Government College of Engineering, Karad

First Year M. Tech in Electrical Power Systems

PS1101: Power System Analysis

Teaching Scheme			Examination Scheme	
Lectures	03 Hrs/week		CT – 1	15
Tutorials	-- Hrs/week		CT – 2	15
Total Credits	03		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

Students will be able to:

1.	calculate voltage phasors and fault currents at all buses from given data using various methods of analysis
2.	Rank various contingencies according to their severity
3.	Estimate the bus voltage phasors given various quantities viz. power flow, voltages, taps , CB status etc
4.	Estimate closeness to voltage collapse and calculate PV curves using continuation power flow

	Course Contents	Hours
Unit 1	• Load flow **:**Overview of Newton-Raphson ,Gauss-Siedel • Fast decoupled methods, convergence properties, sparsity techniques, handling Qmax violations in constant matrix, inclusion in frequency effects	**6**
Unit 2	• Fault Analysis**:** Simultaneous faults • Open conductors faults	8
Unit 3	• Security Analysis: Security state diagram, contingency analysis, generator shift distribution factors • line outage distribution factor, multiple line outages	8
Unit 4	• State Estimation : Sources of errors in measurement • Virtual and Pseudo	6
Unit 5	• Measurement, Observability • Tracking state estimation,	8
Unit 6	• Voltage Stability : Voltage collapse • P-V curve, multiple power flow solution • continuation power flow, optimal multiplies load flow	**6**

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.				

Government College of Engineering, Karad

First Year M. Tech in Electrical Power Systems

PS1102 : Power System Dynamics

Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		CT – 1	15
Tutorials	-- Hrs/week		CT – 2	15
Total Credits	03		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

Students will be able to:

1.	Understand the modeling of synchronous machine in details system
2.	Carry out simulation studies of power system dynamics using MATLAB-SIMULINK, MI POWER
3.	Carry out stability analysis with and without power system stabilizer (PSS)
4.	Understand the load modeling in power

	Course Contents	**Hours**
Unit 1	• Synchronous Machines: Per unit systems • Park's Transformation (modified) • Flux-linkage equations.	**8**
Unit 2	• Voltage and current equations • Formulation of State-space equations • Equivalent circuit.	8
Unit 3	• Sub-transient and transient inductance and Time constants, Simplified models of synchronous machines	6
Unit 4	• Small signal model: Introduction to frequency model.	4
Unit 5	• Excitation systems and Philips-Heffron model • PSS Load modeling.	8
Unit 6	• Modeling of Induction Motors • Prime mover controllers.	6

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.			

Government College of Engineering, Karad

First Year M. Tech in Electrical Power Systems

PS1113: Renewable Energy System

Teaching Scheme			Examination Scheme	
Lectures	03 Hrs/week		CT – 1	15
Tutorials	-- Hrs/week		CT – 2	15
Total Credits	03		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

Students will be able to:

1.	Know about renewable energy
2.	Understand the working of distributed generation system in autonomous/grid connected modes
3.	Know the Impact of Distributed Generation on Power System
4.	Understand Economics of Distributed Generation

	Course Contents	Hours
Unit 1	• Introduction, Distributed vs Central Station Generation • Sources of Energy such as Micro-turbines • Internal Combustion Engines.	**6**
Unit 2	• Introduction to Solar Energy, Wind Energy, Combined Heat and Power • Hydro Energy, Tidal Energy, Wave Energy • Geothermal Energy, Biomass and Fuel Cells.	8
Unit 3	• Power Electronic Interface with the Grid	6
Unit 4	• Impact of Distributed Generation on the Power System • Power Quality Disturbances	8
Unit 5	• Transmission System Operation • Protection of Distributed Generators	8
Unit 6	• Economics of Distributed Generation • Case Studies	6

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.				

Government College of Engineering, Karad

First Year M. Tech in Electrical Power Systems

PS1123 : Smart Grid

Teaching Scheme			Examination Scheme	
Lectures	03 Hrs/week		CT – 1	15
Tutorials	-- Hrs/week		CT – 2	15
Total Credits	03		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

Students will be able to:

1.	Appreciate the difference between smart grid & conventional grid
2.	Apply smart metering concepts to industrial and commercial installations
3.	Formulate solutions in the areas of smart substations, distributed generation and wide area measurements
4.	Come up with smart grid solutions using modern communication technologies

	Course Contents	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	**8**
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 .	8
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)	6
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	8
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	6
Unit 6	• Advanced Metering Infrastructure (AMI), Home Area Network (HAN), Neighborhood Area • Network (NAN), Wide Area Network (WAN)	8

	• 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	

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	
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.	

Government College of Engineering, Karad

First Year M. Tech in Electrical Power Systems

PS1133: High Power Converter

Teaching Scheme			Examination Scheme	
Lectures	03 Hrs/week		CT – 1	15
Tutorials	-- Hrs/week		CT – 2	15
Total Credits	03		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

Students will be able to:

1.	Learn the characteristics of PSDs such as SCRs, GTOs, IGBTs and use them in practical systems and PWM techniques and the ability to use them properly
2.	Knowledge of working of multi-level VSIs, DC-DC switched mode converters, cyclo-converters
3.	Acquire knowledge of power conditioners and their applications
4.	Ability to design power circuit and protection circuit of PSDs and converters

	Course Contents	Hours
Unit 1	• Power electronic systems • An overview of PSDs, multi-pulse diode rectifier, multi-pulse • SCR rectifier	**6**
Unit 2	• Phase shifting transformers, multilevel voltage source inverters: two level voltage source inverter, • cascaded • H bridge multilevel inverter.	8
Unit 3	• Diode clamped multilevel inverters, flying capacitor multilevel inverter	8
Unit 4	• PWM current source inverters, • DC to DC switch mode converters	6
Unit 5	• AC voltage controllers : Cyclo-converters, matrix converter, • Power conditioners and UPS.	8
Unit 6	• Design aspects of converters, protection of devices and circuits	6
Tutorials		

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.	B. K .Bose, “Power Electronics and A.C. Drives”, Prentice Hall, 1986		
2.	Bin Wu, “High power converters and drives”, IEEE press, Wiley Enter science		
Useful Links			
1.			

Government College of Engineering, Karad

First Year M. Tech in Electrical Power Systems

PS1143 : Wind and Solar System

Teaching Scheme			Examination Scheme	
Lectures	03Hrs/week		CT – 1	15
Tutorials	-- Hrs/week		CT – 2	15
Total Credits	03		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

Students will be able to:

1.	Appreciate the importance of energy growth of the power generation from the renewable energy sources and participate in solving these problems
2.	Demonstrate the knowledge of the physics of wind power and solar power generation and all associated issues so as to solve practical problems
3.	Demonstrate the knowledge of physics of solar power generation and the associated issues
4.	Identify, formulate and solve the problems of energy crises using wind and solar energy

	Course Contents	Hours
Unit 1	• Historical development and current status • characteristics of wind power generation □ network integration issues	**8**
Unit 2	• Generators and power electronics for wind turbines, • power quality standards for wind turbines, • Technical regulations for interconnections of wind farm with power systems.	6
Unit 3	• Isolated wind systems, • reactive power and voltage control, • economic aspects.	6
Unit 4	• Impacts on power system dynamics, • power system interconnection	8
Unit 5	• Introduction of solar systems, • merits and demerits, concentrators, various applications.	6
Unit 6	• Solar thermal power generation, • PV power generation, • Energy Storage device. • Designing the solar system for small installations	8

Text Books

1.	Thomas Ackermann, Editor, “Wind power in Power Systems”, John Willy and sons ltd.2005

2.	Siegfried Heier, “Grid integration of wind energy conversion systems”, John Willy and sons ltd., 2006

Reference Books			
1.	K. Sukhatme and S.P. Sukhatme, “Solar Energy”. Tata MacGraw Hill, Second Edition, 1996		

Useful Links			
1.			

Government College of Engineering, Karad

First Year M. Tech in Electrical Power Systems

PS1114 : Electrical Power Distribution System

Teaching Scheme			Examination Scheme	
Lectures	03 Hrs/week		CT – 1	15
Tutorials	-- Hrs/week		CT – 2	15
Total Credits	03		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

Students will be able to:

1.	understand power distribution system
2.	study of Distribution automation and its application in practice
3.	learn SCADA system
4.	Understand difficulties in Implementing Distribution

	Course Contents	Hours
Unit 1	• Distribution of Power, Management, Power Loads, • Load Forecasting Short-term & Long-term, • Power System Loading, Technological Forecasting.	**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	8
Unit 3	• Interconnection of Distribution, • Control & Communication Systems, • Remote Metering, • Automatic Meter Reading and its implementation	6
Unit 4	• SCADA: Introduction, Block Diagram, • SCADA Applied To Distribution Automation. • Common Functions of SCADA, • Advantages of Distribution Automation through SCADA	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	8
Unit 6	• Maintenance of Automated Distribution Systems • Difficulties in Implementing Distribution. • Automation in Actual Practice, Urban/Rural Distribution, Energy Management, AI	**8**

	techniques applied to Distribution Automation	

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		
2.	James Momoh, "Electric Power Distribution, automation, protection & control", CRC Press Course		
Useful Links			
1.			

Government College of Engineering, Karad

First Year M. Tech in Electrical Power Systems

PS1124: Mathematical Methods for Power Engineering

Teaching Scheme			Examination Scheme	
Lectures	03 Hrs/week		CT – 1	15
Tutorials	-- Hrs/week		CT – 2	15
Total Credits	03		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

Students will be able to:

1.	Knowledge about vector spaces, linear transformation, eigenvalues and eigenvectors of linear operators
2.	To learn about linear programming problems and understanding the simplex method for solving linear programming problems in various fields of science and technology
3.	Acquire knowledge about nonlinear programming and various techniques used for solving constrained and unconstrained nonlinear programming problems
4.	Understanding the concept of random variables, functions of random variable and their probability distribution
5	Understand stochastic processes and their classification

	Course Contents	Hours
Unit 1	• Vector spaces, • Linear transformations • Matrix representation of linear transformation	**8**
Unit 2	• Eigen values and Eigen vectors of linear operator	6
Unit 3	• Linear Programming Problems • Simplex Method • Duality • Non Linear Programming problems	8
Unit 4	• Unconstrained Problems • Search methods • Constrained Problems	6
Unit 5	• Lagrange method • Kuhn-Tucker conditions • Random Variables • Distributions	8
Unit 6	• Independent Random Variables • Marginal and Conditional distributions • Elements of stochastic processes	8

Text Books

1.	Kenneth Hoffman and Ray Kunze, “Linear Algebra”, 2nd Edition, PHI, 1992
2.	Erwin Kreyszig, “Introductory Functional Analysis with Applications”, John Wiley & Sons, 2004

Reference Books			
1.	Irwin Miller and Marylees Miller, John E. Freund’s “Mathematical Statistics”, 6th Edn, PHI, 2002		
2.	J. Medhi, “Stochastic Processes”, New Age International, New Delhi., 1994		
3.	A Papoulis, “Probability, Random Variables and Stochastic Processes”, 3rd Edition, McGraw Hill, 2002		
4.	John B Thomas, “An Introduction to Applied Probability and Random Processes”, John Wiley, 2000		
5.	Hillier F S and Liebermann G J, “Introduction to Operations Research”, 7th Edition, McGraw Hill, 2001		
6	Simmons D M, “Non Linear Programming for Operations Research”, PHI, 1975		

Useful Links			
1.			

Government College of Engineering, Karad

First Year M. Tech in Electrical Power Systems

PS1134: Pulse Width Modulation for PE Converter

Teaching Scheme			Examination Scheme	
Lectures	03 Hrs/week		CT – 1	15
Tutorials	-- Hrs/week		CT – 2	15
Total Credits	03		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

Students will be able to:

1.	Appreciate importance of PWM techniques
2.	Implement PWM using different strategies
3.	Control CSI and VSI using PWM
4.	Compare performance of converter for different PWM techniques

	Course Contents	Hours
Unit 1	• Modulation of one inverter phase leg • Modulation of single phase • VSI and 3 phase VSI	**6**
Unit 2	• Zero space vector placement modulation strategies • Losses-Discontinuous modulation • Modulation of CSI	8
Unit 3	• Over modulation of converters • programme modulation strategies	6
Unit 4	• Pulse width modulation for multilevel inverters • Implementation of modulation controller	8
Unit 5	• Continuing developments in modulation as random PWM • PWM for voltage unbalance	8
Unit 6	• Effect of minimum pulse width and dead time	8

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.			

Government College of Engineering, Karad

First Year M. Tech in Electrical Power Systems

PS1144: Electric and Hybrid Vehicles

Teaching Scheme			Examination Scheme	
Lectures	03 Hrs/week		CT – 1	15
Tutorials	-- Hrs/week		CT – 2	15
Total Credits	03		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

Students will be able to:

1.	Acquire knowledge about fundamental concepts, principles, analysis and design of hybrid and electric vehicles.
2.	learn electric drive in vehicles / traction.
3.	Understand hybrid traction,
4.	Understand Matching the electric machine and the internal combustion engine

	Course Contents	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 characterization Transmission characteristics	**8**
Unit 2	• Basic concept of hybrid traction, • Introduction to various hybrid drive-train topologies • Power flow control in hybrid drive-train topologies	8
Unit 3	• Basic concept of hybrid traction, • Introduction to various hybrid drive-train topologies	6
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	8
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	8
Unit 6	• Introduction to energy management and their strategies used in hybrid and electric vehicle • Classification of different energy management strategies Comparison of different	6

	energy management strategies Implementation issues of energy strategies	

Text Books				
1.	Electric And Hybrid Electric Vehicles Braking Systems And Nvh Considerations Author Jurgen R K, Publisher - Sae International			
Reference Books				
1.	Eectric And Hybrid Vehicles Design Fundamentals, Author Husain Iqbal			
2	Modern Electric Hybrid Electric and Fuel Cell Vehicles Fundamentals Theory and Design Author Ehsani M.; Gao Yimin ; Emadia A. Crc Press Newyork			
Useful Links				
1.				

Government College of Engineering, Karad

First Year M. Tech in Electrical Power Systems

PS1115: Business Analytics

Teaching Scheme			Examination Scheme	
Lectures	03 Hrs/week		CT – 1	15
Tutorials	-- Hrs/week		CT – 2	15
Total Credits	03		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

Students will be able to:

1.	Understand the role of business analytics within an organization.
2.	Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.
3.	To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.
4.	To become familiar with processes needed to develop, report, and analyze business data.

	Course Contents	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.	**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.	**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.	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.	**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.	**8**
Unit 6	Recent Trends in : Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.	**4**

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.	

Government College of Engineering, Karad

First Year M. Tech in Electrical Power Systems

PS1125: Industrial Safety

Teaching Scheme			Examination Scheme	
Lectures	03 Hrs/week		CT – 1	15
Tutorials	-- Hrs/week		CT – 2	15
Total Credits	03		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

Students will be able to:

1.	Understand importance of Industrial Safety
2.	Understand importance of maintenance engineering
3.	Understand Fault tracing
4.	Understand importance of preventive maintenance

	Course Contents	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 color codes. Fire prevention and firefighting, equipment and methods.	**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.	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.	6
Unit 4	Fault tracing: Fault tracing-concept and importance, decision treeconcept, 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.	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	6

	electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance.	
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	4

Text Books			
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.			

Government College of Engineering, Karad

First Year M. Tech in Electrical Power Systems

PS1135: Operations Research

Teaching Scheme			Examination Scheme	
Lectures	03 Hrs/week		CT – 1	15
Tutorials	-- Hrs/week		CT – 2	15
Total Credits	03		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

Students will be able to:

1.	Students should able to apply the dynamic programming to solve problems of discreet and continuous variables.
2.	Students should able to apply the concept of non-linear programming
3.	Students should able to carry out sensitivity analysis
4.	Student should able to model the real world problem and simulate it.

	Course Contents	Hours
Unit 1	Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models	**8**
Unit 2	Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming	8
Unit 3	Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT	6
Unit 4	Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.	8
Unit 5	Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation	8

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.	Pannerselvam, Operations Research: Prentice Hall of India 2010
4.	Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

Useful Links			
1.			

Government College of Engineering, Karad

First Year M. Tech in Electrical Power Systems

PS1145: Cost Management of Engineering Project

Teaching Scheme			Examination Scheme	
Lectures	03 Hrs/week		CT – 1	15
Tutorials	-- Hrs/week		CT – 2	15
Total Credits	03		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

Students will be able to:

1.	Understand importance of Cost Management
2.	Understand importance of Project Management
3.	Understand importance of Cost Analysis
4.	Understand Quantitative techniques for cost management

	Course Contents	Hours
Unit 1	Introduction and Overview of the Strategic Cost Management Process	**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.	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	8
Unit 4	Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. 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,	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.	4
Unit 6	Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation,	6

	Learning Curve Theory.			
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.				

Government College of Engineering, Karad

First Year M. Tech in Electrical Power Systems

PS1155: Composite Materials

Teaching Scheme			Examination Scheme	
Lectures	03 Hrs/week		CT – 1	15
Tutorials	-- Hrs/week		CT – 2	15
Total Credits	03		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

Students will be able to:

1.	Understand types of Engineering Materials
2.	Understand Manufacturing of Metal Matrix Composites
3.	Understand Manufacturing of Polymer Matrix Composites
4.	Understand importance of Material Strength

	Course Contents	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.	**8**
Unit 2	REINFORCEMENTS: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements.	4
Unit 3	Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.	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.	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.	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.	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.		
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.			

Government College of Engineering, Karad

First Year M. Tech in Electrical Power Systems

PS1165: Waste of Energy

Teaching Scheme			Examination Scheme	
Lectures	03 Hrs/week		CT – 1	15
Tutorials	-- Hrs/week		CT – 2	15
Total Credits	03		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

Students will be able to:

1.	Understand importance of Energy from Waste
2.	Understand importance of Biomass
3.	Understand Biomass useful properties.
4.	Understand Biomass conversion processes

	Course Contents	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	**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.	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.	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.	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	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.	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.			

Government College of Engineering, Karad

First Year M. Tech in Electrical Power Systems

PS1106 : Research Methodology

Teaching Scheme			Examination Scheme	
Lectures	02 Hrs/week		CT – 1	15
Tutorials	-- Hrs/week		CT – 2	15
Total Credits	02		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

Students will be able to:

1.	Understand research problem formulation
2.	Analyse research related information
3.	Follow research ethics
4.	Understand New Developments in IPR

	Course Contents	Hours
Unit 1	Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations	**8**
Unit 2	Effective literature studies approaches, analysis Plagiarism, Research ethics	4
Unit 3	Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee	6
Unit 4	Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT	8
Unit 5	Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.	6
Unit 6:	New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.	8

Text Books

1.	Stuart Melville and Wayne Goddard, “Research methodology: an introduction for science & engineering students’
2.	T. Ramappa, “Intellectual Property Rights Under WTO”, S. Chand, 2008

Reference Books			
1.	Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”		
2.	Ranjit Kumar, 2nd Edition, “Research Methodology: A Step by Step Guide for beginners”		
3.	Mayall, “Industrial Design”, McGraw Hill, 1992.		
4.	Asimov, “Introduction to Design”, Prentice Hall, 1962.		
5.	Robert P. Merges, Peter S. Menell, Mark A. Lemley, “ Intellectual Property in New Technological Age”, 2016.		
6	Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd ,2007.		
Useful Links			
1.			

Government College of Engineering, Karad

First Year M. Tech in Electrical Power Systems

PS1107:EPS Lab I

Teaching Scheme			Examination Scheme	
Lectures	08 Hrs/week		CT – 1	--
Tutorials	-- Hrs/week		CT – 2	--
Total Credits	04		TA	50
			ESE	50
			Duration of ESE	03 Hrs

Course Outcomes (CO)

Students will be able to:

1.	Specify ratings of power apparatus based on power system design
2.	Understand interconnection of power system components
3.	Create and simulate power system on computational platform
4.	Interface RES to conventional power system

	Course Contents
	Minimum 8experiments on suitable computational platform for deep understanding of power system analysis, dynamics and interconnection of RES. Minimum two experiments on hardware setup to understand use of power electronics in power system.