



St. Johns College of Engineering & Technology (Autonomous)

(Accredited by NAAC, Approved by AICTE, Recognized by UGC under 2(f) & 12(B) An ISO 9001:2015
Certified Institution and Affiliated to JNTUA, Ananthapuramu)

Yerrakota, Yemmiganur-518360, Kurnool (Dist), Andhra Pradesh, India.

M.Tech (Regular-Full time)

(Effective for the students admitted into I-Year from the Academic Year
2024-25 onwards)

Power Electronics & Electrical Drives

I & II YEAR COURSE STRUCTURE AND SYLLABUS



St. John's College of Engineering and Technology

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M.TECH IN POWER ELECTRONICS AND ELECTRICAL DRIVES

M.TECH IN POWER ELECTRONICS & ELECTRICAL DRIVES COURSE STRUCTURE & SYLLABI

SEMESTER – I

S.No.	Course codes	Course Name	Category	Hours per week			Credits
				L	T	P	
1.	24G3D54101	Switched Mode Power Converters	PC	3	0	0	3
2.	24G3D54102	Machine Modelling and Analysis	PC	3	0	0	3
3.	24G3D54103a 24G3D49203b 24G3D54103b	Program Elective I: Power Electronic Control of DC Drives Modern Control Theory Energy Auditing and Management	PE	3	0	0	3
4.	24G3D54104a 24G3D54104b 24G3D49104b	Program Elective II: Solar Energy Conversion Systems Wind Energy Conversion Systems Smart Grid Technologies	PE	3	0	0	3
5.	24G3D54105	Power Electronic Circuit Lab	PC	0	0	4	2
6.	24G3D49205	Renewable Energy Sources Lab	PC	0	0	4	2
7.	24G3DRM101	Research Methodology and IPR	MC	2	0	0	2
8.	24G3DAC101a 24G3DAC101b 24G3DAC101c	Audit Course – I English for Research paper writing Disaster Management Sanskrit for Technical Knowledge	AC	2	0	0	0
Total							18



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M.TECH IN POWER ELECTRONICS AND ELECTRICAL DRIVES

SEMESTER – II

S.No	Course codes	Course Name	Category	Hours per week			Credits
				L	T	P	
1.	24G3D54201	Modern Power Electronics	PC	3	0	0	3
2.	24G3D49202	FACTS Controllers	PC	3	0	0	3
3.	24G3D54202a 24G3D54202b 24G3D54202c	Program Elective III Advanced Electric Drives Advanced Power Semiconductor Devices & Protection Applications of Power Converters	PE	3	0	0	3
4.	24G3D49204a 24G3D54203a 24G3D54203b	Program Elective IV Power Quality AI Techniques in Electrical Engineering Digital Signal Processors and applications	PE	3	0	0	3
5.	24G3D54204	Electric Drives Lab	PC	0	0	4	2
6.	24G3D49206	FACTS Devices & Simulation Lab	PC	0	0	4	2
7.	24G3D54205	Technical seminar	PR	0	0	4	2
8.	24G3DAC201a 24G3DAC201b 24G3DAC201c	Audit Course – II Pedagogy Studies Stress Management for Yoga Personality Development through Life Enlightenment Skills	AC	2	0	0	0
		Total					18



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SEMSTER - III

S.No	Course codes	Course Name	Category	Hours per week			Credits
				L	T	P	
1.	24G3D54301a	Program Elective V: Control & Integration of Renewable Energy Sources	PE	3	0	0	3
	24G3D54301b	Energy Storage Technologies					
	24G3D54301c	Hybrid Electric Vehicle Engineering					
2.	24G3DOE301e	Open Elective: Waste to Energy	OE	3	0	0	3
	24G3DOE301a	Cost Management of Engineering Projects					
	24G3DOE301i	IoT Applications					
3.	24G3D54302	Dissertation Phase – I	PR	0	0	20	10
4.	24G3D54303	Co-curricular Activities					2
		Total					18

SEMESTER - IV

S.No.	Course codes	Course Name	Category	Hours per week			Credits
				L	T	P	
1.	24G3D54401	Dissertation Phase – II	PR	0	0	32	16
Total							16



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M.TECH IN POWER ELECTRONICS AND ELECTRICAL DRIVES

SWITCHED MODE POWER CONVERTERS

I M. Tech – I Semester							SJCET-R24	
Course Code	Category	Hours/Week			Credits	Maximum Marks		
24G3D54101	PC	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	60	100

Course Objective:

To enable students to remember and understand advanced converter topologies, apply these topologies to various switching regulators, analyze the working and waveforms of designed converters, and evaluate the operation of converters in continuous and discontinuous modes.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Understand the concept of Buck and Boost switching regulator topologies, push-pull & forward converter, voltage & current-fed topologies.	L2
CO2	Apply the concept of topologies for various switching regulators.	L3
CO3	Analyze the concepts of half & full bridge converter topologies.	L4
CO4	Evaluate the operation of continuous and discontinuous Flyback converter topologies.	L5
CO5	Evaluate the performance of voltage-fed and current-fed topologies in different converter configurations.	L5

UNIT I FUNDAMENTAL SWITCHING REGULATORS- BUCK & 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 –output 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 – flyback current fed push pull topology.

Textbooks:

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

Reference Books:

1. Ned Mohan, Power Electronics, John Wiley, 3rd edition, 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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M.TECH IN POWER ELECTRONICS AND ELECTRICAL DRIVES

MACHINE MODELLING & ANALYSIS

I M. Tech – I Semester							SJCTET-R24	
Course Code	Category	Hours/Week			Credits	Maximum Marks		
24G3D54102	PC	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	60	100

Course Objective:

To make students understand the basic principles of machine analysis and reference frame theory, apply the concepts of change of variables and transformation to arbitrary reference frames, analyze the dynamic behavior of machines, and design models for machine systems.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Understand the basic principles for machine analysis, including magnetically coupled circuits, voltage equations, and DC machine modeling.	L2
CO2	Apply the concepts of reference frame theory and transformations to analyze machine variables and voltage equations in different reference frames.	L3
CO3	Analyze the dynamic performance and steady-state operation of three-phase induction machines under various reference frames.	L4
CO4	Evaluate the dynamic behavior and transient performance of synchronous machines, applying voltage and torque equations in arbitrary reference frames.	L4
CO5	Design mathematical models for special machines, including permanent magnet brushless DC motors.	L5

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 3-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



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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 MODELING OF SPECIAL MACHINES

Modeling of Permanent Magnet Brushless DC Motor - Operating principle – Mathematical modeling of PM Brushless DC motor - PMDC Motor Drive Scheme.

Textbooks:

1. PaulC. Krause, Oleg Wasyzcuk, Scott S, 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.

Reference Books:

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, “Electric Machinery” ,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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M.TECH IN POWER ELECTRONICS AND ELECTRICAL DRIVES

POWER ELECTRONIC CONTROL OF DC DRIVES

I M. Tech – I Semester								SJCET-R24
Course Code	Category	Hours/Week			Credits	Maximum Marks		
24G3D54103a	PE-I	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	60	100

Course Objective:

To make students understand the concepts of separately excited single-phase and three-phase rectifiers with DC motor load drives, apply various controlling techniques to DC motor drives, analyze the operations of these techniques, and design chopper-controlled DC motor drives for operation in different quadrants.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Remember and understand the concepts of separately excited single-phase and three-phase rectifiers with DC motor load drives.	L1
CO2	Apply the concept of a three-phase naturally commutated bridge circuit as a rectifier or an inverter.	L3
CO3	Analyze the control circuit and steady-state operation of a three-phase controlled converter DC motor drive.	L4
CO4	Analyze current and speed controllers, and their feedback mechanisms for DC motor drives.	L4
CO5	Design chopper-controlled DC motor drives, including steady-state analysis and control mechanisms.	L5

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 rectifier 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 modeling 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



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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

Textbooks:

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.

Reference Books:

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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M.TECH IN POWER ELECTRONICS AND ELECTRICAL DRIVES

MODERN CONTROL THEORY

I M. Tech – I Semester							SJCET-R24	
Course Code	Category	Hours/Week			Credits	Maximum Marks		
24G3D49203b	PE-I	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	60	100

Course Objective:

To make students remember and understand state space representation, solution of state equations, STM, nonlinear system linearization, controllability, observability, duality principles, and stability concepts; apply these concepts to analyze controllability, observability, and pole placement; analyze regulators, stability, sensitivity, and disturbance rejection; and design full-order and reduced-order observers.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Understand the state space representation, controllability and observability concepts, principles of duality, and concepts of optimal and Lyapunov stability.	L2
CO2	Apply the state equations and pole placement by state feedback.	L3
CO3	Analyze the controllability and observability of state models.	L4
CO4	Design full-order observers and reduced-order observers.	L5
CO5	Evaluate the concept of regulator, stability, sensitivity, and disturbance rejection using various methods.	L5

UNIT I STATE VARIABLE DISCRPTION

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, POLE PLACEMENT 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.

Textbooks:

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.

Reference Books:

1. Panos J Antsaklis, and Anthony N. Michel, "Linear Systems", New-age international (P) LTD. Publishers, 2009.
2. John JD Azzo and 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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ENERGY AUDITING AND MANAGEMENT

I M. Tech – I Semester							SJCET-R24	
Course Code	Category	Hours/Week			Credits	Maximum Marks		
24G3D54103b	PE-I	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	60	100

Course Objective:

To make students understand the current energy scenario and importance of energy conservation, acquire knowledge about energy-efficient devices, measure thermal efficiency and other renewable resources, and design suitable energy monitoring systems to analyze and optimize energy consumption in electrical systems.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Understand the importance of energy conservation, present energy scenario, and various energy conservation devices available.	L2
CO2	Apply different methodologies used to reduce losses and various techniques for energy auditing.	L3
CO3	Analyze various instruments available to study different parameters such as heating, etc.	L4
CO4	Analyze the economic evaluation of energy conservation measures.	L4
CO5	Evaluate the economic feasibility of energy conservation measures in electrical systems and devices like motors, transformers, and inverters.	L5

UNIT I ENERGY AUDIT AND DEMAND SIDE MANAGEMENT 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 thermography – 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.

**Textbooks:**

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, (TERI Press, 2006)

Reference Books:

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.T.L.Boten,
3. Liptak B.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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SOLAR ENERGY CONVERSION SYSTEMS

I M. Tech – I Semester							SJCET-R24	
Course Code	Category	Hours/Week			Credits	Maximum Marks		
24G3D54104a	PE-II	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	60	100

Course Objective:

To equip students with a comprehensive understanding of solar cells, photovoltaic systems, and their technologies, enabling them to analyze and design efficient solar energy solutions.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Understand the fundamentals of solar radiation, sun tracking, and empirical methods for estimating and measuring solar radiation.	L2
CO2	Understand the design of solar cells, focusing on short circuit current, open circuit voltage, fill factor, and the effects of series and shunt resistance on efficiency.	L2
CO3	Apply the concept of solar PV modules, series and parallel connections of cells, and design solutions to handle mismatching and hot spots in modules.	L3
CO4	Evaluate the performance of balance of system components in solar PV systems, including batteries, inverters, and Maximum Power Point Tracking (MPPT) algorithms.	L5
CO5	Design standalone PV systems with various loads, incorporating battery storage, DC/AC loads, wire sizing, and grid-connected hybrid PV systems.	L5

UNIT I SOLAR CELL FUNDAMENTALS

Introduction to PV- World energy scenario – Need for sustainable energy sources – Current status of Renewable energy sources – Place of photovoltaic in Energy supply – Solar radiation – The sun and earth movement – Angle of sunrays on solar collectors – Sun tracking – Estimating solar radiation empirically– Measurement of solar radiation.

UNIT II DESIGN OF SOLAR CELLS

Introduction to Solar cells- Solar cell design-Design for high ISC – Design for high VOC – Design for high FF-Upper limits of cell parameters – Short circuit current, open circuit voltage, fill factor, efficiency, losses in solar cells – Model of a solar cell- Effect of series and shunt resistance on efficiency- Effect of solar radiation on efficiency- Analytical techniques.

UNIT III SOLAR PHOTO VOLTAIC MODULES

Solar PV Modules from solar cells– Series and parallel connection of cells– Mismatch in module – Mismatch in series connection – Hot spots in the module- Bypass diode – Mismatching in parallel diode – Design and structure of PV modules – Number of solar cells in a module-Wattage of modules- Fabrication of PV module–PV module power output.

UNIT IV BALANCE OF SOLAR PV SYSTEMS

Basics of Electromechanical cell –Factors affecting performance – Batteries for PV systems –DC to DC converters – Charge controllers – DC to AC converters(Inverters) – Maximum Power Point tracking(MPPT)–Algorithms for MPPT.


UNIT V PV SYSTEM DESIGN AND APPLICATIONS

Introduction to solar PV systems – Standalone PV system configuration – Design methodology of PV systems – 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.

Textbooks:

1. Chetan singh solanki “Solar Photovoltaic Fundamentals: Technologies and Applications”, PHI publications, 3rd edition, 2015.

Reference Books:

1. H.P. Garg, J. Prakash “Solar Energy Fundamentals and applications “Tata McGraw-Hill publishers 1st edition”, 2000.
2. S.Rao& B.B. Parulekar, “Energy Technology”, Khanna publishers, 4th edition, 2005.



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WIND ENERGY CONVERSION SYSTEMS

I M. Tech – I Semester							SJCET-R24	
Course Code	Category	Hours/Week			Credits	Maximum Marks		
24G3D54104b	PE-II	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	60	100

Course Objective:

To equip students with an understanding of wind energy applications, the design of wind turbine blades, the operation of fixed and variable speed wind energy conversion systems, and the analysis of grid integration challenges.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Understand the principles of mechanical to electrical energy conversion in wind energy systems and the design of wind turbine rotors.	L2
CO2	Apply control strategies for wind turbines, including pitch angle, yaw, and power electronic control, and analyze wind speed statistics for site selection.	L3
CO3	Analyze the performance characteristics and dynamic models of induction and synchronous machines used in wind energy conversion.	L4
CO4	Evaluate the operation and reactive power compensation of grid-connected and self-excited induction generators in wind energy systems.	L5
CO5	Design variable-speed wind turbines and explore their applications in hybrid energy systems, including integration with photovoltaic systems.	L5

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



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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.

Textbooks:

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

Reference Books:

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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M.TECH IN POWER ELECTRONICS AND ELECTRICAL DRIVES

SMART GRID TECHNOLOGIES

I M. Tech – I Semester							SJCET-R24	
Course Code	Category	Hours/Week			Credits	Maximum Marks		
24G3D49104b	PE-II	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	60	100

Course Objective:

To understand the significance of smart grid technology, measurement systems, and communication technologies, enhance the quality and security of power supply, and impart knowledge of the economic and regulatory aspects of distributed generation integration.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Understand the overview of smart grid technologies and national initiatives for improving energy distribution.	L2
CO2	Apply modeling, analysis tools, and outage management systems in transmission and distribution systems.	L3
CO3	Analyze the evolution and components of smart metering systems and the implementation of demand-side integration.	L4
CO4	Analyze communication channels and technologies like IEEE 802, mobile communications, and power line communications for smart grid implementation.	L4
CO5	Analyze encryption, authentication, and digital signature techniques to ensure information security in smart grids.	L4

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.

Textbooks:

1. Janaka Ekanayake, Kithsiri Liyanage, et.al., Smart Grid Technology and Applications, Wiley Publications, 1st edition, 2012. Banshi D. Shukla, "Engineering of Wind Energy", Jain Brothers, 1st edition, 2018.
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.

Reference Books:

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.



St. John's College of Engineering and Technology

(AUTONOMOUS)

M.TECH IN POWER ELECTRONICS AND ELECTRICAL DRIVES

POWER ELECTRONICS CIRCUITS LAB

I M. Tech – I Semester							SJCET-R24	
Course Code	Category	Hours/Week			Credits	Maximum Marks		
24G3D54105	PC	L	T	P	C	CIA	SEE	Total
		0	0	4	2	40	60	100

Course Objective:

To enable students to understand the operation, simulation, and design of power electronic converters using MATLAB/Simulink for various controller applications.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Understand the basic concepts and operations of various Power Electronic converters, including rectifiers, inverters, and cycloconverters.	L2
CO2	Apply mathematical relations to determine and verify Total Harmonic Distortion (THD) in power electronic circuits.	L3
CO3	Analyze the output waveforms and performance characteristics of different converters designed using MATLAB/Simulink.	L4
CO4	Design and simulate different power electronic circuits, including rectifiers, inverters, and controllers, using MATLAB/Simulink.	L6
CO5	Develop practical skills in modeling and simulation by designing and analyzing controllers for power electronic systems in MATLAB/Simulink.	L6

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.	Single Phase cycloconverter using MATLAB
8.	Three Phase cycloconverter using MATLAB.
9.	Single Phase Full Controlled Converter with R and R-L loads.
10.	Designing of induction motor using Simulink

Reference Books:

1. Power Electronic Circuits, Devices and Applications-M.H.Rashid-PHI,2017
2. Ned Mohan, Power Electronics, John Wiley, 3rd edition, 2011



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M.TECH IN POWER ELECTRONICS AND ELECTRICAL DRIVES

RENEWABLE ENERGY SYSTEMS LAB

I M. Tech – I Semester							SJCET-R24	
Course Code	Category	Hours/Week			Credits	Maximum Marks		
24G3D49205	PC	L	T	P	C	CIA	SEE	Total
		0	0	4	2	40	60	100

Course Objective:

To equip students with the skills to code in MATLAB/Mi power, apply SVC, STATCOM, and UPFC for voltage profile improvements in power systems, and analyze data related to load flows and the operation of TCSC, STATCOM, and SSSC in transmission networks.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Understand the I-V and P-V curves of solar panels, and describe the effects of series and parallel connections.	L2
CO2	Utilize sun tracking systems and MPPT charge controllers to improve the performance of solar PV systems.	L3
CO3	Analyze the power, voltage, and frequency outputs of wind generators to assess their operational performance.	L4
CO4	Assess the impact of temperature variations and irradiation on the performance and efficiency of photovoltaic arrays.	L5
CO5	Design and simulate solar PV systems, including modeling PV cells and implementing techniques to optimize performance based on temperature and irradiation effects.	L6

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



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

Note : Conduct any 7 experiments from 1-9 list and minimum 3 experiments from 1- 4 of Simulation experiments



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M.TECH IN POWER ELECTRONICS AND ELECTRICAL DRIVES

RESEARCH METHODOLOGY AND IPR

I M. Tech – I Semester							SJCET-R24	
Course Code	Category	Hours/Week			Credits	Maximum Marks		
24G3DRM101	MC	L	T	P	C	CIA	SEE	Total
		2	0	0	2	40	60	100

Course Objective:

To Identify an appropriate research problem in their interesting domain & to Understand ethical issues understand the Preparation of a research project thesis report, Preparation of a research project thesis report, law of patent and copyrights, Adequate knowledge on IPR.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Identify and define a research problem by understanding its sources, characteristics, and objectives.	L1
CO2	Apply effective literature review techniques and adhere to ethical standards in research.	L3
CO3	Analyze various types of intellectual property and describe the patenting process.	L4
CO4	Analyze patent rights, including licensing and technology transfer, for effective use of patent databases.	L4
CO5	Evaluate the application of design thinking principles to address business challenges and innovation.	L5

UNIT I RESEARCH PROBLEM FORMULATION

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, scope, and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations.

UNIT II RESEARCH ETHICS AND EFFECTIVE LITERATURE REVIEW

Effective literature studies approaches, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

UNIT III INTELLECTUAL PROPERTY RIGHTS (IPR)

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT IV PATENT RIGHTS AND TECHNOLOGY TRANSFER

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

UNIT V DESIGN THINKING IN BUSINESS AND INNOVATION

Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs. Design thinking for Startups. Defining and testing Business Models and Business Cases. Developing & testing prototypes.



Textbooks:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students"
2. Wayne Goddard and Stuart **Melville**, "Research Methodology: An Introduction"

Reference Books:

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



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M.TECH IN POWER ELECTRONICS AND ELECTRICAL DRIVES

ENGLISH FOR RESEARCH PAPER WRITING

I M. Tech – I Semester								SJCET-R24
Course Code	Category	Hours/Week			Credits	Maximum Marks		
24G3DAC101a	AC-I	L	T	P	C	CIA	SEE	Total
		2	0	0	0	40	-	40

Course Objective:

This course will enable students to Understand the essentials of writing skills and their level of readability, Learn about what to write in each section, Ensure qualitative presentation with linguistic accuracy.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Understand the essential components of structuring a research paper, focusing on clarity, conciseness, and readability.	L2
CO2	Analyze the role and construction of abstracts, hypotheses, and critical language tools such as paraphrasing and hedging.	L4
CO3	Analyze the effectiveness of literature reviews, data analysis, and conclusions in research writing.	L4
CO4	Analyze skills to construct a clear and effective title, abstract, and introduction in research writing.	L4
CO5	Develop the appropriate language and structure to present methodology, results, and conclusions in a research paper.	L6

UNIT I OVERVIEW OF RESEARCH PAPER STRUCTURE

Overview of a Research Paper- Planning and Preparation- Word Order- Useful Phrases - Breaking up Long Sentences-Structuring Paragraphs and Sentences-Being Concise and Removing Redundancy-Avoiding Ambiguity.

UNIT II CORE COMPONENTS OF A RESEARCH PAPER

Essential Components of a Research Paper- Abstracts- Building Hypothesis-Research Problem - Highlight Findings- Hedging and Criticizing, Paraphrasing and Plagiarism, Cauterization.

UNIT III REVIEW OF LITERATURE AND DATA ANALYSIS

Introducing Review of the Literature – Methodology - Analysis of the Data-Findings - Discussion- Conclusions-Recommendations.

UNIT IV WRITING TITLE, ABSTRACT, AND INTRODUCTION

Key skills needed for writing a Title, Abstract, and Introduction.

UNIT V LANGUAGE FOR METHODOLOGY AND CONCLUSIONS

Appropriate language to formulate Methodology, incorporate Results, put forth Arguments and draw Conclusions.

Suggested Reading:

- Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books) Model Curriculum of Engineering & Technology PG Courses [Volume-I]
- Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
- Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook
- Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011.



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M.TECH IN POWER ELECTRONICS AND ELECTRICAL DRIVES

DISASTER MANAGEMENT

I M. Tech – I Semester								SJCET-R24
Course Code	Category	Hours/Week			Credits	Maximum Marks		
24G3DAC101b	AC-I	L	T	P	C	CIA	SEE	Total
		2	0	0	0	40	-	40

Course Objective:

This course will enable students to Learn to demonstrate critical understanding of key concepts in disaster risk reduction and humanitarian response, Critically evaluate disaster risk reduction and humanitarian response policy and practice from Multiple perspectives,

Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations, Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Understand the definitions, types, and geographical distribution of natural and man-made disasters.	L2
CO2	Analyze the economic, environmental, and social repercussions of various natural and man-made disasters.	L4
CO3	Analyze the knowledge of disaster monitoring and risk evaluation techniques to develop preparedness strategies.	L4
CO4	Evaluate disaster risk assessment techniques and global cooperation strategies in disaster risk reduction.	L5
CO5	Create effective mitigation plans using structural and non-structural strategies relevant to disaster.	L6

UNIT I INTRODUCTION TO DISASTERS

Introduction: Disaster: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade 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 IMPACTS OF DISASTERS

Repercussions of Disasters and Hazards: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

UNIT III DISASTER PREPAREDNESS

Disaster Preparedness and Management: Preparedness: Monitoring of Phenomena Triggering A disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT IV RISK ASSESSMENT AND REDUCTION

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

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.

Suggested Reading:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies
2. "New Royal book Company. Sahni, Pardeep Et.Al.(Eds.), "Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.
3. Goel S.L., Disaster Administration And Management Text And Case Studies", Deep & Deep Publication Pvt. Ltd., New Delhi



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M.TECH IN POWER ELECTRONICS AND ELECTRICAL DRIVES

SANSKRIT FOR TECHNICAL KNOWLEDGE

I M. Tech – I Semester								SJCET-R24
Course Code	Category	Hours/Week			Credits	Maximum Marks		
24G3DAC101c	AC-I	L	T	P	C	CIA	SEE	Total
		2	0	0	0	40	-	40

Course Objective:

This course will enable students to get a working knowledge in illustrious Sanskrit, the scientific language in the world, Learning of Sanskrit to improve brain functioning, Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power the engineering scholars equipped.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Understand the structure and pronunciation of basic Sanskrit alphabets.	L2
CO2	Apply knowledge of Sanskrit tenses to form simple sentences.	L3
CO3	Analyze Sanskrit root words to build vocabulary and sentence order.	L4
CO4	Evaluate the contributions of Sanskrit literature to technical fields.	L5
CO5	Create connections between Sanskrit concepts and foundational principles in engineering and mathematics.	L6

UNIT I SANSKRIT ALPHABETS

Alphabets in Sanskrit.

UNIT II SANSKRIT TENSES & SENTENCES

Past/Present/Future Tense, Simple Sentences.

UNIT III INTRODUCTION TO SANSKRIT ROOTS

Order, Introduction of roots.

UNIT IV SANSKRIT LITERATURE

Technical information about Sanskrit Literature.

UNIT V TECHNICAL CONCEPTS IN SANSKRIT

Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics.

Suggested Reading:

1. "Abhyas pustakam" –Dr. Vishwas, Sanskrit-Bharti Publication, New Delhi
2. "Teach Yourself Sanskrit" Prathama Deeksha- Vempati Kutumb shastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi



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M.TECH IN POWER ELECTRONICS AND ELECTRICAL DRIVES

MODERN POWER ELECTRONICS

I M. Tech – II Semester								SJCET-R24
Course Code	Category	Hours/Week			Credits	Maximum Marks		
24G3D54201	PC	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	60	100

Course Objective:

To make the student understand and analyze the construction, operation, and characteristics of power semiconductor devices and various inverters, resonant converters, and modulation techniques, and to apply this knowledge to select suitable devices for specific converter topologies.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Understand the characteristics and operation of high-power semiconductor devices such as SCRs, GTOs, GCTs, and IGBTs	L2
CO2	Analyze the operation of series resonant inverters and evaluate the performance of Class-E resonant inverters.	L4
CO3	Analyze zero current switching (ZCS) and zero voltage switching (ZVS) resonant converters, including their advantages and disadvantages.	L4
CO4	Analyze sinusoidal PWM and space vector modulation techniques to analyze harmonic content in multi-level inverters.	L4
CO5	Analyze multilevel inverter topologies and modulation schemes, including carrier-based and phase-shifted PWM.	L4

UNIT I HIGH-POWER SEMI CONDUCTOR DEVICES

Introduction – High Power Switching Devices – Diodes – Silicon-Controlled Rectifier (SCR) – Gate Turn Off (GTO) Thyristor –Gate Commutated Thyristor (GCT) –Insulated Gate Bipolar Transistor (IGBT) –Other Switching Devices –Operation of Series Connected Devices –Main Causes of Voltage Unbalance –Voltage Equalization for GCTs– 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 bridge 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 dc link inverters- Evaluation of L and C for zero current switching inverter –Numerical problems.

UNIT IV MULTI LEVEL INVERTERS I

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 MULTI LEVEL INVERTERS II

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.

Textbooks:

1. Mohammed H. Rashid, “Power Electronics”, Pearson Education, 4th edition, 2017.
2. Ned Mohan, Tore M.Undel and William P.Robbins, “Power Electronics”, John Wiley & Sons, 3rd edition, 2007.

Reference Books:

1. Daniel W. Hart, “Power Electronics”, McGraw Hill 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 Publishers, 2006.
4. Philip T. 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.



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M.TECH IN POWER ELECTRONICS AND ELECTRICAL DRIVES

FACTS CONTROLLERS

I M. Tech – II Semester								SJCET-R24
Course Code	Category	Hours/Week			Credits	Maximum Marks		
24G3D49202	PC	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	60	100

Course Objective:

To provide students with a comprehensive understanding of the fundamentals, control mechanisms, and benefits of various FACTS controllers, including STATCOM, SVC, GCSC, TSSC, and TCSC, along with the objectives of shunt and series compensation in power systems.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Understand the operation of different FACTS controllers and converter topologies (12, 24, and 48-pulse configurations).	L2
CO2	Analyze the performance of SVC and STATCOM in VAR generation and voltage regulation.	L4
CO3	Analyze the control schemes for GCSC, TSSC, and TCSC in series compensation.	L4
CO4	Analyze the control system for independent real and reactive power flow using UPFC.	L4
CO5	Analyze the operating principles and control structures of the Interline Power Flow Controller (IPFC).	L4

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)

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.

UNIT V INTERLINE POWER FLOW CONTROLLER (IPFC)

Introduction, basic operating principle and characteristics of IPFC, control structure, practical and application considerations, generalized and multifunctional fact controllers

**Textbooks:**

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 – Esquivel, Hugué Ambriz – perez, Cesar Angeles – Camacho, WILEY, 1st edition, 2004



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M.TECH IN POWER ELECTRONICS AND ELECTRICAL DRIVES

ADVANCED ELECTRIC DRIVES

I M. Tech – II Semester								SJCET-R24
Course Code	Category	Hours/Week			Credits	Maximum Marks		
24G3D54202a	PE-III	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	60	100

Course Objective:

To provide students with a comprehensive understanding of the working principles, control strategies, and design techniques for various AC and special-purpose motor drives, including induction, PMSM, BLDC, and switched reluctance motors, with a focus on scalar, vector, and direct torque control methods.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Understand the principles of scalar and vector control in induction motor drives, including V/f control with slip compensation.	L2
CO2	Apply indirect vector control techniques for induction motor drives, including sensor less control and decoupling strategies.	L3
CO3	Apply vector control techniques to the operation of synchronous motor drives, including self-controlled and cycloconverter-fed synchronous motors.	L3
CO4	Analyze control systems for Permanent Magnet Synchronous Motors (PMSM) and Brushless DC (BLDC) drives using vector control methods.	L4
CO5	Evaluate control strategies for Switched Reluctance Motor (SRM) drives, including converter design and sensor less control techniques.	L5

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 dq model of 3 -phase IM with simulation.

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 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



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M.TECH IN POWER ELECTRONICS AND ELECTRICAL DRIVES

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.

Textbooks:

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”, IEEE Press, 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.



St. John's College of Engineering and Technology

(AUTONOMOUS)

M.TECH IN POWER ELECTRONICS AND ELECTRICAL DRIVES

ADVANCED POWER SEMICONDUCTOR DEVICES AND PROTECTION

I M. Tech – II Semester								SJCET-R24
Course Code	Category	Hours/Week			Credits	Maximum Marks		
24G3D54202b	PE-III	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	60	100

Course Objective:

To equip students with a thorough understanding of power semiconductor devices, the ability to apply this knowledge to emerging technologies, analyze electromagnetic interference and its effects, and design protection circuits and devices.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Understand the I-V characteristics and safe operating areas of BJTs and Power MOSFETs.	L2
CO2	Understand the switching characteristics and safe operating areas of Gate Turn-Off (GTO) thyristors and Insulated Gate Bipolar Transistors	L2
CO3	Apply knowledge of emerging semiconductor devices like power JFETs and MOS-controlled thyristors in modern electronic circuits.	L3
CO4	Analyze effective passive components and EMI shielding techniques to mitigate electromagnetic interference in power electronic systems.	L4
CO5	Analyze noise sources in switched-mode power supplies (SMPS) and design appropriate protection circuits such as heat sinks and voltage/current protectors.	L4

UNIT I BJT & 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 ELECTRO MAGNETIC COMPATIBILITY

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

Textbooks:

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, 3rd Edition, 1995.
3. Loganathan Umanand, “Power Electronics: Essentials and Applications”, Wiley India Pvt. Ltd, 2009.

Online Learning Resources:

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



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M.TECH IN POWER ELECTRONICS AND ELECTRICAL DRIVES

APPLICATIONS OF POWER CONVERTERS

I M. Tech – II Semester								SJCET-R24
Course Code	Category	Hours/Week			Credits	Maximum Marks		
24G3D54202c	PE-III	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	60	100

Course Objective:

To enable students to understand the power electronic application requirements, remember different power converters, analyze power supplies for microprocessors and computers, and apply this knowledge to design bi-directional DC-DC converters for charge/discharge applications.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Understand the use of high-frequency inverters for induction heating applications, including cooking, hardening, melting, and welding.	L2
CO2	Identify and apply suitable power converters for lighting, pumping, and refrigeration systems, including LED drivers and PV-fed power supplies.	L3
CO3	Analyze power supplies designed for high voltage applications such as X-ray, radar, and space missions.	L4
CO4	Develop power converters tailored for low voltage, high current applications in modern microprocessors and computer systems.	L6
CO5	Design bi-directional DC-DC converters for applications in electric traction, automotive electronics, and charge/discharge processes.	L6

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.

Textbooks:

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, 2nd Edition, 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



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design”, John Wiley and Sons, 3rd edition, 2007

3. M. H. Rashid, “Power Electronics Circuits , Devices and Applications”, Pearson publications, 3rd Edition, 2004



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M.TECH IN POWER ELECTRONICS AND ELECTRICAL DRIVES

POWER QUALITY

I M. Tech – II Semester								SJCET-R24
Course Code	Category	Hours/Week			Credits	Maximum Marks		
24G3D49204a	PE-IV	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	60	100

Course Objective:

To enable the students to understand power quality definitions and standards, remember measurement and problem-solving methods, apply knowledge to different types of loads, and analyze harmonic methodology, mitigation techniques, and case studies.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Understand the fundamentals and terminology of power quality.	L2
CO2	Apply concepts related to power frequency disturbances, transients, and transient waveforms.	L3
CO3	Analyze harmonic methodology and electromagnetic interference (EMI) concepts.	L4
CO4	Analyze the necessity of grounding and methods of grounding.	L4
CO5	Analyze the different techniques for measuring and solving power quality problems.	L4

UNIT I INTRODUCTION TO POWER QUALITY

Definition of Power Quality - Power Quality Progression - Power Quality Terminology - Power Quality Issues- 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.

Textbooks:

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. 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



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M.TECH IN POWER ELECTRONICS AND ELECTRICAL DRIVES

AI TECHNIQUES IN ELECTRICAL ENGINEERING

I M. Tech – II Semester							SJCET-R24	
Course Code	Category	Hours/Week			Credits	Maximum Marks		
24G3D54203a	PE-IV	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	60	100

Course Objective:

To enable the students to locate and understand soft computing methodologies, observe feedforward and feedback neural networks, practice fuzzy logic control and its design, and analyze genetic algorithms and their operations.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Understand the fundamental models, architectures, and learning processes in neural networks.	L2
CO2	Apply different neural network paradigms, including backpropagation and radial basis functions, to solve problems.	L3
CO3	Analyze fuzzy logic systems and implement fuzzy inference and defuzzification techniques in real-world applications.	L4
CO4	Develop genetic algorithm-based solutions by using reproduction operators, crossover, and mutation techniques.	L6
CO5	Develop AI techniques, including neural networks, fuzzy logic, and genetic algorithms, to solve electrical engineering problems such as load forecasting and motor control.	L6

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 FUZZY LOGIC

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

UNIT IV GENETIC ALGORITHMS

Introduction-Encoding- Fitness Function-Reproduction operators-Genetic Modeling – Genetic operators- Crossover- Single-site crossover –Two-point cross over- 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.

**Textbooks:**

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.

Reference Books:

1. P.D. Wasserman, Van Nostrand Reinhold, " Neural Computing Theory & 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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M.TECH IN POWER ELECTRONICS AND ELECTRICAL DRIVES

DIGITAL SIGNAL PROCESSORS AND APPLICATIONS

I M. Tech – II Semester							SJCET-R24	
Course Code	Category	Hours/Week			Credits	Maximum Marks		
24G3D54203b	PE-IV	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	60	100

Course Objective:

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

Course Outcomes:

COs	Statements	Blooms Level
CO1	Understand the basic and advanced concepts of different DSP Processors.	L2
CO2	Apply the basic and advanced concepts in order to develop various programmable based DSP applications.	L3
CO3	Analyze the operation and performance of DSP based designs for various real time issues.	L4
CO4	Design / create DSP based controllers and processors for various simulation /real time based applications.	L6

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 C2xxDSP Instruction Set.

UNIT II DATA TRANSFER AND COMMUNICATION

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 III DSP CONTROLLER TMS320LF24

Interrupt system of TMS320LF2407- Introduction to Interrupts - Interrupt Hierarchy - Interrupt Control Registers- Initializing and Servicing Interrupts in Software- real time control with interrupts. The analog-to-digital converter (ADC)-ADC Overview- Operation of the ADC and programming modes.

UNIT IV DSP CONTROLLER APPLICATIONS

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) –



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Programmable Interconnect Point (PIP)- HDL programming –overview of Spartan 6 & ISE Design Suite, Implementation of PWM technique with SPARTAN-6 FPGA

Textbooks:

1. HamidA.Tolyat, “DSP based Electromechanical Motion Control”, CRCpress, 1st edition, 2004.
2. WayneWolf, “FPGAbasedsystemdesign”, Prenticehall, 1st edition, 2004.

Reference Books:

1. Application Notes from the website of Texas Instruments
2. Spartan-6FPGAConfigurableLogicBlock, 2010
3. XilinxSpartan6Datasheets



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M.TECH IN POWER ELECTRONICS AND ELECTRICAL DRIVES

ELECTRIC DRIVES LAB

I M. Tech – II Semester								SJCET-R24
Course Code	Category	Hours/Week			Credits	Maximum Marks		
24G3D54204	PE-IV	L	T	P	C	CIA	SEE	Total
		0	0	4	2	40	60	100

Course Objective:

To enable students to understand, analyze, and apply torque-speed characteristics of DC motors, 3-phase induction motors, and PMSMs with various converters, as well as to analyze the performance of induction motors and different drives using modulation techniques and v/f control methods.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Apply hardware and software tools for electric drives systems	L3
CO2	Analyze the practical challenges in electric drive systems	L4
CO3	Analyze the various modulation techniques on different motor drives.	L4
CO4	Analyze the performance of induction motors with different converter connections.	L4
CO5	Design and implement V/f control on different drive systems	L6

LIST OF EXPERIMENTS:

- Torque-Speed characteristics of DC motor using DC chopper.
- Symmetrical angle control of 1-phase AC motor connected to AC voltage controller
- Single-Phase dual converter connected separately excited DC motor drive
- Speed control of 3-phase induction motor using open-loop V/f control technique
- Torque-Speed characteristics of a 3-phase induction motor using IM - IM comprehensive drive system
- Study of a Neutral Point Clamped inverter fed three-phase induction motor drive
- Pulse width modulation control of 1-phase AC motor connected to AC voltage controller
- Torque-Speed characteristics of a 3-phase Permanent Magnet Synchronous Motor (PMSM) using PMSM- IM comprehensive drive system
- Torque-speed characteristics of a Separately Excited DC motor Drive fed by a two-pulse centre- tapped thyristor rectifier.
- Torque-speed characteristics of a 6-pulse fully controlled rectifier fed Separately Excited DC motor Drive
- Study of a four-quadrant Separately excited DC motor drive fed by dual- converter with circulating current control.
- Study Class-D commutated chopper fed Separately Excited DC motor Drive
- Verification of spectral performance of a 3-Ph VSI with V/Hz control of 3-Ph IM drives
- Torque speed characteristics of a 3-Ph induction motor fed by a 3-Ph VSI
- Implementation of centre spaced space vector modulation with DSP for V/Hz



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M.TECH IN POWER ELECTRONICS AND ELECTRICAL DRIVES

control of induction motor drives.

15. Implementation of discontinuous space vector modulation with DSP for V/Hz control of induction motor drives.

Note: Any ten experiments out of the list provided.



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M.TECH IN POWER ELECTRONICS AND ELECTRICAL DRIVES

FACTS DEVICES & SIMULATION LAB

I M. Tech – II Semester								SJCET-R24
Course Code	Category	Hours/Week			Credits	Maximum Marks		
24G3D49206	PE-IV	L	T	P	C	CIA	SEE	Total
		0	0	4	2	40	60	100

Course Objective:

To focus on coding for power systems and the application of advanced compensation devices like SVC, STATCOM, and UPFC. If you need help with coding examples in MATLAB/Mi Power, analysis techniques, or understanding these devices.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Understand load balancing using compensators	L2
CO2	Apply load balancing techniques using compensators	L3
CO3	Analyze load flow incorporating SVC and STATCOM	L4
CO4	Evaluate transmission line characteristics with and without compensation	L5
CO5	Develop simulation models for STATCOM and UPFC	L6

LIST OF EXPERIMENTS:

- Voltage regulation using shunt and series compensation
- Load balancing in power system network using compensators
- Simulation of TCSC
- Voltage profile improvement using SVC
- Voltage profile improvement using STATCOM
- Transient Stability enhancement using STATCOM.
- Simulation of UPFC with mathematical models
- Load flow incorporating SVC
- Load flow incorporating STATCOM
- Simulation of DVR
- Transmission Line Characteristics (P vs δ , Q vs δ , P vs Distance, Q vs Distance and V vs Distance) with and without Compensation
- Sizing- simulation and operation of TCR and FC-TCR for a transmission line fed by an ac supply and feeding
 - Resistive/inductive/capacitive load one at a time
 - A load which can have leading as well as lagging behavior
- Sizing- simulation and operation of TCSC for a transmission line fed by an ac supply and feeding
 - Resistive/inductive/capacitive load one at a time
 - 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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M.TECH IN POWER ELECTRONICS AND ELECTRICAL DRIVES

PEDAGOGY STUDIES

I M. Tech – II Semester								SJCET-R24
Course Code	Category	Hours/Week			Credits	Maximum Marks		
24G3DAC201a	AC-II	L	T	P	C	CIA	SEE	Total
		2	0	0	0	40	-	40

Course Objective:

This course will enable students to Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers & Identify critical evidence gaps to guide the development.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Explain foundational concepts, theories of learning, and methodologies for researching pedagogy.	L2
CO2	Identify and classify pedagogical practices used by teachers in various educational contexts.	L3
CO3	Analyze evidence for the effectiveness of pedagogical approaches and the role of curriculum and teacher support.	L4
CO4	Evaluate strategies for professional development and the impact of resource limitations on learning outcomes.	L5
CO5	Formulate strategies for addressing research gaps in pedagogy and enhancing dissemination and impact.	L6

UNIT I INTRODUCTION AND METHODOLOGY

Aims and rationale, Policy back ground, Conceptual frame work and terminology Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions. Overview of methodology and Searching.

UNIT II THEMATIC OVERVIEW

Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.

UNIT III EFFECTIVENESS OF PEDAGOGICAL PRACTICES

Evidence on the effectiveness of pedagogical practices, Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

UNIT IV PROFESSIONAL DEVELOPMENT

Alignment with classroom practices and follow-up support, Peer support, Support from the head teacher and the community. Curriculum and assessment, Barriers to learning: limited resources and large class sizes.

UNIT V RESEARCH GAPS AND FUTURE DIRECTIONS

Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact.



Suggested Reading:

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272-282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.



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M.TECH IN POWER ELECTRONICS AND ELECTRICAL DRIVES

STRESS MANAGEMENT FOR YOGA

I M. Tech – II Semester								SJCET-R24
Course Code	Category	Hours/Week			Credits	Maximum Marks		
24G3DAC201b	AC-II	L	T	P	C	CIA	SEE	Total
		2	0	0	0	40	-	40

Course Objective:

This course will enable students to achieve overall health of body and mind & To overcome stress.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Explain the eight parts of yoga (Ashtanga) and their significance.	L2
CO2	Illustrate the concepts of Yam and Niyam for self-discipline.	L2
CO3	Apply ethical practices like ahimsa and satya for stress reduction.	L3
CO4	Practice basic asanas and pranayama techniques for stress relief.	L4
CO5	Evaluate the benefits of various yoga poses and breathing techniques.	L5

UNIT I ASHTANGA YOGA

Definitions of Eight parts of yoga.(Ashtanga).

UNIT II YAM AND NIYAM

Yam and Niyam.

UNIT III DOS AND DON'Ts IN LIFE

Do's and Don't sin life.

i) Ahinsa, satya, astheya, bramhacharya and aparigraha

ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan.

UNIT IV ASAN AND PRANAYAM

Asan and Pranayam.

UNIT V YOGA POSES AND BREATHING TECHNIQUES

i) Various yog poses and their benefits for mind & body

ii) Regularization of breathing techniques and its effects-Types of pranayama.

Suggested Reading:

1. 'Yogic Asanas for Group Training -Part-I': Janardan Swami Yoga bhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata



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M.TECH IN POWER ELECTRONICS AND ELECTRICAL DRIVES

PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

I M. Tech – II Semester							SJCET-R24	
Course Code	Category	Hours/Week			Credits	Maximum Marks		
24G3DAC201c	AC-II	L	T	P	C	CIA	SEE	Total
		2	0	0	0	40	-	40

Course Objectives: This course will enable students:

- To learn to achieve the highest goal happily
- To become a person with stable mind, pleasing personality and determination
- To awaken wisdom in students

Course Outcomes (CO): Student will be able to

- Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
- The person who has studied Geeta will lead the nation and mankind to peace and prosperity
- Study of Neetishatakam will help in developing versatile personality of students

UNIT - I		
Neetisatakam- Holistic development of personality Verses-19,20,21,22(wisdom) Verses-29,31,32(pride & heroism) Verses-26,28,63,65(virtue)		
UNIT - II		
Neetisatakam- Holistic development of personality Verses-52,53,59(dont's) Verses-71,73,75,78(do's)		
UNIT - III		
Approach to day to day work and duties. Shrimad Bhagwad Geeta: Chapter 2-Verses 41,47,48, Chapter 3-Verses 13,21,27,35, Chapter 6-Verses 5,13,17,23,35, Chapter 18-Verses 45,46,48.		
UNIT - IV		
Statements of basic knowledge. Shrimad Bhagwad Geeta: Chapter 2-Verses 56,62,68 Chapter 12 - Verses 13,14,15,16,17,18 Personality of Role model. Shrimad Bhagwad Geeta:		
UNIT - V		
Chapter 2-Verses 17, Chapter 3-Verses 36,37,42, Chapter 4-Verses 18,38,39 Chapter 18- Verses 37,38,63		
Suggested Reading		
1. "Srimad Bhagavad Gita" by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata 2. Bhakti-hari's Three Satakam (Niti-sringar-vairagya) by P. Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.		



St. John's College of Engineering and Technology

(AUTONOMOUS)

M.TECH IN POWER ELECTRONICS AND ELECTRICAL DRIVES

CONTROL & INTEGRATION OF RENEWABLE ENERGY SOURCES

II M. Tech – I Semester							SJCET-R24	
Course Code	Category	Hours/Week			Credits	Maximum Marks		
24G3D54301a	PE-V	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	100	100

Course Objective:

To equip students with a comprehensive understanding of power system operation and control, focusing on the integration of distributed renewable energy sources, generation principles from non-conventional energy, and addressing control challenges in various types of generators.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Analyze the effects of renewable energy penetration on grid stability and power quality, and understand the boundaries and configuration of electric grid systems.	L4
CO2	Analyze the principles of operation and control of dynamic generation technologies such as reciprocating engines, gas turbines, and wind-based systems.	L4
CO3	Analyze the operation of static energy conversion devices, including fuel cells and photovoltaic generators, and understand various storage technologies.	L4
CO4	Analyze control issues and challenges in integrating various energy sources like diesel, PV, wind, and fuel cells, and apply appropriate control strategies for load frequency and voltage control.	L4
CO5	Develop optimized integrated systems for renewable energy sources, addressing stability, protection issues, and control requirements for both centralized and distributed systems.	L6

UNIT I INTRODUCTION TO ELECTRIC GRID

Electric grid introduction, Supply guarantee and power quality, Stability, Effects of renewable energy penetration into 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 non conventional 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 non



linear controllers, predictive controllers and adaptive controllers, Fault-ride through Capabilities, Load frequency and Voltage Control.

UNIT V SYSTEM INTEGRATION AND CONTROL

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, Cases studies.

Textbooks:

1. Ali Keyhani Mohammad Marwali and MinDai, "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,"MicrogridsandActiveDistributionNetworks",IETPowerElectronicsSeries,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. BinWu,YongqiangLang,NavidZargari,"PowerConversionandControlofWindEnergySystems",Wiley- IEEE Press, 1st edition, 2011.



St. John's College of Engineering and Technology

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M.TECH IN POWER ELECTRONICS AND ELECTRICAL DRIVES

ENERGY STORAGE TECHNOLOGIES

II M. Tech – I Semester								SJCET-R24
Course Code	Category	Hours/Week			Credits	Maximum Marks		
24G3D54301b	PE-V	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	100	100

Course Objective:

To equip students with a comprehensive understanding of generalized storage techniques, the features and management of energy storage systems, and the potential of the electrical energy storage market through various forecasting methods.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Understand and evaluate the roles and impacts of electrical energy storage technologies in electricity usage, addressing issues such as peak demand, supply flexibility, and grid congestion.	L2
CO2	Understand and compare various types of energy storage systems, including mechanical, electrochemical, chemical, electrical, and thermal storage technologies.	L2
CO3	Apply knowledge of energy storage systems to assess their current and emerging applications, including utility and consumer uses, renewable energy integration, and smart grid technologies.	L3
CO4	Apply and control energy storage systems, evaluate the demand for energy storage, and apply valuation techniques for operational optimization and market analysis.	L3
CO5	Evaluate the market potential for energy storage systems by 2030, using various estimation methods and understanding the future impacts of renewable energy integration and vehicle-to-grid concepts.	L5

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 view point 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), Super conducting 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 SCADA" – 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.

Textbooks:

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:

www.ecofys.com/com/publications



St. John's College of Engineering and Technology

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M.TECH IN POWER ELECTRONICS AND ELECTRICAL DRIVES

HYBRID ELECTRIC VEHICLE ENGINEERING

II M. Tech – I Semester								SJCET-R24
Course Code	Category	Hours/Week			Credits	Maximum Marks		
24G3D54301c	PE-V	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	100	100

Course Objective:

To equip students with a comprehensive understanding of the concepts, performance analysis, energy management strategies, and design principles of hybrid and battery electric vehicles.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Understand the fundamental principles and historical context of hybrid and electric vehicles, including their environmental and energy impacts..	L2
CO2	Analyze different electric and hybrid drive-train topologies, evaluating their power flow control and fuel efficiency.	L4
CO3	Analyze the configuration, control, and efficiency of various motor drives (DC, induction, PM, SRM) used in hybrid and electric vehicles.	L4
CO4	Evaluate different energy storage systems such as batteries, fuel cells, supercapacitors, and hybrid energy storage devices used in hybrid and electric vehicles.	L5
CO5	Create energy management strategies for hybrid and electric vehicles, comparing different approaches and implementing case studies like HEV and BEV design.	L6

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 Switch 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).

Textbooks:

1. Iqbal Hussein, "Electric and Hybrid Vehicles: Design Fundamentals", CRC Press, 3rd edition, 2021.
2. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, "Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design", CRC Press, 2nd edition, 2009.
3. Ali Emadi, "Advanced Electric Drive Vehicles", CRC Press, 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:

<http://nptel.ac.in/syllabus/108103009>



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M.TECH IN POWER ELECTRONICS AND ELECTRICAL DRIVES

WASTE TO ENERGY

II M. Tech – I Semester								SJCET-R24
Course Code	Category	Hours/Week			Credits	Maximum Marks		
24G3DOE301e	OE	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	100	100

Course Objective:

This course will enable students to Understand energy generation from waste, classification of waste types, and technologies for waste-to-energy conversion, knowledge of biomass pyrolysis, gasification, combustion, and conversion processes, about biogas properties, bioenergy systems, biomass resources, classifications, and biomass energy programs in India.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Explain types of waste as fuel and conversion devices.	L2
CO2	Describe pyrolysis processes and their applications.	L3
CO3	Analyze gasification techniques and gasifier designs.	L4
CO4	Analyze biomass combustion devices and operations.	L4
CO5	Evaluate biogas technology, biomass conversions, and applications.	L5

UNIT I INTRODUCTION TO ENERGY FROM WASTE
Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors.
UNIT II BIOMASS PYROLYSIS
Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods – Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.
UNIT III BIOMASS GASIFICATION
Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation
UNIT IV BIOMASS COMBUSTION
Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.
UNIT V BIOGAS AND BIOMASS ENERGY SYSTEMS
Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification -Biomass conversion processes - Thermo chemical conversion - Direct combustion – biomass gasification- pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production -
Urban waste to energy conversion - Biomass energy programme in India.

Textbooks:

1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 2018
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., TMH,



2017

Reference Books:

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

Online Learning Resources:

<https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-ch13/>
<https://www.youtube.com/watch?v=x2KmjbCvKtk>



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M.TECH IN POWER ELECTRONICS AND ELECTRICAL DRIVES

COST MANAGEMENT OF ENGINEERING PROJECTS

II M. Tech – I Semester								SJCET-R24
Course Code	Category	Hours/Week			Credits	Maximum Marks		
24G3DOE301a	OE	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	100	100

Course Objective:

This course will enable students to Understand cost concepts, objectives of costing systems, and the cost management process, Analyze cost behavior concerning volume, profit, and pricing decisions, Apply target costing, life cycle costing, and activity-based cost management in projects or business, Discuss budgeting and budgetary control for effective cost management, Learn about different types of projects, project contracts, stages of execution, and project cost control.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Explain cost concepts in decision-making and cost systems.	L2
CO2	Apply cost behaviors, profit planning, and decision-making tools.	L3
CO3	Analyze target costing, life cycle costing, and activity-based management techniques.	L4
CO4	Analyze Develop flexible, performance, and zero-based budgets.	L4
CO5	Evaluate project execution stages, types of contracts, and cost control tools.	L5

UNIT I	STRATEGIC COST MANAGEMENT PROCESS
Introduction and Overview of the Strategic Cost Management Process - Cost concepts in decision making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.	
UNIT II	COST BEHAVIOR AND PROFIT PLANNING
Cost Behavior and Profit Planning: Marginal Costing- Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems; Pareto Analysis Just-in-time approach, Theory of constraints.; Divisional performance management: - Measurement of Divisional profitability - pricing decisions - transfer pricing.	
UNIT III	ADVANCED COSTING METHODS
Target costing- Life Cycle Costing - Activity-Based Cost management:- Activity based costing- Value-Chain Analysis- Bench Marking; Balanced Score Card.	
UNIT IV	BUDGETARY CONTROL
Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.	
UNIT V	PROJECT COST CONTROL AND EXECUTION
Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and	



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contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process.

Textbooks:

1. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
2. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher

Reference Books:

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd

Online Learning Resources:

- <https://nptel.ac.in/courses/105/104/105104161/>
<https://nptel.ac.in/courses/112/102/112102106/>



St. John's College of Engineering and Technology

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M.TECH IN POWER ELECTRONICS AND ELECTRICAL DRIVES

INTERNET OF THINGS & ITS APPLICATIONS

II M. Tech – I Semester							SJCET-R24	
Course Code	Category	Hours/Week			Credits	Maximum Marks		
24G3DOE301i	OE	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	100	100

Course Objective:

This course aims to Introduce the fundamental concepts of IoT and physical computing, Expose students to various embedded boards and IoT platforms, Provide an understanding of IoT communication protocols, Familiarize students with APIs for IoT applications, Enable students to design and create simple IoT applications.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Explain IoT fundamentals and design principles.	L2
CO2	Analyze and apply embedded computing basics.	L3
CO3	Utilize communication protocols and APIs in IoT.	L4
CO4	Evaluate business models and startup strategies.	L5
CO5	Design for mass production and consider ethical implications.	L6

UNIT I OVERVIEW OF IOT

The Internet of Things: An Overview, The Flavor of the Internet of Things, The “Internet” of “Things”, The Technology of the Internet of Things, Enchanted Objects, Who is Making the Internet of Things?

Design Principles for Connected Devices: Calm and Ambient Technology, Privacy, Web Thinking for Connected Devices, Affordances.

Prototyping: Sketching, Familiarity, Costs Vs Ease of Prototyping, Prototypes and Production, Open source Vs Close source, Tapping into the community.

UNIT II EMBEDDED DEVICES

Electronics, Embedded Computing Basics, Arduino, Raspberry Pi, Mobile phones and tablets, Plug

Computing: Always-on Internet of Things.

UNIT III COMMUNICATION IN THE IOT

Internet Communications: An Overview, IP Addresses, MAC Addresses, TCP and UDP Ports, Application Layer Protocols.

Prototyping Online Components: Getting Started with an API, Writing a New API, Real-Time Reactions, Other Protocols Protocol.

UNIT IV BUSINESS MODELS

A short history of business models, The business model canvas, Who is the business mode for, Models, Funding an Internet of Things startup, Lean Startups.

Manufacturing: What are you producing, Designing kits, Designing printed circuit boards.

UNIT V MANUFACTURING AND ETHICS

Manufacturing continued: Manufacturing printed circuit boards, Mass-producing the case and other fixtures, Certification, Costs, Scaling up software.

Ethics: Characterizing the Internet of Things, Privacy, Control, Environment, Solutions.

Textbooks:

1. Adrian McEwen, Hakim Cassimally - Designing the Internet of Things, Wiley



Publications, 2012

Reference Books:

1. HaiderRaad Fundamentals of IoT and Wearable Technology Design, Wiley Publications2020.
2. KashishAraShakil,Samiya Khan, Internet of Things (IoT) Concepts and Applications, Springer Publications 2020.