Access Same–Time Information System : Structure of OASIS – Processing of Information – Transfer capability on OASIS – Definitions Transfer Capability Issues – ATC – TTC – TRM – CBM calculations – Methodologies to calculate ATC.

UNIT–III : **Congestion Management** : Introduction to congestion management – Methods to relieve congestion.

UNIT–IV: **Electricity Pricing:** Introduction – Electricity price volatility electricity price indexes – Challenges to electricitypricing – Construction offorward price curves – Short–time price forecasting.

UNIT–V: **Power system operation in competitive environment:** Introduction – Operational planning activities of ISO – The ISO in pool markets – The ISO in bilateral markets – Operational planning activities of a Genco.

Ancillary Services Management: Introduction – Reactive power as an ancillary service – A review – Synchronous generators as ancillary service providers.

TEXT BOOKS:

1. Kankar Bhattacharya,MathH.J.Boller,JaapE.Daalder,'Operation of Restructured Power System' Klum,er Academic Publisher – 2001

2. Mohammad Shahidehpour, and Muwaffaq alomoush,– "Restructured electrical Power systems" Marcel Dekker, Inc. 2001

REFERENCE BOOKS:

1. Loi Lei Lai; "Power system Restructuring and Deregulation", Jhon Wiley & Sons Ltd., England.

2. Electrical Power Distribution Case studies from Distribution reform, up grades and Management (DRUM) Program, by USAID/India, TMH.

WEB LINK: https://archive.nptel.ac.in/courses/108/101/108101005/

B.TECH . ELECTRICAL AND ELECTRONICS ENGINEERING (R22)

Programmable Logic Controllers& SCADA (D28OE4)
(Open Elective – IV)

B. Tech. VIII Sem **L T P C**
3 0 0 3

Course Outcomes: At the end of this course, students will be able to
1. Understand the concepts of PLC.
2. Illustrate the fundamentals of PLC for electrical devices
3 . Analyze the operation of counters
4. Apply instructions in PLCs.
5. Investigate implementation of SCADA.

UNITI:

Programmable Logic Controllers: Introduction, parts of PLC, principles of operation, modifying the operation, PLC s versus computers, PLC size and application.

PLC Hardware Components: The I/O section, discrete I/O modules, analog I/O modules, special I/O modules, I/O specifications, central processing unit (CPU), memory design, memory types, programming terminal devices, recording and retrieving data human machine interfaces (HMIs).

Basics of PLC programming: Processor memory organization, program scan, PLC programming languages, relay-type instructions, instruction addressing, branch instructions, internal relay instructions, programming examine if –closed and if-open instructions, entering the latter diagram.

UNITII:

Developing fundamental PLC wiring diagrams and ladder logic programs: Electromagnetic control relays, contactors, motor starters, manually operated switches, mechanical operated switches, sensors, output control devices, seal-in circuits, latching relays, converting relay schematics into PLC ladder programs.

UNITIII:

Programming counters: Counter's instructions, up-counter, down-counter, cascading counters, incremental encoder-counter applications, combining counter and timer functions.

Program control instructions: Master control reset instruction, jump instruction, subroutine functions, immediate input and immediate output instructions ,forcing external I/O addresses, safety circuitry, fault routine, temporary end instruction, suspend instruction.

UNITIV:

Data manipulation instructions: Data manipulation, data transfer operation, data compare instructions, data manipulation programs, numerical data I/O inter faces, closed- loop control.

Math instructions: Match instructions, addition instruction, subtraction instruction, multiplication instruction, and division instruction, file arithmetic operations.

UNITV:

Sequencer and shift register instructions: Mechanical sequencers, sequencer instructions, sequencer programs, bit shift registers, word shift operations.

Process control network system and SCADA: Types of processes, structure of control systems, ON/OFF control PID control, Motion control, data communications, supervisory control and data acquisition (SCADA).

TEXTBOOKS:

1. ProgrammableLogicControllers,W.Bolton,5thedition,NewnesELSEVIER, 2009
2. PLCs &SCADA: Theory and Practice, Rajesh Mehra, Laxmi Publications, 2012.

REFERENCEBOOKS:

1. Industrial applications of programmable logic controllers and SCADA, Kunal Chakraborty, Palash De, IndranilRoy, AnchorAcademicPublishing,2016
2. Ladderlogicprogrammingfundamentals,A.J.Wright,2nd edition, AB Prominent publisher, 2020

WEB LINK: https://nptel.ac.in/courses/108105088

B.TECH. ELECTRICAL&ELECTRONICSENGINEERING (R22)

ENERGY FROM WASTE (D28OE4)
(Open Elective – IV)

B. Tech VIII Sem **L T P C**
3 0 0 3

Course Objectives:

1. To enable students to understand of the concept of Waste to Energy.
2. To linklegal, technical and management principles for production of energy form waste.
3. To learn about the best available technologies for waste to energy.
4. To analyze of case studies for understanding success and failures.
5. To facilitate the students in developing skills in the decision-making process

Course Outcomes:
Upon completion of this course the student will be able to:

1. Apply the knowledge about the operations of Waste to Energy Plants.
2. Analyze the various aspects of Waste to Energy Management Systems.
3. Carryout Techno-economic feasibility for Waste to Energy Plants.
4. Apply the knowledge in planning and operations of Waste to Energy plants.

UNIT I
Introduction to Energy from Waste: Classification of wastes fuel–Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors.

UNIT II

Biomass Pyrolysis: Pyrolysis–Types, slowfast–Manufactureofcharcoal–Methods –Yieldsand application – Manufacture of pyrolytic oils and gases, yields and applications.

UNIT III

Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidizedbed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

UNIT IV

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bedcombustors,Types,inclinedgratecombustors,Fluidizedbedcombustors, Design, construction and operation - Operation of all the above biomass combustors.

UNIT V

Biogas: Propertiesofbiogas(Calorificvalueandcomposition)-Biogasplanttechnology and status - Bio energy system - Design and constructional features - Biomass resources and Their classification - Biomass conversion processes - Thermo chemical conversion – Direct combustion
-biomass gasification - pyrolysis and liquefaction - biochemical conversion -anaerobic digestion Types of biogas Plants – Applications - Alcohol production from biomass -Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

TEXTBOOKS:

1. Non-Conventional Energy, Desai, AshokV.,Wiley EasternLtd.,1990.
2. Biogas Technology- A Practical HandBook- Khandelwal,K. C.andMahdi, S.S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.

REFERENCEBOOKS:

1. Food, Feed and Fuel from Biomass, Challal,D. S.,IBHPublishingCo. Pvt.Ltd., 1991.
2. Biomass Conversion and Technology, C.Y.Were Ko-Brobby and E.B.Hagan, John Wiley & Sons, 1996.

Web Link: https://onlinecourses.nptel.ac.in/noc20_ch16/preview