SHADAN WOMEN'S COLLEGE OF ENGINEERING AND TECHNOLOGY
An UGC Autonomous Institution, Affiliated to JNTUH
Khairtabad, Hyderabad, Telangana (India)
B. Tech. IV YEAR - ELECTRICAL AND ELECTRONICS ENGINEERING
COURSE STRUCTURE & SYLLABUS (R23 Regulations)

IV YEAR I SEMESTER

S.No.	Course Code	Course Title	L	T	P	Credits
1	EE701PC	Power Electronic Applications to Renewable Energy Systems	3	1	0	4
2		Open Elective-II	3	0	0	3
3		Professional Elective-III	3	0	0	3
4		Professional Elective-IV	3	0	0	3
5	EE702PC	Fundamentals of Management for Engineers	2	0	0	2
6	EE703PC	Simulation of Renewable Energy Systems Laboratory	0	0	4	2
7	EE704PC	Project Stage-I	0	0	6	3
		Total Credits	**14**	**1**	**10**	**20**

IV YEAR II SEMESTER

S.No.	Course Code	CourseTitle	L	T	P	Credits
1		Open Elective-III	3	0	0	3
2		Professional Elective-V	3	0	0	3
3		Professional Elective-VI	3	0	0	3
4	EE801PC	Project Stage–II including Seminar	0	0	22	11
		Total Credits	**9**	**0**	**22**	**20**

***MC – Satisfactory/Unsatisfactory**

Professional Elective - I

EE511PE	IoT Applications in Electrical Engineering
EE512PE	High Voltage Engineering
EE513PE	Computer Aided Electrical Machine Design

Professional Elective-II

EE621PE	Cyber-Physical Systems
EE622PE	Power Semiconductor Drives
EE623PE	Wind and Solar Energy systems

Professional Elective-III

EE731PE	Mobile Application Development
EE732PE	Signals and Systems
EE733PE	Electric and Hybrid Vehicles

Professional Elective-IV

EE741PE	HVDC Transmission
EE742PE	Power System Reliability
EE743PE	Embedded Systems Applications

Professional Elective-V

EE851PE	Power Quality &FACTS
EE852PE	Solar Power Batteries
EE853PE	AI Techniques in Electrical Engineering

Professional Elective-VI

EE861PE	Smart Grid Technologies
EE862PE	Electrical Distribution Systems
EE863PE	Machine Learning Applications to Electrical Engineering

OPENELECTIVES

Open Elective-I:

EE611OE	Renewable Energy Sources
EE612OE	Fundamental of Electric Vehicles

Open Elective-II:

EE721OE	Utilization of Electric Energy
EE722OE	Energy Storage Systems

Open Elective-III:

EE831OE	Charging Infrastructure for Electric Vehicles
EE832OE	Reliability Engineering

EE701PC: POWER ELECTRONIC APPLICATIONS TO RENEWABLE ENERGY SYSTEMS

IV Year B.Tech. EEEI-Sem **LT PC**
3 1 04

Pre requisite: Power Electronics, Renewable Energy Sources

Course Objectives:

- To impart knowledge on different types of renewable energy systems.
- Toanalyzetheoperationofelectricalgeneratorsusedforthewindenergyconversion Systems.
- To know the operation of power converters and PV systems operation.

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

- Proficiently demonstrate various renewable energy technologies utilized for electrical power generation.
- Analyze the operating principles of different types of wind generators and identify suitable converters (AC-DC, DC-DC, AC-AC) for renewable energy systems.
- Interpret and analyze various wind and photo voltaic (PV)systems, including stand-alone ,grid-connected, and hybrid configurations, showcasing a comprehensive understanding of renewable energy applications.

UNIT-I:

Solar cell characteristics and their measurement, PV Module, PV array, Partial shading of a solar cell and a module, the diode, Power conditioning unit, maximum power point tracker, Implementation of PerturbandObserveMethod,IncrementalConductanceMethod,Batterycharger/dischargecontroller.

UNIT-II:

Centralized Inverters, String Inverters, Multi-string Inverters, Module Integrated Inverter/Micro-inverters, Inverter Topology, Model of Inverter, Sizing Batteries and Inverters for a Solar PV System.
Types of PV Systems: Grid-Connected Solar PV System, Stand-Alone Solar PV System.

UNIT-III:

Introduction to wind: Characteristics, Wind Turbine, Fixed and Variable-Speed Wind Turbines, ComponentsofWECS,DescriptionofComponents,TypesofWindTurbineGenerators,Economics of Wind Energy Conversion Systems, Linking Wind Turbines onto the Grid, Power Converter Topologies for Wind Turbine Generators.

UNIT-IV:

Modeling of Permanent Magnet Synchronous Generators, Doubly Fed Induction Generators, Squirrel cage Induction Generators wind turbine, Control of Power converters for WECS.

UNIT- V:

Hybrid Energy Systems ,Need for Hybrid Energy Systems, Range and types of Hybrid systems, Hybrid SolarPV/WindEnergySystem,ArchitectureofSolar-WindHybridSystemandGridconnectedissues.

TEXTBOOKS:

1. S.N. Bhadra, D. Kastha,S.Banerjee,"WindElectricalSystems",OxfordUniversityPress,2005.
2. S. N. Bhadra, D.Kastha, &S.Banerjee"WindElectricalSystems",OxfordUniversityPress, 2009.
3. Rashid.M.H,"PowerElectronicsHandbook",AcademicPress,2001.

REFERENCEBOOKS:

1. Rai.G.D,"Non-conventionalenergysources", KhannaPublishers,1993.
2. Rai.G.D,"Solarenergyutilization", KhannaPublishes,1993.
3. Gray,L.Johnson,"Windenergysystem",PrenticeHallofIndia,1995.
4. B.H.Khan"Non-conventionalEnergy sources",McGraw-hill,2nd Edition,2009

EE721OE: UTILIZATION OF ELECTRICENERGY
(OpenElective-II.1)

IV Year B.Tech. EEEI-Sem **LT PC**
3 00 3

Pre-requisites: Electrical Machines-I and Electrical Machines-II

Course Objectives: Objectives of this course are

- To understand the fundamentals of illumination and good lighting practices
- To understand the methods of electric heating and welding.
- Tounderstandtheconceptsofelectricdrivesandtheirapplicationtoelectricaltractionsystems.

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

- Understand basic principles of electric heating and welding.
- Determine the lighting requirements for flood lighting, house hold and industrial needs.
- Calculateheatdevelopedininductionfurnaceandevaluatespeedtimecurvesfortraction

UNIT-I:

ElectricalHeating: Advantages and methods of electric heating, resistance heating, induction heating and dielectric heating.

UNIT-II:

Electric Welding: Electric welding equipment, resistance welding and arc welding, comparison between AC and DC welding. Electrolysis process: principle of electrolysis, electroplating, metal extraction and metal processing, electromagnetic stirs.

UNIT-III:

Illumination: Terminology, Laws of illumination, coefficient of Utilization and depreciation, Polar curves, Photometry, integrating sphere, sources of light, fluorescent lamps, compact fluorescent lamps, LED lamps discharge lamps, mercury vapor lamps, sodium vapor lamps and neon lamps, comparison between tungsten filament lamps and fluorescent tubes. Basic principles of light control, Types and design of lighting scheme, lighting calculations, factory lighting, streetlighting and flood lighting.

UNIT-IV:

ElectricTraction: Systems of electric traction and track electrification- DC system, single phase and 3-phase low frequency and high frequency system, composite system, kan do system, comparison between AC and DC systems, problems of single-phase traction with current unbalance and voltage unbalance. Mechanics of traction movement, speed—time curves for different services, trapezoidal and quadrilateral speed—timecurves,tractiveeffort,power,specificenergyconsumption,effectofvarying accelerationandbraking,retardation,adhesiveweightandbrakingretardation,coefficientofadhesion.

UNIT-V:

SystemsofTrainLighting:specialrequirementsoftrainlighting,methodsofobtainingunidirectional polarity constant output- single battery system, Double battery parallel block system, coach wiring, lighting by making use of 25KV AC supply.

TEXTBOOKS:

1. H.Partab: Modern ElectricTraction,DhanpatRai&Co,2007.
2. E.Openshaw Taylor: Utilisation of ElectricEnergy,OrientLongman,2010.

REFERENCEBOOKS:

1. H.Partab:Art&ScienceofUtilizationofElectricEnergy,DhanpatRai&Sons,1998.
2. N.V.Suryanarayana:UtilizationofElectricalpowerincludingElectricdrivesandElectricTraction, New Age Publishers, 1997.

EE722OE:ENERGYSTORAGESYSTEMS

(OpenElective-II.2)

IV Year B.Tech. EEEI-Sem **L T P C**

3 0 0 3

Course Objectives: to prepare the students to

- To introduce generalized storage techniques and analyze the different features of storage systems
- To know the management and applications of energy storage technologies
- Toknowaboutelectricalenergystoragemarketpotentialbydifferentforecastingmethods

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

- Understand the role of electrical energy storage technologies in electricity usage
- Know the behavior and features and applications of energy storage system
- Understand the hierarchy, demand for energy storage and valuation techniques.

UNIT-I:

The Roles Of Electrical Energy Storage Technologies In Electricity Use: Characteristics of electricity,ElectricityandtherolesofEES,Highgenerationcostduringpeak-demandperiods,Needfor continuous and flexible supply, Long distance between generation and consumption, Congestion in powergrids,Transmissionbycable,EmergingneedsforEES,Morerenewableenergy,lessfossilfuel, SmartGriduses,Therolesofelectricalenergystoragetechnologies,Therolesfromtheviewpointofa utility, The roles from the viewpoint of consumers, The roles from the viewpoint of generators of renewable energy.

UNIT-II:

Types And 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, Lead-Acid Batteries, Lithium-Ion Batteries, Flow batteries, Other Batteries in Development, Chemical energy storage, Hydrogen (H2), Synthetic natural gas (SNG), Electrical storage systems, Double-layer capacitors (DLC), Superconducting magnetic energy storage (SMES),Thermal storage systems, Standards for EES, Technical comparison of EES technologies.

UNIT-III:

Applications Of EES: Present status of applications, Utility use (conventional power generation, grid operation & service), Consumer use (uninterruptable power supply for large consumers), EES installed capacity worldwide, new trends in applications, Renewable energy generation, Smart Grid, Smart Micro grid, Smart House, Electric vehicles,

UNIT-IV:

Management And Control Hierarchy Of EES: 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.

DemandForEnergyStorage: GrowthinVariableEnergyResources,Relationshipbetweenbalancing services and variable energy resources, Energy Storage Alternatives, Variable Generator Control, Demand Management, Market Mechanisms, and Longer-Term Outlook.

Valuation Techniques: Overview, Energy Storage Operational Optimization, Market Price Method, Power System Dispatch Model Method, Ancillary Service Representation, Energy Storage Representation, Survey of Valuation Results.

UNIT-V:

Forecast Of EES Market Potential By 2030: EES market potential for overall applications, EES market estimation by Sandia National Laboratory (SNL), EES market estimation by the Boston Consulting Group(BCG),EESmarketestimationforLi-ionbatteriesbythePanasonicGroup,EESmarketpotential estimationforbroadintroductionofrenewableenergies,EESmarketpotentialestimationforGermany by Fraunhofer, Storage of large amounts of energy in gas grids, EES market potential estimation for EuropebySiemens,EESmarketpotentialestimationbytheIEA,Vehicletogridconcept,EESmarket potential in the future.

TEXTBOOKS:

1. PowerSystemEnergyStorageTechnologies,1stEditionbyPaulBreeze,AcademicPress
2. EnergyStorage:SystemsandComponents,byAlfredRufer,CRCPress,2017

REFERENCEBOOKS:

1. Energy Storage Fundamentals, Materials and Applications, by Huggins and Robert, Springer.
2. www.ecofys.com/com/publications

EE731PE:MOBILE APPLICATION DEVELOPMENT

(ProfessionalElective-III.1)

IV Year B.Tech. EEE I-Sem **LT PC**

3 00 3

Prerequisites

1. Acquaintance with JAVA programming
2. A Course on DBMS

Course Objectives

- To demonstrate the understanding of the fundamentals of Android operating systems
- To improves their skill so fusing Androids of ware development tools
- To demonstrate their ability to develops of ware with reasonable complexity on mobile platform
- To demonstrate their ability to deploy software to mobile devices
- To demonstrate their ability to debug programs running on mobile devices

Course Outcomes

- Understand the working of Android OS Practically.
- Develop Android user interfaces
- Develop, deploy and maintain the Android Applications.

UNIT-I

Introduction to Android Operating System: Android OS design and Features – Android development framework,SDKfeatures,InstallingandrunningapplicationsonAndroidStudio,CreatingAVDs,Types ofAndroidapplications,BestpracticesinAndroidprogramming,AndroidtoolsAndroidapplication components – Android Manifest file, Externalizing resources like values, themes, layouts, Menus etc, Resourcesfordifferentdevicesandlanguages,RuntimeConfigurationChanges

Android Application Lifecycle–Activities, Activity lifecycle, activity states, monitoring state changes

UNIT- II

Android User Interface: Measurements–Device and pixel density in dependent 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 click sor 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 SQ Lite database, creating and opening a database, creating tables, inserting retrieving and etindelg data, Registering Content Providers, Using content Providers (insert, delete, retrieve and update)

TEXTBOOK:

1. ProfessionalAndroid4ApplicationDevelopment,RetoMeier,WileyIndia,(Wrox),2012.

REFERENCEBOOKS:

1. Android Application Development for Java Programmers, James C Sheusi, Cengage Learning, 2013.
2. BeginningAndroid4ApplicationDevelopment,Wei-MengLee,WileyIndia(Wrox),2013.

EE732PE: SIGNALS AND SYSTEMS
(ProfessionalElective-III.2)

IV Year B.Tech. EEEI-Sem **L TPC**
3 0 0 3

Prerequisite: Digital Signal Processing, Control Systems, Laplace Transforms, Numerical Methods and Complex variables

Course Objectives:

- To develop ability to analyze linear systems and signals
- To develop critical understanding of mathematical methods to analyze linear systems and signals
- To know the various transform techniques and sampling principles

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

- Understand the concepts of continuous time and discrete time systems.
- Analyze systems in complex frequency domain.
- Understand sampling theorem and its implications.

UNIT-I:

Introduction To Signals And Systems: Signals and systems as seen in everyday life, and in various branches of engineering and science. Signal properties: periodicity, absolute integrability, determinism and stochastic character. Some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time-limited signals; continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, reliability. Examples.

UNIT-II:

Behaviour of Continuous and Discrete-Time LTI Systems: Impulse response and step response, convolution, input-output behaviour with aperiodic convergent inputs, cascade interconnections. Characterization of causality and stability of LTI systems. System representation through differential equations and difference equations. State-space Representation of systems. State-Space Analysis, Multi-input, multi-output representation. State Transition Matrix and its Role. Periodic inputs to an LTI system, the notion of a frequency response and its relation to the impulse response.

UNIT-III:

FourierTransforms: Fourier series representation of periodic signals, Waveform Symmetries, Calculation of Fourier Coefficients. Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem.

UNIT-IV:

Laplace and Z- Transforms: Review of the Laplace Transform for continuous time signals and systems, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behavior. The z-Transform for discrete time signals and systems, system functions, poles and zeros of systems and sequences, z-domain analysis.

UNIT-V:

Sampling And Reconstruction

The Sampling Theorem and its implications. Spectra of sampled signals. Reconstruction: ideal interpolator, zero-orderhold, first-orderhold. Aliasing and itseffects. Relation between continuous and discrete time systems. Introduction to the applications of signal and system theory: modulation for communication, filtering, feedback control systems.

TEXTBOOKS:

1. A. V. Oppenheim, A. S. Willsky and S. H. Nawab, “Signals and systems”, Prentice Hall India, 1997.
2. J.G.ProakisandD.G.Manolakis,“DigitalSignalProcessing:Principles,Algorithms,and Applications”, Pearson, 2006.

REFERENCEBOOKS:

1. H.P.Hsu,“Signalsandsystems”,Schaum’sseries,McGrawHillEducation,2010.
2. S.HaykinandB.V.Veen,“SignalsandSystems”,JohnWileyandSons,2007.
3. A.V.OppenheimandR.W.Schafer,“Discrete-TimeSignalProcessing”,PrenticeHall,2009.
4. M.J.Robert“FundamentalsofSignalsandSystems”,McGrawHillEducation,2007.
5. B.P.Lathi,“LinearSystemsandSignals”,OxfordUniversityPress,2009.

EE733PE:ELECTRIC AND HYBRIDVEHICLES
(ProfessionalElective-III.3)

IV Year B.Tech. EEEI-Sem	**LT**	**PC**
	3 00	**3**

Pre requisite: Power Semiconductor Drives, Electrical Drives and Control, Utilization of Electric Energy

Course Objectives:

- To understand the fundamental concepts, principles, analysis and design of hybrid and electric vehicles.
- To know the various aspects of hybrid and electric drive train such as their configuration,
- To have a knowledge on types of electric machines that can be used energy storage devices, etc.

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

- Understand the models to describe hybrid vehicles and their performance.
- Understand the different possible ways of energy storage.
- Understand the different strategies related to energy storage systems.

UNIT-I:

Introduction: Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, 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, introductionto 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, Fly wheel 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: 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 ofaHybridElectricVehicle(HEV),DesignofaBatteryElectricVehicle(BEV).

TEXTBOOKS:

1. C.Mi,M.A.MasrurandD.W.Gao,"HybridElectricVehicles:PrinciplesandApplicationswith Practical Perspectives", John Wiley & Sons, 2011.
2. S.Onori,L.SerraoandG.Rizzoni,"HybridElectricVehicles:EnergyManagementStrategies", Springer, 2015.

REFERENCEBOOKS:

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.

EE741PE:HVDCTRANSMISSION

(ProfessionalElective-IV.1)

IV Year B.Tech. EEE I-Sem L T P C

3 0 0 3

Prerequisite: Power System-I, Power System-II, Power System Protection, Power System Operation and Control, Power Electronics

Course Objectives:

TocompareEHVACandHVDCandunderstandGraetzcircuitwith6and12pulseoperation

To control HVDC systems with various methods and to perform power flow analysis in AC/DC systems

TodescribevariousprotectionmethodsforHVDCsystemsandHarmonics

CourseOutcomes:Attheendofthiscourse,studentswillbeable to:

CompareEHVACandHVDCsystemandtodescribevarioustypesofDClinks

DescribevariousmethodsforthecontrolofHVDCsystemsandtoperformpowerflowanalysis in AC/DC systems

Describe various protection methods for HVDC systems and classify Harmonics and design different types of filters

UNIT-I

Basic ConceptsNecessity of HVDC systems, Economics and Terminal equipment of HVDC transmission systems, Types of HVDC Links, Apparatus required for HVDC Systems, Comparison of ACandDCTransmission,ApplicationofDCTransmissionSystem,PlanningandModerntrendsinD.C. Transmission.

Analysis of HVDC Converters:Choice of Converter Configuration, Analysis of Graetz circuit, Characteristicsof6Pulseand12Pulseconverters,Casesoftwo3phaseconvertersinY/Ymode— their performance.

UNIT-II

Converter and HVDC System Control:Principle of DC Link Control, Converters Control Characteristics,Firing angle control, Current and extinction anglecontrol, 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, ControllerEquations,SolutionofDCloadflow,P.U.SystemforDCquantities,solutionofAC-DCPower flow-Simultaneous Method-Sequential method.

UNIT-IV

ConverterFaults andProtection: 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:Generationof Harmonics,Characteristicsharmonics, calculationofACHarmonics,Non- Characteristics harmonics, adverse effects of harmonics, Calculation of voltage and Current harmonics, Effect of Pulse number on harmonics

Filters:TypesofACfilters,DesignofSingletunedfilters–DesignofHighpassfilters.

TEXTBOOKS:

1. "K.R. Padiyar", HVDC Power Transmission Systems: Technology and system Interactions, New Age International (P) Limited, and Publishers, 1990.
2. "SKKamakshaiah,VKamaraju",HVDCTransmission,TMHPublishers,2011

REFERENCEBOOKS:

1. "S.Rao",EHVACandHVDCTransmissionEngineeringandPractice,Khannapublications,3rdEdition 1999.
2. "JosArrillaga", HVDC Transmission, The institution of electrical engineers, IEE power & energy series 29, 2ndedition 1998.
3. "E.W.Kimbark",DirectCurrentTransmission,JohnWileyandSons,volume1,1971.
4. "E.Uhlmann",PowerTransmissionbyDirectCurrent,B.S.Publications,2009

EE742PE:POWERSYSTEMRELIABILITY
(ProfessionalElective-IV.2)

IVYearB.Tech.EEEI-Sem **LT PC**
3 0 03

Prerequisite: Reliability Engineering,PowerSystem-I,PowerSystem-II,PowerSystemOperationand Control

Course Objectives:

- Todescribethegenerationsystemmodelandrecursiverelationforcapacitivemodelbuilding
- Toexplaintheequivalenttransitionalrates,cumulativeprobabilityandcumulativefrequency
- Todeveloptheunderstandingofrisk,systemandloadpointreliabilityindices

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

- Describe merging generation and load models
- Estimate loss of load and energy in dices for generation systems model
- Applyvariousindicesfordistributionsystemandevaluatereliabilityofinterconnectedsystems

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 interms of the hazardrate. Hazardmodels - Bath tubcurve, Effect of preventive maintenance. Measures of reliability: Mean Time to Failure and Mean Time between Failures.

UNIT-II:

GeneratingSystemReliabilityAnalysis

Generation system model – capacity outage probability tables – Recursive relation for capacitive model building– sequentialadditionmethod–unitremoval–Evaluationoflossofloadandenergyindices– Examples.FrequencyandDurationmethods–Evaluationofequivalenttransitionalratesofidentical and non-identical units – Evaluation of cumulative probability and cumulative frequency of non-identical generatingunits–2-leveldailyloadrepresentation-merginggenerationandloadmodels–Examples.

UNIT-III:

OperatingReserveEvaluation

Basicconcepts- risk indices – PJM methods – securityfunction approach – rapid start and hot reserve units – Modeling using STPM approach.

BulkPowerSystemReliabilityEvaluation:

Basic configuration – conditional probability approach – system and load point reliability indices – weathereffectsontransmissionlines–WeightedaveragerateandMarkovmodel–Commonmode failures.

InterconnectedSystemReliabilityAnalysis

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 cumulativeprobabilityandcumulativefrequency.

UNIT-IV:

DistributionSystemReliabilityAnalysis

Basic Techniques – Radial networks –Evaluation of Basic reliability indices, performance indices – loadpoint and system reliability indices – customer oriented, loss and energy-oriented indices – Examples. Basicconceptsofparalleldistributionsystemreliability

UNIT-V:

SubstationsandSwitchingStations

Effects of short-circuits - breaker operation – Open and Short-circuit failures – Active and Passive failures—switchingafterfaults—circuitbreakermodel—preventivemaintenance—exponential maintenancetimes.

TEXTBOOKS:

1. ReliabilityEvaluationofPowersystemsbyR.Billinton,R.N.Allan,BSPublications,2007.
2. ReliabilityModelinginElectricPowerSystemsbyJ.Endrenyi,JohnWileyandSons,1978

REFERENCEBOOKS:

1. ReliabilityEngineering:TheoryandPracticebyAlessandroBirolini,SpringerPublications.
2. AnIntroductiontoReliabilityandMaintainabilityEngineeringbyCharlesEbeling,TMH Publications.
3. ReliabilityEngineeringbyE.Balaguruswamy,TMHPublications.
4. ReliabilityEngineeringbyElsayedA.Elsayed,PrenticeHallPublications.

EMBEDDEDSYSTEMSAPPLICATIONS

(ProfessionalElective-IV.3)

IVYearB.Tech.EEEI-Sem **LT PC**

3 0 03

Prerequisite: CLanguage,I/O,AnalogandDigitalinterfacing,andperipherals.

CourseObjectives:

- Toequipwiththebasicconceptsofembeddedsystem,applicationsinwhichtheyareused,
- Todescribetoolsandmethodologiesneededforembeddedsystemdesign.
- ToknowRTOSconceptsandfamiliarwiththecharacteristicsoflatencyinreal-timesystems.

CourseOutcomes: Attheendofthiscourse,studentswillbeableto:

- Understandthemicroprocessorarchitectureanditscomponentsusedinembeddedsystems
- Writethe8051-assemblylanguagecodeandEmbedded'C'codeforinterfacingvarious devices.
- Developsimpleembeddedsystemsforrealtimeoperations

UNIT-I:

EmbeddedSystemsBasics:

IntroductiontoEmbeddedsystems,Examplesofembeddedsystems,TypicalHardware,Gates,Timing Diagrams, Memory, Microprocessors, Buses, Direct Memory Access, Interrupts, Microprocessor Architecture, and Interrupt Basics.

UNIT-II:

The8051Architecture: Introduction,8051MicrocontrollerHardware,Input/outputPinPortsand Circuits, External Memory, Serial data Input/output, Interrupts.

UNIT-III:

EmbeddedCProgramming: OverviewoftheCstandardlibrary,EmbeddedSystemOrientedTopics, MISRAC—DesigningSaferCPrograms,Basicsofeventdrivenprogramming.

BasicAssemblyLanguageProgrammingConcepts: TheAssemblyLanguageProgramming Process, Programming Tools and Techniques, Programming the 8051.

UNIT-IV:

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

BasicDesignUsingaReal-TimeOperatingSystem: MessageQueues,MailboxesandPipes,Timer Functions, Events, Memory Management, Interrupt Routines in an RTOS Environment

UNIT-V:

Applications: Introduction,keyboards,HumanFactor,KeySwitchFactors,KeyboardConfigurations, Displays, Seven-Segment Numeric Display, D/A and A/D Conversions.

EmbeddedSoftwareDevelopmentTools: HostandTargetmachines,Linker/LocatorsforEmbedded Software, Getting Embedded Software into the Target System; Debugging Techniques: Testing on Host Machine, Using Laboratory Tools, An Example System.

TEXTBOOKS:

1. AnEmbeddedSoftwarePrimer,DavidE.Simon,PearsonEducation.
2. The8051Microcontroller,ThirdEdition,KennethJ.Ayala,Thomson.

REFERENCEBOOKS:

1. EmbeddedMicrocomputerSystemsRealTimeInterfacing,JonathanW.Valvano,Cengage Learning.
2. 8051Microcontrollers,SatishShah,OxfordHigherEducation.
3. MicroControllers,AjayVDeshmukhi,TMH.
4. EmbeddedSystemDesign,FrankVahid,TonyGivargis,JohnWiley.
5. Microcontrollers, Rajkamal,Pearson Education. a.http://nptel.ac.in/courses.phpb.http://jntuk-coeerd.in/

EE702PC:FUNDAMENTALSOFMANAGEMENTFORENGINEERS

IVYearB.Tech.EEEI-Sem **LT PC**
2 0 02

Course Objective: To understand the Management Concepts, applications of Concepts in Practical aspects of business and development of Managerial Skills for Engineers.

CourseOutcome: The students understand the significance of Management in their Profession. The various Management Functions like Planning, Organizing, Staffing, Leading, Motivation and Control aspectsarelearntinthis course.ThestudentscanexploretheManagementPracticesintheir domain area.

UNIT-1:IntroductiontoManagement:
Definition,NatureandScope,Functions,ManagerialRoles,LevelsofManagement,ManagerialSkills, Challenges of Management; Evolution of Management- Classical Approach- Scientific and Administrative Management; The Behavioral approach; The Quantitative approach; The Systems Approach; Contingency Approach, IT Approach.

UNIT–2:PlanningandDecisionMaking:
General Framework for Planning - Planning Process, Types of Plans, Management by Objectives; Production Planning and Control. Decision making and Problem Solving - Programmed and Non Programmed Decisions, Steps in Problem Solving and Decision Making; Bounded Rationality and InfluencesonDecisionMaking;GroupProblemSolvingandDecisionMaking,CreativityandInnovation in Managerial Work.

UNIT-3:OrganizationandHRM:
Principles of Organization: Organizational Design& Organizational Structures; Departmentalization, Delegation;Empowerment, Centralization,Decentralization,Recentralization;OrganizationalCulture; Organizational Climate and Organizational Change.
Human Resource Management& Business Strategy: Job Satisfaction, Job Enrichment, Job Enlargement, Talent Management, Strategic Human Resource Planning; Recruitment and Selection; Training and Development; Performance Appraisal.

UNIT-4:LeadingandMotivation:
Leadership, Power and Authority, Leadership Styles; Behavioral Leadership, Situational Leadership, Leadership Skills, Leader as Mentor and Coach, Leadership during adversity and Crisis; Handling Employee and Customer Complaints, Team Leadership.
Motivation - Types of Motivation; Relationship between Motivation, Performance and Engagement, ContentMotivationalTheories-NeedsHierarchyTheory,TwoFactorTheory,TheoryXandTheoryY.

UNIT-5:Controlling:
Control, Types and Strategies for Control, Steps in Control Process, Budgetary and Non- Budgetary Controls. Characteristics of Effective Controls, Establishing control systems, Control frequency and Methods.

TEXTBOOKS:

1. ManagementEssentials,AndrewDuBrin,9e,CengageLearning,2012.
2. FundamentalsofManagement,StephenP.Robbins,PearsonEducation,2009.

REFERENCEBOOKS:

1. EssentialsofManagement,KoontzKleihrich,TataMc-GrawHill.
2. ManagementFundamentals,RobertNLussier,5e,CengageLearning,2013.
3. IndustrialEngineeringandManagement:IncludingProductionManagement,T.R.Banga,S.C Sharma, Khanna Publishers.

EE703PC:SIMULATIONOFRENEWABLEENERGYSYSTEMSLAB

IVYearB.Tech.EEEI-Sem **LT PC**
0 0 42

Prerequisite: RenewableEnergySystems,PowerElectronics

CourseObjectives:

- Develop proficiency in modeling the steady-state and dynamic characteristics of photovoltaic (PV), fuel cell, and wind energy sources.
- Understand and analyze power converter topologies for stand-alone and grid-connected PV, fuel cell, and wind energy systems.
- Exploreadvancedtopicsinpowerelectronics,includingmaximumpowerpointtracking,power factor correction, switched capacitor DC-DC converters, ZVS/ZCS configurations, compensation schemes, and new power converter topologies.

CourseOutcomes: Attheendofthiscourse,studentswillbeableto:

- Demonstrate theability to model andanalyzethe steady-state anddynamic characteristics of PV, fuel cell, and wind energy sources.
- Apply knowledge to understand, design, and analyze power converter topologies for both stand-alone and grid-connected PV, fuel cell, and wind energy systems.
- Acquire advanced expertise in power electronics, covering topics such as maximum power point tracking, power factor correction, switched capacitor converters, ZVS/ZCS configurations, compensation schemes, and new power converter topologies.

Listofexperiments:

1. Modellingthesteadystateanddynamiccharacteristicsofthefollowing
   (i) PV,
   (ii) Fuelcell and
   (iii) Windenergysources
2. Powerconvertertopologies forstand –aloneandgridconnected
   (i) PV,
   (ii) Fuelcell and
   (iii) Windenergysources
3. MaximumPowerPointTrackingSchemes
4. PowerfactorcorrectiontechniquesforACtoDCsystems
5. SwitchedcapacitorDC–DCpowerconverters
6. ZVS,ZCSconfigurations
7. CompensationSchemes for VAR,harmonics and phase imbalancePower conversionand Electric Drives
8. Newpowerconvertertopologiesandtheiranalysis,modellingandsimulation
9. Highfrequencylinkpowerconversion
10. RadiationeffectsonpowerelectronicsystemsandcomponentsEMI/EMC
11. Analysis,measurementandmitigationofEMIinElectronicandpowerelectronicsystems
12. MicrogridPowerQuality

***Note:** PerformthesimulationoftheabovelistofexperimentswithMATLAB/anySimulationsoftware

TEXTBOOKS:

1. S.N.Bhadra,D.Kastha,S.Banerjee,"WindElectricalSystems",OxfordUniversityPress,2005.
2. S.N.Bhadra,D.Kastha,&S.Banerjee"WindElectricalSystems",OxfordUniversityPress, 2009.
3. Rashid.M.H,"PowerElectronicsHandbook",AcademicPress,2001.

REFERENCEBOOKS:

1. Rai.G.D,"Non-conventionalenergysources",KhannaPublishers,1993.
2. Rai.G.D,"Solarenergyutilization",KhannaPublishes,1993.
3. Gray,L.Johnson,"Windenergysystem",PrenticeHallofIndia,1995.
4. B.H.Khan"Non-conventionalEnergysources",McGraw-hill,2nd Edition,2009

EE831OE:CHARGINGINFRASTRUCTUREFORELECTRICVEHICLES
(OpenElective-III.1)

IVYearB.Tech.EEEII-Sem **LT PC**
3 0 03

Prerequisite: None,InterestinElectricVehicles.

CourseObjectives:

- Gainunderstandingofthevariouscomponentsinvolvedinanelectricvehiclechargingsystem.
- Comprehend the different types of electric vehicle chargers, along with the applicable standards governing their design and operation.
- Interpretthediversecommunicationprotocolsutilizedinelectricvehiclechargingsystemsand stay familiar with the latest trends in this evolving field.

CourseOutcomes: Attheendofthiscourse,studentswillbeableto:

- UnderstandthevariouscomponentsofElectricvehiclechargingsystem
- ComprehendthedifferenttypesofElectricvehiclechargersandtheirstandards
- InterpretthevariouscommunicationprotocolsandrecenttrendsinElectricvehiclecharging

UNIT-I:
IntroductiontoEVcharging:
ElectricVehicleCharging;ChargingModes;ElectricVehicleSupplyEquipment(EVSE):Types, Components of EV Battery Chargers; Challenges in Electric Vehicle Charging.

UNIT-II:
Chargersizingandstandards:
ChargerClassification;SlowChargingandFastCharging;DCChargingandACCharging;Selection andSizingofChargers:ChargerConnectorsandCables;ChargingStandards:Connectors,Supply Equipment; EMI/EMC; Testing Methods for Chargers and EVSE

UNIT-III:
EVchargercommunicationsprotocols:
OpenChargePointProtocol(OCPP);OpenSystemInterconnectionLayerModel(OSI);AdaptedPWM SignalbasedLow-levelCommunication;PLCbasedHigh-levelCommunication;CANCommunication; Billing and Authentication

UNIT-IV:
Publicchargininfrastructure:
Location,PlanningandImplementationofPublicChargingStations;Components;SelectionandSizing -HT/LTEquipment&Cables;Protection;SafetyStandards:PolicyandRegulatoryAspects;EV Charging Station and their Business Models; Economic Aspects; Major Challenges

UNIT-V:
FuturefrontiersinEVcharging:
Bulk Charging;Battery Swapping; Wireless Charging; EVs as Distributed Storage Resources: Grid to Vehicle(G2V)andVehicletoGrid(V2G),V2XConcept,IntegrationofChargingStationwithRenewable Sources and its Impact on the Grid

TEXTBOOKS:

1. IqbalHusain,"ElectricandHybridVehicles:DesignFundamentals",3rdEdition,CRCPress, 2021
2. CodeofPracticeforElectricVehicleChargingEquipmentInstallation,4thEdition,IET,2020.

REFERENCEBOOKS:

1. SheldonS.Williamson,"EnergyManagementStrategiesforElectricandPlug-inHybrid
2. ElectricVehicles",1stEdition,Springer,2013.
3. TomDenton,"AutomotiveElectricalandElectronicSystems",5thEdition,Routledge,2018.
4. WolfhardLawrenz,"CANSystemEngineering:FromTheorytoPracticalApplications", Springer, 2nd Edition, 2013.
Weblink:https://www.udemy.com/course/charging-infrastructure-for-electric-vehicles/

EE832OE:RELIABILITYENGINEERING

(OpenElective-III.2)

IVYearB.Tech.EEEII-Sem **LT PC**

3 0 03

Prerequisite: Mathematics-III(LaplaceTransforms,NumericalMethodsandComplexvariables)

CourseObjectives:

- Tointroducethebasicconceptsofreliability,variousmodelsofreliability
- Toanalyzereliabilityofvarioussystems
- Tointroducetechniquesoffrequencyandduration forreliabilityevaluationofrepairable systems

CourseOutcomes: Attheendofthiscourse,studentswillbeableto:

- modelvarioussystemsapplyingreliabilitynetworksandevaluationofthesame
- estimatethelimitingstateprobabilitiesofrepairablesystems
- applyvariousmathematicalmodelsforevaluatingreliabilityofirreparablesystems

UNIT-I:

Basic Probability Theory: Elements of probability, probability distributions, Random variables, Density andDistributionfunctions-Mathematicalexpected—varianceandstandarddeviation—**BINOMIAL DISTRIBUTION:** Concepts,properties,engineeringapplications.

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-setapproach-Eventtreeandreducedeventtreemethods-Relationshipsbetweentieandcut-sets- Examples.

UNIT-III:

Probability Distributions In Reliability Evaluation: Distribution concepts, Terminology of distributions,Generalreliabilityfunctions,Evaluationofthereliabilityfunctions,shapeofreliability functions–Poissondistribution–normaldistribution,exponentialdistribution,Weibulldistribution.

NetworkReliabilityEvaluationUsingProbabilityDistributions: ReliabilityEvaluationofSeries systems,Parallelsystems–Partiallyredundantsystems-determinationofreliabilitymeasure-MTTF forseriesandparallelsystems—Examples.

UNIT-IV:

Discrete Markov Chains: Basic concepts- Stochastic transitional probability matrix- time dependent probabilityevaluation-LimitingStateProbabilityevaluation-Absorbingstates–Application.

ContinuousMarkovProcesses:Modelingconcepts-Statespacediagrams-Unreliabilityevaluationof 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-Cutsetapproach-Commonmodefailuresmodelingandevaluationtechniques-Examples.

TEXTBOOKS:

1. RoyBillintonandRonaldNAllan,ReliabilityEvaluationofEngineeringSystems,PlenumPress.
2. E.Balagurusamy,ReliabilityEngineeringbyTataMcGraw-HillPublishingCompanyLimited

REFERENCEBOOKS:

1. ReliabilityEngineering:TheoryandPracticebyAlessandroBirolini,SpringerPublications.
2. AnIntroductiontoReliabilityandMaintainabilityEngineeringbyCharlesEbeling,TMH Publications.
3. ReliabilityEngineeringbyElsayedA.Elsayed,PrenticeHallPublications.

EE851PE:POWERQUALITY&FACTS
(ProfessionalElective-V.1)

IVYearB.Tech.EEEII-Sem **LT PC**
3 0 03

Prerequisite: PowerElectronics,PowerSystemOperationandControl,HVDCTransmission

CourseObjectives:

- Definepowerqualityandexplorevarioustermsassociatedwithit.Studyvoltage-relatedpower quality issues, focusing on short and long interruptions.
- Conductadetailedstudyoncharacterizingvoltagesags,withaspecificemphasisonmagnitude and three-phase unbalanced voltage sags. Understand how power quality issues affect the behaviour of power electronics loads and rotating machinery.
- GainanunderstandingofFACTScontrollers,theircontrollableparameters,andtypes.Explore the importance of shunt and series compensation, focusing on the control and comparison of STATCOM and SVC, and the functioning and regulation of other FACTS devices like GCSC, TSSC, and TCSC.

CourseOutcomes: Attheendofthiscourse,studentswillbeableto:

- Developanawarenessoftheseverityofpowerqualityissuesindistributionsystems,focusing on their impact and challenges.
- Understand the concept of transforming voltage sags from upstream (higher voltages) to downstream (lower voltage) in the distribution system.
- Demonstrate competence in selecting controllers based on specific applications and system requirements. Thoroughly understand various systems and their requirements, including the control circuits of shunt controllers (SVC & STATCOM) and series controllers (GCSC, TSSC, andTCSC)forenhancingtransientstability,preventingvoltageinstability,anddampingpower oscillations.

UNIT-I:

PowerQuality Problems InDistribution Systems: Power Quality problems in distribution systems: TransientandSteadystatevariationsinvoltageandfrequency.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. AnalysisofuncompensatedACtransmissionlines.PassiveReactivePowerCompensation.Shuntand 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:

CombinedCompensators: IntroductiontoUnifiedPowerFlowController,Basic operatingprinciples, Conventional control capabilities, independent control of real and reactive power.

TEXTBOOKS:

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

REFERENCEBOOKS:

1. PowerQuality,C.Sankaran,CRCPress4.Understandingpowerqualityproblems,MathH. Bollen, IEEE press.
2. "Understanding FACTS –Concepts and Technology of Flexible AC Transmission Systems" Narain G. Honorani, Laszlo Gyugyi

EE852PE:SOLARPOWERBATTERIES
(ProfessionalElective-V.2)

IVYearB.Tech.EEEII-Sem **LT PC**
3 0 03

Prerequisite: RenewableEnergySources,EnergyStorageSystems

CourseObjectives:

- TounderstandthePVsystemsandthesolarpowerbatteriesoperation
- ToanalyzethesolarPVsystemstoragewithbatteries.
- TounderstandGridTievs.Off-GridSolarBatterySystem

CourseOutcomes: Attheendofthiscourse,studentswillbeableto:

- Knowoperatingprincipesofdifferenttypesofsolarpowerbatteries
- Usethebatteriesforeffectivestorageofsolar PV.
- Gaintheknowledgeonenvironmentalimpactsofsolarpowerbatteries.

UNIT-I:

IntroductiontosolarPVsystems,basicsofStorageforsolarPVsystems,StorageforsolarPVsystems: the batteries, Introduction to Solar Power Batteries, terminology associated, understanding Solar Battery Specifications, working principle, Series Vs. Parallel, Charging parameters, cycle life, Temperature effects, BatteryDesign and Construction,Importantcomponentsin batteryconstruction.

UNIT-II:

PrimaryandSecondarybatteries,ClassificationofSecondarybatteries,i.eLead-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:

SolarBatteryCosts,DecliningCost,factorscontributetotheperformanceofsolarbattery,selectionof 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.

TEXTBOOKS:

1. S. Sumathi and L. Ashok Kumar, Solar PV and Wind Energy Conversion Systems: An IntroductiontoTheory,ModelingwithMATLAB/SIMULINK,andtheRoleofSoftComputing Techniques, Springer 2011
2. H.A.Kiehne,"BatteryTechnologyHandbook"by*Publisher:*CRCPress2003
3. https://core.ac.uk/download/pdf/30044842.pdf
4. HandbookonBatteryEnergyStorageSystem
5. https://www.adb.org/sites/default/files/publication/479891/handbook-battery-energy-storage-

system.pdf

REFERENCEBOOKS:

1. CristinaArcherandS.Lovejoy,BatteryTechnologyforElectricVehicles:PublicScienceand Private Innovation, Springer 2015
2. SoterisA.Kalogirou,"SolarEnergyEngineering:ProcessesandSystems"by,AcademicPress, *Year:*2009
3. https://files.bregroup.com/bre-co-uk-file-library-copy/filelibrary/nsc/Documents%20Library/NSC%20Publications/88031-BRE_Solar-Consumer-Guide-A4-12pp.pdf
4. https://www.sunwize.com/tech-notes/solar-battery-basics/
5. https://palmetto.com/learning-center/blog/how-does-a-solar-battery-work
6. https://www.letsgosolar.com/faq/what-is-a-solar-battery/
7. https://www.purevolt.ie/domestic-solar/equipment/solar-storage-batteries.php

EE853PE:AITECHNIQUESINELECTRICALENGINEERING
(ProfessionalElective-V.3)

IVYearB.Tech.EEEII-Sem **LT PC**
3 0 03

Pre-requisites: PowerSystemsOperationandControl

CourseObjectives:

- Tolocatesoftcommandingmethodologies,suchasartificial neuralnetworks,Fuzzylogicand genetic Algorithms.
- To observe the concepts of FFN and concept of fuzziness involved in various systems andcomprehensive knowledge of fuzzy logic control and to design the fuzzy control
- Toanalyzegeneticalgorithm,geneticoperationsandgeneticmutations.

CourseOutcomes: Attheendofthiscourse,studentswillbeableto:

- Understandfeedforwardneuralnetworks,feedbackneuralnetworksandlearningtechniques.
- Understandfuzzinessinvolvedinvarioussystemsandfuzzysettheory.
- Developfuzzylogiccontrolandgeneticalgorithmforapplicationsinelectricalengineering.

UNIT-I:

Artificial Neural Networks: Introduction, Models of Neuron Network-Architectures –Knowledge representation, Artificial Intelligence andNeural 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:

ApplicationsOfAITechniques: Load forecasting, Load flow studies, Economic load dispatch, Load frequency control, Singleareasystemand twoarea system,Reactive powercontrol, Speedcontrol of DC and AC Motors.

TEXTBOOKS:

1. S. Rajasekaran and G.A.V.PaiNeural Networks, Fuzzy Logic & Genetic Algorithms, PHI, New Delhi, 2003.
2. RoberJ.Schalkoff,ArtificialNeuralNetworks,TataMcGrawHillEdition,2011.

REFERENCEBOOKS:

1. P. D. Wasserman; Neural Computing Theory & Practice, Van Nostrand Reinhold, New York, 1989.
2. BartKosko;NeuralNetwork&FuzzySystem,PrenticeHall,1992
3. D.E.Goldberg,GeneticAlgorithms,Addison-Wesley1999.

EE861PE:SMARTGRIDTECHNOLOGIES
(ProfessionalElective-VI.1)

IVYearB.Tech.EEEII-Sem **LT PC**
3 0 03

Pre-requisites:None

CourseObjectives:

- Todefendsmartgriddesigntomeettheneedsofautility
- Toselectissuesandchallengesthatremaintobesolved
- 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.

CourseOutcomes: Attheendofthecoursethestudentwillbeableto:

- Understandthefeaturesofsmallgridinthecontextof Indiangrid.
- Understandtheroleofautomationintransmissionanddistribution.
- Applyevolutionaryalgorithmsforsmartgridandunderstandoperation,maintenanceofPMUs, 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– Smartgrid Functions-TraditionalPowerGridandSmart Grid–NewTechnologiesforSmart Grid—Advantages– IndianSmartGrid–KeyChallengesforSmartGrid.

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:

ToolsAndTechniquesForSmartGrid: ComputationalTechniques–StaticandDynamicOptimization Techniques –Computational Intelligence Techniques –Evolutionary Algorithms –Artificial Intelligence techniques.

UNIT-IV:

DistributionGenerationTechnologies: IntroductiontoRenewableEnergyTechnologies–Microgrids – StorageTechnologies –Electric Vehicles and plug –in hybrids –Environmental impact and Climate Change – Economic Issues.

Communication Technologies And Smart Grid: Introduction to Communication Technology— Synchro-PhasorMeasurementUnits(PMUs)–WideAreaMeasurementSystems(WAMS).

UNIT-V:

ControlOfSmartPowerGridSystem

Load Frequency Control (LFC) in Micro Grid System –Voltage Control in Micro Grid System – Reactive PowerControlinSmartGrid.CaseStudiesandTestbedsfortheSmartGrids.

TEXTBOOKS:

1. StuartBorlase,SmartGrids,Infrastructure,TechnologyandSolutions,CRCPress,2013
2. GilMasters,RenewableandEfficientElectricPowerSystem,Wiley-IEEEPress,2004.

REFERENCEBOOKS:

1. A.G.PhadkeandJ.S.Thorp,"SynchronizedPhasorMeasurementsandtheirApplications", Springer Edition, 2010.
2. T.Ackermann,WindPowerinPowerSystems,Hoboken,NJ,USA,JohnWiley,2005.

EE862PE:ELECTRICALDISTRIBUTIONSYSTEMS
(ProfessionalElective-VI.2)

IVYearB.Tech.EEEII-Sem **LT PC**
3 0 03

Prerequisites: PowerSystem–I,PowerSystem-II

CourseObjectives:

- Tounderstanddesignconsiderationsoffeeders
- Tocomputevoltage,dropandpowerlossinfeeders
- Tounderstandprotection,PFimprovementandvoltagecontrol

CourseOutcomes: Attheendofthiscourse,studentswillbeable to:

- designthefeedersandcomputepowerlossandvoltagedropofthefeeders
- designprotectionofdistributionsystems
- understandtheimportanceofvoltagecontrolandpowerfactorimprovement

UNIT-I:

GeneralConcepts

Introduction to distribution system, Distribution system planning, Factors effecting the Distribution system planning, Load modelling 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.

DistributionFeeders

Design Considerations of Distribution Feeders: Radial, loop and network types of primary feeders, Introductiontolowvoltagedistributionsystems(LVDS)andHighvoltagedistributionsystems(HVDS), voltage levels, Factors effecting the feeder voltage level, feeder loading, Application of general circuit constants (A, B, C, D) to radial feeders, basic design practice of the secondary distribution system, secondary banking, secondary network types, secondary mains.

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: Objectivesofdistributionsystemprotection,typesofcommonfaultsandprocedureforfault 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 coordinationprocedure,Typesofprotectioncoordination:FusetoFuse,Auto-ReclosertoFuse,Circuit breaker to Fuse, Circuit breaker to Auto-Recloser.

UNIT-IV:

CompensationForPowerFactorImprovement: Capacitivecompensationforpower-factorcontrol- Differenttypes of powercapacitors,shuntandseries capacitors, effect ofshuntcapacitors(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, Equipmentforvoltagecontrol,effectofshuntcapacitors,effectofseriescapacitors,effectofAVB/AVR on voltage control, line drop compensation, voltage fluctuations.

TEXTBOOKS:

1. TuranGonen,ElectricPowerDistributionSystemEngineering,CRCPress,3rdEdition2014.
2. V.Kamaraju,ElectricalPowerDistributionSystems,TataMcGrawHillPublishingCompany,2ndedition, 2010.

REFERENCEBOOKS:

1. G.RamMurthy,ElectricalPowerDistributionhandbook,2ndedition,Universitypress2004.
2. A.S.Pabla,ElectricPowerDistribution,TataMcGrawHillPublishingcompany,6thedition,2013.

EE863PE:MACHINELEARNINGAPPLICATIONSTOELECTRICALENGINEERING
(ProfessionalElective-VI.3)

IVYearB.Tech.EEEII-Sem **LT PC**
3 0 03

Prerequisites: Mathematics,Python

CourseObjectives:

- Todevelopafoundationalunderstandingofmachinelearningprinciplesandtechniques.
- Toexploreandunderstandhowmachinelearningcanbeintegratedintovariouselectrical engineering applications.
- Togainhands-onexperienceinimplementingmachinelearningalgorithmstosolvereal-world electrical engineering problems.

CourseOutcomes: Attheendofthiscourse,studentswillbeable to:

- Demonstrateproficiencyinapplyingmachinelearningalgorithmstosolvereal-worldproblems in electrical engineering
- Integratemachinelearningprinciplseffectivelyintoelectricalengineeringapplications,
- Enhanceproblem-solvingskillsbysuccessfullyaddressingcomplexissuesinelectrical engineering through machine learning.

UNIT-I:

IntroductiontoMachineLearning:

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

UNIT-II:

FundamentalsofElectricalEngineeringRelevanttoML:

Overviewofelectricalcircuitsandsystems,Signalprocessingbasics,Introductiontocontrolsystems

UNIT-III:

DataPreprocessingandFeatureEngineering:

Datacleaningandhandlingmissingvalues,Featurescalingandnormalization,Featureextractionand selection

UNIT-IV:

MachineLearningAlgorithmsforElectricalEngineeringApplications

Regressionandclassificationalgorithms,Decisiontreesandensemblemethods,Neuralnetworksand deep learning, Support vector machines, Clustering algorithms for pattern recognition

UNIT-V:

CaseStudiesandApplicationsinElectricalEngineering

PowersystemoptimizationusingML,Faultdetectionanddiagnosticsinelectricalsystems,Smartgrid applications, Signal processing with ML, Control system optimization and adaptive control using ML

TEXTBOOKS:

1. C.AldrinRenoldandSumathiS.,PatternRecognitionandMachineLearning,WileyIndia,2015.
2. S. Rajasekaran and G. Aghila, Machine Learning: An Algorithmic Perspective, Chapman and Hall/CRC,2018
3. ChandraShekharYadav,S.Ramakrishnan,andU.RajendraAcharya,MachineLearning: Concepts, Methodologies, Tools and Applications, Springer 2018.

REFERENCEBOOKS:

1. EthemAlpaydin,IntroductiontoMachineLearning,MITPress2010
2. ChristopherM.Bishop,PatternRecognitionandMachineLearning,Springer,2006.
3. KevinP.Murphy,MachineLearning:AProbabilisticPerspective,MITPress2012.