Government College of Engineering, Karad				
First Year M. Tech (SEM-I) in Electrical Power Systems				
PS2101: Power System Analysis				
Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		MSE	20
Tutorials	--		ISE	20
Total Credits	03		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite : Power system, Network Analysis

Course Outcomes (CO): Students will be able to

CO1	Calculate voltage phasors at all buses, given the data using various methods of load flow.
CO2	Rank various contingencies according to their severity
CO3	Estimate the bus voltage phasors given various quantities viz. power flow, voltages, taps, CB status etc
CO4	Estimate closeness to voltage collapse and calculate PV curves using continuation power flow

	Course Contents	CO	Hours
Unit 1	• Load flow: Overview of Newton-Raphson, Gauss-Siedel • fast decoupled methods, convergence properties, sparsity techniques, handling Quax violations in constant matrix, inclusion in frequency effects • AVR in load flow, handling of discrete variable in load flow	**CO1**	**06**
Unit 2	• Fault Analysis: Simultaneous faults • open conductor faults • generalized method of fault analysis	**CO2**	**08**
Unit 3	• Security Analysis: Security state diagram, contingency analysis, generator shift, distribution factors • line outage distribution factor, multiple line outages • overload index ranking	**CO3**	**08**
Unit 4	• Power System Equivalents: WARD • REI. equivalents	**CO3**	**06**
Unit 5	• State Estimation: Sources of errors in measurement • Virtual and Pseudo • Measurement, Observability • Tracking state estimation, • WSL method, bad data correction.	**CO3**	**08**
Unit 6	• Voltage Stability: Voltage collapse • P-V curve, multiple power flow solution • continuation power flow, optimal multiplies load flow • voltage collapse proximity indices.	**CO4**	**06**

Text Books

1. J.J. Grainger &W.D.Stevenson, "Power system analysis", McGraw Hill ,2003
2. L.P. Singh, "Advanced Power System Analysis and Dynamics", New Age International, 2006.

Reference Books

1. A. R. Bergen & Vijay Vittal, "Power System Analysis",Pearson, 2000
2. G.L. Kusic, "Computer aided power system analysis",Prentice Hall India, 1986
3. A.J. Wood, "Power generation, operation and control", John Wiley, 1994
4. P.M. Anderson, "Faulted power system analysis", IEEE Press, 1995

Useful Links

1. https://onlinecourses.nptel.ac.in/noc19_ee62/preview Power System Analysis, IIT Kharagpur
2. https://www.coursera.org/learn/electric-power-systems
3. https://www.coursera.org/specializations/industrial-power-systems-analysis-and-stability

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Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	2	2	-	1	3
CO 2	1	3	1	1	2
CO 3	2	2	1	1	1
CO 4	2	3	1	2	1

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	4	10
Understand	5	4	10
Apply	5	4	10
Analyse	5	4	10
Evaluate	-	4	10
Create	-	-	10
TOTAL	20	20	60

Chairman BoS
Electrical Engineering Department

Government College of Engineering, Karad				
First Year M. Tech (SEM-I) in Electrical Power Systems				
PS2102: Power System Dynamics				
Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		MSE	20
Tutorials	-		ISE	20
Total Credits	03		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite : Synchronous Machines, Control Systems

Course Outcomes (CO): Students will be able to

CO1	Demonstrate the modelling of synchronous machine in details system
CO2	Construct models for induction motors and assess their dynamic behaviour
CO3	Derive and interpret flux-linkage equations for synchronous machines
CO4	Analyse the behaviour of synchronous machines under different operating conditions using per unit system concepts

	Course Contents	CO	Hours
Unit 1	• Synchronous Machines: Per unit systems • Park's Transformation (modified) • Flux-linkage equations.	**CO1**	**08**
Unit 2	• Voltage and current equations • Formulation of State-space equations • Equivalent circuit.	**CO1**	**08**
Unit 3	• Sub-transient and transient inductance and Time constants, Simplified models of synchronous machines	**CO2**	**06**
Unit 4	• Small signal model: Introduction to frequency model.	**CO2**	**04**
Unit 5	• Excitation systems and Philips-Heffron model • PSS Load modelling	**CO3**	**08**
Unit 6	• Modelling of Induction Motors • Prime mover controllers.	**CO4**	**06**

Text Books

1. P. M. Anderson & A. A. Fouad "Power System Control and Stability", Galgotia, New Delhi, 1981
2. J Machowski, J Bialek& J. R W. Bumby, "Power System Dynamics and Stability", John Wiley & Sons, 1997

Reference Books

1. P.Kundur, "Power System Stability and Control", McGraw Hill Inc., 1994. .
2. E.W. Kimbark, "Power system stability", Vol. I & III, John Wiley & Sons, New York 2002

Useful Links

1. https://nptel.ac.in/courses/108101004 Power System Dynamics and Control, IIT Bombay
2. https://www.iitp.ac.in/~siva/2021/ee549/index.html

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Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	3	3	1	3	-
CO 2	3	3	1	3	-
CO 3	3	3	2	2	1
CO 4	3	3	3	3	3

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern(with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	4	10
Understand	5	4	10
Apply	5	4	10
Analyse	5	4	10
Evaluate	-	4	10
Create	-	-	10
TOTAL	20	20	60

Chairman BoS
Electrical Engineering Department

Government College of Engineering, Karad				
First Year M. Tech (SEM-I) in Electrical Power Systems				
PS2113: Smart Grid (Elective I)				
Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		MSE	20
Tutorials	00 Hrs/week		ISE	20
Total Credits	03		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite: Power System Analysis, Power System Protection and Switchgear

Course Outcomes (CO): Students will be able to

CO1	Appreciate the difference between smart grid & conventional grid
CO2	Apply smart metering concepts to industrial and commercial installations
CO3	Formulate solutions in the areas of smart substations, distributed generation and wide area measurements
CO4	Select smart grid solutions using modern communication technologies

	Course Contents	CO	Hours
Unit 1	• Introduction to Smart Grid, Evolution of Electric Grid • Concept of Smart Grid, Definitions • Need of Smart Grid, Concept of Robust & Self-Healing Grid Present development • & International policies in Smart Grid	**CO1**	**08**
Unit 2	• Introduction to Smart Meters, Real Time Prizing, Smart Appliances, Automatic Meter Reading(AMR) • Outage Management System(OMS) • Plug in Hybrid Electric Vehicles(PHEV), Vehicle to Grid, Smart Sensors, Home & Building Automation • Smart Substations, Substation Automation, Feeder Automation.	**CO2**	**08**
Unit 3	• Geographic Information System(GIS) • Intelligent Electronic Devices(IED) & their application for monitoring & protection, Smart storage like Battery, SMES, Pumped Hydro, Compressed Air Energy Storage, Wide Area Measurement System(WAMS) • Phase Measurement Unit(PMU)	**CO3**	**06**
Unit 4	• Concept of micro-grid, need & applications of micro-grid, formation of micro-grid, Issues of interconnection, protection & control of micro-grid. □ Plastic & Organic solar cells, thin film solar cells, Variable speed wind generators, fuel-cells, micro-turbines • Captive power plants, Integration of renewable energy sources	**CO3**	**08**
Unit 5	• Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources • Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring Power Quality Audit	**CO4**	**06**
Unit 6	• Advanced Metering Infrastructure (AMI), Home Area Network (HAN), Neighbourhood Area • Network (NAN), Wide Area Network (WAN) • Bluetooth, ZigBee, GPS, Wi-Fi, Wi-Max based communication, • Wireless Mesh Network, Basics of CLOUD Computing & Cyber Security for Smart Grid □ Broadband over Power line (BPL) • IP based protocols	**CO4**	**08**

Text Books

1. Ali Keyhani, "Design of smart power grid renewable energy systems", Wiley IEEE, 2011
2. Clark W. Gellings, "The Smart Grid: Enabling Energy Efficiency and Demand Response", CRC Press , 2009

Reference Books

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1.	JanakaEkanayake, Nick Jenkins, KithsiriLiyanage, "Smart Grid: Technology and Applications", Wiley 2012
2.	Stuart Borlase, "Smart Grid: Infrastructure, Technology and solutions" CRC Press
3.	A.G.Phadke, "Synchronized Phasor Measurement and their Applications", Springer
Useful Links	
1.	https://www.smartgrid.gov/the_smart_grid/smart_grid.html
2.	https://www.energy.gov/smart-grid

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	2	2	2	1	1
CO 2	2	2	3	2	1
CO 3	3	2	1	1	3
CO 4	3	2	2	1	2

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern(with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	4	10
Understand	5	4	10
Apply	5	4	10
Analyse	5	4	10
Evaluate	-	4	10
Create	-	-	10
TOTAL	20	20	60

Chairman BoS
Electrical Engineering Department

Government College of Engineering, Karad				
First Year M. Tech (SEM-I) in Electrical Power Systems				
PS2123: High Power Converter (Elective I)				
Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		MSE	20
Tutorials	--		ISE	20
Total Credits	03		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite : Power Electronics, Control Systems, Power System Fundamentals, Analog and Digital Electronics, Signals and Systems

Course Outcomes (CO): Students will be able to

CO1	Differentiate characteristics of PSDs such as SCRs, GTOs, IGBTs and use them in practical systems and PWM techniques and the ability to use them properly
CO2	Test Knowledge of working of multi-level VSIs, DC-DC switched mode converters, cyclo-converters
CO3	Defend use of power conditioners and their applications
CO4	Design power circuit and protection circuit of PSDs and converters

	Course Contents	CO	Hours
Unit 1	• Power electronic systems • An overview of PSDs, multi-pulse diode rectifier, multi-pulse • SCR rectifier	**CO1**	**06**
Unit 2	• Phase shifting transformers, multilevel voltage source inverters: two level voltage source-inverter, • cascaded • H bridge multilevel inverter.	**CO1**	**08**
Unit 3	• Diode clamped multilevel inverters, flying capacitor multilevel inverter	**CO2**	**08**
Unit 4	• PWM current source inverters, • DC to DC switch mode converters	**CO3**	**06**
Unit 5	• AC voltage controllers: Cyclo-converters, matrix converter, • Power conditioners and UPS.	**CO2**	**08**
Unit 6	• Design aspects of converters, protection of devices and circuits	**CO4**	**06**

Text Books

1. N. Mohan, T. M. Undeland and W. P. Robbins, "Power Electronics: Converter, Applications and Design", John Wiley and Sons, 1989
2. M.H. Rashid, "Power Electronics", Prentice Hall of India, 1994.

Reference Books

1. Bin Wu, "High power converters and drives", IEEE press, Wiley Enter science
2. Bin Wu, "High power converters and drives", IEEE press, Wiley Enter science

Useful Links

1. https://nptel.ac.in/courses/108102157 High Power Multilevel Converters- Analysis, design and operational issues, IIT Delhi
2. https://www.edx.org/learn/engineering/the-georgia-institute-of-technology-multilevel-converters-for-mediumhigh-power-applica
3. https://skill-lync.com/electrical-engineering-courses/design-concepts-power-electronic-converters-industries

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Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	2	2	2	1	1
CO 2	3	2	3	1	2
CO 3	3	2	2	2	1
CO 4	2	2	2	1	2

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern(with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	4	10
Understand	5	4	10
Apply	5	4	10
Analyse	5	4	10
Evaluate	-	4	10
Create	-	-	10
TOTAL	20	20	60

Chairman BoS
Electrical Engineering Department

Government College of Engineering, Karad				
First Year M. Tech (SEM-I) in Electrical Power Systems				
PS2133: Non-conventional Energy Systems (Elective I)				
Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		MSE	20
Tutorials	00 Hrs/week		ISE	20
Total Credits	03		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite: Renewable energy sources, Energy Conversion Technique, fundamentals of power systems

Course Outcomes (CO): Students will be able to

CO1	Evaluate diverse energy sources for distributed generation systems
CO2	Synthesize the impact of distributed generation on power systems and grid interface:
CO3	Analyse and propose solutions for power quality disturbances in distributed generation systems
CO4	Formulate economic analyses and develop strategies for optimizing distributed generation systems

	Course Contents	CO	Hours
Unit 1	• Introduction, Distributed vs Central Station Generation • Sources of Energy such as Micro-turbines • Internal Combustion Engines.	**CO 1**	**06**
Unit 2	• Introduction to Solar Energy, Wind Energy, Combined Heat and Power • Hydro Energy, Tidal Energy, Wave Energy • Geothermal Energy, Biomass and Fuel Cells.	**CO 1**	**08**
Unit 3	• Power Electronic Interface with the Grid	**CO 2**	**06**
Unit 4	• Impact of Distributed Generation on the Power System • Power Quality Disturbances	**CO 2**	**08**
Unit 5	• Transmission System Operation • Protection of Distributed Generators	**CO 3**	**08**
Unit 6	• Economics of Distributed Generation • Case Studies	**CO 4**	**06**

Text Books

1. RanjanRakesh, Kothari D.P, Singal K.C, "Renewable Energy Sources and Emerging Technologies", 2nd Ed. Prentice Hall of India ,2011
2. Math H.Bollen, Fainan Hassan, "Integration of Distributed Generation in the Power System", July 2011, Wiley –IEEE Press

Reference Books

1. Loi Lei Lai, Tze Fun Chan, "Distributed Generation: Induction and Permanent Magnet Generators", October 2007, Wiley-IEEE Press.
2. Roger A.Messenger, Jerry Ventre, "Photovoltaic System Engineering", 3rd Ed, 2010
3. James F.Manwell, Jon G.McGowan, Anthony L Rogers, "Wind energy explained: Theory Design and Application", John Wiley and Sons 2nd Ed, 2010

Useful Links

1. https://www.coursera.org/learn/wind-energy
2. https://online.stanford.edu/courses/xeiet200-planning-sustainable-future-wind-water-and-sun
3. https://www.futurelearn.com/microcredentials/microgrid-market-and-policy

Mapping of COs and POs

PO → / CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	2	2	2	1	1
CO 2	2	2	3	2	1

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CO 3	3	2	1	1	3
CO 4	3	2	2	1	2

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern(with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	4	10
Understand	5	4	10
Apply	5	4	10
Analyse	5	4	10
Evaluate	-	4	10
Create	-	-	10
TOTAL	20	20	60

Chairman BoS
Electrical Engineering Department

Government College of Engineering, Karad				
First Year M. Tech (SEM-I) in Electrical Power Systems				
PS2114: Electrical Power Distribution System (Elective II)				
Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		MSE	20
Tutorials	-		ISE	20
Total Credits	03		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite : Power System Fundamentals, Electrical Machines, Switchgear and Protection, Control Systems, Basic Electrical Engineering.

Course Outcomes (CO): Students will be able to

CO1	Organise power distribution systems
CO2	Formulate strategies for efficient distribution system management and control
CO3	Analyse complex challenges in distribution network restoration and power quality
CO4	Design and present comprehensive automation solutions for distribution systems

	Course Contents	CO	Hours
Unit 1	• Distribution of Power, Management, Power Loads, • Load Forecasting Short-term & Long-term, • Power System Loading, Technological Forecasting.	**CO1**	**6**
Unit 2	• Advantages of Distribution Management System (D.M.S.) Distribution Automation: Definition, • Restoration / Reconfiguration of Distribution Network, Different Methods and constraints • Power Factor Correction	**CO2**	**8**
Unit 3	• Interconnection of Distribution, • Control & Communication Systems, • Remote Metering, • Automatic Meter Reading and its implementation	**CO3**	**6**
Unit 4	• SCADA: Introduction, Block Diagram, • SCADA Applied to Distribution Automation. • Common Functions of SCADA, • Advantages of Distribution Automation through SCADA	**CO3**	**8**
Unit 5	• Calculation of Optimum Number of Switches, Capacitors, Optimum Switching vice Placement in Radial, • Distribution Systems, Sectionalizing Switches – Types, Benefits, • Bellman's Optimality Principle, • Remote Terminal Units, • Energy efficiency in electrical distribution & Monitoring	**CO1**	**8**
Unit 6	• Maintenance of Automated Distribution Systems • Difficulties in Implementing Distribution. • Automation in Actual Practice, Urban/Rural Distribution, Energy Management, AI techniques applied to Distribution Automation	**CO4**	**8**

Text Books

1. A.S. Pabla, " Electric Power Distribution", Tata McGraw Hill Publishing Co. Ltd., Fourth Edition.
2. M.K. Khedkar, G.M. Dhole, "A Text Book of Electrical power Distribution Automation", University Science Press, New Delhi

Reference Books

1. Anthony J Panseni, "Electrical Distribution Engineering", CRC Press

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2.	James Momoh, "Electric Power Distribution, automation, protection & control", CRC Press Course
Useful Links	
1.	https://www.coursera.org/learn/electrical-power-distribution
2.	https://www.udemy.com/course/electrical-power-distribution-course/

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	2	2	2	1	1
CO 2	3	2	3	1	2
CO 3	3	2	2	2	3
CO 4	2	2	2	1	2

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern(with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	4	10
Understand	5	4	10
Apply	5	4	10
Analyse	5	4	10
Evaluate	-	4	10
Create	-	-	10
TOTAL	20	20	60

Chairman BoS
Electrical Engineering Department

Government College of Engineering, Karad				
First Year M. Tech (SEM-I) in Electrical Power Systems				
PS2124: Control of Converters (Elective II)				
Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		MSE	20
Tutorials	00 Hrs/week		ISE	20
Total Credits	03		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite: Power Electronics, Control Systems, Signals and Systems, Analog Electronics, Digital Electronics.

Course Outcomes (CO): Students will be able to

CO1	Demonstrate the importance of PWM techniques
CO2	Compare different PWM strategies
CO3	Control CSI and VSI using PWM
CO4	Compare performance of converter for different PWM techniques

	Course Contents	CO	Hours
Unit 1	• Modulation of one inverter phase leg • Modulation of single phase • VSI and 3 phase VSI	**CO1**	**06**
Unit 2	• Zero space vector placement modulation strategies • Losses-Discontinuous modulation • Modulation of CSI	**CO2**	**08**
Unit 3	• Over modulation of converters • programme modulation strategies	**CO3**	**06**
Unit 4	• Pulse width modulation for multilevel inverters • Implementation of modulation controller	**CO2**	**08**
Unit 5	• Continuing developments in modulation as random PWM • PWM for voltage unbalance	**CO4**	**08**
Unit 6	• Effect of minimum pulse width and dead time	**CO4**	**08**

Text Books

1. D. Grahame Holmes, Thomas A. Lipo, "Pulse width modulation of Power Converter: Principles and Practice", John Wiley & Sons, 03-Oct-2003
2. Bin Vew, "High Power Converter", Wiley Publication

Reference Books

1. Marian K. Kazimicrczuk, "Pulse width modulated dc-dc power converter", Wiley Publication

Useful Links

1. https://www.coursera.org/learn/converter-control
2. https://onlinecourses.nptel.ac.in/noc22_ee100/preview
3. https://www.my-mooc.com/en/mooc/advanced-converter-control-techniques/

Chairman BoS
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Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	2	2	1	1	1
CO 2	3	2	2	1	2
CO 3	3	2	3	2	3
CO 4	2	2	2	1	2

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern(with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	4	10
Understand	5	4	10
Apply	5	4	10
Analyse	5	4	10
Evaluate	-	4	10
Create	-	-	10
TOTAL	20	20	60

Chairman BoS
Electrical Engineering Department

Government College of Engineering, Karad				
First Year M. Tech (SEM-I) in Electrical Power Systems				
PS2134: Electrical and Hybrid Vehicles (Elective II)				
Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		MSE	20
Tutorials	-		ISE	20
Total Credits	03		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite: Electrical Machines, Power Electronics, Control Systems, Electric Drives, Battery Management Systems, Vehicle Dynamics (Basics).

Course Outcomes (CO): Students will be able to

CO1	Acquire knowledge about fundamental concepts, principles, analysis and design of hybrid and electric vehicles.
CO2	Evaluate the societal and environmental significance of hybrid and electric vehicles
CO3	Synthesize mathematical models to describe vehicle performance and power sources
CO4	Design and present comprehensive strategies for energy management in hybrid and electric vehicles

	Course Contents	CO	Hours
Unit 1	• History of hybrid and electric vehicles, • Social and environmental importance of hybrid and electric vehicles • Impact of modern drive-trains on energy supplies • Basics of vehicle performance, vehicle power source characterizationTransmission characteristics • Mathematical models to describe vehicle performance	**CO1**	**(08)**
Unit 2	• Basic concept of hybrid traction, • Introduction to various hybrid drive-train topologies • Power flow control in hybrid drive-train topologies • Fuel efficiency analysis.	**CO1**	**(08)**
Unit 3	• Basic concept of hybrid traction, • Introduction to various hybrid drive-train topologies • Power flow control in hybrid drive-train topologies • Fuel efficiency analysis.	**CO2**	**(06)**
Unit 4	• Introduction to electric components used in hybrid and electric vehicles • Configuration and control of DC Motor drives • Configuration and control of Introduction Motor drives configuration and control of Permanent Magnet Motor Drives Configuration and control of Switch Reluctance • Motor drives, drive system efficiency	**CO3**	**(08)**
Unit 5	• Matching the electric machine and the internal combustion engine (ICE) • Sizing the propulsion motor, sizing the power electronics Selecting the energy storage technology • Communications, supporting subsystems	**CO1**	**(08)**
Unit 6	• Introduction to energy management and their strategies used in hybrid and electric vehicle • Classification of different energy management strategies Comparison of different energy management strategies Implementation issues of energy strategies	**CO4**	**(06)**

Text Books

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Electrical Engineering Department

1.	Sira -Ramirez, R. Silva Ortigoza, "Control Design Techniques in Power Electronics Devices", Springer.
Reference Books	
1.	Siew-Chong Tan, Yuk-Ming Lai, Chi Kong Tse, "Sliding mode control of switching Power Converters"
Useful Links	
1.	https://intellipaat.com/electric-vehicle-course-iit-roorkee/?utm_source=google&utm_medium=search&utm_term=course%20hybrid%20and%20electric%20vehicles&utm_campaign=s_iitr_ev_in&gclid=EAIaIQobChMIs5m72MXCgAMV5SqDAx3tcgf1EAAYASAAEgJxHvD_BwE
2.	https://www.mygreatlearning.com/pgp-electric-vehicle-design-online-course?&utm_source=search&utm_medium=gc9302765&utm_campaign=evd_course-ph-south-ser-lead-pr-pgp_evd&campaign_id=17478854335&adgroup_id=136608836337&ad_id=628213287075&utm_target=kwd-295304205529&Keyword=electric%20vehicle%20training&placement=&gclid=EAIaIQobChMIs5m72MXCgAMV5SqDAx3tcgf1EAAYAiAAEgLhTPD_BwE
3.	https://www.udemy.com/course/electric-hybrid-vehicle-certification-program/?--=&utm_source=adwords&utm_medium=udemyads&utm_campaign=LongTail_la.EN_cc.INDIA&utm_content=deal4584&utm_term=_._ag_118445032537_._ad_618853564450_._kw__._de_c_._dm__._pl__._ti_dsa-1212271230479_._li_9302765_._pd__._&matchtype=&gclid=EAIaIQobChMIs5m72MXCgAMV5SqDAx3tcgf1EAAYBCAAEgJ9OPD_BwE

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	2	3	2	1	1
CO 2	1	2	3	1	1
CO 3	3	1	1	2	3
CO 4	2	2	2	1	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	4	10
Understand	5	4	10
Apply	5	4	10
Analyse	5	4	10
Evaluate	-	4	10
Create	-	-	10
TOTAL	20	20	60

Chairman BoS
Electrical Engineering Department

Government College of Engineering, Karad				
First Year M. Tech (SEM-I) in Electrical Power Systems				
RM2105: Research Methodology				
Teaching Scheme			**Examination Scheme**	
Lectures	02 Hrs/week		MSE	20
Tutorials	-- Hrs/week		ISE	20
Total Credits	02		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite: Technical Writing, Data Analysis, Ethics in Research.

Course Outcomes (CO): Students will be able to

CO1	Understand basic concepts of various research areas, identify and define appropriate research topics concerned to Engineering and related areas.
CO2	Prepare a research proposal to investigate the problem and achieve results/outcomes from the project.
CO3	Develop skill of writing/publishing a research paper/topic in conferences and reputed journals.
CO4	Illustrate need of information about Intellectual Property Right, Patent rights.

	Course Contents	CO	Hours
Unit 1	**Introduction:** Meaning and objectives of research, Types of research, Research approaches, Research process, Research problem, Selection of research problem, defining research problem, Literature review, Meta-analysis, Effect sizes, Integrating research findings, identification of Research gaps, Errors in research.	**CO 1**	**4**
Unit 2	**Data Collection and Analysis:** Primary data collection through observations and interviews, Questionnaire surveys, Secondary data collection, Data processing, Measures of central tendency and dispersion, mean, median, mode, range, variance, standard deviation, inter-quartile range, histogram.	**CO1**	**4**
Unit 3	**Research Design:** Meaning, need, and features of good design, Dependent, independent, and extraneous variables, Experimental and control groups, Treatments, Experiment, Research designs in exploratory studies, Research designs in descriptive studies, Experimental research designs **Sampling:** Need for sampling, Population, Normal distribution, Steps in sampling, sample size, errors in sampling, measurement techniques.	**CO2**	**5**
Unit 4	**Hypothesis Testing**: Null and alternative hypothesis, Level of significance, Type I and type II error, Two-tailed and one-tailed tests, Procedure of hypothesis testing, Preparation of ANOVA Table and calculation of F-ratio.	**CO2**	**5**
Unit 5	**Effective Technical Writing:** Research proposal, Technical Paper writing, Review paper, Report writing, Referencing **Research and publication Ethics:** Plagiarism, Citation, Journal indexing, Open access publishing. SCI journals, research ethics, principals and practice.	**CO3**	**5**
Unit 6	**IPR Patent Rights:** Patents, Trade and Copyright, Process of patenting, Licensing and transfer of technology, Geographical indications. New developments in IPR	**CO4**	**5**

Text Books

1. C.R. Kothari, "Research Methodology Methods and Techniques, Second revised edition, New Age International Publisher, 2006 (Units 1 to 4)
2. Montgomery, Douglas C. & Runger, George C. "Applied Statistics & Probability", 2007 (Unit 2 &3)
3. S. K. Yadav, "Research and Publication Ethics", 1st edition, Springer publication, 2024 (Unit 5, 6)
4. Paneer Selvam – Research Methodology

Reference Books

1. Ranjit Kumar, (2006), "Research Methodology- A Step-By-Step Guide for Beginners", Pearson Education, Delhi
2. Trochim, William M.K., "Research Methods", Biztantra, Dream tech Press, New Delhi, 2nd Edition, 2003
3. Kalyan. C. Kanakala, "Fundamentals of Intellectual Property", Asia Law House, ISBN: 9789381849514, 1st edition, 2012
4. Krishnaswamy, K. N., Sivakumar, Appa Iyer and Mathi Rajan, M. "Management Research Methodology:Integration of Principles, Methods and Techniques", Pearson Education, New Delhi, 2006

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5.	Donald R. Cooper, Pamela S. Schindler, "Business Research Methods", Tata McGraw-Hill Co. Ltd., 8th Edition,2006
Useful Links	
1.	https://www.explorable.com/research-methodology
2.	http://www.socscidiss.bham.ac.uk/methodologies.html
3.	http://www.humanities.manchester.ac.uk/studyskills/methodology.html
4.	http://www.palgrave.com/choosing-appropriate-research-methodologies

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	2	3	-	3	-
CO 2	2	2	-	2	3
CO 3	2	3	-	2	3
CO 4	3	3	-	2	2

1: Slight(Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern(with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	4	10
Understand	5	4	10
Apply	5	4	10
Analyse	5	4	10
Evaluate	-	4	10
Create	-	-	10
TOTAL	20	20	60

Chairman BoS
Electrical Engineering Department

Government College of Engineering, Karad				
First Year M. Tech (SEM-I) in Electrical Power Systems				
PS2106: Renewable Energy Laboratory				
Teaching Scheme			**Examination Scheme**	
Lectures	--		MSE	--
Tutorials	-- Hrs/week		ISE	25
Total Credits	02		ESE	25
Practical's	04 Hrs/week		Duration of ESE	03 Hrs

Prerequisite: Basic Electrical Engineering, Power Electronics, Renewable Energy Systems, Energy Conversion Techniques

Course Outcomes (CO): Students will be able to

CO1	Analyse and evaluate different renewable energy sources, such as solar, wind and select the most suitable option based on specific energy requirements and environmental considerations.
CO2	Weigh the performance data obtained from renewable energy systems, using statistical methods and modelling techniques
CO3	Design and create an innovative and sustainable renewable energy system that addresses a real-world energy challenge.

	Course Contents	**CO**
	Minimum 8 experiments on suitable computational platform to provide students hands-on experience and theoretical understanding of various renewable energy sources, technologies, and their applications. The course aims to develop analytical skills, practical knowledge, and the ability to design innovative solutions in the field of renewable energy.	**CO1, CO2, CO3**

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	2	2	-	1	3
CO 2	1	2	2	1	2
CO 3	2	2	2	1	1

1: Slight(Low) 2: Moderate (Medium) 3: Substantial (High)

Chairman BoS
Electrical Engineering Department

Government College of Engineering, Karad				
First Year M. Tech (SEM-I) in Electrical Power Systems				
PS2107: Advance Simulation Laboratory				
Teaching Scheme			**Examination Scheme**	
Lectures	--		MSE	--
Tutorials	-- Hrs/week		ISE	50
Total Credits	02		ESE	--
Practical's	04 Hrs/week		Duration of ESE	02 Hrs 30 Min

Prerequisite : Programming Fundamentals, Power System, Control Systems, MATLAB/Simulink, Computational Methods

Course Outcomes (CO): Students will be able to

CO1	Analyse simulation results to evaluate the performance, stability, and behaviour of electrical systems, employing MATLAB, PSIM, ANSYS software's
CO2	Critically assess the impact of parameter variations on system responses and make informed recommendations for system optimization.
CO3	Develop advanced simulation models that integrate multiple software tools, demonstrating the ability to model and solve real-world problems.

	Course Contents	**CO**
	Minimum 8experiments on suitable computational platform to provide students with a comprehensive understanding of various simulation techniques and software tools in the field of electrical Power system. The course aims to equip students with the skills to model, analyze, and optimize complex systems and solve practical engineering problems using advanced simulation methods.	**CO1, CO2, CO3**

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	2	2	-	1	3
CO 2	1	2	2	1	2
CO 3	2	2	2	-	1

1: Slight(Low) 2: Moderate (Medium) 3: Substantial (High)

Chairman BoS
Electrical Engineering Department

Government College of Engineering, Karad				
First Year M. Tech (SEM-I) in Electrical Power Systems				
OE2118: Business Analytics				
Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		MSE	20
Tutorials	-- Hrs/week		ISE	20
Total Credits	03		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite: Statistics, Probability and Random Processes, Linear Algebra, Calculus, Programming Fundamentals.

Course Outcomes (CO): Students will be able to

CO1	Judge role of business analytics within an organization.
CO2	Analyse data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.
CO3	Weigh business analytics to formulate and solve business problems and to support managerial decision making.
CO4	Develop, report, and analyse business data.

	Course Contents	**CO**	**Hours**
Unit 1	Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organisation, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.	**CO 1, CO 4**	**9**
Unit 2	Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.	**CO1,CO2, CO 4**	**8**
Unit 3	Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.	**CO 1, CO 3**	**9**
Unit 4	Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.	**CO1, CO 3**	**10**
Unit 5	Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making.	**CO3, CO 4**	**8**
Unit 6	Recent Trends in: Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.	**CO2, CO 3,**	**4**

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		CO4	

Text Books	
1.	Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press.
Reference Books	
1.	Business Analytics by James Evans, persons Education.
Useful Links	
1.	https://www.edx.org/learn/business-analytics
2.	https://www.coursera.org/specializations/business-analytics
3.	https://www.coursera.org/specializations/business-analytics?utm_source=gg&utm_medium=sem&utm_campaign=B2C_INDIA_google-cybersecurity-certificates_PMax-arte-NRL_within_14D&utm_content=B2C&campaignid=20361657342&adgroupid=&device=c&keyword=&matchtype=&network=x&devicemodel=&adpostion=&creativeid=&hide_mobile_promo&gclid=EAIaIQobChMIwLqD_MXCgAMVa5pmAh2G2QxvEAMYAyAAEgLI5_D_BwE

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	2	2	2	1	1
CO 2	3	2	3	1	2
CO 3	3	2	2	2	3
CO 4	2	2	2	1	2

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern(with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	4	10
Understand	5	4	10
Apply	5	4	10
Analyse	5	4	10
Evaluate	-	4	10
Create	-	-	10
TOTAL	20	20	60

Chairman BoS
Electrical Engineering Department

Government College of Engineering, Karad				
First Year M. Tech (SEM-I) in Electrical Power Systems				
OE2128: Industrial Safety				
Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		MSE	20
Tutorials	-- Hrs/week		ISE	20
Total Credits	03		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite : Engineering Mechanics, Strength of Materials, Thermodynamics, Fluid Mechanics, Environmental Studies, Basics of Electrical Engineering.

Course Outcomes (CO): Students will be able to

CO1	Analyse the causes, types, and consequences of industrial accidents and hazards
CO2	Synthesize strategies for effective maintenance engineering and equipment upkeep
CO3	Evaluate corrosion prevention methods and wear reduction techniques
CO4	Design systematic fault-tracing approaches for diverse equipment

	Course Contents	**CO**	**Hours**
Unit 1	Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety colour codes. Fire prevention and firefighting, equipment and methods.	**CO 1, CO 4**	**8**
Unit 2	Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.	**CO 1CO 2, CO 4**	**8**
Unit 3	Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.	**CO 1, CO 3**	**6**
Unit 4	Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault-finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic,automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.	**CO1, CO 3**	**8**
Unit 5	Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance.	**CO3, CO 4**	**6**
Unit 6	Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets,Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance	**CO 1, CO 3, CO 4**	**4**

Text Books

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1.	Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2.	Maintenance Engineering, H. P. Garg, S. Chand and Company.
Reference Books	
1.	Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
2.	Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.
Useful Links	
1.	https://www.udemy.com/course/industrial-safety-processes/?utm_source=adwords&utm_medium=udemyads&utm_campaign=DSA_Catchall_la.EN_cc.INDIA&utm_content=deal4584&utm_term=_._ag_82569850245_._ad_533220805577_._kw__._de_c_._dm__._pl__._ti_dsa-41250778272_._li_9302765_._pd__._&matchtype=&gclid=EAIaIQobChMIjK3WucbCgAMVf5lmAh2DcQW2EAAYAiAAEgIwcfD_BwE
2.	https://onlinecourses.nptel.ac.in/noc19_me40/preview

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	2	2	2	1	1
CO 2	3	2	3	1	2
CO 3	3	2	2	2	3
CO 4	2	2	2	1	2

Assessment Pattern(with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	4	10
Understand	5	4	10
Apply	5	4	10
Analyse	5	4	10
Evaluate	-	4	10
Create	-	-	10
TOTAL	20	20	60

Chairman BoS
Electrical Engineering Department

Government College of Engineering, Karad				
First Year M. Tech (SEM-I) in Electrical Power Systems				
OE2138: Operations Research				
Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		MSE	20
Tutorials	-- Hrs/week		ISE	20
Total Credits	03		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite : Linear Algebra, Numerical Methods, Optimization Techniques, Programming Fundamentals, Engineering Mathematics

Course Outcomes (CO): Students will be able to

CO1	Construct problems of discreet and continuous variables.
CO2	Execute the concept of non-linear programming
CO3	Formulate sensitivity analysis
CO4	Model the real-world problem and simulate it.

	Course Contents	CO	Hours
Unit 1	Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models	**CO 1, CO 4**	**8**
Unit 2	Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming	**CO 1CO 2, CO 4**	**8**
Unit 3	CPM/PERT - Network representation of project, critical path, optimum scheduling by CPM, crashing of project.	**CO 1, CO 3**	**6**
Unit 4	Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.	**CO1, CO 3**	**8**
Unit 5	Single variable Optimization, Unconstrained multivariable optimization, Nonlinear programming with equality constraint, Nonlinear programming KKT conditions	**CO3**	**6**
Unit 6	Numerical optimization: Non-linear programming - unimodal function, unrestricted search, Region elimination techniques, Fibonacci Method, Golden Section Methods, Interpolation Methods	**CO4**	**6**

Text Books

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.

Reference Books

1. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
2. Hitler Libermann Operations Research: McGraw Hill Pub. 2009
3. Panneerselvam, Operations Research: Prentice Hall of India 2010
4. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

Useful Links

1. https://onlinecourses.nptel.ac.in/noc19_ma29/preview
2. https://www.coursera.org/learn/operations-research-theory
3. https://www.classcentral.com/course/swayam-operations-research-14219

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Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	3	3	2	3	2
CO 2	3	3	3	3	3
CO 3	3	2	2	3	1
CO 4	3	2	1	2	2

1: Slight(Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern(with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	4	10
Understand	5	4	10
Apply	5	4	10
Analyse	5	4	10
Evaluate	-	4	10
Create	-	-	10
TOTAL	20	20	60

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Government College of Engineering, Karad				
First Year M. Tech (SEM-I) in Electrical Power Systems				
OE2148: Cost Management of Engineering Project				
Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		MSE	20
Tutorials	-- Hrs/week		ISE	20
Total Credits	03		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite: Engineering Economics, Project Management, Financial Management.

Course Outcomes (CO): Students will be able to

CO1	Analyse cost concepts and their role in decision-making processes
CO2	Synthesize methodologies for effective project management and execution
CO3	Evaluate advanced costing techniques and their application in business strategies
CO4	Design integrated cost management approaches for performance enhancement

	Course Contents	CO	Hours
Unit 1	Introduction and Overview of the Strategic Cost Management Process	**CO 1, CO 4**	**6**
Unit 2	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.	**CO1, CO 2, CO 4**	**8**
Unit 3	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 non-technical 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 contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process	**CO 1, CO 3**	**8**
Unit 4	Cost Behaviour and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning,	**CO1, CO 3**	**6**
Unit 5	Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.	**CO3**	**4**
Unit 6	Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.	**CO4**	**6**

Text Books

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting

Reference Books

1. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
2. Ashish K. Bhattacharya, Principles & Practices of CostAccounting A. H. Wheeler publisher
3. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

Useful Links

1. https://www.coursera.org/learn/scope-time-management-cost
2. https://www.udemy.com/course/engineering-cost-management-course/

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3.	https://online.rice.edu/courses/scope-time-management-cost

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	2	2		1	3
CO 2	1	3	1	1	2
CO 3	2	2	1	1	1
CO 4	2	3	1	2	1

1: Slight(Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern(with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	4	10
Understand	5	4	10
Apply	5	4	10
Analyse	5	4	10
Evaluate	-	4	10
Create	-	-	10
TOTAL	20	20	60

Chairman BoS
Electrical Engineering Department

Government College of Engineering, Karad				
First Year M. Tech (SEM-I) in Electrical Power Systems				
OE2158: Composite Materials				
Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		MSE	20
Tutorials	-- Hrs/week		ISE	20
Total Credits	03		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite : Materials Science, Mechanics of Materials, Manufacturing Processes.

Course Outcomes (CO): Students will be able to

CO1	Evaluate the impact of reinforcement characteristics on composite performance
CO2	Synthesize manufacturing methods and applications of diverse composite types
CO3	Analyse mechanical behaviour and failure criteria of composite materials
CO4	Design composite material systems based on strength and laminar failure criteria

	Course Contents	CO	Hours
Unit 1	Introduction: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.	**CO 1, CO 4**	**8**
Unit 2	Reinforcements: Preparation-layup, curing, properties and applications of glass fibres, carbon fibres, Kevlar fibres and Boron fibres. Properties and applications of whiskers, particle reinforcements.	**CO 1CO 2, CO 4**	**4**
Unit 3	Mechanical Behaviour of composites: Rule of mixtures, Inverse rule of mixtures. Iso-strain and Iso-stress conditions.	**CO 1, CO 3**	**2**
Unit 4	Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.	**CO1, CO 3**	**6**
Unit 5	Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.	**CO3**	**8**
Unit 6	Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.	**CO4**	**8**

Text Books

1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.

Reference Books

1. Hand Book of Composite Materials-ed-Lubin.
2. Composite Materials – K.K.Chawla.

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3.	Composite Materials Science and Applications – Deborah D.L. Chung.
4.	Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi
Useful Links	
1.	https://www.udemy.com/course/composite-materials/
2.	https://www.classcentral.com/course/swayam-introduction-to-composites-10005
3.	https://engineering.purdue.edu/online/courses/mechanics-composite-materials
4.	https://onlinecourses.nptel.ac.in/noc19_me67/preview

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	2	2	3	1	2
CO 2	2	2	3	1	1
CO 3	2	1	3	1	2
CO 4	2	1	3	1	2

1: Slight(Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern(with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	4	10
Understand	5	4	10
Apply	5	4	10
Analyse	5	4	10
Evaluate	-	4	10
Create	-	-	10
TOTAL	20	20	60

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Government College of Engineering, Karad				
First Year M. Tech (SEM-I) in Electrical Power Systems				
OE2168: Waste to Energy				
Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		MSE	20
Tutorials	-- Hrs/week		ISE	20
Total Credits	03		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite: Environmental Engineering, Thermodynamics, Chemical Engineering Basics.

Course Outcomes (CO): Students will be able to

CO1	Differentiate various waste-to-energy conversion devices and their fuel sources
CO2	Justify biomass pyrolysis processes, yields, and applications
CO3	Analyse biomass gasification technologies, operation, and equilibrium considerations
CO4	Evaluate the properties and applications of biogas and its production technologies

	Course Contents	CO	Hours
Unit 1	Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors	**CO1, CO4**	**8**
Unit 2	Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.	**CO1,CO2, CO 4**	**8**
Unit 3	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.	**CO1, CO3**	**6**
Unit 4	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.	**CO1, CO3**	**8**
Unit 5	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	**CO3**	**4**
Unit 6	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.	**CO4**	**4**

Text Books

1. Non-Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.

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.

Useful Links

1. https://onlinecourses.nptel.ac.in/noc20_ch16/preview

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2.	https://www.udemy.com/course/the-concept-of-waste/
3.	https://www.classcentral.com/course/swayam-waste-to-energy-conversion-7960

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	2	2	2	2	3
CO 2	1	3	1	2	3
CO 3	2	2	1	2	2
CO 4	2	3	1	2	3

1: Slight(Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern(with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	4	10
Understand	5	4	10
Apply	5	4	10
Analyse	5	4	10
Evaluate	-	4	10
Create	-	-	10
TOTAL	20	20	60

Chairman BoS
Electrical Engineering Department

Government College of Engineering, Karad				
First Year M. Tech (SEM-II) in Electrical Power Systems				
PS2201:Digital Protection of Power System				
Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		MSE	20
Tutorials	-- Hrs/week		ISE	20
Total Credits	03		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite : Power System Protection, Power System fundamentals

Course Outcomes (CO): Students will be able to

CO1	Investigate evolution of digital relays
CO2	Justify importance of Digital Relays
CO3	Apply Mathematical approach towards protection
CO4	Develop various Protection algorithms

	Course Contents	CO	Hours
Unit 1	• Evolution of digital relays from electromechanical relays • Performance and operational characteristics of digital protection	**CO 1, CO 4**	**6**
Unit 2	• Mathematical background to protection algorithms • Finite difference techniques	**CO 1CO 2, CO 4**	**6**
Unit 3	• Interpolation formulae • Forward, backward and central difference interpolation • Numerical differentiation • Curve fitting and smoothing • Least squares meth	**CO 1, CO 3**	**8**
Unit 4	• Basic elements of digital protection • Signal conditioning: transducers, surge protection, analog filtering, analog multiplexers • Conversion subsystem: the sampling theorem, signal aliasing • Error, sample and hold circuits, multiplexers, analog to digital conversion • Digital filtering concepts, • The digital relay as a unit consisting of hardware and software	**CO1, CO 3**	**8**
Unit 5	• Sinusoidal wave-based algorithms • Sample and first derivative (Mann and Morrison) algorithm.	**CO3**	**8**
Unit 6	• Fourier Algorithm: Full cycle window algorithm, fractional cycle window algorithm. • Least Squares based algorithms. Differential equation -based algorithms. • Digital Differential Protection of Transformers. • Digital Line Differential Protection.	**CO4**	**8**

Text Books

1. A.G. Phadke and J. S. Thorp, "Computer Relaying for Power Systems", Wiley/Research studies Press, 2009
2. A.T. Johns and S. K. Salman, "Digital Protection of Power Systems", IEEE Press,1999

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Reference Books	
1.	S. R. Bhide, "Digital Power System Protection" PHI
2.	"L. P. Singh, "Digital Protection", John Wiley & Sons Inc
Useful Links	
1.	https://onlinecourses.nptel.ac.in/noc22_ee46/preview
2.	https://archive.nptel.ac.in/courses/117/107/117107148/
3.	https://www.classcentral.com/course/swayam-power-system-protection-19974

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	2	2	2	1	1
CO 2	3	2	3	1	2
CO 3	3	2	2	2	3
CO 4	2	2	2	1	2

1: Slight(Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern(with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	4	10
Understand	5	4	10
Apply	5	4	10
Analyse	5	4	10
Evaluate	-	4	10
Create	-	-	10
TOTAL	20	20	60

Chairman BoS
Electrical Engineering Department

Government College of Engineering, Karad				
First Year M. Tech (SEM-II) in Electrical Power Systems				
PS2202:Real Time Control of Power System				
Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		MSE	20
Tutorials	-- Hrs/week		ISE	20
Total Credits	03		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite : Control Systems, Power System Operation and Control

Course Outcomes (CO): Students will be able to

CO1	Apply analytical methods for modelling and real-time monitoring of power system components
CO2	Evaluate load frequency control strategies and their application using modern control theory and AI
CO3	Analyse optimal control techniques for economic dispatch and power flow optimization
CO4	Design and implement reactive power control strategies in power systems

	Course Contents	CO	Hours
Unit 1	Analytical Methods: Modelling& Identification of power system components, Real time data processing, Real time monitoring using phasor measurement.	**CO 1, CO 4**	**6**
Unit 2	Load Frequency Control: Objectives, tie line bias control, flat frequency control, supplementary control, interconnected areas, two area, three area systems, state variable model for single, two, three area cross coupling between control loops (AVR,AGC), Application of modern control theory, Application of Artificial Intelligence, AGC using Kalman method	**CO 1CO 2, CO 4**	**8**
Unit 3	Optimal Control: Generation mix, Optimum economic dispatch, Optimum generation allocation, Solution techniques for optimum power flow such as gradients, Newton's linear programming, Non-linear programming methods such as Dommeltinney, EL Abiad-James. Dynamic programming methods. Fuel scheduling using linear programming, hydro solution to hydro thermal scheduling, short range and long range (Dynamic programming solution to hydro thermal scheduling), and scheduling problems Kirchmeyers method of co-ordinate equation.	**CO 1, CO 3**	**8**
Unit 4	Reactive power control: Need for adjustable reactive power, excitation control, tap changing transformers, fundamental concepts of series and dynamic shunt compensation, principles of static compensators and applications. Automatic P.F controlling scheme.	**CO1, CO 3**	**6**
Unit 5	State estimation: Power system state estimation,least square estimation of AC networks, estimation of orthogonal decomposition, application of state estimation to power systems.	**CO1, CO 4**	**6**
Unit 6	SCADA and DAS: Power system security, contingency analysis, energy control centres, centralized and de-centralized control, SCADA systems, Recent trends on real time operations. Substation automation, remote metering, energy audit Reconfiguration of distribution networks under normal conditions for loss minimization and restoration of distribution system.	**CO 4, CO 3, CO 2**	**8**

Text Books

1. B.Handschlw, "Real Time Control Of Electric Power System"
2. Recent Trends In Electric Energy System—J.Nandaand D.P. Kothari

Reference Books

1. Computer Aided System Analysis and Control—Mahalanabis Kothari Ahason
2. Power System Operation and Control—P.S.R.Murthy

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3.	Electric Energy System Theory an Introduction—OlleD.Elgerd
4.	Reactive Power Control of Electric Power System-T.J.E.Miller
Useful Links	
1.	https://www.udemy.com/course/electric-power-protectionswitchgear-and-control-masterclass/?--=&utm_source=adwords&utm_medium=udemyads&utm_campaign=LongTail_la.EN_cc.INDIA&utm_content=deal4584&utm_term=_._ag_118445032537_._ad_618853564450_._kw__._de_c_._dm__._pl__._ti_dsa-1212271230479_._li_9302765_._pd__._&matchtype=&gclid=EAIaIQobChMIobPTzsjCgAMVi2l9Ch1dzws4EAAYASAAEgLZWvD_BwE
2.	https://onlinecourses.nptel.ac.in/noc23_ee128/preview
3.	https://www.ntnu.edu/studies/courses/ET8105

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	2	2	2	1	1
CO 2	2	2	2	1	2
CO 3	1	2	2	2	1
CO 4	2	2	2	1	2

1: Slight(Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern(with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	4	10
Understand	5	4	10
Apply	5	4	10
Analyse	5	4	10
Evaluate	-	4	10
Create	-	-	10
TOTAL	20	20	60

Chairman BoS
Electrical Engineering Department

Government College of Engineering, Karad				
First Year M. Tech (SEM-II) in Electrical Power Systems				
PS2213: Restructured Power Systems (Elective III)				
Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		MSE	20
Tutorials	-		ISE	20
Total Credits	03		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite : Power System Operation and Control, Power System Economics

Course Outcomes (CO): Students will be able to

CO1	Identify the need of regulation and deregulation.
CO2	Define and describe the Technical and Non-technical issues in Deregulated Power Industry.
CO3	Identify and give examples of existing electricity markets.
CO4	Classify different market mechanisms and summarize the role of various entities in the market. PE

	Course Contents	CO	Hours
Unit 1	• Fundamentals of restructured system • Market architecture • Load elasticity • Social welfare maximization	**CO1**	**08**
Unit 2	• OPF: Role in vertically integrated systems and in restructured markets • congestion management	**CO1**	**08**
Unit 3	• Optimal bidding • Risk assessment • Hedging • Transmission pricing • Tracing of power	**CO2**	**08**
Unit 4	• Ancillary services • Standard market design • Distributed generation in restructured markets	**CO3**	**08**
Unit 5	• Developments in India • IT applications in restructured markets	**CO4**	**06**
Unit 6	• Working of restructured power systems • PJM, Recent trends in Restructuring	**CO4**	**06**

Text Books

1. LorrinPhilipson, H. Lee Willis, "Understanding electric utilities and de-regulation", Marcel Dekker Pub.,1998.
2. Steven Stoft, "Power system economics: designing markets for electricity", John Wiley and Sons, 2002

Reference Books

1. Kankar Bhattacharya, Jaap E. Daalder, Math H.J. Boolen, "Operation of restructured power systems", Kluwer Academic Pub., 2001.
2. Mohammad Shahidehpour, MuwaffaqAlomoush, "Restructured electrical power systems: operation, trading and volatility", Marcel Dekker.

Useful Links

1. https://archive.nptel.ac.in/courses/108/101/108101005/
2. https://www.amrita.edu/course/restructured-power-system-optimisation/

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Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	3	3	2	3	2
CO 2	3	3	3	3	3
CO 3	3	2	2	3	1
CO 4	3	2	1	2	2

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern(with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	4	10
Understand	5	4	10
Apply	5	4	10
Analyse	5	4	10
Evaluate	-	4	10
Create	-	-	10
TOTAL	20	20	60

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Electrical Engineering Department

Government College of Engineering, Karad				
First Year M. Tech (SEM-II) in Electrical Power Systems				
PS2223: Dynamics of Machines (Elective III)				
Teaching Scheme			**Examination Scheme**	
Lectures	03Hrs/week		MSE	20
Tutorials	--Hrs/week		ISE	20
Total Credits	03		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite : Electrical Machines, Control Systems, Dynamics, Mechanics of Materials

Course Outcomes (CO): Students will be able to

CO1	Formulate Performance characteristics of machine.
CO2	Judge dynamics of machine.
CO3	Derive and apply complete voltage and torque equations for primitive 4-winding commutator machines
CO4	Evaluate performance and characteristics of three-phase induction motors using transformed equations and reference frames.

	Course Contents	CO	Hours
Unit 1	• Stability. • Primitive 4 Winding Commutator Machine. • Commutator Primitive Machine. • Complete Voltage Equation of Primitive 4 Winding Commutator Machine.	**CO1**	**06**
Unit 2	• Torque Equation. Analysis of Simple DC Machines using the Primitive Machine Equations. • The Three Phase Induction Motor. Transformed Equations. • Different Reference Frames for Induction Motor Analysis Transfer Function Formulation	**CO2**	**10**
Unit 3	• Three Phase Salient Pole Synchronous Machine. • Parks Transformation- Steady State Analysis.	**CO2**	**06**
Unit 4	• Large Signal Transient. Small Oscillation Equations in State Variable form • Dynamical Analysis of Interconnected Machines	**CO2**	**06**
Unit 5	• Large Signal Transient Analysis using Transformed Equations. • DC Generator /DC Motor System.	**CO3**	**08**
Unit 6	• Alternator/Synchronous Motor System.	**CO4**	**04**

Text Books

1. D.P.Sengupta & J.B.Lynn," Electrical Machine Dynamics"TheMacmillanPressLtd.1980
2. R. Krishnan "Electric Motor Drives, Modelling, Analysis, and Control", Pearson Education.,2001

Reference Books

1. .P.C.Kraus, "Analysis of Electrical Machines", McGraw Hill Book Company,1987
2. .I.Boldia&S.A.Nasar,"Electrical Machine Dynamics", The Mac Millan Press Ltd.1992.
3. C.V.Jones, "The Unified Theory of Electrical Machines", Butterworth,London.1967

Useful Links

1. https://archive.nptel.ac.in/courses/108/106/108106023/
2. https://onlinecourses.nptel.ac.in/noc23_ee55/preview

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Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	3	2	2	1	1
CO 2	3	2	3	1	2
CO 3	3	2	1	2	1
CO 4	2	2	2	1	1

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern(with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	4	10
Understand	5	4	10
Apply	5	4	10
Analyse	5	4	10
Evaluate	-	4	10
Create	-	-	10
TOTAL	20	20	60

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Electrical Engineering Department

Government College of Engineering, Karad				
First Year M.Tech (SEM-II) in Electrical Power Systems				
PS2233: Power Apparatus and Devices (Elective III)				
Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		MSE	20
Tutorials	--		ISE	20
Total Credits	03		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite : Electrical machine Design, Electrical Machines, , Power System Fundamentals, Electrical Materials.

Course Outcomes (CO): Students will be able to

CO1	Apply principles of machine design to determine appropriate loadings and dimensions for electrical machines
CO2	Analyse factors affecting the efficiency, losses, and heating of electrical machines, and select suitable cooling methods
CO3	Evaluate design considerations and calculations for transformers, including losses, efficiency, and magnetic properties
CO4	Design stator and rotor windings, analyse leakage flux, and optimize machine performance using design data

	Course Contents	CO	Hours
Unit 1	• Principles of Design of Machines-Specific loadings, choice of magnetic and electric loadings • Real and apparent flux densities, temperature rise calculation, Separation of main dimension for DC machines • Induction machines and synchronous machines • Design of Transformers-General considerations, output equation, emf per turn, choice of flux density and current density, main dimensions, leakage reactance and conductor size, design of tank and cooling	**CO1**	**08**
Unit 2	• Specific loadings, choice of magnetic and electric loadings Real and apparent flux-densities, temperature rise calculation • Separation of main dimension for DC machines • Induction machines and synchronous machines • Heating and cooling of machines, types of ventilation, continuous and intermittent rating	**CO2**	**08**
Unit 3	• General considerations, output equation, emf per turn, choice of flux density and current density, main dimensions, leakage reactance and conductor size, design of tank and cooling tubes • Calculation of losses, efficiency and regulation • Forces winding during short circuit	**CO3, CO4**	**08**
Unit 4	• Choice of specific electric and magnetic loadings, efficiency, power factor • Number of slots in stator and rotor • Elimination of harmonic torques	**CO3, CO4**	**06**
Unit 5	• Design of stator and rotor winding, slot leakage flux • Leakage reactance, equivalent resistance of squirrel cage rotor, Magnetizing current, efficiency from design data	**CO3, CO4**	**06**
Unit 6	• Types of alternators, comparison, specific loadings, output co-efficient, design of main dimensions • Introduction to Computer Aided Electrical Machine Design Energy efficient machines	**CO4**	**06**

Text Books

1. ClaytonA.E,"The Performance and Design of D.C. Machines",Sir I. Pitman &sons,Ltd.

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2.	M.G.Say, "The Performance and Design of A.C. Machines", Pitman
Reference Books	
1.	Sawhney A. K, "A course in Electrical Machine Design", Dhanpat Rai & Sons, 5th Edition
Useful Links	
1.	https://www.udemy.com/topic/electrical-design/
2.	https://www.udemy.com/course/electrical-power-equipment/

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	2	2	2	1	
CO 2	2	2	2	1	2
CO 3	3	2	2	2	1
CO 4	2	2	1	1	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern(with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	4	10
Understand	5	4	10
Apply	5	4	10
Analyse	5	4	10
Evaluate	-	4	10
Create	-	-	10
TOTAL	20	20	60

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Electrical Engineering Department

Government College of Engineering, Karad				
First Year M. Tech (SEM-II) in Electrical Power Systems				
PS2214:Power Quality (Elective IV)				
Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		MSE	20
Tutorials	-- Hrs/week		ISE	20
Total Credits	03		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite: Power Electronics, Electrical Machines

Course Outcomes (CO): Students will be able to

CO1	Differentiate harmonics, harmonic introducing devices and effect of harmonics on system equipment and loads
CO2	Develop analytical modelling skills needed for modelling and analysis of harmonics in networks and components
CO3	Design problems of active power factor correction based on static VAR compensators and its control techniques
CO4	Relate shunt active power filtering techniques for harmonics.

	Course Contents	CO	Hours
Unit 1	• Introduction-power quality-voltage quality-overview of power • Quality phenomena classification of power quality issues. • Power quality measures and standards-THD-TIF-DIN-C-message weights. • Flicker factor transient phenomena-occurrence of power quality problems • Power acceptability curves-IEEE guides • Standards and recommended practices.	**CO1, CO2**	**05**
Unit 2	• Harmonics-individual and total harmonic distortion • RMS value of a harmonic waveform • Triplex harmonics. Important harmonic introducing devices. SMPS • Three phase power converters-arcing devices saturable devices • Harmonic distortion of fluorescent lamps-effect of power system harmonics on power system equipment and loads.	**CO1, CO2**	**08**
Unit 3	• Modelling of networks and components under non-sinusoidal conditions • Transmission and distribution systems • Shunt capacitors-transformers. Electric machines. • Ground systems loads that cause power quality problems. • Power quality problems created by drives and its impact on drive	**CO3, CO4**	**06**
Unit 4	• Mitigation of Power quality problems, Power factor improvement- Passive Compensation. • Passive Filtering. Harmonic Resonance. • Active Power Factor Corrected Single Phase Front End • Control Methods for Single Phase APFC. • Three Phase APFC and Control Techniques • PFC based on Bilateral Single Phase and Three Phase Converter	**CO3, CO4**	**06**
Unit 5	• Hamilton-Jacobi-Bellman equation - model reference adaptive systems (MRAS) - Design hypothesis.	**CO3, CO4**	**08**
Unit 6	• Introduction to design method based on the use of Lyapunov function. • Design and simulation of variable structure adaptive model following control.	**CO4**	**08**

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Text Books	
1.	G.T. Heydt, "Electric power quality", McGraw-Hill Professional, 2007
2.	Math H. Bollen, "Understanding Power Quality Problems", IEEE Press, 2000
Reference Books	
1.	J. Arrillaga, "Power System Quality Assessment", John wiley, 2000
2.	J. Arrillaga, B.C. Smith, N.R. Watson & A. R.Wood,"Power system Harmonic Analysis", Wiley, 1997
Useful Links	
1.	https://onlinecourses.nptel.ac.in/noc23_ee63/preview
2.	https://www.udemy.com/course/introduction-to-power-quality/

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	2	2	3	1	2
CO 2	2	2	3	1	1
CO 3	2	1	3	1	2
CO 4	2	1	3	1	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern(with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	4	10
Understand	5	4	10
Apply	5	4	10
Analyse	5	4	10
Evaluate	-	4	10
Create	-	-	10
TOTAL	20	20	60

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Electrical Engineering Department

Government College of Engineering, Karad

First Year M. Tech (SEM-II) in Electrical Power Systems

PS2224:FACTS and Power Devices (Elective IV)

Teaching Scheme			**Examination Scheme**	
Lectures	03Hrs/week		MSE	20
Tutorials	-- Hrs/week		ISE	20
Total Credits	03		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite : Power Electronics, Power System Protection, Electrical Materials, Circuit Theory

Course Outcomes (CO): Students will be able to

CO1	Acquire knowledge about the fundamental principles of Passive and Active Reactive Power Compensation Schemes at Transmission and Distribution level in Power Systems.
CO2	Learn various Static VAR Compensation Schemes like Thyristor/GTO Controlled Reactive Power Systems, PWM, Inverter based Reactive Power Systems and their controls.
CO3	Develop analytical modelling skills needed for modelling and analysis of such Static VAR Systems.
CO4	Compare IEEE power quality standards

	Course Contents	**CO**	**Hours**
Unit 1	• Reactive power flow control in Power Systems • Control of dynamic power unbalances in Power System • Power flow control-Constraints of maximum transmission line loading • Benefits of FACTS Transmission line compensation- Uncompensated line Shunt compensation - Series compensation –Phase angle control. • Reactive power compensation – Shunt and Series compensation principles – Reactive compensation at transmission and distribution level.	**CO 1**	**8**
Unit 2	• Static versus passive VAR compensator, Static shunt compensators: SVC and • STATCOM - Operation and control of TSC, TCR and STATCOM Compensator control • Comparison between SVC and STATCOM.	**CO1, CO2**	**4**
Unit 3	• Static series compensation: TSSC, SSSC -Static voltage and phase angle regulators – TCVR and TCPAR • Operation and Control –Applications • Static series compensation – GCSC,TSSC, TCSC • Static synchronous series compensators and their Control	**CO1, CO3**	**6**
Unit 4	• SSR and its damping Unified Power Flow Controller: Circuit Arrangement • Operation and control of UPFC- Basic Principle of P and Q control • Independent real and reactive power flow control- Applications.	**CO1**	**4**
Unit 5	• Introduction to interline power flow controller. • Modelling and analysis of FACTS, Controllers Passive filters, active filtering	**CO2**	**6**
Unit 6	• Voltage swells, sags, flicker, unbalance and mitigation of these problems by power line conditioners • IEEE standards on power quality.	**CO4**	**4**

Text Books

1. K R Padiyar, "FACTS Controllers in Power Transmission and Distribution", New Age International Publishers,

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	2007
2.	X P Zhang, C Rehtanz, B Pal, "Flexible AC Transmission Systems- Modelling and Control",Springer Verlag, Berlin, 2006
Reference Books	
1.	N.G. Hingorani, L. Gyugyi, "Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems", IEEE Press Book, Standard Publishers and Distributors, Delhi, 2001.
2.	K.S.Sureshkumar ,S.Ashok , "FACTS Controllers & Applications", E-book edition, Nalanda Digital Library, NIT Calicut,2003.
3.	G T Heydt , "Power Quality", McGraw-Hill Professional, 2007.
4.	T J E Miller, "Static Reactive Power Compensation", John Wiley and Sons, Newyork, 1982.
Useful Links	
1.	https://onlinecourses.nptel.ac.in/noc23_ee58/preview
3.	https://www.classcentral.com/course/swayam-facts-devices-119462

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	2	2	2	2	3
CO 2	1	3	1	2	3
CO 3	2	2	1	2	2
CO 4	2	3	1	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern(with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	4	10
Understand	5	4	10
Apply	5	4	10
Analyse	5	4	10
Evaluate	-	4	10
Create	-	-	10
TOTAL	20	20	60

Chairman BoS
Electrical Engineering Department

Government College of Engineering, Karad				
First Year M.Tech (SEM-II) in Electrical Power Systems				
PS2234: SCADA systems and Applications(Elective IV)				
Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		MSE	20
Tutorials	00 Hrs/week		ISE	20
Total Credits	03		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite : Power System Operation and Control, Communication Systems.

Course Outcomes (CO): Students will be able to

CO1	Demonstrate understanding of SCADA fundamentals and its evolution
CO2	Employ communication technologies in SCADA systems and compare various architectures
CO3	Relate the role of intelligent devices and communication protocols in SCADA networks
CO4	Design SCADA applications for utility automation and industrial sectors

	Course Contents	CO	Hours
Unit 1	• Introduction to SCADA • Data acquisition systems • Evolution of SCADA • Communication technologies	**CO1,CO2, CO3**	**(08)**
Unit 2	• Monitoring and supervisory functions • SCADA applications in Utility Automation • Industries SCADA	**CO1,CO2, CO3**	**(06)**
Unit 3	• Industries SCADA System Components • Schemes- Remote Terminal Unit(RTU) • Intelligent Electronic Devices(IED) • Programmable Logic Controller(PLC) • Communication Network, SCADA Server, SCADA/HMI Systems	**CO1,CO2, CO3**	**(08)**
Unit 4	• SCADA Architecture • Various SCADA architectures, advantages and disadvantages of each system • Single unified standard architecture-IEC61850.	**CO1,CO2, CO3**	**(08)**
Unit 5	• SCADA Communication • Various industrial communication technologies • Wired and wireless methods and fiber optics • Open standard communication protocols	**CO1,CO2, CO3**	**(08)**
Unit 6	• SCADA Applications: Utility applications • Transmission and Distribution sector operations, monitoring, analysis and improvement • Industries- oil, gas and water • Case studies, Implementation, Simulation Exercises	**CO4**	**(06)**

Text Books

1. Stuart A Boyer:"SCADA- Supervisory Control and Data Acquisition", Instrument Society of America Publications, USA,2004
2. Gordon Clarke, Deon Reynders: "Practical Modern SCADA Protocols: DNP3,60870.5and Related Systems", Newnes Publications, Oxford, UK,2004

Reference Books

1. William T. Shaw,"Cyber security for SCADA systems", Penn Well Books,2006
2. David Bailey, Edwin Wright,"Practical SCADA for industry",Newnes,2003
3. Michael Wiebe,"A guide to utility automation: AMR, SCADA, and IT systems for electric power",Penn Well1999

Useful Links

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1.	https://www.udemy.com/course/learn-scada-in-a-day-starting-from-scratch/?gclid=EAIaIQobChMI9dnilsrCgAMVD1orCh1HgQeOEAAYASAAEgKK5fD_BwE&matchtype=b&utm_campaign=Long Tail_la.EN_cc.INDIA&utm_content=deal4584&utm_medium=udemyads&utm_source=adwords&utm_term=_.ag_78875707083_.ad_533133858411_.kw_scada+training_.de_c_.dm_.pl_.ti_kwd-1010276589_.li_9302765_.pd_.
2.	https://www.udemy.com/course/arduino-scada-system-interface-with-arduino/

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	2	2	2	2	3
CO 2	1	2	1	2	3
CO 3	2	2	1	2	2
CO 4	2	3	1	2	3

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern(with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	4	10
Understand	5	4	10
Apply	5	4	10
Analyse	5	4	10
Evaluate	-	4	10
Create	-	-	10
TOTAL	20	20	60

Chairman BoS
Electrical Engineering Department

Government College of Engineering, Karad				
First Year M. Tech (SEM-II) in Electrical Power Systems				
PS2215:Power System Transients (Elective V)				
Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		MSE	20
Tutorials	00 Hrs/week		ISE	20
Total Credits	03		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite: Fundamentals of Transient Analysis and Signal Processing

Course Outcomes (CO): Students will be able to

CO1	Gain knowledge of various transients that could occur in power system and their mathematical formulation
CO2	Design various protective devices in power system for protecting equipment and personnel
CO3	Select insulation coordination
CO4	Design power system for transient analysis

	Course Contents	CO	Hours
Unit 1	• Fundamental circuit analysis of electrical transients • Laplace Transform method of solving simple Switching transients • Damping circuits -Abnormal switching transients, Three-phase circuits and transients • Computation of power system transients	**CO1**	**08**
Unit 2	• Principle of digital computation – Matrix method of solution • Modal analysis- Z transform- Computation using EMTP • Lightning, switching and temporary over voltages, Lightning • Physical phenomena of lightning.	**CO1**	**08**
Unit 3	• Interaction between lightning and power system • Influence of tower footing resistance and Earth Resistance • Switching: Short line or kilometric fault • Energizing transients - closing and • re-closing of lines • line dropping, load rejection – over voltages induced by faults	**CO2**	**08**
Unit 4	• Switching HVDC line Travelling waves on transmission line • Circuits with distributed Parameters Wave Equation • Reflection, Refraction, Behaviour of Travelling waves at the line terminations • Lattice Diagrams – Attenuation and Distortion • Multi-conductor system • and Velocity wave	**CO3**	**08**
Unit 5	• Insulation co-ordination: Principle of insulation co-ordination in Air Insulated substation (AIS) and Gas Insulated Substation (GIS) Coordination between insulation and protection level • Statistical approach	**CO4**	**06**

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Unit 6	• Protective devices • Protection of system against over voltages • lightning arresters, substation earthling	CO1, CO4	06

Text Books	
1.	Allan Greenwood, "Electrical Transients in Power System", Wiley & Sons Inc. New York, 1991
Reference Books	
1.	Juan A. Martinez-Velasco "Power System Transients Parameter Determination" © 2010 by Taylor and Francis Group, LLC CRC Press is an imprint of Taylor & Francis Group, an Informa business
2.	Gevork Gharehpetian, Atousa Yazdani, Behrooz Zaker "Power System Transients Modelling Simulation and Applications" 1ST edition" ISBN 9781032185583248 Pages 212 B/W Illustrations Published January 27, 2023 by CRC Press
Useful Links	
1.	https://www.udemy.com/course/electrical-power-system-stability-beginner-to-advanced/
2.	https://pdhonline.com/courses/e491/e491_new.htm

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	2	2	2	1	1
CO 2	3	2	3	1	2
CO 3	3	2	2	2	3
CO 4	2	2	2	1	2

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern(with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	4	10
Understand	5	4	10
Apply	5	4	10
Analyse	5	4	10
Evaluate	-	4	10
Create	-	-	10
TOTAL	20	20	60

Chairman BoS
Electrical Engineering Department

Government College of Engineering, Karad				
First Year M. Tech (SEM-II) in Electrical Power Systems				
PS2225: AI Techniques(Elective V)				
Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		MSE	20
Tutorials	00 Hrs/week		ISE	20
Total Credits	03		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite: Fundamentals of Programming, Basics of Data Structures and Algorithms, Fundamentals of Machine Learning.

Course Outcomes (CO): Students will be able to

CO1	Demonstrate understanding of AI concepts, problems, and techniques
CO2	Employ heuristic search techniques and analyse production system characteristics
CO3	Relate knowledge representation approaches using predicate logic and rule-based systems
CO4	Synthesize various AI reasoning methods, including symbolic reasoning under uncertainty and statistical reasoning

	Course Contents	CO	Hours
Unit 1	What is AI (Artificial Intelligence)? The AI Problems, The Underlying Assumption, what are AI Techniques, The Level of The Model, Criteria for Success, Some General References, One Final Word Problems, State Space Search & Heuristic Search Techniques: Defining the Problems as A State Space Search, Production Systems, Production Characteristics, Production System Characteristics, And Issues in The Design of Search Programs, Additional Problems. Generate-And-Test, Hill Climbing, Best-First Search, Problem Reduction, Constraint Satisfaction, means –Ends Analysis.	**CO1**	**08**
Unit 2	Knowledge Representation Issues: Representations And Mappings, Approaches to Knowledge Representation. Using Predicate Logic: Representation Simple Facts in Logic, Representing Instance and Isa Relationships, Computable Functions and Predicates, Resolution. Representing Knowledge Using Rules: Procedural Versus Declarative Knowledge, Logic Programming, Forward Versus Backward Reasoning.	**CO1, CO2**	**08**
Unit 3	Symbolic Reasoning Under Uncertainty: Introduction to Non monotonic Reasoning, Logics for Non-Monotonic Reasoning. Statistical Reasoning: Probability And Bays' Theorem, Certainty Factors and Rule-Base Systems, Bayesian Networks, Dempster Shafer Theory	**CO2, CO3**	**06**
Unit 4	Fuzzy Logic. Weak Slot-and-Filler Structures: Semantic Nets, Frames. Strong Slot-and-Filler Structures: Conceptual Dependency, Scripts, CYC	**CO3, CO4**	**06**
Unit 5	Game Playing: Overview, And Example Domain: Overview, Mini Max, Alpha-Beta Cut-off, Refinements, Iterative deepening, The Blocks World, Components of A Planning System, Goal Stack Planning, Nonlinear Planning Using Constraint Posting, Hierarchical Planning, Reactive Systems, Other Planning Techniques. Understanding: What is understanding? What makes it hard? As constraint satisfaction	**CO4**	**08**
Unit 6	Natural Language Processing: Introduction, Syntactic Processing, Semantic Analysis, Semantic Analysis, Discourse and Pragmatic Processing, Spell Checking Connectionist Models: Introduction: Hopfield Network, Learning in Neural Network, Application of Neural Networks, Recurrent Networks, Distributed Representations, Connectionist AI And Symbolic AI.	**CO4**	**08**

Text Books

1. Elaine Richand Kevin Knight "Artificial Intelligence", 2nd Edition, Tata Mcgraw-Hill,2005.

Reference Books

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1.	Stuart Russel and Peter Norvig, "Artificial Intelligence: A Modern Approach",3rd Edition, Prentice Hall,2009.
Useful Links	
1.	https://www.udemy.com/course/artificial-intelligence-az/
2.	https://onlinecourses.nptel.ac.in/noc22_cs56/preview

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	2	2	2	1	1
CO 2	3	2	3	1	2
CO 3	3	2	2	1	3
CO 4	2	3	1	1	2

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern(with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	4	10
Understand	5	4	10
Apply	5	4	10
Analyse	5	4	10
Evaluate	-	4	10
Create	-	-	10
TOTAL	20	20	60

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Electrical Engineering Department

Government College of Engineering, Karad				
First Year M.Tech (SEM-II) in Electrical Power Systems				
PS2235:Industrial Load Modelling and Control (Elective V)				
Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		MSE	20
Tutorials	----		ISE	20
Total Credits	03		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite :Basics of Industrial Automation, Fundamentals of Signal Processing.

Course Outcomes (CO): Students will be able to

CO1	Relate electric energy scenario and demand side management strategies in industrial settings
CO2	Apply electricity pricing models and optimization algorithms to control industrial loads
CO3	Illustrate the impact of reactive power management and power quality on industries, along with filter application
CO4	Justify impact of reactive power management and power quality on industries, along with filter application

	Course Contents	CO	Hours
Unit 1	• Electric Energy Scenario-Demand Side Management-Industrial Load Management • Load Curves-Load Shaping Objectives • Methodologies-Barriers • Classification of Industrial Loads • Continuous and Batch Processes-Load Modelling	**CO1**	**8**
Unit 2	• Electricity pricing–Dynamic and spot pricing-Models • Direct load control-Interruptible load control • Bottom up approach-scheduling-Formulation of load Models • Optimization and control algorithms-Case studies	**CO1**	**8**
Unit 3	• Reactive power management in industries controls-power quality impacts • Application of filters Energy saving in industries	**CO2, CO4**	**6**
Unit 4	• Cooling and heating loads • Load profiling • Modelling-Cool storage • Types-Control strategies • Optimal operation • Problem formulation-Case studies	**CO3**	**8**
Unit 5	• Captive power units • Operating and control strategies • Power Pooling-Operation models • Energy banking • Industrial Cogeneration	**CO4**	**6**
Unit 6	• Selection of Schemes Optimal Operating Strategies • Peak load saving • Constraints Problem Formulation-Case study • Integrated Load management for Industries	**CO4**	**6**

Text Books

1. C.O.Bjork" Industrial Load Management-Theory, Practice and Simulations", Elsevier, the Netherlands,19892
2. C.W.GellingsandS.N.Talukdar,.Load management concepts. IEEE Press, NewYork,1986

Reference Books

1. Y.ManichaikulandF.C.Schweppe,"Physically based Industrial load",IEEETrans.onPAS,

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	April1981
2.	H.G.Stoll ,"Least cost Electricity Utility Planning",Wiley Interscience Publication, USA,1989.
3.	I.J. Nagarath and D.P.Kothari,.Modern Power System Engineering., Tata McGraw Hill publishers, NewDelhi,1995
4.	IEEE Bronze Book-"Recommended Practice for Energy Conservation and cost-effective planning In Industrial facilities",IEEEInc,USA
Useful Links	
1.	https://onlinecourses.nptel.ac.in/noc23_ee128/preview

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	3	2	2	1	1
CO 2	2	2	2	3	2
CO 3	3	2	2	2	1
CO 4	2	2	2	1	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern(with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	4	10
Understand	5	4	10
Apply	5	4	10
Analyse	5	4	10
Evaluate	-	4	10
Create	-	-	10
TOTAL	20	20	60

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Electrical Engineering Department

Government College of Engineering, Karad				
First Year M. Tech (SEM-II) in Electrical Power Systems				
PS2206: Laboratory 3 (Based on Elective III)				
Teaching Scheme			**Examination Scheme**	
Lectures	--		MSE	--
Tutorials	-- Hrs/week		ISE	25
Total Credits	02		ESE	25
Practical's	04 Hrs/week		Duration of ESE	02 Hrs 30 Min
Prerequisite : Programming Fundamentals, Power System, Control Systems, MATLAB/Simulink, Computational Methods				
Course Outcomes (CO): Students will be able to				
CO1	Develop a simulation model of a power system.			
CO2	Analyse the power system apparatus.			
CO3	Analyse the real time problems faced in power system			

	Course Contents	CO
	Minimum 8experiments on suitable computational platform to provide students with a comprehensive understanding of various simulation techniques and software tools in the field of electrical Power system. The course aims to equip students with the skills to model, analyze, and optimize complex systems and solve practical engineering problems using advanced simulation methods.	**CO1, CO2, CO3**

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	2	2	-	1	3
CO 2	1	2	2	1	2
CO 3	2	2	2	-	1

1: Slight(Low) 2: Moderate (Medium) 3: Substantial (High)

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Electrical Engineering Department

Government College of Engineering, Karad				
First Year M. Tech (SEM-II) in Electrical Power Systems				
PS2207: Laboratory 4 (Based on Elective 4 and 5)				
Teaching Scheme			**Examination Scheme**	
Lectures	--		MSE	--
Tutorials	-- Hrs/week		ISE	50
Total Credits	02		ESE	--
Practical's	04 Hrs/week		Duration of ESE	--
Prerequisite : Power System, Control Systems,Computational Methods				
Course Outcomes (CO): Students will be able to				
CO1	Analyse and solve power system problems			
CO2	Evaluate and optimise power system performance			
CO3	Apply technical skills to real world power system challenge			

	Course Contents	**CO**
	Minimum 8experiments on suitable computational platform to provide students with a comprehensive understanding of various simulation techniques and software tools in the field of electrical Power system. The course aims to equip students with the skills to model, analyze, and optimize complex systems and solve practical engineering problems using advanced simulation methods.	**CO1, CO2, CO3**

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	2	2	1	1	3
CO 2	1	2	2	1	2
CO 3	2	2	2	1	1

1: Slight(Low) 2: Moderate (Medium) 3: Substantial (High)

Chairman BoS
Electrical Engineering Department

Government College of Engineering, Karad				
First Year M. Tech in (SEM-II) Electrical Power Systems				
PS2208: Mini Project/ Industrial Training				
Teaching Scheme			**Examination Scheme**	
Lectures	--		MSE	--
Tutorials	-- Hrs/week		ISE	100
Total Credits	02		ESE	--
Practical's	04 Hrs/week		Duration of ESE	03 Hrs

Prerequisite: Fundamentals of Electrical Engineering, Basics of Power Systems, Fundamentals of Electrical Machines, Basics of Power Electronics, Fundamentals of Control Systems, Basics of Programming

Course Outcomes (CO): Students will be able to

CO1	Organise technical reports documenting project objectives, methodologies, findings, and conclusions, adhering to professional standards and best practices.
CO2	Support effectively with team members or industry professionals, communicate project progress, challenges, and results, and present findings in a clear and concise manner.
CO3	Demonstrate the ability to adapt to new technologies, methodologies, and industry trends, showcasing a commitment to lifelong learning and professional development.

	Course Contents
	Students should undergo industrial training or carry out mini project as per the guidelines given by respective guide.

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	3	2	2	1	1
CO 2	2	2	2	3	2
CO 3	3	2	2	2	1
CO 4	2	2	2	1	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern(with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	4	10
Understand	5	4	10
Apply	5	4	10
Analyse	5	4	10
Evaluate	-	4	10
Create	-	-	10
TOTAL	20	20	60

Chairman BoS
Electrical Engineering Department

Government College of Engineering, Karad				
Second Year (Sem.III) M.Tech. Electrical Power Systems				
PS2301: Dissertation Phase-I				
Teaching Scheme			**Examination Scheme**	
Practical	14Hrs/week		ISE	100
Total Credits	07		ESE	100

Prerequisite: Fundamentals of Research Methodology, Basics of Literature Review, Fundamentals of Technical Writing, Basics of Project Management.

Course Outcomes (CO): Students will be able to

CO1	Investigate problem statement.
CO2	Organize research hypothesis
CO3	Analyse the problem statement using appropriate mode simulation/modelling tools
CO4	Plan and budget the technical project by market survey

Course Contents

The Dissertation Work should preferably be a problem with research potential and should involve scientific research, design, generation/collection and analysis of data, determining solution and must preferably bring out the individual contribution. It should be based on the area in which the candidate has undertaken the dissertation work as per the common instructions for all branches of MTech. The examination shall consist of the preparation of report consisting of a detailed problem statement and a literature review. The preliminary results (if available) of the problem may also be discussed in the report. The work has to be presented in front of the examiners panel set by Program and PG coordinator. The candidate has to be irregular contact with his guide and the top of dissertation must be mutually decided by the guide and student.

Syllabus Contents:

The dissertation / project topic should be selected / chosen to ensure the satisfaction of the need to establish a direct link between education, national development and productivity and thus reduce the gap between the world of work and the world of study. The dissertation should have the following:

- Relevance to social needs of society
- Relevance to value addition to existing facilities in the institute
- Relevance to industry need
- Problems of national importance
- Research and development in various domain

The student should complete the following:

- Literature survey, problem definition
- Motivation for study and objectives
- Preliminary design/ feasibility/ modular approaches
- Report and presentation

Guidelines for Dissertation Phase–I:

- The dissertation may be carried out in-house i.e. department's laboratories and centres OR in industry approved by Program head.
- After multiple interactions with guide and based on comprehensive literature survey, the student shall identify the domain and define dissertation objectives. The referred literature should preferably include referred Journals. In case of Industry sponsored projects, the relevant application notes, while papers, product catalogues should be referred and reported.

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	• Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and phase wise work distribution, and submit the proposal within a month from the date of registration. • Phase–I deliverables: A document report comprising of summary of literature survey, detailed objectives, project specifications, paper and/or computer aided design, proof of concept/functionality, part results, and record of continuous progress. • Phase I evaluation: A committee comprising of guides of respective specialization shall assess the progress/ performance of the student based on report, presentation and Q&A. • In case of unsatisfactory performance, committee may recommend repeating the phase-I work.		

List of Submission:	
1.	Dissertation report prepared using Latex.

Mapping of COs and POs

PO →CO↓	PO1	PO2	PO3	PO4	PO5
CO1		2	1	2	2
CO2			1		
CO3		3	3	3	3
CO4		2		2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern(with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	4	10
Understand	5	4	10
Apply	5	4	10
Analyse	5	4	10
Evaluate	-	4	10
Create	-	-	10
TOTAL	20	20	60

Chairman BoS
Electrical Engineering Department

Government College of Engineering, Karad				
Second Year (Sem.–III) M. Tech. Electrical Engineering (Electrical Power Systems)				
PS2302: MOOCs /OPEN COURSE				
Teaching Scheme			**Examination Scheme**	
Lectures	-		MSE	-
Tutorials	-		ISE	-
Total Credits	03		ESE	100

Prerequisite: Basics of Research Skills, Fundamentals of Communication, Basics of Self-Motivation, Fundamentals of Digital Literacy

Course Outcomes (CO): Students will be able to

CO1	Select appropriate MOOC course
CO2	Learn from online sources

Course Contents

- Online courses available on digital platform like MOOCs/ NPTEL/ Coursera etc. during the academic semester will be reviewed and listed by departmental faculty board before start of every semester. Suitable course for registered candidate will be recommended by Guide and Program Head considering skillsets and knowledge required for dissertation work of the individual candidate (from the list). It shall have minimum 8-12 weeks duration, peer graded assignment and examination to award grade by online course offering agency. The report of course completed with copy of Grade Report shall be submitted to the examination section.
- In case online course is not available, departmental committee will specially design syllabusfor course under self-learning mode and guide will conduct end semester examination to award the grade.
- Students with pending MOOC courses can proceed with Dissertation Phase-I if their work is satisfactory, but results will be kept pending until MOOC courses are completed. Students must pass MOOC courses to be eligible for Dissertation Phase-II final presentation.

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	3	2	2	1	1
CO 2	2	2	2	3	2
CO 3	3	2	2	2	1
CO 4	2	2	2	1	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern(with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	4	10
Understand	5	4	10
Apply	5	4	10
Analyse	5	4	10
Evaluate	-	4	10
Create	-	-	10
TOTAL	20	20	60

Chairman BoS
Electrical Engineering Department

Government College of Engineering, Karad				
Second Year (Sem. IV) M.Tech. Electrical Power Systems				
PS2401: Dissertation Phase-II				
Teaching Scheme			**Examination Scheme**	
Practical	32Hrs/week		ISE	100
Total Credits	16		ESE	200

Prerequisite: Fundamentals of Research Methodology, Basics of Literature Review, Fundamentals of Technical Writing, Basics of Project Management.

Course Outcomes (CO): Students will be able to

CO1	Assemble technical research work.
CO2	Develop hardware.
CO3	Support inferences from the findings and present conclusion.
CO4	Test his presentation skills for technical paper and report writing

Course Contents

This phase is a continuation of Dissertation work started in semester III. Student has to submit the report in prescribed format. The dissertation should be presented in standard format as provided by the department. The candidate has to prepare a detailed project report consisting of introduction of the problem, problem statement, literature review, objectives of the work, methodology (experimental set up or numerical details as the case may be) of solution and results and discussion. The report must bring out the conclusions of the work and future scope for the study. The work has to be presented in front of the examiners panel consisting of an approved external examiner, an internal examiner and a guide, co-guide etc. as decided by the Program Head and PG coordinator.

The dissertation stage II is based on a report prepared by the students on dissertation topic allotted to him.
It may be based on:

- Experimental verification/ Proof of concept.
- Design, fabrication, testing of Communication System.

The viva-voce examination will be based on the above report and work.

Guidelines for Dissertation Phase–II:

- During phase –II, student is expected to exert on detail design, development verification and testing of the proposed work as per the schedule. Accomplished results/ contributions/ innovations should be published in terms of research papers in reputed journals and reviewed focused conferences ORIP/Patents.
- Phase – II deliverables: A dissertation report as per the specified format, developed system in the form of hardware and/or software.
- Phase-II evaluation: Guide along with appointed external examiner shall assess the progress/ performance of the student based on report and presentation. In case of unsatisfactory performance, committee may recommend for extension of work.

List of Submission:	
1.	Dissertation report prepared using Latex.

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Mapping of COs and POs

PO→ CO↓	PO 1	PO 2	PO 3	PO 4	PO 5
CO1	-	2	2	2	2
CO2	-	3	3	3	3
CO3	-	-	-	-	-
CO4	-	-	1	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern(with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	4	10
Understand	5	4	10
Apply	5	4	10
Analyse	5	4	10
Evaluate	-	4	10
Create	-	-	10
TOTAL	20	20	60

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