SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY: PUTTUR
(AUTONOMOUS)
Power Electronics (M .Tech)
Department of Electrical and Electronics Engineering (EEE)

I Year I Semester

S.No.	Subject Code	Name of the Course / Laboratory	No. of Periods per week			No. of Credits
			L	T	Lab/ Practice	
1	25EE2101	Switched Mode Power Converters	3	-	-	3
2	25EE2102	Machine Modelling and Analysis	3	-	-	3
Programme Elective (PE)-I						
3	25EE2103	DC Drives	3	-	-	3
	25EE2104	Modern Control Theory				
	25EE2105	Energy Auditing and Management				
Programme Elective (PE)-II						
4	25EE2106	Solar Energy Conversion Systems	3	-	-	3
	25EE2107	Wind Energy Conversion Systems				
	25EE2108	Smart Grid Technologies				
5	25EE2109	Power Electronics Lab	-	-	4	2
6	25EE2110	Renewable Energy Sources Lab	-	-	4	2
7	25ME3111	Research Methodology and IPR	2	0	0	2
8	25EE2111	**Skill Enhancement Course** AI Techniques in Electrical Engineering	2	0	0	2
Audit Course- I						
9	25EC4232	English for Research Paper Writing	2	-	-	-
	25CE1031	Disaster Management				
	25CS5831	Essence of Indian Traditional Knowledge				
Contact Periods/Week			**18**	**-**	**8**	**20**
			Total 26/Week			

I Year II Semester

S.No.	Subject Code	Name of the Course / Laboratory	No. of Periods per week			No. of Credits
			L	T	Lab/ Practice	
1	25EE2112	Advanced Power Electronics	3	-	-	3
2	25EE2113	FACTS Controllers	3	-	-	3
Programme Elective (PE) – III						
3	25EE2114	AC Drives	3	-	-	3
	25EE2115	Advanced Power Semiconductor Devices & Protection				
	25EE2116	Applications of Power Converters				
Programme Elective (PE)-IV						
4	25EE2117	Power Quality	3	-	-	3
	25EE2118	EV Charging Infrastructure & Technology				
	25EC4231	Digital Signal Processors and Applications				
5	25EE2119	Electric Drives Lab	-	-	4	2
6	25EE2120	FACTS Devices & Simulation Lab	-	-	4	2
7	25CS5822	Quantum Technologies and Applications	2	-	-	2
8	25EE2121	Comprehensive Viva Voce	-	-	-	2
Audit Course – II						
9	25EE2130	Pedagogy Studies	2	-	-	-
	25EE2131	Personality Development Through Life Enlightenment Skills				
	25CS5832	Yoga For Stress Management				
Contact Periods/Week			**16**	**-**	**8**	**20**
			Total 24/Week			

****Students have to undergo an Industry Internship after I Year II Semester for a duration of 6 to 8 weeks**

II Year I Semester

S.No.	Subject Code	Name of the Course / Laboratory	No. of Periods per week			No. of Credits
			L	T	Lab/ Practice	
Program Elective – V						
1	25EE2122 25EE2123 25EE2124	Control & Integration of Renewable Energy Sources Energy Storage Technologies Hybrid Electric Vehicle Engineering	3	-	-	3
2		Open Elective-I	3	-	-	3
3	25EE2125	Dissertation Phase – I	-	-	20	10
4	25EE2126	Industry Internship	-	-	-	2
5	25EE2127	Co- Curricular Activities	-	-	-	1
Contact Periods/Week			**6**	**-**	**20**	**19**
			Total 26/Week			

Open Elective-I

25EE2129	Photovoltaic Systems

II Year II Semester

S.No.	Subject Code	Name of the Course / Laboratory	No. of Periods per week			No. of Credits
			L	T	Lab/ Practice	
1	25EE2128	Dissertation Phase – II	-	-	-	
Contact Periods/Week			**-**	**-**	**32**	**16**
			Total 32/Week			**16**

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(25EE2101) SWITCHED MODE POWER CONVERTERS

COURSE OBJECTIVES:

1. *Remember and understand the concept of advanced converter topologies.*
2. *Apply the concept of topologies for various switching regulators.*
3. *Analyze the working and waveforms of the converters designed.*
4. *Evaluate the operation of converters in continuous and discontinuous modes.*
5. *Design power electronic converters considering efficiency, reliability, and performance parameters.*
6. *Develop problem-solving skills in selecting appropriate converter topologies for specific industrial and renewable energy applications.*

COURSE OUTCOMES:

After the completion of the course, student would be able to:

1. *Remember and understand the concept of Buck and Boost switching regulator topologies push-pull & forward converter, voltage & current fed topologies.*
2. *Apply the concept of topologies for various switching regulators.*
3. *Analyze the concepts of half & full bridge converter topologies.*
4. *Evaluate the operation of continuous and dis-continuous Flyback converter topologies.*
5. *Design and simulate converter circuits to meet given specifications using modern engineering tools.*
6. *Assess and compare different converter topologies for power electronics applications such as DC power supplies, renewable systems, and electric drives.*

UNIT I

FUNDAMENTAL SWITCHING REGULATORS –BUCK AND BOOST TOPOLOGIES: Buck Switching Regulator Topology: Basic Operation - Significant Current waveforms -Buck regulator efficiency-Design relations of output filter inductor and capacitor. Boost Switching Regulator Topology: Basic Operation – Quantitative relations –Discontinuous and Continuous modes -Design relations.

UNIT II

PUSH-PULL AND FORWARD CONVERTER TOPOLOGIES: Push-Pull Topology: Basic Operation – Master/slave outputs - Flux imbalance -Power transformer design relations - Primary, secondary peak and RMS currents - output power and input voltage limitations - output filter design relations. Forward Converter Topology: Basic operation -Design relations - Slave output voltages - secondary load-freewheeling diode and inductor currents. Forward converter with unequal power and reset winding turns - power transformer design and output filter design.

UNIT III

HALF AND FULL BRIDGE CONVERTER TOPOLOGIES : Half Bridge Converter Topology: Basic Operation-Half bridge magnetic-output filter calculations, blocking capacitor to avoid flux

imbalance- Half bridge leakage inductance problems. Full Bridge Converter Topology: Basic Operation-Full Bridge magnetic –out put filter calculations – transformer primary blocking capacitor.

UNIT IV

FLYBACK CONVERTER TOPOLOGIES : Discontinuous-Mode Fly backs: Basic operation - relation between output voltage versus input voltage-on time output load - design relations and sequential decision requirements –fly back converter, disadvantages. Continuous Mode Fly backs: Basic operation - Discontinuous mode to continuous mode transition - design relations– continuous mode fly backs.

UNIT V

VOLTAGE-FED AND CURRENT- FED TOPOLOGIES: Definitions-deficiencies of voltage fed pulse width modulated full wave bridge-buck voltage fed full wave bridge topology – basic operation buck voltage fed full wave bridge– advantages-drawbacks in buck voltage fed full wave bridge - buck current fed full wave bridge topology – basic operation – fly back current fed push pull topology.

TEXT BOOKS:

1. Pressman A. I, Switching Power Supply Design, McGraw Hill,3rdedition,2009.
2. Mitchell D. M, DC-DC Switching Regulator Analysis, Mc Graw Hill, 1st edition, 1988

REFERENCES:

1. Ned Mohan, Power Electronics, JohnWiley,3rdedition,2011.
2. Otmar Kingenstein, Switched Mode Power Supplies in Practice, John Wiley, 1st edition,1991.
3. Billings K.H., Handbook of Switched Mode Power Supplies, McGrawHill, 3rd edition, 2010.
4. Nave M.J, Power Line Filter Design for Switched- Mode Power Supplies, Mark Nave Consultants, 2nd edition, 2010.

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(25EE2102) MACHINE MODELLING & ANALYSIS

COURSE OBJECTIVES:

The objectives of this course

1. *Understand the fundamentals of electromechanical energy conversion and the concept of energy balance in electrical machines.*
2. *Understand the basic principles for machine analysis and reference frame theory.*
3. *Apply the concept of Change of Variables, and Transformation to an Arbitrary Reference Frame.*
4. *Analyse the dynamic analysis of machines.*
5. *Design the modelling of machines.*
6. *Gain insights into the control and performance aspects of electrical machines in modern drive systems and automation.*

COURSE OUTCOMES:

After the completion of the course student should be able to

1. *Understand the Concept Magnetically Coupled Circuits, Types of DC machines, commonly used Reference Frames*
2. *Understand the Concept machines variables, Time domain and state equations, Permanent Magnet Brushless DC Motor Operating principle.*
3. *Apply the concept of Change of Variables and Transformation to an Arbitrary Reference Frame, Equal Area Criteria.*
4. *Analyse the Free Acceleration Characteristics viewed from Various Reference Frames, Steady-State Analysis and its Operation.*
5. *Design the modelling of DC machines, Three phase Induction machines, Synchronous machine.*
6. *Analyse the dynamic analysis of machines, Mathematical modelling of PM Brushless DC motor.*

UNIT- I

BASIC PRINCIPLES AND ANALYSIS OF DC MACHINES : Basic Principles for Machine Analysis: Magnetically coupled circuits - Machine windings - Air-Gap MMF-Winding inductances - Voltage equations.

Modelling and Analysis of DC Machines:Elementary theory of DC Machine - Voltage and Torque Equations- Types of DC Machines - Permanent and Shunt DC Motors - Time-Domain and State-Equations.

UNIT- II

REFERENCE FRAME THEORY : Fundamentals of Transformations - Equations of Transformations - Change of Variables and Transformation to an Arbitrary Reference Frame - Commonly used Reference Frames - Transformation between Reference Frames - Steady-State Phasor Relationships and Voltage Equations

UNIT- III

MODELLING& DYNAMIC ANALYSIS OF THREE PHASE INDUCTION MACHINES : Voltage and Torque Equations in Machine Variables - Voltage and Torque Equations in Arbitrary Reference Frame - Steady-State Analysis and its Operation. Free Acceleration Characteristics viewed from Various Reference Frames - Dynamic Performance during Sudden Changes in Load Torque - Dynamic Performance during A Three-Phase Fault at the Machine Terminals.

UNIT- IV

MODELLING& DYNAMIC ANALYSIS OF SYNCHRONOUS MACHINES; Voltage in Machine Variables - Torque equation in Machine Variables - Voltage Equations in Arbitrary and Rotor Reference Frame - Torque Equations in Substitute Variable- Steady-State Analysis and its Operation.

Dynamic Performance of Synchronous Machine - Three-Phase Fault, Comparison of Actual and Approximate Transient Torque Characteristics - Equal Area Criteria.

UNIT- V

MODELLING OF SPECIAL MACHINES: Modelling of Permanent Magnet Brushless DC Motor - Operating principle – Mathematical modelling of PM Brushless DC motor - PMDC Motor Drive Scheme.

TEXT BOOKS:

1. PaulC. Krause, Oleg Wasyzczuk, ScottS, Sudhoff, “Analysis of Electric Machinery and Drive Systems”, IEEE Press, 3rd Edition, 2013.
2. R. Krishnan,“Electric Motor Drives, Modeling, Analysis and Control” , Pearson Education India, 4th edition, 2015.

REFERENCES:

1. P. C. Krause, “Analysis of Electric Machinery”, McGraw Hill, 3rd edition, 2013
2. Samuel Seely, “Electro mechanical Energy Conversion”, Tata Mc Graw Hill Publishing Company, 1st edition, 1962.
3. A.E, Fitzgerald, Charles Kingsley, Jr, and Stephan D ,Umanx, “ElectricMachinery” ,Tata Mc Graw Hill, 7thEdition, 2020.
4. P. Kundur, “Power System Stability and Control”, MC Graw Hill Education, 1st edition, 2006.

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(25EE2103) DC DRIVES
(PE-I)

COURSE OBJECTIVES:

The objectives of this course

1. *To study the operation and characteristics of single-phase and three-phase controlled bridge rectifiers feeding DC motor loads under various operating conditions.*
2. *To understand the working of three-phase naturally commutated converters used as rectifiers and inverters with different types of loads.*
3. *To analyze the performance of phase-controlled DC motor drives and understand the modeling and control of converter-fed DC drives.*
4. *To design and implement current and speed controllers for closed-loop control of DC motor drives, including feedback systems.*
5. *To understand the operation, modeling, and control of chopper-controlled DC motor drives, including single, two, and four-quadrant operation.*
6. *To evaluate converter and chopper performance in terms of power factor, harmonics, torque pulsations, and design considerations for industrial applications.*

COURSE OUTCOMES:

After the completion of the course student should be able to

1. *Remember and understand the concept Separately excited single phase and three phase rectifier with DC Motor load drives.*
2. *Analyze the characteristics of three-phase naturally commutated bridge circuits functioning as rectifiers or inverters with various load conditions..*
3. *Develop models for three-phase converter-controlled DC motor drives and perform steady-state performance analysis.*
4. *Design and tune current and speed controllers for DC motor drives, incorporating feedback and compensation techniques.*
5. *Simulate and analyze chopper-controlled DC motor drives, including PWM and hysteresis control methods for closed-loop operation.*
6. *Assess the effects of harmonics, torque pulsations, and power factor on converter and chopper-fed DC motor systems for improved drive performance.*

UNIT- I

CONTROLLED BRIDGE RECTIFIER (1-Φ& 3-Φ) WITH DC MOTOR LOAD: Separately excited DC motors with rectified single-phase supply-single phase semi converter and single-phase full converter for continuous and discontinuous modes of operation–power and power factor.

Three phase semi converter and three phase full converter for continuous and discontinuous modes of operation–power and power factor– Addition of Freewheeling diode.

UNIT- II

THREE PHASE NATURALLY COMMUTATED BRIDGE CIRCUIT AS A RECTIFIER OR AS AN INVERTER: Three phase-controlled bridge rectifiers with passive load impedance - resistive load and ideal supply – Highly inductive load and ideal supply for load side and supply side quantities - shunt capacitor compensation – three phase-controlled bridge rectifier inverter.

UNIT- III

PHASE CONTROLLED DC MOTOR DRIVES: Three phase-controlled converter - control circuit - control modelling of three phase converter – Steady state analysis of three phase converter control DC motor drive – Two quadrant, three phase converter-controlled DC motor drive – DC motor and load, converter.

UNIT- IV

CURRENT AND SPEED CONTROLLED DC MOTOR DRIVES: Current and Speed controllers -current and speed feedback — Design of controllers - Current and Speed controllers – Motor equations– Filter in the speed feedback loop speed controller–current reference generator – current controller and flow chart for simulation – Harmonics and associated problems– sixth harmonics torque.

UNIT- V

CHOPPER CONTROLLED DC MOTOR DRIVES: Principle of operation of the chopper– Four quadrant chopper circuit–Chopper for inversion –Chopper with other power devices – model of the chopper –input to the chopper – Steady state analysis of chopper-controlled DC motor drives –rating of the devices– Pulsating torque – Closed loop operation of DC motor Drives - Speed controlled drive system – current control loop – pulse width modulated current controller – hysteresis current controller– modelling of current controller– design of current.

TEXT BOOKS:

1. Fundamentals of Electric Drives –G.K.Dubey– Narosa Publications -2nd edition, 2020.
2. Power Semiconductor drives–S.B.Dewanand A.Straughen –Wiley India edition-1st edition, 2009.

REFERENCES:

1. Power Electronics and motor control–Shepherd, Hulley, Liang, CUPress, 2nd edition 1995
2. Electric motor drives modeling, Analysis and control –R.Krishnan, PHI, 5th edition, 2015
3. Power Electronic Circuits, Devices and Applications-M. H. Rashid, PHI, 4thedition, 2017

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(25EE2104) MODERN CONTROL THEORY
(PE-I)

COURSE OBJECTIVES:

The objectives of this course:

1. *To explain the concepts of state variables analysis.*
2. *To study state-space representation, and canonical forms including controllability, observability, transfer function realization*
3. *To study and analyze non-linear systems.*
4. *To apply the comprehensive knowledge of optimal theory for Control Systems.*
5. *To analyze the concept of stability for nonlinear systems and their categorization.*
6. *To analyze and synthesize control systems for linear as well as nonlinear dynamic processes*

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

1. *Analyze and evaluate principles and concepts of Modern control system*
2. *To perform an analysis of state variables for any real-time system*
3. *Implement the principles of optimal control to any system*
4. *Ability to determine system stability, controllability, and observability*
5. *Analyze stability of nonlinear systems using Lyapunov method*
6. *Apply basic principles and techniques to develop linear control systems*

UNIT- I

STATE VARIABLE DESCRIPTION: Introductory matrix algebra and linear Vector Space, State space representation of systems- Linearization of a non-linear System- Solution of state equations- Evaluation of State Transition Matrix (STM).

UNIT- II

TRANSFORMATION, POLEPLACEMENT AND CONTROLLABILITY: Similarity transformation and invariance of system properties due to similarity transformations. Minimal realization of SISO, SIMO and MISO transfer functions. Discretization of a continuous time state space model- Conversion of state space model to transfer function model using Fadeeva algorithm- Fundamental theorem of feedback control - Controllability and Controllable canonical form - Pole assignment by state feedback using Ackermann's formula– Eigen structure assignment problem.

UNIT- III

OPTIMAL CONTROL: Linear Quadratic Regulator (LQR) problem and solution of algebraic Riccati equation using Eigen value and Eigen vector methods- iterative method- Controller design using output feedback.

UNIT- IV

OBSERVERS: Observability and observable canonical form-Design of full order observer using Ackermann's formula -Bass Gura algorithm- Duality between controllability and observability- Full order Observer based controller design- Reduced order observer design.

UNIT- V

STABILITY ANALYSIS AND SENSITIVITY: Internal stability of a system- Stability in the sense of Lyapunov- Asymptotic stability of linear time invariant continuous and discrete time systems- Solution of Lyapunov type equation- Model decomposition and decoupling by state feedback- Disturbance rejection- sensitivity and complementary sensitivity functions.

TEXT BOOKS:

1. K. Ogata, "Modern Control Engineering", Prentice Hall, India, 5th edition, 2010.
2. T. Kailath, "Linear Systems", Prentice Hall, 2016.
3. N.K. Sinha, "Control Systems", New Age International, 4th edition, 2013.

REFERENCES:

1. Panos J Antsaklis, and Anthony N.Michel, "Linear Systems", New-age international (P) LTD. Publishers, 2009.
2. John JD Azzoand C. H. Houpis, "Linear Control System Analysis and Design conventional and Modern", Mc Graw- Hill Book Company, 3rd edition, 1988.
3. B.N.Dutta, "Numerical Methods for linear Control Systems", Elsevier Publication, 2007.
4. C.T. Chen "Linear System Theory and Design-PHI, India,1984.
5. Richard C. Dorf and Robert H. Bishop, "Modern Control Systems", 11th Edition, Pearson Edu., India, 2009

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(25EE2105) ENERGY AUDITING AND MANAGEMENT
(PE-I)

COURSE OBJECTIVES:

The objectives of this course:

1. *To provide an understanding of energy scenario, conservation techniques, and demand-side management in power utilities.*
2. *To introduce the concepts and methods of conducting energy audits in various industrial and utility sectors.*
3. *To familiarize students with different types of instruments used for measuring energy performance in systems.*
4. *To impart knowledge on energy conservation opportunities in thermal, HVAC, lighting, and renewable systems.*
5. *To develop the ability to evaluate the economic aspects of energy conservation measures.*
6. *To emphasize the role of energy managers and auditors in achieving sustainable energy utilization and cost-effective operation.*

COURSE OUTCOMES:

Students will be able to:

On successful completion of this course, the student will be able to

1. *Explain the need and importance of energy conservation and management in power systems.*
2. *Perform detailed energy audits and prepare comprehensive energy audit reports.*
3. *Identify and use appropriate instruments for energy measurement and analysis.*
4. *Apply energy conservation techniques in HVAC, lighting, and thermal systems*
5. *Analyze and evaluate the cost-effectiveness of energy conservation measures.*
6. *Propose and implement energy management strategies for industrial and utility applications.*

UNIT- I

ENERGY AUDIT AND DEMAND SIDE MANAGEMENT (DSM) IN POWER UTILITIES: Energy Scenario & Conservation -Demand Forecasting Techniques- Integrated Optimal Strategy for Reduction of T&D Losses - DSM Techniques and Methodologies- Loss Reduction in Primary and Secondary Distribution system and capacitors - Energy Management — Role of Energy Managers – Energy Audit-Metering.

UNIT- II

ENERGY AUDIT: Energy audit concepts - Basic elements and measurements - Mass and energy balances - Scope of energy auditing in industries - Evaluation of energy conserving opportunities and environmental management - Preparation and presentation of energy audit reports - case studies and potential energy savings.

UNIT- III

INSTRUMENTATION: General Audit Instrumentation –Measuring building losses – Applications of IR thermo graphy – Measurement of electrical system performance – Measurement of heating, ventilation, air conditioning system performance – Measurement of combustion systems.

UNIT- IV

ENERGY CONSERVATION: Energy conservation in HVAC systems and thermal power plants, Solar systems, Fan and Lighting Systems - Different light sources and luminous efficiency

UNIT- V

ECONOMIC EVALUATION OF ENERGY CONSERVATION: Energy conservation in electrical devices and systems - Economic evaluation of energy conservation measures - Electric motors and transformers - Inverters and UPS - Voltage stabilizers.

TEXT BOOKS:

1. Frank kreith and D. Yogi goswamy/ Editors, "Energy Management and conservation handbook". NewYork,2008.
2. WC Turner: Energy Management Handbook, Seventh Edition, (Fairmont Press Inc., 2007)
3. YP Abbi and Shashank Jain: Handbook on Energy Audit and Environment Management, (TERIPress, 2006)

REFERENCES:

1. Albert Thumann, and William J. Younger, "Handbook of Energy Audits", Marcel Dekker, Inc., Newyork, 6th edition, 2003.
2. D.A.Reay, Industrial Energy Conservation-Pergamon Press, 1980.
3. T.L.Boten, LiptakB.G.,(Ed)Instrument Engineers Handbook, Chinton Book Company, 2004.
4. Hodge B.K, Analysis and Design of Energy Systems, Prentice Hall, 2002.
5. Larry C.Witte, Schmidt & Brown, Industrial energy management and utilization. Hemisphere publishing, Co.NewYork,1988.

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(25EE2106) SOLAR ENERGY CONVERSION SYSTEMS
(PE-II)

COURSE OBJECTIVES:

1. *Understand the fundamentals of solar cell.*
2. *Apply the photovoltaic systems and various technologies of solar PV cells, about manufacture, sizing and operating techniques.*
3. *Analyze Series and parallel connection of cells, Hot spots in the module, Algorithms for MPPT.*
4. *Understand the operation and characteristics of DC–DC converters, inverters, and charge controllers*
5. *Design Solar cells and PV system.*
6. *Understand the solar PV energy systems adhering to power quality and grid standards.*

COURSE OUTCOMES:

Students will be able to:

1. *Understand the fundamental principles of photovoltaic effect, characteristics of solar cells, and various PV materials used in solar energy conversion.*
2. *Analyze the effects of partial shading on PV arrays and apply appropriate interconnection and reconfiguration techniques to enhance power output.*
3. *Evaluate and implement different maximum power point tracking (MPPT) algorithms for both uniform and non-uniform solar irradiance conditions.*
4. *Describe the operation and characteristics of DC–DC converters, inverters, and charge controllers used in PV systems.*
5. *Design standalone and grid-connected photovoltaic systems for various applications with proper component sizing and system optimization.*
6. *Apply technical knowledge to develop efficient, reliable, and sustainable solar PV energy systems adhering to power quality and grid standards.*

UNIT- I

SOLAR CELL FUNDAMENTALS: Introduction to solar PV system, history of photovoltaics, photovoltaic effect, photovoltaic cell, PV Cell Material, equivalent circuit, electrical characteristics, PV terminology, maximum power point tracking.

UNIT- II

PARTIAL SHADING: Partial shading of PV arrays, causes, effect of partial shading on PV power, hot spots, bypass diode, PV characteristics, interconnection schemes, series and parallel connection, total cross tied (TCT), honey comb (HC), bridge linked (BL), reconfiguration techniques, electrical array reconfiguration techniques, Su Do Ku based reconfiguration technique.

UNIT- III

MPPT: Maximum power point tracking algorithm, direct methods, differentiation method, feedback voltage or current method, perturb and observe method, incremental conductance method, parasitic capacitance method, indirect methods, curve fitting method, look up table method, open circuit voltage sensing method, short circuit current sensing method, artificial intelligence techniques, artificial neural network, fuzzy logic, genetic algorithm, algorithm for non-uniform insulation conditions, Fibonacci search method, short current pulse method, two stage method.

UNIT- IV

CONVERTER AND INVERTER OPERATIONS: Buck converter, boost converter, buck boost converter, CUK converter, SEPIC converter, charge controller, shunt controller, series controller, inverters, inverter operation, power quality standards, grid interconnection techniques.

UNIT- V

PV SYSTEM DESIGN AND APPLICATIONS: Design of PV powered DC fan without battery- Standalone system with DC load using MPPT- Design of PV powered DC pump- Design of standalone system with battery and AC/DC load – Wire sizing in PV system – Precise sizing of PV systems – Hybrid PV systems –Grid connected PV systems, Rooftop Systems.

TEXT BOOKS:

1. Chetan Singh Solangi, 'Solar Photovoltaics-Fundamentals, Technologies and Applications', PHI
2. Learning Pvt Ltd, Delhi,2011.
3. Van Overstraeton and Metens R.P,. ‘Physics, Technology and use of Photovoltaics', Adam Hilger,Bristol, 1996.

REFERENCES:

1. Konrad Mertens, ‘Photovoltaics Fundamentals technology and Practice’, Wiley publications 2014.
2. Chetan Singh Solangi, ‘Solar Photovoltaics Technology and Systems’, 2013.

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M.Tech-PE

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(25EE2107) WIND ENERGY CONVERSION SYSTEMS
(PE-II)

COURSE OBJECTIVES:

1. *To provide a comprehensive understanding of the fundamental principles and historical development of wind energy conversion and turbine aerodynamics.*
2. *To analyze various types of wind energy conversion systems and evaluate their performance characteristics under different operating conditions.*
3. *To study the control strategies of wind turbines, including pitch, stall, yaw, and power electronic control for efficient energy capture.*
4. *To develop detailed knowledge of induction and synchronous machines used in wind energy systems and their dynamic modeling aspects.*
5. *To examine the operation and performance of grid-connected and self-excited induction generators, including reactive power control and excitation requirements.*
6. *To explore advanced wind generation technologies using variable-speed turbines and their integration in hybrid renewable energy systems.*

COURSE OUTCOMES: *Students will be able to:*

1. *Understand fundamental principles and design of wind turbines and their aerodynamics.*
2. *Analyze wind turbine control methods including pitch, stall, and yaw control.*
3. *Model and evaluate induction and synchronous machines used in WECS.*
4. *Examine self-excited and grid-connected induction generators with reactive power management.*
5. *Understand variable-speed turbine technologies and their hybrid applications.*
6. *Apply simulation and analysis tools for designing efficient wind energy systems.*

UNIT- I

FUNDAMENTALS OF WIND TURBINES: Historical background - Basics of mechanical to electrical energy conversion in wind energy -Types of wind energy conversion devices – Definition - Solidity, tip speed ratio, power coefficient, wind turbine ratings and specifications- Aerodynamics of wind rotors - Design of the wind turbine rotor.

UNIT- II

WIND TURBINE CONTROL SYSTEMS & SITE ANALYSIS: Wind Turbine-Torque speed characteristics-Pitch angle control –Stall control –Power electronic control – Yaw control – Control strategy – Wind speed measurements – Wind speed statistics –Site and turbine selection.

UNIT- III

BASICS OF INDUCTION AND SYNCHRONOUS MACHINES: The Induction Machine – Constructional features - Equivalent circuit model- Performance characteristics -Saturation characteristics – Dynamic d-q model – The wound field synchronous machine – The permanent magnet synchronous machine – Power flow between two synchronous sources – Induction generator versus synchronous generator.

UNIT- IV

GRID CONNECTED AND SELF-EXCITED INDUCTION GENERATOR OPEARTION: Constant voltage, constant frequency- Single output system –Double output system with current converter & voltage source inverter–Equivalent circuits–Reactive power and harmonics- Reactive power compensation–variable voltage, variable frequency–The self-excitation process–Circuit model for the self-excited induction generator–Analysis of steady state operation–The excitation requirement–Effect of a wind generator on the network.

UNIT- V

WIND GENERATION WITH VARIABLE- SPEED TURBINES AND APPLICATION: Classification of schemes–Operating area–Induction generators–Doubly fed induction generator – Wound field synchronous generator – The permanent magnet generator – Merits and limitations of wind energy conversion systems – Application in hybrid energy systems – Diesel generator and photo voltaic systems –Wind photovoltaic systems.

TEXT BOOKS:

1. S.N. Bhadra, D. Kastha, S. Banerjee, “wind electrical systems”, Oxford University Press, 1st edition, 2005.
2. Banshi D. Shukla, “Engineering of Wind Energy”, Jain Brothers, 1st edition, 2018

REFERENCES:

1. S.Rao& B.B. Parulekar, “Energy Technology”, Khanna publishers, 4th edition, 2005.
2. N.K.Bansal,M. Kleemann, Michael Meliss, Renewable Energy sources & Conversion Technology, Tata Mcgraw Hill Publishers & Co., 1st edition, 1990

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(25EE2108) SMART GRID TECHNOLOGIES
(PE-II)

COURSE OBJECTIVES:

1. *To know the importance of smart grid technology functions over the present grid.*
2. *To get the knowledge about the transmission and distribution management.*
3. *To study about the smart metering and demand side integration.*
4. *To study about the communication technologies for the smart grid.*
5. *To enhance the quality, efficiency and security of power supply.*
6. *To impart an understanding of economics, policies and technical regulations for DG integration.*

COURSE OUTCOMES:

Students will be able to:

1. *Understand the importance of smart grid technology functions over the present grid.*
2. *Apply the knowledge about the transmission and distribution management.*
3. *Analyse smart metering and demand side integration.*
4. *Apply the concept of communication technologies for the smart grid.*
5. *Determine the quality, efficiency and security of power supply.*
6. *Impart an understanding of economics, policies and technical regulations for DG integration.*

UNIT- I

SMART GRIDS: Smart grid overview- ageing assets and lack of circuit capacity- thermal constraints, operational constraints, security of supply- national initiatives- early smart grid initiatives- active distribution networks- virtual power plant- other initiatives and demonstrations- overview of the technologies required for the smart grid.

UNIT- II

TRANSMISSION AND DISTRIBUTION MANAGEMENT : Data Sources- Energy Management System-Wide Area Applications, Visualization Techniques- Data Sources and Associated External Systems- SCADA- Customer Information System- Modeling and Analysis Tools, Distribution System Modeling- Topology Analysis- Load Forecasting- Power Flow Analysis- Fault Calculations- State Estimation- Applications-System Monitoring- Operation-Management- Outage Management System-Overview of energy storage technologies.

UNIT- III

SMART METERING AND DEMAND SIDE INTEGRATION: Overview- Smart metering – Evolution of electricity metering- key components of smart metering- smart meters: an overview of the hardware used – signal acquisition- signal conditioning-analogue to digital conversion-computation-input/output and communication. Communication infrastructure and protocols for smart metering - Home area network, Neighborhood Area Network- Data Concentrator- meter data management system- Protocols for communication. Demand Side Integration- Services

Provided by DSI-Implementation of DSI- Hardware Support- Flexibility Delivered by consumers from the Demand Side- System Support from DSI.

UNIT- IV

COMMUNICATION TECHNOLOGIES FOR THE SMART GRID: Data Communications: Dedicated and Shared Communication Channels, Switching Techniques, Circuit Switching, Message Switching, Packet Switching- Communication Channels, Introduction to TCP/IP.
Communication Technologies: IEEE 802 Series- Mobile Communications- Multi-Protocol Label Switching-Power line Communication.

UNIT- V

INFORMATION SECURITY FOR THE SMART GRID: Overview- Encryption and Decryption, Symmetric Key Encryption- Public Key Encryption- Authentication- Authentication Based on Shared Secret Key- Authentication Based on Key Distribution Center- Digital Signatures- Secret Key Signature-Public Key Signature- Message Digest.

TEXT BOOKS:

1. Janaka Ekanayake, Kithsiri Liyanage, et.al., Smart Grid Technology and Applications, Wiley Publications, 1st edition, 2012.
2. James Momoh, Smart Grid: Fundamentals of Design and Analysis, Wiley, IEEE Press, 1st edition, 2012.
3. Bharat Modi, Anuprakash, Yogesh Kumar, Fundamentals of Smart Grid Technology, S.K Kataria& Sons, 1st edition, 2019.

REFERENCES:

1. Eric D. Knapp, Raj Samani, Applied Cyber Security and the Smart Grid-Implementing Security Controls into the Modern Power Infrastructure, Syngress Publishers, 1st edition, 2013.
2. Nouredine Hadjsaid, Jean Claude Sabonnadiere, Smart Grids, Wiley Blackwell Publications, 1st edition, 2012.
3. Peter-Fox Penner, Smart Power: Climate Changes, the Smart Grid and the future of electric utilities, Island Press, 1st edition, 2010.

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(25EE2109) POWER ELECTRONICS LAB

COURSE OBJECTIVES:

1. *Understand the operation of Power Electronic converters.*
2. *Gain a fair knowledge on the programming and simulation of Power Electronic converters.*
3. *Apply the MATLAB/ Simulink for various controllers.*
4. *Design a rectifier, inverter and cycloconverter.*
5. *Design a chopper, voltage controller and induction motor.*
6. *Understand the performance of PWM controller and DC-DC push-pull regulator.*

COURSE OUTCOMES: *Students will be able to:*

1. *Understand the basic concept and its operation of Power Electronic converters.*
2. *Analyse the output waveforms of the various converters designed.*
3. *Apply mathematical relations to find THD and verify it practically.*
4. *Design different controllers using Simulink.*
5. *Analyse the output waveforms a chopper, voltage controller and induction motor.*
6. *Analyse the performance of PWM controller and DC-DC push-pull regulator.*

LIST OF EXPERIMENTS:

1. Single Phase Fully Controlled Converter with R and R-L loads using MATLAB
2. Three Phase Fully Controlled Converter with R and R-L loads using MATLAB
3. Single Phase AC Voltage Controller with R and R-L loads using MATLAB.
4. Three Phase AC Voltage Controller with R and R-L loads using MATLAB.
5. Three Phase Inverter in 180° & 120° Conduction Mode with Star & Delta Connected loads using MATLAB.
6. Buck, Boost and Buck- Boost converter using MATLAB.
7. Closed loop control of Buck and Boost converter
8. Single Phase cycloconverter using MATLAB
9. Three Phase cycloconverter using MATLAB.
10. Single Phase Full Controlled Converter with R and R-L loads.
11. Designing of induction motor using Simulink
12. Performance measurement and analysis of 1-phase IGBT inverter with sinusoidal PWM control
13. Performance measurement and analysis of isolated DC-DC push-pull regulator
14. Hysteresis current control of a single-phase inverter

REFERENCES:

1. PowerElectronicCircuits,DevicesandApplications-M.H.Rashid–PHI,2017
2. Ned Mohan, Power Electronics, JohnWiley,3rdedition,2011
3. https://pe2-iitd.vlabs.ac.in/List%20of%20experiments.html

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(25EE2110) RENEWABLE ENERGY SOURCES LAB

COURSE OBJECTIVES:

1. *Understand the characteristics and behavior of renewable energy sources such as solar PV panels, wind generators, and batteries under different operating conditions.*
2. *Develop practical skills in configuring, testing, and analyzing renewable energy systems, including PV arrays, MPPT controllers, inverters, and battery management.*
3. *Gain experience in modeling and simulating renewable energy components, studying the effects of environmental factors like irradiation, temperature, and wind speed on system performance.*
4. *Apply control and power electronics techniques (such as MPPT algorithms and DC-DC converters) for enhancing the efficiency, stability, and integration of renewable energy systems into the grid.*
5. *Apply modern simulation tools to model and analyze the behavior of renewable energy components and systems.*
6. *Reinforce the theoretical concepts of renewable energy systems through practical and simulated lab work.*

COURSE OUTCOMES: *Students will be able to:*

1. *To observe the I-V and P-V curves and Series and Parallel connection of Solar systems.*
2. *To study the sun tracking and MPPT Charge Controllers of Solar systems.*
3. *To analyse Power, Voltage & Frequency Measurement of Wind Generator.*
4. *To Understand the Effect of temperature variation and Irradiation on Photovoltaic Array.*
5. *To Examine the charging/discharging behavior of batteries and their role in hybrid systems.*
6. *Develop simulation models of PV and wind systems and assess the effect of temperature and irradiation.*

LIST OF EXPERIMENTS:

1. Draw the I-V and P-V curves of Solar Panel using PV Panel
2. Study of Series and Parallel connection of Solar Panels
3. Study of Sun tracking system
4. Maximum Power Point Tracking Charge Controllers
5. Inverter control for Solar PV based systems
6. Power, Voltage & Frequency Measurement of output of Wind Generator
7. Impact of load and wind speed on power output and its quality
8. Performance of frequency drop characteristics of induction generator at different loading condition
9. Charging and Discharging characteristics of Battery

Simulation Experiments

1. Modelling of PV Cell
2. Effect of temperature variation on Photovoltaic Array
3. Effect of Irradiation on a Photovoltaic Array
4. Design of solar PV boost converter using P&O MPPT technique

Web Sources: https://www.vlab.co.in

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(25ME3111) RESEARCH METHODOLOGY AND IPR

COURSE OBJECTIVES:

1. *To understand the research design process and data collection methods.*
2. *To develop skills in data analysis and reporting.*
3. *To familiarize students with intellectual property rights (IPR) and patents.*
4. *To apply research skills in real-world contexts.*

COURSE OUTCOMES:

1. *Recall key concepts and terminology related to research design, data collection, and intellectual property rights.*
2. *Explain the importance of research design and data analysis in research studies, and describe the concept of intellectual property rights.*
3. *Design a research study, including data collection and analysis methods, and apply intellectual property rights principles to protect research findings.*
4. *Analyze research studies to identify strengths and limitations, and evaluate the effectiveness of data collection and analysis methods.*
5. *Assess the impact of intellectual property rights on research and innovation, and evaluate the effectiveness of research designs and methods.*
6. *Develop a comprehensive research plan, including a detailed research design, data collection and analysis methods, and a plan for protecting intellectual property.*

UNIT - I
FUNDAMENTALS OF RESEARCH METHODOLOGY

Overview of research process and design - Types of Research - Approaches to Research (Qualitative vs Quantitative) - Observation studies, Experiments and Surveys - Use of Secondary and exploratory data to answer the research question - Importance of Reasoning in Research and Research ethics - Documentation Styles (APA/IEEE etc.) - Plagiarism and its consequences

Learning Outcomes

- Recall key concepts of the research process, including different types and approaches to research, and the importance of ethics.
- Differentiate between qualitative and quantitative research approaches and the various uses of secondary data.
- Identify the core principles of research design and ethics, including plagiarism and documentation styles.
- Explain the significance of reasoning and ethical conduct in all stages of the research process.
- Apply knowledge of different documentation styles, such as APA and IEEE, to properly cite sources and avoid plagiarism.

UNIT - II
DATA COLLECTION AND SOURCES

Importance of Data Collection - Types of Data - Data Collection Methods - Data Sources - primary, secondary and Big Data sources - Data Quality & Ethics - Tools and Technology

for Data Collection

Learning Outcomes

- Identify different types of data and the various methods for collecting both primary and secondary data.
- Explain the importance of data quality and ethical considerations in data collection.
- Differentiate between primary, secondary, and Big Data sources.
- Describe the various tools and technologies used for effective data collection.
- Analyze the ethical implications of data collection and ensure data quality in a research study.

UNIT - III

DATA ANALYSIS AND REPORTING

Overview of Multivariate analysis - Experimental research, cause-effect relationship, and development of hypotheses- Measurement systems analysis, error propagation, and validity of experiments - Guidelines for writing abstracts, introductions, methodologies, results, and discussions - Writing Research Papers & proposals

Learning Outcomes

- Apply knowledge of multivariate analysis and experimental research to develop hypotheses and analyze data.
- Explain the process of measurement systems analysis and error propagation in experimental design.
- Formulate clear and concise abstracts, introductions, and methodologies for research papers.
- Write effective results and discussion sections based on data analysis.
- Develop comprehensive research papers and proposals based on proper data analysis and reporting guidelines.

UNIT - IV

UNDERSTANDING INTELLECTUAL PROPERTY RIGHTS

Intellectual Property – The concept of IPR, Evolution and development of concept of IPR, IPR development process, Trade secrets, utility Models, IPR & Bio diversity, Role of WIPO and WTO in IPR establishments, Right of Property, Common rules of IPR practices, Types and Features of IPR Agreement, Trademark, Functions of UNESCO in IPR maintenance.

Learning Outcomes

- Recall the fundamental concepts of Intellectual Property (IP) and its evolution.
- Describe the roles of organizations like WIPO and WTO in the establishment of IPR.
- Differentiate between various types of IPR, including trade secrets and trademarks.
- Explain the common rules and features of IPR agreements and the role of UNESCO.
- Analyze the relationship between IPR and biodiversity, and its broader impact.

UNIT - V

PATENTS

Patents – objectives and benefits of patent, Concept, features of patent, Inventive step, Specification - Types of patent application, process E-filling, Examination of patent, Grant of patent, Revocation, Equitable Assignments, Licenses, Licensing of related patents, patent agents, Registration of patent agents

Learning Outcomes

- Explain the objectives, benefits, and key features of a patent, including the concept of an inventive step.
- Differentiate between the various types of patent applications and the e-filing process.
- Describe the process of patent examination, grant, and revocation.

- Identify the roles of patent agents and the process for their registration.
- Analyze the concepts of equitable assignments, licenses, and licensing of related patents.

TEXT BOOKS:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students" Juta & Co Ltd (December 1, 1996)
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction" Juta Academic; 2nd edition (April 28, 2004)

REFERENCES:

1. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners" Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd , 2007.
2. Mayall, "Industrial Design", McGraw Hill, 1992. Niebel , "Product Design", McGraw Hill, 1974.
3. Asimov, "Introduction to Design", Prentice Hall, 1962.
4. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016.
5. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008.

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(25EE2111) AI TECHNIQUES IN ELECTRICAL ENGINEERING (SE)

COURSE OBJECTIVES:

1. *To understand neural network models and learning methods for designing intelligent systems.*
2. *To observe the concepts of feed forward neural networks and about feedback neural networks.*
3. *To understand the principles of fuzzy sets, membership functions, and fuzzy logic for modeling uncertainty in real-world problems*
4. *To apply fuzzy inference systems and defuzzification methods for decision-making and control applications.*
5. *To understand and apply genetic algorithms for solving optimization and engineering problems efficiently.*
6. *To analyze genetic algorithm, genetic operations and genetic mutations*

COURSE OUTCOMES:

1. *Understand feed forward neural networks, feedback neural networks and learning techniques.*
2. *Analyze various neural network paradigms such as MLP, RBF, SOM, Functional Link, and Hopfield networks for solving engineering problems.*
3. *Understand the fundamental concepts of fuzzy logic, fuzzy sets, membership functions, and their operations in handling uncertainty and imprecision.*
4. *Apply fuzzy inference systems and defuzzification methods to design rule-based decision-making.*
5. *Develop genetic algorithm for applications in electrical engineering.*
6. *Analyze & Develop fuzzy logic control for applications in electrical engineering*

UNIT- I

ARTIFICIAL NEURAL NETWORKS: Introduction-Models of Neural 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-Self – organizing Map –Radial Basis Function Network–Functional link network– Hopfield Network.

UNIT- III

FUZZYLOGIC: 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- Crossover- Single–site crossover –Two-point crossover– Multi point crossover-Uniform crossover–Matrix crossover-Crossover 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 – Small Signal Stability (Dynamic stability)- 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, 2nd edition,2017.
2. Sudarshan K. Valluru and T. Nageswara Rao, "introduction to Neural Networks, Fuzzy Logic & Genetic Algorithms", Jaico Publishing House, 1st edition, 2010.

REFERENCES:

1. P.D.Wasserman, VanNostrand Reinhold,"NeuralComputingTheory&Practice",NewYork,1st . Eddition ,1989
2. Bart Kosko,"Neural Network & Fuzzy System", Prentice Hall,1992.
3. G.J.Klir and T.A.Folger, "Fuzzy sets, Uncertainty and Information", Pearson, 1st edition, 2015.
4. D.E.Goldberg, "Genetic Algorithms", Pearson Education India, 1st edition, 2008.

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(25EC4232) ENGLISH FOR RESEARCH PAPER WRITING

(Audit Course-I)

COURSE OBJECTIVES:

1. *To equip students with the fundamentals of academic English for research paper writing.*
2. *To develop students' advanced reading skills for analyzing and evaluating research articles.*
3. *To refine students' grammar and language skills for clarity and precision in research writing.*
4. *To master the skills of revising, editing, and proofreading research papers.*
5. *To familiarize students with the role of technology and AI in research writing, including digital literacy and ethical considerations.*

COURSE OUTCOMES:

1. *Recall the key language aspects and structural elements of academic writing in research papers.*
2. *Explain the importance of clarity, precision, and objectivity in research writing.*
3. *Apply critical reading strategies and advanced grammar skills to analyze and write research papers.*
4. *Evaluate research papers to check for plagiarism, structure, clarity, and language accuracy.*
5. *Evaluate the effectiveness of different language and technology tools in research writing, including AI-assisted tools and plagiarism detection software.*
6. *Develop a well-structured research paper that effectively communicates complex ideas.*

UNIT I

Fundamentals of Academic English

Academic English - MAP (Message-Audience-Purpose) - Language Proficiency for Writing - Key Language Aspects - Clarity and Precision - Objectivity - Formal Tone - Integrating References - Word order - Sentences and Paragraphs - Link Words for Cohesion - Avoiding Redundancy / Repetition - Breaking up long sentences - Structuring Paragraphs - Paraphrasing Skills – Framing Title and Sub-headings

UNIT II

Reading Skills for Researchers

Reading Academic Texts - Critical Reading Strategies - Skimming and Scanning - Primary Research Article vs. Review Article - Reading an Abstract - Analyzing Research Articles - Identifying Arguments - Classifying Methodologies - Evaluating Findings - Making Notes

UNIT III

Grammar Refinement for Research Writing

Advanced Punctuation Usage - Grammar for Clarity - Complex Sentence Structures - Active- Passive Voice - Subject-Verb Agreement - Proper Use of Modifiers - Avoiding Ambiguous Pronoun References - Verb Tense Consistency - Conditional Sentences

UNIT IV

Mastery in Refining Written Content/Editing Skills

Effective Revisions - Restructuring Paragraph - Editing vs Proofreading, Editing for Clarity and Coherence - Rectifying Sentence Structure Issues - Proofreading for Grammatical Precision – Spellings - Tips for Correspondence with Editors - Critical and Creative Phases of Writing

UNIT V

Technology and Language for Research

Digital Literacy and Critical Evaluation of Online Content - Technology and Role of AI in Research Writing – Assistance in Generating Citations and References - Plagiarism and Ethical Considerations – Tools and Awareness – Fair Practices

TEXTBOOKS:

1.Bailey. S. A*cademic Writing: A Handbook for International Students.* London and New York: Routledge,2015.

2.Adrian Wallwork, *English for Writing Research Papers*, Springer New York Dordrecht Heidelberg London, 2011.

REFERENCE BOOKS:

1. Craswell, G. *Writing for Academic Success,* Sage Publications, 2004.
2. Peter Elbow, *Writing With Power, E-book*, Oxford University Press, 2007
3. Oshima, A. & Hogue, A. *Writing Academic English*, Addison-Wesley, New York, 2005
4. Swales, J. & C. Feak, Academic Writing for Graduate Students: Essential Skills
5. and Tasks. Michigan University Press, 2012.
6. 5.Goldbort R.*Writing for Science*, Yale University Press (available on Google Books), 2006
7. Day R.*How to Write and Publish a Scientific Paper*, Cambridge University Press, 2006

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-ge04/
2. https://onlinecourses.swayam2.ac.in/ntr24_ed15/preview

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(25CE1031) DISASTER MANAGEMENT
(Audit Course-I)

COURSE OBJECTIVES:

1. *To enable the students to understand the fundamental concepts of disasters, hazards, their factors, and significance with special reference to India.*
2. *To prepare them to classify and analyze different types of natural and man-made disasters, their causes, magnitude, and impacts.*
3. *To foster them develop understanding of disaster preparedness, monitoring systems, and the role of government, community, and media.*
4. *To equip them in learning risk assessment techniques, disaster risk reduction strategies, and the importance of global and national cooperation.*
5. *To foster their ability to think critically and respond to disasters and design effective mitigation measures (structural and non-structural) with a focus on emerging trends and Indian disaster management programs*.

COURSE OUTCOMES

On successful completion, students will be able to:

1. *Define and distinguish between hazards and disasters, and explain their types, nature, and impacts.*
2. *Identify and map disaster-prone areas in India and understand the epidemiological consequences of disasters.*
3. *Assess the economic, social, and ecological repercussions of major natural and man-made disasters.*
4. *Demonstrate knowledge of disaster preparedness tools such as remote sensing, meteorological data, risk evaluation, and community awareness.*
5. *Apply risk assessment methods and propose disaster risk reduction strategies at local, national, and global levels.*
6. *Formulate and evaluate structural and non-structural disaster mitigation strategies, with emphasis on Indian programs and emerging trends.*

UNIT –I

Introduction

Disaster - Definition, Factors and Significance - Difference Between Hazard and Disaster - Natural and Man-made Disasters - Difference, Nature, Types and Magnitude - Disaster Prone Areas in India - Study of Seismic Zones - Areas Prone to Floods and Droughts, Landslides and Avalanches - Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami - Post-Disaster Diseases and Epidemics.

UNIT - II

Repercussions of Disasters and Hazards

Economic Damage - Loss of Human and Animal Life - Destruction of Ecosystem - Natural Disasters - Earthquakes, Volcanism, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster - Nuclear Reactor Meltdown - Industrial

Accidents - Oil Slick sand Spills - Outbreaks of Disease and Epidemics War and Conflicts

UNIT - III

Disaster Preparedness and Management

Preparedness - Monitoring of Phenomena - Triggering a Disasteror Hazard - Evaluation of Risk-Application of Remote Sensing - Data from Meteorological and Other Agencies - Media Reports- Governmental and Community Preparedness

UNIT - IV

Risk Assessment

Disaster Risk -Concept and Elements, Disaster Risk Reduction - Global and National Disaster Risk Situation -Techniques of Risk Assessment – Global Co-Operation in Risk Assessment and Warning - People's participation in Risk Assessment – Strategies for Survival

UNIT - V

Disaster Mitigation

Meaning, Concept and Strategies of Disaster Mitigation – Emerging Trends in Mitigation - Structural Mitigation and Non- Structural Mitigation - Programs of Disaster Mitigation in India

TEXT BOOKS

1. Gupta, H. K. Disaster Management. Universities Press, 2003
2. Singh, R. B. Natural Hazards and Disaster Management. Rawat Publications, 2006.

REFERENCE BOOKS

1. Coppola, D. P. (2020). Introduction to International Disaster Management (4th ed.). Elsevier.
2. Shaw, R., & Izumi, T. (2022). Science and Technology in Disaster Risk Reduction in Asia. Springer.
3. Wisner, B., Gaillard, J. C., & Kelman, I. (2021). Handbook of Hazards and Disaster Risk Reduction and Management (2nd ed.). Routledge.
4. Saini, V. K. (2021). Disaster Management in India: Policy, Issues and Perspectives. Sage India.
5. Kelman, I. Disaster by Choice: How Our Actions Turn Natural Hazards into Catastrophes, Oxford University Press, 2022
6. Sahni, P. & Dhameja, A. Disaster Mitigation: Experiences and Reflections. Prentice Hall of India, 2004.

Online Resources

1. National Disaster Management Authority (NDMA), India: https://ndma.gov.in – official guidelines, reports, and policy frameworks.
2. United Nations Office for Disaster Risk Reduction (UNDRR): https://www.undrr.org – Sendai Framework, global risk reduction strategies.
3. Global Disaster Alert and Coordination System (GDACS): https://www.gdacs.org – real-time disaster alerts.
4. World Health Organization (WHO) – https://www.who.int/emergencies – disaster-related health guidelines.

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(25CS5831) ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE
(Audit Course-I)

COURSE OBJECTIVES:

The objective of this course is

1. *To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the importance of roots of knowledge system.*
2. *To make them understand the need for protecting traditional knowledge and its significance in the global economy.*
3. *To make them understand the legal frame work and policies related to traditional knowledge protection.*
4. *To enable them to understand the relationship between traditional knowledge and intellectual property rights.*
5. *To make them explore the applications of traditional knowledge in different sectors, such as engineering, medicine, agriculture, and biotechnology*

COURSE OUTCOMES: At the end of the course, students will be able to

1. *Define and explain the concept of traditional knowledge, its nature, characteristics, and scope*
2. *Understand the need for protecting traditional knowledge and its significance in the global economy*
3. *Explain the legal framework and policies related to traditional knowledge protection*
4. *Apply traditional knowledge in different sectors, such as engineering, medicine, agriculture, and biotechnology*
5. *Analyze the importance of traditional knowledge in various contexts, including its historical impact and social change*
6. *Analyze the relationship between traditional knowledge and intellectual property rights, including patents and non-IPR mechanisms*

UNIT-I: Introduction to traditional knowledge - Definition, Nature and characteristics, scope and importance - Kinds of traditional knowledge - Physical and social contexts in which traditional knowledge develop - Historical impact of social change on traditional knowledge systems - Indigenous Knowledge (IK) – Characteristics - traditional knowledge vis-à-vis indigenous knowledge -Traditional knowledge Vs western knowledge, traditional knowledge vis-à-vis formal knowledge

LEARNING OUTCOMES:

At the end of the unit the student will able to:

- Understand the concept of traditional knowledge.
- Contrast and compare characteristics, importance& kinds of traditional knowledge.
- Analyze physical and social contexts of traditional knowledge.
- Evaluate social change on traditional knowledge.

UNIT-II: Protection of traditional knowledge- Need for protecting traditional knowledge - Significance of TK Protection - Value of TK in global economy - Role of Government to harness TK.

LEARNING OUTCOMES:

At the end of the unit the student will able to:

- Know the need of protecting traditional knowledge.
- Apply significance of TK protection.
- Analyze the value of TK in global economy.
- Evaluate role of government
-

UNIT-III: Legal frame work and TK - A)The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 - Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act) – B)The Biological Diversity Act 2002 and Rules 2004 - the protection of traditional knowledge bill, 2016 - Geographical Indicators Act 2003.

LEARNING OUTCOMES:

At the end of the unit the student will able to:

- Understand legal frame work of TK.
- Contrast and compare the ST and other traditional forest dwellers
- Analyze plant variant protections
- Understand the rights of farmers forest dwellers

UNIT-IV: Traditional knowledge and Intellectual property - Systems of traditional knowledge protection - Legal concepts for the protection of traditional knowledge - Certain non-IPR mechanisms of traditional knowledge protection - Patents and traditional knowledge - Strategies to increase protection of traditional knowledge -Global legal FORA for increasing protection of Indian Traditional Knowledge.

LEARNING OUTCOMES:

At the end of the unit the student will able to:

- Understand TK and IPR
- Apply systems of TK protection.
- Analyze legal concepts for the protection of TK.
- Evaluate strategies to increase the protection of TK.

UNIT-V: Traditional knowledge in different sectors - Traditional knowledge and Engineering - Traditional medicine system - TK and Biotechnology - TK in Agriculture - Traditional societies depend on it for their food and healthcare needs - Importance of conservation and sustainable development of environment - Management of biodiversity, Food security of the country and protection of TK

LEARNING OUTCOMES:

At the end of the unit the student will be able to:

- Know TK in different sectors.
- Apply TK in Engineering.

- Analyze TK in various sectors.
- Evaluate food security and protection of TK in the country.

PRESCRIBED BOOKS:

1. Mahadevan, B., Bhat Vinayak Rajat, Nagendra Pavana R.N. *Introduction to Indian Knowledge System: Concepts and Applications*, PHI Learning Pvt.Ltd. Delhi, 2022.
2.Basanta Kumar Mohanta and Vipin Kumar Singh,*Traditional Knowledge System and Technology in India*, PratibhaPrakashan 2012.

REFERENCE BOOKS

1. Pride of India: A Glimpse into India's Scientific Heritage, Samskrita Bharati, New Delhi.
2. Kak, S.C. "On Astronomy in Ancient India", Indian Journal of History of Science, 22(3), 1987
3. Subbarayappa, B.V. and Sarma, K.V. *Indian Astronomy: A Source Book*, Nehru Centre, Mumbai, 1985.
4. Bag, A.K. *History of Technology in India*, Vol. I, Indian National Science Academy, New Delhi, 1997.
5. Acarya, P.K. *Indian Architecture*, Munshiram Manoharlal Publishers, New Delhi, 1996.
6. Banerjea, P. *Public Administration in Ancient India*, Macmillan, London, 1961.
7. Kapoor Kapil, Singh Avadhesh,*Indian Knowledge Systems Vol – I & II*, Indian Institute of Advanced Study, Shimla, H.P., 2022

E-Resources:

1.https://www.youtube.com/watch?v=LZP1StpYEPM 2.http://nptel.ac.in/courses/121106003/

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I M. Tech. – II Sem.

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(25EE2112) ADVANCED POWER ELECTRONICS

COURSE OBJECTIVES

To make the student

1. *Remember and Understand the construction, operation and characteristics of various power semiconductor devices and to analyze the cause of voltage unbalance and necessary actions for equalization of GCTs and IGBTs.*
2. *Analyze the construction and working principle of various types of resonant pulse inverters, resonant converters and multi inverters.*
3. *Analyze the various pulse modulations and advanced modulations techniques available.*
4. *Apply the above concepts to choose appropriate device for a particular converter topology.*

COURSE OUTCOMES (COs)

On successful completion of this course, students will be able to

1. *Understand the characteristics of various power semiconductor devices.*
2. *Analyze the operation of various types of resonant pulse inverters, resonant converters and multi inverters.*
3. *Analyze various pulse modulation and advanced modulation techniques available.*
4. *Apply the above concepts to choose appropriate device for particular topology.*

UNIT I
HIGH-POWER SEMICONDUCTOR DEVICES

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

UNIT II
RESONANT PULSE INVERTERS

Resonant pulse inverters–Series resonant inverters-Series resonant inverters with unidirectional and bidirectional switches-Analysis of half bride resonant inverter-Evaluation of currents and Voltages of a simple resonant inverter–Analysis of half bridge and full bridge resonant inverter with bidirectional switches– Frequency response of series resonant inverter for series loaded inverter and parallel resonant inverters– Voltage control of resonant inverters- Class-E resonant inverter–Class-E resonant rectifier-
Evaluation of values of C and L for class E inverter and Class E rectifier – Numerical problems.

UNIT III
RESONANT CONVERTERS

Resonant converters- Zero current switching resonant converters – L type - M type– Zero voltage Switching resonant converters – comparison between ZCS and ZVS resonant converters- Two quadrant ZVS resonant converters – Resonant dclink inverters- Evaluation of L and C for zero current switching inverter – Numerical problems.

UNIT IV
MODULATION TECHNIQUES

Sinusoidal PWM –Modulation Scheme –Harmonic Content –Over modulation– Third Harmonic Injection PWM–Space Vector Modulation–Switching States–Space Vectors–Dwell Time Calculation–Modulation Index – Switching Sequence– Spectrum Analysis –Even-Order Harmonic Elimination –Discontinuous Space

Vector Modulation– H-Bridge Inverter– Bipolar Pulse Width Modulation – Uni polar Pulse Width Modulation.

UNIT V

MULTILEVEL INVERTERS

Multilevel Inverter Topologies–CHB Inverter with Equal DC Voltage–H-Bridges with Unequal DC Voltages - Carrier Based PWM Schemes – Phase-Shifted Multicarrier Modulation–Level-Shifted Multicarrier Modulation– Comparison Between Phase and Level Shifted PWM Schemes –Staircase Modulation –Diode Clamped Multilevel Inverters – Three Level Inverter – Converter Configuration – Switching State – Commutation–Space Vector Modulation – Stationary Space Vectors–Dwell Time Calculation–Relationship Between V_{ref} Location and Dwell Times – Switching Sequence Design – Inverter Output Wave forms and Harmonic Content– Even-Order Harmonic Elimination

TEXT BOOKS:

1. Mohammed H.Rashid, ―Power Electronics‖, Pearson Education, 4th edition, 2017.
2. NedMohan, Tore M.Undel and and William P.Robbind, ―Power Electronics‖, John wiley &Sons, 3rd edition, 2007.

REFERENCE BOOKS:

1. Daniel W. Hart, ―Power Electronics‖ , McGrawHill Publications,1st edition, 2010.
2. V.R.Moorthi,―Power Electronics Devices, Circuits and Industrial applications‖, Oxford University Press,2005.
3. Dr.P.S.Bimbhra, ―Power Electronics‖, Khanna Pubishers,2006.
4. PhilipT.Krein, ―Elements of Power Electronics‖, Oxford University Press,2nd edition, 2014.
5. Bin Wu, ―High-Power Converters and AC Drives‖, IEEE Press A john Wiley &Sons, 2nd edition, 2017

ONLINE LEARNING RESOURCES:

1. **https://nptel.ac.in/courses/108107128**
2. https://onlinecourses.nptel.ac.in/noc20_ee28/preview

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(25EE2113) FACTS CONTROLLERS

COURSE OBJECTIVES

To make the student

1. *To understand the fundamentals of FACTS Controllers, Importance of controllable parameters and types of FACTS controllers & their benefits.*
2. *To explain control of STATCOM and SVC and their comparison and the regulation of STATCOM.*
3. *To remember the objectives of Shunt and Series compensation.*
4. *To analyze the functioning and control of GCSC, TSSC and TCSC.*

COURSE OUTCOMES (COs)

On successful completion of this course, students will be able to

1. *Understand various control techniques for the purpose of identifying the scope and for selection of specific FACTS controllers.*
2. *Remember different types of controllable VAR generation and variable impedance techniques.*
3. *Design simple converters using FACTS controllers.*
4. *Understand the operation of Unified Power Controller and Hybrid Arrangements.*

UNIT I
FACTS CONCEPTS, VSI AND CSI

Transmission interconnections power flow in an AC system, loading capability limits, Dynamic stability considerations, importance of controllable parameters basic types of FACTS controllers, benefits from FACTS controllers. Single phase three phase full wave bridge converters transformer connections for 12 pulse, 24 and 48 pulse operation. Three level voltage source converter, pulse width modulation converter, basic concept of current source converters, and comparison of current source converters with voltage source converters.

UNIT II
SHUNT COMPENSATION

Objectives of shunt compensation - Methods of controllable var generation - Variable impedance type static var generators - switching converter type var generators - hybrid var generators – Comparison of SVC and STATCOM.

UNIT III
SERIES COMPENSATION

Objectives of series compensation – GTO Thyristor Controlled Series Capacitor (GCSC) - Thyristor Switched Series Capacitor (TSSC) - Thyristor Controlled Series Capacitor (TCSC) - Control schemes for TCSC, TSSC and TCSC.

UNIT IV
UNIFIED POWER FLOW CONTROLLER (UPFC) & INTERLINE POWER FLOW CONTROLLER (IPFC)

Introduction - The Unified Power Flow Controller - Basic Operating Principles - Conventional Transmission Control Capabilities - Independent Real and Reactive Power Flow Control - Control Structure - Basic Control System for P and Q Control - Hybrid Arrangements: UPFC With a Phase Shifting Transformer. Introduction, basic operating principle and characteristics of IPFC, control structure, practical and application considerations, generalized and multifunctional fact controllers.

UNIT V
SPECIAL FACTS DEVICES

TCPAR: Thyristor controlled phase angle regulator, NGH sub-synchronous reactance damper, TCBR: thyristor controlled breaking resistor, D-STATCOM: Distribution STATCOM, UPQC: Unified power quality controller.

TEXT BOOKS:

1. Understanding FACTS – Concepts and technology of Flexible AC Transmission systems, Narain G. Hingorani, Laszlo Gyugyi, IEEE Press, WILEY, 1st Edition, 2000, Reprint 2015.
2. FACTS Controllers in Power Transmission and Distribution, Padiyar K.R., New Age International Publishers, 1st Edition, 2007.

REFERENCE BOOKS:

1. Flexible AC Transmission Systems: Modelling and Control, Xiao – Ping Zhang, Christian Rehtanz, Bikash Pal, Springer, 2012, First Indian Reprint, 2015.
2. FACTS – Modelling and Simulation in Power Networks, Enrigue Acha, Claudio R. Fuerte – Esquival, Huge Ambriz – perez, Cesar Angeles – Camacho, WILEY, 1st edition, 2004

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108107114
2. http://www.digimat.in/nptel/courses/video/108107114/L02.html

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(25EE2114) AC DRIVES
(PE-III)

COURSE OBJECTIVES

To make the student

1. *Remember and understand the working principle and control of various AC and Special purpose motor Drives.*
2. *Analyze the control strategies for VSI fed sensor-less induction motor drives, CSI fed induction motor drives, and VSI fed poly– phase induction motors.*
3. *Analyze and apply control schemes for PMSM, BLDC and Switched Reluctance Motor drives.*
4. *Design high performance induction motor drives using the principles of Scalar control and develop vector control, direct torque control and introduction of five phase induction motor drive.*

COURSE OUTCOMES (COs)

Student will be able to

1. *Understand the working principle and operation of AC and Special purpose motor Drives.*
2. *Formulate the control strategies for VSI fed sensor-less induction motor drives, CSI fed induction motor drives, and VSI fed poly– phase induction motors.*
3. *Implement control schemes for PMSM, BLDC and Switched Reluctance Motor drives.*
4. *Analyze high performance induction motor drives using the principles of Scalar control and develop vector control, direct torque control and introduction of five phase induction motor drive.*

UNIT I
INDUCTION MOTOR DRIVES

Control of Induction Motor Drive - Scalar control of induction motor-Principle of vector control and field orientation Sensor less control and flux observers - Direct torque and flux control of induction motor Multilevel converter-fed induction motor drive - Utility friendly induction motor drive Implementation of V/f control with slip compensation scheme, Review of dq0 model of 3 – Phase IM with simulation studies.

UNIT II
CONTROL TECHNIQUES OF IM DRIVES

Direct vector control -Indirect vector control with feedback- Indirect vector control with feed–forward-Indirect vector control in various frames of reference -Decoupling of vector control with feed forward compensation - sensor less control of IM, Direct Torque Control of IM - Speed control of wound induction motor with rotor side control - introduction to five phase induction motor drives.

UNIT III
SYNCHRONOUS MOTOR DRIVES

Control of Synchronous Motor - Self controlled synchronous motor – Vector control of synchronous motor - Cycloconverter fed synchronous motor drive -Control of synchronous reluctance motor.

UNIT IV
PERMANENT MAGNET MOTOR DRIVES

PM Synchronous motors: Types – Construction - operating principle-Expression for torque - Model of PMSM - Implementation of vector control for PMSM - BLDC drives- PMDC motor drives.

UNIT V

SRM DRIVE & ITS CONTROLLER

Construction - Operating Principle -Torque expression-SRM configuration and its controller design – converter topologies – control strategies – Sensor less control. Principles of fuzzy logic control and neural network– Design methodology and block diagram implementation of DC drive and vector controlled induction motor. Recent trends in fuzzy control of electrical drives. MATLAB simulation – Fuzzy logic speed control of three phase induction motor drive –Adaptive speed control for induction motor drives using neural network.

TEXT BOOKS:

1. Modern Power Electronics & AC Drives – B.K. Bose, Pearson, Second edition,2005.
2. R.Krishnan, ―Electric Motor Drives: Modelling, Analysis and Control‖, Pearson, 1st edition,2015.

REFERENCE BOOKS:

1. Bin-Wu, ―High– Power Converters and AC Drives‖, IEEEPress, John Wiley &Sons, 2nd edition, 2017
2. M.B.Patil, V.Ramanarayanan, V.T. Ranganathan, ―Simulation of Power Electronic Circuits‖, Narosa Publications, 2009, Reprint 2013.
3. Relevant Papers from journals.
4. P.C. Krause,O. Wasynczuk,S. D. Sudhoff and Steven D. Pekarek, ―Analysis of Electric Machinery‖, Wiley, IEEE Press, 3rd edition, 2013.
5. P. S. Bhimbra, ―Generalized Theory of Electric Machines‖, Khanna Publication, 7th edition, 2021.
6. Ion Boldea , Syed A. Nasar ―Electric Drives 3rd Edition, Kindle Edition‖ 3rd Edition,2016.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108104011
2. https://nptel.ac.in/courses/108104140

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(25EE2115) ADVANCED POWER SEMICONDUCTOR DEVICES & PROTECTION
(PE-III)

COURSE OBJECTIVES

To make the student

1. *Remember and Understand the construction, operation, characteristics and safe operating regions of various power semiconductor devices such as BJT, MOSFET, GTO and IGBT.*
2. *Apply the basics of above to understand the various types of emerging power semi conductor devices such as power JFET and MOS controlled thyristor.*
3. *Analyze the concept of Electro Magnetic Interference, Noise, their sources and effect of them on electronic equipment.*
4. *Design protection devices and circuits like heat sinks, voltage and current protection circuits.*

COURSE OUTCOMES (COs)

Student will be able to

1. *To understand the characteristics of various power semiconductor devices such as BJT, MOSFET, GTO and IGBT.*
2. *Apply the basics to understand the various types of emerging power semiconductor devices.*
3. *To analyze the concept of Electro Magnetic Interference, Noise, their sources and effect of them on electronic equipment.*
4. *To design protection devices and circuits like heat sinks, voltage and current protection circuits.*

UNIT I
BJTS & POWER MOSFET

Introduction- Vertical power transistor structures- I-V characteristics- Operation – Switching characteristics- Break down voltages-Second break down- ON state losses- Safe Operation Areas- Design of drive circuits for BJTs- Snubber circuits for BJTs and Darling tons. Power MOSFETs -Introduction-Basic structures- I-V characteristics- Physics of device operation- Switching Characteristics-Operation limitations – Safe Operating Areas- Design of gate drive circuits-Snubber circuits.

UNIT II
GTO & IGBT

Introduction- Basic structures- I-V characteristics- Physics of device operation-GTO switching characteristics- Snubber circuits- Over protection of GTOs. Insulated Gate Bipolar Transistors - Introduction- Basic structures- I-V characteristics-Physics of device operation- Latch in IGBT switching characteristics-Device limits and Safe Operating Areas- Snubber circuits.

UNIT III
EMERGING DEVICES AND CIRCUITS

Introduction-Power junction field effect transistors- Field Controlled Thyristor- JFET based devices versus other power devices- MOS controlled Thyristors- High voltage integrated circuits- New Semi- conductor materials- Introduction to Gallium Nitride and Silicon Carbide Devices.

UNIT IV
PASSIVE COMPONENTS AND ELECTROMAGNETIC COMPATIBILITY

Introduction- Design of inductor- Transformer design- Selection of capacitors and resistors-Current Measurements-Heatsinking circuit layout– Electromagnetic Interference(EMI)- Sources of

EMI Electromagnetic Interference in Power Electronic Equipment.

UNIT V

NOISE & PROTECTION DEVICES

Noise sources in SMPS- Diode Storage Charge Noise- Noise generated due to switching-Common noises sources in SMPS- Noises Due to High frequency transformer- Measurement of Noise- Minimizing EMI-EMI shielding- EMI standards. Protection of Devices& Circuits - Cooling & Heat sinks – Thermal modeling of power switching devices- Snubber circuits – Reverse recovery transients – Supply and load side transients – Voltage protections– Current protections.

TEXT BOOKS:

1. M.H.Rashid, —Power Electronics Circuits, Devices and Applications‖ Pearson Education, 4th edition, 2017.
2. Mohanand Undel and, —Power Electronics Converters, Applications and Design‖, JohnWiley &Sons,3rd edition, 2007.
3. B.W.Williams,—Power Electronics Circuit Devices, Drivers and Applications and passive components‖, MC Graw hill higher education, 2nd edition, 1992.

REFERENCE BOOKS:

1. Vithayathil, —Power Electronics Circuits‖, MC Graw Hill Education, Indian edition, 2017.
2. W.C. Lander, —Power Electronics Circuits‖, Tata MCGraw Hill,3rdEdition, 1995.
3. Loganathan Umanand, —Power Electronics: Essentials and Applications‖, Wiley IndiaPvt. Ltd,2009.

ONLINE LEARNING RESOURCES:

1. http://nptelonlinecourses.iitm.ac.in/courses/108104011/

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(25EE2116) APPLICATIONS OF POWER CONVERTERS
(PE-III)

COURSE OBJECTIVES

To make the student

1. *Understand the power electronic application requirements.*
2. *Remember the various power converters used in different applications for high and low voltage power supplies.*
3. *Analyze the various power supplies used in modern microprocessor and computer loads.*
4. *Apply the above concepts to design a bi-directional DC-DC converters for charge/discharge applications.*

COURSE OUTCOMES (COs)

Student will be able to

1. *To understand the power electronic application requirements.*
2. *To identify the suitable power converter from the available configurations.*
3. *To develop the improved power converters for any stringent application requirements.*
4. *To design a bi-directional DC-DC converters for charge/discharge applications.*

UNIT I
INVERTERS FOR INDUCTION HEATING

For induction cooking – high frequency inverters for induction heating - Induction hardening – Melting – Electric welding control – Welding applications.

UNIT II
POWER CONVERTERS FOR LIGHTING, PUMPING AND REFRIGERATION SYSTEMS

Electronic ballast - LED power drivers for indoor and outdoor applications - PFC based grid fed LED drivers - PV/ battery fed LED drivers –PV fed power supplies for pumping/refrigeration -Applications.

UNIT III
HIGH VOLTAGE POWER SUPPLIES

Power supplies for X-ray applications - Power supplies for radar applications-Power supplies for space applications.

UNIT IV
LOW VOLTAGE HIGH CURRENT POWER SUPPLIES

Power converters for modern microprocessor and computer load.

UNIT V
BI-DIRECTIONAL DC-DC (BDC) CONVERTERS

Electric traction - Automotive Electronics and charge/discharge applications -Line Conditioners and Solar Charge Controllers.

TEXT BOOKS:

1. Ali Emadi, A. Nasiri and S. B. Bekiarov, ―Uninterruptible Power Supplies and Active Filters‖,CRC

Press, 1st edition, 2005.
2. M. Ehsani,Y. Gao, E. G. Sebastien and A. Emadi, —Modern Electric, Hybrid Electric and Fuel Cell Vehicles‖, Standards media, 2ndEdition,2009.

REFERENCE BOOKS:

1. William Ribbens, —Understanding Automotive Electronics‖, BH, 8th edition, 2003.
2. N. Mohan, T.M. Undeland and W.P. Robbins, —Power Electronics Converters, Applications and design‖, John Wiley and Sons, 3rd edition, 2007
3. M. H. Rashid, —Power Electronics Circuits , Devices and Applications‖, Pearson publications, 3rd Edition, 2004

ONLINE LEARNING RESOURCES:

1. https://www.researchgate.net/publication/379065707
2. https://www.researchgate.net/publication/261652332
3. https://www.iqsdirectory.com/articles/power-supply/high-voltage-power-supplies.html
4. https://ieeexplore.ieee.org/document/975371
5. https://onlinelibrary.wiley.com/doi/full/10.1155/jece/9876615

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(25EE2117) POWER QUALITY
(PE- IV)

COURSE OBJECTIVES

To make the student

1. *To understand power quality definition, power quality standards.*
2. *To remember measuring & solving power quality problems.*
3. *To apply the various types of linear and nonlinear loads.*
4. *To analyse harmonic methodology, mitigation techniques and case study.*

COURSE OUTCOMES (COs)

Student will be able to

1. *Understand different techniques of measuring & solving power quality problems Understand the fundamentals & terminology of power quality.*
2. *Apply the concept of power frequency disturbances, types of transients & transient waveforms.*
3. *Analyze the harmonic methodology & Electromagnetic Interference concepts.*
4. *Remember the necessity of grounding and methods of grounding.*

UNIT I
INTRODUCTION TO POWER QUALITY

Definition of Power Quality - Power Quality Progression - Power Quality Terminology - Power Quality Issues– Voltage swells, sags, flicker, Responsibilities of Power Suppliers and Users-Power Quality Standards.

UNIT II
POWER FREQUENCY DISTURBANCE & TRANSIENTS

Introduction to Power Frequency Disturbance - Common Power Frequency Disturbances – Characteristics of Low Frequency Disturbances - Voltage Tolerance Criteria- ITIC Graph - Introduction to Transients -Transient System Model - Examples of Transient Models and their Response - Power System Transient Modeling – Types and Causes of Transients -Examples of Transient Waveforms.

UNIT III
HARMONICS & ELECTROMAGNETIC INTERFERENCE (EMI)

Definition of Harmonics - Harmonic Number (h) - Odd and Even Order Harmonics - Harmonic Phase Rotation and Phase Angle - Voltage and Current Harmonics - Individual and Total Harmonic Distortion - Harmonic Signatures - Effect of Harmonics On Power System Devices - Guidelines For Harmonic Voltage and Current Limitation - Harmonic Current Mitigation - Introduction to EMI - Frequency Classification – Electrical Fields- Magnetic Fields-EMI Terminology-Power Frequency Fields-High Frequency Interference-EMI Susceptibility- EMI Mitigation-Cable Shielding-Health Concerns of EMI.

UNIT IV
GROUNDING AND BONDING

Introduction to Grounding and Bonding-Shock and Fire Hazards-NEC Grounding Requirements-Essentials of a Grounded System-Ground Electrodes-Earth Resistance Tests-Earth Ground Grid Systems-Power Ground System-Signal Reference Ground (SRG)-SRG Methods-Single and Multipoint Grounding –Ground Loops – Electro Chemical Reaction -Examples of Grounding Anomalies.

UNIT V

MEASURING AND SOLVING POWER QUALITY PROBLEMS

Introduction to Power Quality Measurements-Power Quality Measurement Devices-Power Quality Measurements Test Locations-Test Duration-Instrument Setup- Instrument Guidelines – Power quality mitigating concepts and devices.

TEXT BOOKS:

1. Power quality by C. Sankaran, CRC Press, 1st Edition, 2001
2. Electrical Power Systems Quality, Roger C. Dugan, Mark F. Mc Granaghan, Surya Santoso, H.
3. Wayne Beaty, 2nd Edition, TMH Education Pvt. Ltd, 1996.

REFERENCE BOOKS:

1. Understanding Power quality problems by Math H. J.Bollen IEEE Press, 1st edition, 2000.
2. Power quality enhancement using custom power devices by Arindam, Ghosh, Gerard Ledwich, Kluwer, Academic publishers, 1st edition, 2002.

ONLINE LEARNING RESOURCES

1. **https://nptel.ac.in/courses/108106025**
2. https://onlinecourses.nptel.ac.in/noc21_ee103/preview

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(25EE2118) EV CHARGING INFRASTRUCTURE & TECHNOLOGY
(PE- IV)

COURSE OBJECTIVES

To make the student

1. *Understand the fundamentals of EV charging infrastructure, including charging technologies, standards, and power ratings.*
2. *Learn the principles of location planning and spatial allocation for effective establishment of EV charging stations within urban areas.*
3. *Gain knowledge of electricity supply and regulatory frameworks, along with the role of DISCOMs in supporting EV charging infrastructure.*
4. *Evaluate models of EV-grid integration and implementation strategies, including smart charging approaches and deployment models in India.*

COURSE OUTCOMES (COs)

Student will be able to

1. *Differentiate AC and DC charging systems and explain their technical standards and requirements.*
2. *Apply location planning methodologies to identify suitable sites for EV charging infrastructure considering demand and urban planning principles.*
3. *Analyze the impact of EV charging on the electricity grid and propose strategies for effective EV-grid integration using smart charging concepts.*
4. *Compare different implementation models of EV charging infrastructure in India and recommend suitable approaches for real-world deployment.*

UNIT I
AN OVERVIEW OF EV CHARGING INFRASTRUCTURE

Orientation to EV charging infrastructure, brief introduction to technical concepts of electric vehicle supply equipment, AC and DC charging, power ratings, and charging standards.

UNIT II
LOCATION PLANNING AND LAND ALLOCATION

The location and site planning aspects for EV charging, framing the principles of location planning and demonstrating a methodology for spatial allocation of charging demand, identifying enabling processes and policies to integrate public charging in urban planning.

UNIT III
CONNECTING EVs TO THE ELECTRICITY GRID

Supply of electricity for charging infrastructure, familiarizing with the regulations that govern electricity supply for EV charging, the role of DISCOMs in provision of EV charging connections and the three methods of arranging for power supply for charging infrastructure.

UNIT IV
ACHIEVING EFFECTIVE EV-GRID INTEGRATION

Site-level considerations for supply of electricity to assess grid-level impacts, highlighting the need for smart charging to minimize adverse impacts of EV charging loads on the grid.

UNIT V
MODELS OF EV CHARGING IMPLEMENTATION

Typical roles within an implementation model for EV charging infrastructure and identifying three models in India – the government-driven model, the consumer-driven model and the charge point operator-driven model – for charging infrastructure implementation.

TEXT BOOKS:

1. Sulabh Sachan, P. Sanjeevikumar, Sanchari Deb, ―Smart Charging Solutions for Hybrid and Electric Vehicles‖, Wiley Publications, March 2022.
2. Handbook of Electric Vehicle Charging Infrastructure Implementation Version-1

REFERENCE BOOKS:

1. Vahid Vahidinasab, Behnam Mohammadi-Ivatloo, ―Electric Vehicle Integration via Smart Charging, Springer, 2022.
2. Alam, Mohammad Saad, Pillai, Reji Kumar, Murugesan, N, ―Developing Charging Infrastructure and Technologies for Electric Vehicles‖, IGI Global Publisher, December 2021.

ONLINE LEARNING RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc25_ee134/preview

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(25EC4231) DIGITAL SIGNAL PROCESSORS AND APPLICATIONS
(PE-IV)

COURSE OBJECTIVES

To make the student

1. *Identify and describe the basic and advanced concepts of various DSP Processors.*
2. *To use the basic and advanced concepts in order to develop various programmable based DSP applications.*
3. *To explain the operation and performance of DSP based designs.*
4. *To create DSP based controllers and processors for various simulation /real time based applications.*

COURSE OUTCOMES (COs)

Student will be able to

1. *Understand the basic and advanced concepts of different DSP Processors.*
2. *Apply the basic and advanced concepts in order to develop various programmable based DSP applications.*
3. *Analyze the operation and performance of DSP based designs for various real time issues.*
4. *Design / create DSP based controllers and processors for various simulation /real time based applications.*

UNIT I
DSP CONTROLLER TMSLF2407

Introduction to the TMSLF2407 DSP Controller- Brief Introduction to Peripherals - Types of Physical Memory-Software Tools. C2XX DSP CPU and instruction set- Introduction to the C2XX DSP Core and Code Generation – The Components of the C2XX DSP Core - Mapping External Devices to the C2XX Core and the Peripheral Interface -System Configuration Registers –Memory -Memory Addressing Modes -Assembly Programming Using the C2XX DSP Instruction Set.

UNIT II
DATA TRANSFER AND COMMUNICATION

The location and site planning aspects for EV charging, framing the principles of location planning and demonstrating a methodology for spatial allocation of charging demand, identifying enabling processes and policies to integrate public charging in urban planning.

UNIT III
DSP CONTROLLER TMS320LF24

Parallel and Serial Data Transfer- Pin Multiplexing (MUX) and General Purpose I/O Overview-Multiplexing and General Purpose I/O Control Registers - Using the General Purpose I/O Ports, Serial Communication.

UNIT IV
DSP CONTROLLER TMS320LF24

Event Managers (EVA, EVB)- Overview of the Event Manager (EV) - Event Manager Interrupts – General Purpose (GP) Timers- Compare Units - Capture Units and Quadrature Encoded Pulse (QEP) Circuitry – General Event Manager Information-PWM Signal Generation with Event Managers and interrupts, Measurement of speed with Capture Units, Implementation of Space Vector Modulation with DSPTMSLF2407A.

UNIT V

FIELD PROGRAMMABLE GATE ARRAY

Field Programmable Gate Arrays- Introduction to Field Programmable Gate Arrays – CPLD Vs FPGA – Types of FPGA, Configurable logic Blocks (CLB), Input/output Block (IOB) –Programmable Interconnect Point (PIP)- HDL programming –Overview of Spartan 6 & ISE Design Suite, Implementation of PWM technique with SPARTAN-6 FPGA.

TEXT BOOKS:

1. HamidA.Tolyat,—DSP based Electromechanical Motion Control‖, CRCpress,1st edition, 2004.
2. Wayne Wolf, —FPGAbasedsystemdesign‖,Prenticehall,1st edition, 2004.

REFERENCE BOOKS:

1. Application Notes from the website of Texas Instruments
2. Spartan-6FPGA Configurable Logic Block,2010
3. Xilinx Spartan 6 Datasheets

ONLINE LEARNING RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc24_ee16/preview
2. https://nptel.ac.in/courses/117102060

R25 M.Tech -PE

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I M. Tech. – II Sem.

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(25EE2119) ELECTRIC DRIVES LAB

COURSE OBJECTIVES

To make the student

1. *Understand and analyze torque speed characteristics of DC motors, 3 phase Induction Motor and PMSM with various converters connected.*
2. *Apply and analyze various modulation techniques on different drives.*
3. *Analyze performance of Induction Motors when different converters are connected.*
4. *Analyze various types of drives when v/f control method are applied.*

COURSE OUTCOMES (COs)

Student will be able to

1. *To get practical training and hand on for the hardware and software application used in electric drives.*
2. *To understand the practical problems and limitations of the methods used in electric drives.*
3. *Apply and analyze various modulation techniques on different motor drives.*
4. *Analyze performance of Induction Motors when different converters are connected.*

List of Experiments:

1. Torque-Speed characteristics of DC motor using DC chopper
2. Symmetrical angle control of 1-phase AC motor connected to AC voltage controller
3. Single-Phase dual converter connected separately excited DC motor drive
4. Speed control of 3-phase induction motor using open-loop V/f control technique
5. Torque-Speed characteristics of a 3-phase induction motor using IM comprehensive drive system
6. Study of a Neutral Point Clamped in verterfed three-phase induction motor drive
7. Pulse width modulation control of1-phase AC motor connected to AC voltage controller
8. Torque-Speedcharacteristicsofa3-phasePermanent Magnet Synchronous Motor(PMSM) using PMSM- IM comprehensive drive system
9. Torque-speed characteristics of a Separately Excited DC motor Drive fed by a two-pulse centre- tapped thyristor rectifier.
10. Torque-speed characteristics of a 6-pulse fully controlled rectifier fed Separately Excited DC motor drive
11. Study of a four-quadrant Separately excited DC motor drive fed by dual-converter with circulating current control
12. Study Class-D commutated chopper fed Separately Excited DC motor drive
13. Verification of spectral performance of a 3-PhVSI with V/Hz control of 3-Ph IM drives
14. Torque speed characteristics of a 3-Phinduction motor fed by ad3-PhVSI
15. Implementation of centre spaced space vector modulation with DSP for V/Hz control of induction motor drives
16. Implementation of discontinuous space vector modulation with DSP for V/Hz control of induction motor drives

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(25EE2120) FACTS DEVICES & SIMULATION LAB

COURSE OBJECTIVES

To make the student

1. Understand how to write the coding in simulation..
2. Apply the SVC, STATCOM for voltage profile improvements & UPFC in power system networks.
3. Analyze the data related to load flows incorporating SVC & STATCOM.
4. Analyze operation of TCSC, STATCOM & SSSC for a transmission line fed by an ac supply.

COURSE OUTCOMES (COs)

Student will be able to

1. *Understand Load balancing using compensators.*
2. *Apply load balancing using Compensators.*
3. *Analyse load flow incorporating SVC & STATCOM.*
4. *Develop a Simulation model for STATCOM & UPFC.*

List of Experiments:

1. Voltage regulation using shunt and series compensation
2. Load balancing in power system network using compensators
3. Simulation of TCSC
4. Voltage profile improvement using SVC
5. Voltage profile improvement using STATCOM
6. Transient Stability enhancement using STATCOM.
7. Simulation of UPFC with mathematical models
8. Load flow incorporating SVC
9. Load flow incorporating STATCOM
10. Simulation of DVR
11. Transmission Line Characteristics (P vs δ, Q vs δ, P vs Distance, Q vs Distance and V vs Distance) with and without Compensation
12. Sizing- simulation and operation of TCR and FC-TCR for a transmission line fed by an ac supply and feeding
    (a) Resistive/inductive/capacitive load one at a time
    (b) A load which can have leading as well as lagging behavior
13. Sizing- simulation and operation of TCSC for a transmission line fed by an ac supply and feeding
    (a) Resistive/inductive/capacitive load one at a time
    (b) A load which can have leading as well as lagging behavior
14. Sizing- simulation and operation of STATCOM for a transmission line fed by an ac supply and feeding
    (a) Resistive/inductive/capacitive load one at a time
    (b) A load which can have leading as well as lagging behavior
15. Sizing- simulation and operation of SSSC for a transmission line fed by an ac supply and feeding
    (a) Resistive/inductive/capacitive load one at a time
    (b) A load which can have leading as well as lagging behavior

Web Sources: https://www.vlab.co.in

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(25CS5822) QUANTUM TECHNOLOGIES AND APPLICATIONS

COURSE OBJECTIVES

1. *Present core quantum principles such as superposition and entanglement without mathematical formalism.*
2. *Develop conceptual clarity on qubits, quantum states, and information frameworks.*
3. *Examine the theoretical challenges in realizing scalable quantum systems.*
4. *Introduce foundational ideas in quantum communication and computing.*
5. *Highlight applications, industrial adoption, and future research directions in quantum technologies.*

COURSE OUTCOMES (COs)

Upon completion, the learner will be able to:

1. *Explain fundamental quantum concepts conceptually.*
2. *Distinguish classical information systems from quantum information frameworks. Identify the principal theoretical limitations in building quantum computers.*
3. *Describe the conceptual basis of quantum communication and computation.*
4. *Discuss current applications, technological trajectories, and career opportunities in the quantum domain.*

UNIT I
FOUNDATIONS OF QUANTUM THEORY AND TECHNOLOGIES

Transition from classical to quantum physics. Key conceptual principles: Superposition, Entanglement, Uncertainty, Wave-particle duality. Quantum states and measurement; the role of the observer. Representative quantum systems: electrons, photons, atoms. Concept of quantization and discrete energy levels. Strategic relevance of quantum technologies.

Overview of major domains: Computing, Communication, Sensing. Global quantum initiatives: India's National Quantum Mission, EU Quantum Flagship, USA, China.

UNIT II
CONCEPTUAL STRUCTURE OF QUANTUM INFORMATION

Qubits: qualitative understanding using spin and polarization. Classical bits vs quantum bits: distinctions and implications. Quantum systems (non-engineering perspective): trapped ions, superconducting qubits, photonics. Coherence and decoherence mechanisms. Abstract notions: quantum states, measurement operators, Hilbert space—interpretation without mathematics. Entanglement and non-locality as foundational resources. Quantum vs classical information principles; philosophical considerations.

UNIT III
BUILDING A QUANTUM COMPUTER – CHALLENGES AND REQUIREMENTS

Conceptual prerequisites for functional quantum hardware. Fragility of quantum states: decoherence, noise, stability issues. Requirements: isolation, error resilience, scalability, control. Why maintaining entanglement is difficult; theoretical necessity of quantum error correction. Comparative overview of hardware platforms (superconducting circuits, trapped ions, photonics).Current progress vs scientific constraints; conceptual view of quantum software‘s role.

UNIT IV
QUANTUM COMMUNICATION AND COMPUTING

(Redundant explanations removed, retaining only unique themes.)Quantum vs classical communication paradigms. Essentials of Quantum Key Distribution (QKD) and its security rationale. Entanglement- enabled communication protocols. Concept of the Quantum Internet and secure global networking. Introduction to quantum computing and quantum parallelism. Conceptual comparison of classical and quantum gate operations. Challenges: decoherence, noise, and the necessity of error correction frameworks.

UNIT V
APPLICATIONS, INDUSTRY, AND FUTURE DIRECTIONS

Application domains: Healthcare and drug discovery, Material science and chemistry, Optimization and logistics, Quantum sensing and precision timing. Case studies: IBM, Google, Microsoft, PsiQuantum. Ethical, societal, and policy considerations. Barriers to adoption: cost, skilled workforce, standards. Emerging research and career landscapes; India's strategic opportunity in the global quantum ecosystem.

TEXT BOOKS:

1. Nielsen & Chuang, Quantum Computation and Quantum Information, Cambridge University Press, 2010.
2. Rieffel & Polak, Quantum Computing: A Gentle Introduction, MIT Press, 2011.
3. Chris Bernhardt, Quantum Computing for Everyone, MIT Press, 2019.

REFERENCE BOOKS:

1. David McMahon, Quantum Computing Explained, Wiley, 2008.
2. Kaye, Laflamme, Mosca, An Introduction to Quantum Computing, OUP, 2007. Scott Aaronson, Quantum Computing Since Democritus, CUP, 2013.
3. Susskind & Friedman, Quantum Mechanics: The Theoretical Minimum, Basic Books, 2014. Rosenblum & Kuttner, Quantum Enigma, OUP, 2011.
4. Benenti et al., Principles of Quantum Computation and Information, World Scientific, 2004. DST India and MeitY: Official Quantum Mission Reports, 2020 onwards.
5. Quantum Flagship EU: Roadmaps and Strategy Documents.

ONLINE LEARNING RESOURCES:

1. IBM Quantum Experience & Qiskit Textbook Coursera – Quantum Mechanics and Quantum Computation (UC Berkeley) edX – Quantum Internet & Quantum Computers
2. YouTube – Quantum Computing for the Determined (Michael Nielsen)

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(25EE2130) PEDAGOGY STUDIES

COURSE OBJECTIVES

1. *To enable the students to understand the aims, rationale, policy background, and conceptual frameworks in pedagogy, curriculum, and teacher education research.*
2. *To develop an understanding of diverse pedagogical practices*
3. *To make them learn the methodologies for assessing the effectiveness of pedagogical practices and teacher education models.*
4. *To enable them to learn professional development strategies, including peer support, community engagement, and alignment with curriculum and assessment.*

COURSE OUTCOMES (COs)

Students will be able to

1. *Define and explain key concepts, frameworks, and methodologies in pedagogy and teacher education research.*
2. *Critically analyze pedagogical practices used in diverse classroom settings, with reference to teacher education and curriculum design.*
3. *Evaluate the effectiveness of pedagogical approaches using quality assessment tools and theory of change models.*
4. *Apply evidence-based strategies to improve classroom practices, curriculum alignment, and teacher professional development.*
5. *Identify and address barriers to learning through innovative pedagogical strategies.*
6. *Design and propose research studies that contribute to filling gaps in pedagogy, curriculum, and teacher education, with focus on dissemination and impact.*

UNIT I
FOUNDATIONS OF PEDAGOGY

Introduction to pedagogy and its importance in education - Historical and philosophical foundations of pedagogy - Theories of learning and teaching (behaviorist, cognitive, constructivist) - Role of pedagogy in shaping educational practices - Role of technology in modern pedagogy (ICT, e-learning, blended learning)

UNIT II
TEACHING-LEARNING PROCESSES

Understanding the teaching-learning process - Lesson planning and curriculum design - Strategies for effective teaching and learning (expository, collaborative, experiential) - Use of technology to enhance teaching-learning processes (multimedia, simulations, gamification)

UNIT III
TECHNOLOGY INTEGRATION IN EDUCATION

Educational technology and system design - Instructional design models (ADDIE, ASSURE, Dick and Carey Model) - Emerging trends in e-learning (social learning, MOOCs, mobile learning) - ICT tools for teaching and learning (Learning Management Systems, online resources)

UNIT IV
PEDAGOGY AND ASSESSMENT

Pedagogy, pedagogical analysis, and assessment - Types of assessment (placement, formative, diagnostic, summative) - Technology-based assessment tools (online quizzes, polls, discussions)

- Rubrics for self and peer evaluation- Reflective Practices

UNIT V
CONTEMPORARY ISSUES AND TRENDS
Inclusive education and technology (assistive technology, accessibility) - Change management and innovation in education - Quality assurance and evaluation in education (TQM, Six Sigma) - Future trends in pedagogy and technology (AI, AR, VR in education) - Personalized learning and adaptive teaching

TEXT BOOKS:

1. Alexander, R. J. *Essays on Pedagogy*. Routledge, 2008.
2. Shulman, L. S. *The Wisdom of Practice: Essays on Teaching, Learning, and Learning to Teach*. Jossey-Bass, 2004

REFERENCE BOOKS:

1. *Teaching for the Future: Effective Teacher Education and Pedagogical Practices*. OECD Publishing., 2021
2. Fullan, M., & Edwards, M. *System Change in Education: Sustainability and Impact*. Routledge, 2022.
3. Coe, R., Rauch, C., Kime, S., & Singleton, D. *Great Teaching Toolkit: Evidence Review*. Evidence Based Education., 2020
4. Zeichner, K. M. *The Struggle for the Soul of Teacher Education*. Routledge, 2024
5. UNESCO. *Global Education Monitoring Report: Pedagogy, Teachers and Learning*. UNESCO Publishing, 2024
6. Hattie, J. *Visible Learning: A Synthesis of Over 800 Meta-Analyses Relating to Achievement*. Routledge., 2009
7. Darling-Hammond, L. *Teacher Education Around the World: What Can We Learn from International Practice?* Routledge, 2007

ONLINE LEARNING RESOURCES:

1. **UNESCO Education Resources –** https://www.unesco.org/education
2. **OECD Education and Skills –** https://www.oecd.org/education
3. **ERIC (Education Resources Information Center) –** https://eric.ed.gov (peer-reviewed papers, reports).
4. **World Bank Education –** https://www.worldbank.org/en/topic/education (research reports on teacher development in developing countries).
5. **NPTEL/SWAYAM MOOCs –** Teacher education and pedagogy-focused courses.
6. **Google Scholar Alerts –** set alerts for "pedagogical practices", "teacher education", "curriculum research" for the latest academic papers.

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(25EE2131) PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

COURSE OBJECTIVES

This course will enable students:

1. *To develop students' self-awareness by identifying their strengths, weaknesses, opportunities, and challenges (SWOC analysis).*
2. *To enable students to understand and apply the principles of emotional intelligence and effective interpersonal communication.*
3. *To cultivate positive thinking, resilience, mindfulness, and a growth-oriented mindset.*
4. *To enhance verbal and non-verbal communication skills, including confidence in public speaking and professional presentations.*
5. *To familiarize students with leadership styles, teamwork strategies, and collaborative problem-solving in personal and professional contexts.*

COURSE OUTCOMES (COs)

Students will be able to

1. *Define and explain key concepts of self-awareness, personality, and personal growth.*
2. *Identify and apply strategies of emotional intelligence to regulate emotions and build effective interpersonal relationships*
3. *Demonstrate positive thinking, gratitude, and resilience to overcome personal and professional challenges*
4. *Analyze barriers to effective communication and apply verbal and non-verbal communication techniques in diverse contexts.*
5. *Prepare, deliver, and evaluate effective presentations and public speeches with confidence*
6. *Develop leadership and teamwork skills to collaborate, negotiate, and solve problems in group settings.*

UNIT I

SELF-AWARENESS AND PERSONAL GROWTH

Understanding personality and its development- Identifying strengths, weaknesses, opportunities, and challenges (SWOC analysis)- Setting personal and professional goals- Practicing Self-Reflection and Journaling (Activities: Personalitya assessments, self reflection exercises, group discussions, SWOC analysis worksheet, Action Plan, SMART goal activities, Reflective journaling, Self-care Planning)

UNIT II

EMOTIONAL INTELLIGENCE AND INTERPERSONAL SKILLS

Understanding emotional intelligence and its importance - Developing self-awareness, self-regulation, and motivation - Building effective communication and interpersonal skills- Conflict resolution and negotiation strategies. (Activities: Emotional Intelligence Quiz, Self-Reflection exercises, feedback sessions, mindfulness exercises, Positive self-talk, Active Listening exercises, conflict-resolution Role-play, Case studies & Group activities)

UNIT III

POSITIVE THINKING AND ATTITUDE

Understanding the power of positive thinking- Developing a growth mindset and resilience - Practicing gratitude and mindfulness- Overcoming negative thoughts and behaviors (Activities on positive thinking, growth mindset, mindfulness and self-care plan for overcoming negative thoughts)

UNIT IV

EFFECTIVE COMMUNICATION AND PRESENTATION SKILLS

Understanding the importance of effective communication- Developing verbal and non-verbal communication skills- Preparing and delivering effective presentations- Building confidence and public speaking skills (Activities: Group discussions, Case studies, Role-Play, Non-verbal communication exercises, Practice presentations, Peer feedback, Public speaking exercises, Storytelling, Debates)

UNIT V

LEADERSHIP AND TEAMWORK

Understanding leadership styles and qualities - Developing leadership skills and qualities- Building effective teams and teamwork strategies- Practicing collaboration and problem-solving (Activities: Case studies, Group discussions, Debates, Leadership role-playing, team building activities, Group projects, Collaborative problem-solving exercies, feedback sessions)

TEXT BOOKS:

1. Daniel Goleman,*Emotional Intelligence: Why It Can Matter More Than IQ*, Bantam Books, 2017.
2. Stephen R. Covey, *The 7 Habits of Highly Effective People*, Simon & Schuster, 2020.

REFERENCE BOOKS:

1. Dale Carnegie, *How to Win Friends and Influence People*, Simon & Schuster, 2020.
2. Brian Tracy, *Goals!: How to Get Everything You Want Faster Than You Ever Thought Possible*, Berrett-Koehler Publishers, 2021.
3. Robin Sharma, *The 5 AM Club: Own Your Morning, Elevate Your Life*, HarperCollins, 2020.
4. Carol S. Dweck, *Mindset: The New Psychology of Success*, Random House, 2016.
5. Daniel H. Pink,*Drive: The Surprising Truth About What Motivates Us*, Riverhead Books, 2018.
6. John C. Maxwell, *Leadershift: 11 Essential Changes Every Leader Must Embrace*, HarperCollins, 2019.

ONLINE LEARNING RESOURCES:

1. **Coursera –** *Personal Development Specialization* (https://www.coursera.org)
2. **edX –** *Leadership and Emotional Intelligence Courses* (https://www.edx.org)
3. **FutureLearn –** *Mindfulness and Resilience Training* (https://www.futurelearn.com)
4. **MindTools –** Practical resources on leadership, communication, and emotional intelligence (https://www.mindtools.com)
5. **Positive Psychology –** Articles and tools on resilience, gratitude, and well-being (https://positivepsychology.com)
6. **TED Talks –** Inspirational talks on leadership, communication, and self-growth (https://www.ted.com)

Harvard Business Review (HBR) – Leadership, negotiation, and workplace communication (https://hbr.org)

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(25CS5832) YOGA FOR STRESS MANAGEMENT

COURSE OBJECTIVES

1. *To make the students understand the foundational concepts of Yoga, including Ashtanga (eight limbs) as prescribed in classical texts.*
2. *To enable them analyze the principles of Yama and Niyama, and their role in ethical, personal, and social development.*
3. *To make them learn do's and don'ts of life through the practice of ahimsa, satya, astheya, brahmacharya, aparigraha, shaucha, santosh, tapa, swadhyaya, and ishwar-pranidhana.*
4. *To make them practice asanas and pranayama techniques for physical fitness, mental balance, and spiritual awareness.*
5. *To make them understand the holistic lifestyle through regular yoga practice, leading to personality development.*

COURSE OUTCOMES (COs)

Students will be able to

1. *Explain the eight limbs of Yoga (Ashtanga) and their interrelationship in holistic development.*
2. *Demonstrate understanding of Yama and Niyama as ethical guidelines and apply them in personal and professional life.*
3. *Differentiate between do's and don'ts in daily life with reference to Yogic principles like ahimsa, satya, and swadhyaya.*
4. *Perform selected asanas and pranayama techniques with correct posture, breathing, and awareness.*
5. *Evaluate the physical, mental, and emotional benefits of yoga practices in stress reduction, concentration, and self-discipline.*
6. *Integrate yoga philosophy and practices into a personal routine for sustainable health and inner growth.*

UNIT I

Definitions of Eight parts of yoga.(Ashtanga)

UNIT II

Yam and Niyam.

UNIT III

Do's and Don'tsin life.
Ahinsa, satya, astheya, bramhacharya and aparigraha ii)Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

UNIT IV

Asanand Pranayam

UNIT V

i) Various yoga poses and their benefits for mind and body
Regularization of breathing techniques and its effects-Types of pranayam problem-solving exercies, feedback sessions)

TEXT BOOKS:

1. Swami Prabhavananda and Christopher Isherwood (translation & commentary), *Patanjali Yoga Sutras,*Sri Ramakrishna Math, 1953.
2. B.K.S. Iyengar, *Light on Yoga,* Thorsons, 2003.

REFERENCE BOOKS:

1. T.K.V. Desikachar, *The Heart of Yoga: Developing a Personal Practice,* Inner Traditions 2nd Edition, 1999.
2. Acharya Yatendra, *Yoga & Stress Management*, Fingerprint Publishers, 2019
3. Yamini Muthanna, *The Power of Yoga,* Om Books International, 2015.
4. Nayaswami Devarshi, *Kriya Yoga: Spiritual Awakening for the New Age,* Ananda Sangha Publications, 2023.

ONLINE LEARNING RESOURCES:

1. **NPTEL / SWAYAM Online Courses –** Yoga and Physical Education modules.
2. **AYUSH Ministry Website**: https://yoga.ayush.gov.in – official yoga resources, protocols, and research.
3. **Yoga Journal**: https://www.yogajournal.com – practical guides, research updates, asana tutorials.
4. **Art of Living Foundation**: https://www.artofliving.org – pranayama, meditation, and wellness practices.
5. **YouTube Channels** (scholarly & practice-based):

- *Sivananda Yoga Vedanta Centre*
- *Yoga with Adriene* (for practical asana guidance)

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(25EE2122) CONTROL & INTEGRATION OF RENEWABLE ENERGY SOURCES
(PE-V)

COURSE OBJECTIVES

To make the student:

1. *A strong understanding of power systems, their operation and control focussed on the issues related to the integration of distributed renewable generation into the network.*
2. *To learn the principles of generating Heat Energy and Electrical energy from Non-conventional / Renewable Energy Sources.*
3. *To gain understanding of Control issues and challenges in various types of generators.*
4. *To Deep understanding about integration techniques for RE sources*

COURSE OUTCOMES (COs)

Students will be able to

1. *Knowledge on different renewable energy sources and storage devices.*
2. *Recognize, model and simulate different renewable energy sources.*
3. *Analyze, model and simulate basic control strategies required for grid connection.*
4. *Implement a complete system for standalone/grid connected system.*

UNIT I
INTRODUCTION TO ELECTRIC GRID

Electric grid introduction, Supply guarantee and power quality, Stability, Effects of renewable energy penetration in to the grid, Boundaries of the actual grid configuration, Consumption models and patterns, static and dynamic energy conversion technologies, interfacing requirements.

UNIT II
DYNAMIC ENERGY CONVERSION TECHNOLOGIES

Introduction to different conventional and nonconventional dynamic generation technologies, principle of operation and analysis of reciprocating engines, gas and micro turbines, hydro and wind based generation technologies, control and integrated operation of different dynamic energy conversion devices.

UNIT III
STATIC ENERGY CONVERSION TECHNOLOGIES

Introduction to different conventional and nonconventional static generation technologies, principle of operation and analysis of fuel cell, photovoltaic based generators, and wind based generation technologies, different storage technologies such as batteries, fly wheels and ultra capacitors, plug-in-hybrid vehicles, control and integrated operation of different static energy conversion devices.

UNIT IV
INTEGRATION OF DIFFERENT ENERGY CONVERSION TECHNOLOGIES

Control issues and challenges in Diesel, PV, wind and fuel cell based generators, PLL, Modulation Techniques, Dimensioning of filters, Linear and nonlinear controllers, predictive controllers and adaptive controllers, Fault- ride through Capabilities, Load frequency and Voltage Control.

UNIT V

Resources evaluation and needs, Dimensioning integration systems, Optimized integrated systems, Interfacing requirements, integrated Control of different resources, Distributed versus Centralized Control, Synchro Converters, Grid connected and Islanding Operations, stability and protection issues, load sharing, Case studies.

TEXT BOOKS:

1. AliKeyhani Mohammad Marwali and Min Dai, ―Integration of Green and Renewable Energy in Electric Power System‖, John Wiley publishing company, 1st edition, 2010.
2. S.Chowdhury, S.P.Chowdhury, P.Crossley, ―Microgrids and Active Distribution Networks‖, IET Power Electronics Series,2012
3. G. Masters, ―Renewable and Efficient Electric Power Systems, IEEE-Wiley Publishers, 2nd edition,2013.

REFERENCE BOOKS:

1. Quing- Chang Zhong, ―Control of Power Inverters in Renewable Energy and Smart Grid Integration‖, Wiley, IEEE Press, 1st edition, 2013.
2. Bin Wu,Yongqiang Lang, Navid Zargari, ―Power Conversion and Control of Wind Energy Systems‖,Wiley- IEEE Press, 1st edition, 2011.

ONLINE LEARNING RESOURCES:

1. https://www.youtube.com/watch?v=cGHlV0EavaQ

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(25EE2123) ENERGY STORAGE TECHNOLOGIES
(PE - V)

COURSE OBJECTIVES

To make the student:

1. *Understand generalized storage techniques.*
2. *Analyze the different features of energy storage systems.*
3. *Apply management and applications of energy storage technologies.*
4. *Know about electrical energy storage market potential by different forecasting methods.*

COURSE OUTCOMES (COs)

Students will be able to

1. *Understand the role of electrical energy storage technologies in electricity usage, hierarchy, demand for energy storage and valuation techniques.*
2. *Analyze the behavior and features of electrical energy storage systems.*
3. *Apply energy storage system concepts to electric vehicles.*
4. *Get knowledge about energy storage forecasting methods.*

UNIT I

THE ROLES OF ELECTRICAL ENERGY STORAGE TECHNOLOGIES IN ELECTRICITY USE

Characteristics of electricity, Electricity and the 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, 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 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, DEMAND AND VALUATION OF EES

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 SCADAl–aggregation of many dispersed batteries. Demand For Energy Storage: Growth in Variable Energy Resources, Relationship between balancing 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), EES market estimation for Li-ion batteries by the Panasonic Group, EES market potential estimation for broad introduction of renewable energies, EES market potential estimation for Germany by Fraunhofer, Storage of large amounts of energy in gas grids, EES market potential estimation for Europe by Siemens, EES market potential estimation by the IEA,Vehicle to grid concept, EES market potential in the future.

TEXT BOOKS:

1. Paul Breeze, ―Power System Energy Storage Technologies‖ Academic Press, 1st Edition, 2018.
2. Alfred Rufer, ―Energy Storage: Systems and Components‖, CRC Press, 1st edition, 2017.

REFERENCE BOOKS:

1. Robert A. Huggins, ―Energy Storage Fundamentals, Materials and Applications‖, Springer, 2nd edition, 2015.

ONLINE LEARNING RESOURCES:

1. www.ecofys.com/com/publications

R25 M.Tech -PE

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY: PUTTUR
(AUTONOMOUS)

II M. Tech. – I Sem.

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(25EE2124) HYBRID ELECTRIC VEHICLE ENGINEERING
(PE-V)

COURSE OBJECTIVES

To make the student:

1. *Understand the fundamental concepts, principles, analysis of hybrid eclectic vehicle.*
2. *Analyze the performance, configuration and control of hybrid electric vehicles.*
3. *Compare different energy management strategies.*
4. *Design of battery electric vehicles.*

COURSE OUTCOMES (COs)

Students will be able to

1. *Understand of hybrid electric vehicles and different energy to rage techniques.*
2. *Analyze the advantages and disadvantages of hybrid electric vehicles over conventional vehicles and merits. and demerits of hybrid electric trains over electrical trains.*
3. *Discuss the electric population, motor drive technologies.*
4. *Design of battery electric vehicles.*

UNIT I
INTRODUCTION TO HYBRID ELECTRIC VEHICLES

Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, and mathematical models to describe vehicle performance. History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy
supplies.

UNIT II
HYBRID 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. 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 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 Switched Reluctance Motor drives, drive system efficiency.

UNIT IV
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..

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. Iqbal Hussein, ―Electric and Hybrid Vehicles: Design Fundamentals‖, CRC Press, 3rd edition, 2021.
2. Mehrdad Ehsani, Yimi Gao, SebastianE. Gay, Ali Emadi, ―Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design‖, CRC Press, 2nd edition, 2009.
3. Ali Emadi, ―AdvancedElectricDriveVehicles‖,CRCPress,1st edition, 2017.

REFERENCE BOOKS:

1. James Larminie, John Lowry, ―Electric Vehicle Technology Explained‖, Wiley, 2nd edition, 2012.
2. Sheldon S. Williamson, ― Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles‖, Springer,1st edition, 2013.

ONLINE LEARNING RESOURCES:

1. http://nptel.ac.in/syllabus/108103009

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II M. Tech. – I Sem.

L	T	P	C
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(25EE2129) PHOTOVOLTAIC SYSTEMS
(OE-I)

COURSE OBJECTIVES

1. *To introduce photovoltaic systems.*
2. *To deal with various technologies of solar PV cells.*
3. *To understand details about manufacture, sizing and operating techniques.*
4. *To have knowledge of design considerations.*

COURSE OUTCOMES (COs)

Students will be able to

1. *Identify photovoltaic system components and system types.*
2. *Calculate electrical energy and power.*
3. *Correctly size system components, design considerations of solar equipment.*
4. *Design a basic grid-tie PV system.*

UNIT I
SOLAR ENERGY

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

UNIT II
SOLAR CELLS

Manufacture of Solar Cells-Technologies, Design of Solar cells, Photovoltaic modules, Design requirements, Encapsulation systems, Manufacture, Power rating, Hotspot effect, Design qualifications.

UNIT III
PROTECTION AND MEASUREMENTS

Flat plate arrays, Support structures, Module interconnection and cabling, Lightning protection, Performance measurement using natural sun light and simulator, Determination of temperature coefficients, Internal series resistance, Curve correction factor.

UNIT IV
PHOTOVOLTAIC SYSTEMS

Photovoltaic systems, Types, General design considerations, System sizing, Battery sizing, Inverter sizing, Design examples, Balance of PV systems.

UNIT V
MAXIMUM POWER POINT TRACKERS

Maximum power point trackers, Perturb and observe, Incremental conductance method, Hill climbing method, Hybrid and complex methods, Data based and other approximate methods, Instrument design, Other MPP techniques, Grid interactive PV system.

TEXT BOOKS:

1. F.C.Treble, —Generating electricity from Sun‖, Pergamon Press.
2. A.K.Mukherjee, Nivedita Thakur,‖ Photovoltaic systems: Analysis and design‖, PHI, 2011.

REFERENCE BOOKS:

1. C.S.Solanki,‖ Solar Photovoltaic's: Fundamentals, Technologies and applications‖, PHI, 2009.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/117108141