BOARD OF STUDIES MEETING – 2018-19

K.S.R.M COLLEGE OF ENGINEERING

AUTONOMOUS

Department of Electrical and Electronics Engineering

Minutes of the Meeting

Date	08.06.2018	**Day**	Friday
Time	11.00AM to 1.30PM	**Venue**	HoD Chamber
Dept./SS	EEE	**Convener**	Smt C.N.Arpitha

Members Present: 08 **Members Absent: 00**

S.No	Name	Designation	Member	Signature	S.No	Name	Designation	Member
1.	Smt. C.N. Arpitha	Associate Professor and HoD	Chairman		7	Dr. T.Gowri Manohar Yesuratnam	Professor SV University, Tirupati	Expert
2.	Dr. K. Amaresh	Professor	Member		8	Dr. Y.V.Siva Reddy	G.P.R College, Kurnool	Expert
3.	Sri M. Bhaskar Reddy	Associate Professor	Member					
4.	Sri K. Kalyan Kumar	Associate Professor	Member					
5.	Smt. Saleha Tabassum	Associate Professor	Member					
6.	Sri P. Durga Prasad	Assistant Professor	Member					

BOARD OF STUDIES MEETING – 2018-19

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Minutes of the Meeting:

Smt C.N.Arpitha welcomed all the members to the meeting and presented the agenda of the BoS meeting. There solutions are:

S.No.	Item	Presenteranddiscussion	Resolution
1	Suggestions regarding modifications in the syllabus for the following regulations: R15 -IV B.Tech Syllabus R18 -I B.Tech Syllabus R18 -M.Tech I and IIyear Syllabus	The Chairman (HoD) and members of the department participated in a meeting with the experts nominated by Academic Council and University for BoS.	The committee discussed mainly about the course structure the contents of the subjects for both UG and PG program R18 regulations.
2	Regarding Course structure	The Chairman, BoS is authorized to make any changes or modifications in the course structure and in the content if needed in due course time.	The main outcome of the meeting is moderate changes, addit and deletion of some concepts.
3	Discussion on Action taken report based on stakeholders' feedback	The BoS members appreciated that new topics were introduced in the syllabus as per feedback from all stakeholders, action taken report.	R15 -IV B. Tech Syllabus, R18 -I B.Tech Syllabus and R18 - M.Tech I and II year Syllabus were approved comprising of r courses.

Smt C.N.Arpitha HoD & BoS chairman of EEE department conveyedthanks to all internal and external BoS members for giving suggestions and inputs for B.Tech curriculum. As per the suggestions given through feedback obtained from all stakeholders, action taken reportand BoS members necessary modifications have been incorporated in the structure and syllabus of B.Tech and M.Tech Syllabus.

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Course Structure and Syllabus for M. Tech. Power Systems (PS) w.e.f. 2018 -19

I-SEMESTER

S. No.	C /PE/A	Course Code	Course Name	L	T	P	IM	EM	C R
1	C 1	1852101	Power System Analysis	3	0	0	40	60	3
2	C 2	1852102	Power System Dynamics - I	3	0	0	40	60	3
3	PE1	1852103	Renewable Energy System	3	0	0	40	60	3
		1852104	Smart grids	3	0	0	40	60	3
		1852105	Wind and Solar Systems	3	0	0	40	60	3
4	PE 2	1852106	Electrical Power Distribution System	3	0	0	40	60	3
		1852107	Mathematical Methods for Power Engineering	3	0	0	40	60	3
		1852108	Electric and Hybrid Vehicles	3	0	0	40	60	3
5	---	1800109	Research Methodology and IPR	2	0	0	40	60	2
6	Lab 1	1852110	Power System Lab - I	0	0	3	50	50	2
7	Lab 2	1852111	Power System Simulation Lab-I	0	0	3	50	50	2
8	A 1	---	Audit Course I	2	0	0	40	-	0
			Total	14	0	8	350	400	18

*** C - Course * PE - Professional Elective * A - Audit Course**

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II SEMESTER

S. No.	C /PE/A	Course Code	Course Name	L	T	P	IM	EM	C R
1	C 3	1852201	Digital Protection of Power System	3	0	0	40	60	3
2	C 4	1852202	Power System Dynamics - II	3	0	0	40	60	3
3	PE 3	1852203	Restructured Power Systems	3	0	0	40	60	3
		1852204	Energy Auditing and Management	3	0	0	40	60	3
		1852205	Power Apparatus Design	3	0	0	40	60	3
4	PE 4	1852206	SCADA System and Applications	3	0	0	40	60	3
		1852207	Power Quality	3	0	0	40	60	3
		1852208	AI Techniques	3	0	0	40	60	3
5	C 5	1852209	Mini Project	0	0	4	100	-	2
6	Lab 3	1852210	Power System Lab -II	0	0	4	50	50	2
7	Lab 4	1852211	Power Systems Simulation Lab -II	0	0	4	50	50	2
8	A II	--	Audit Course II	2	0	0	40	-	-
			Total	12	0	12	410	340	18

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III SEMESTER

S. No.	C /PE/A	Course Code	Course Name	L	T	P	IM	EM	C R
1	PE 5	1852301	Power System Transients	3	0	0	40	60	3
		1852302	Industrial Load Modeling and Control	3	0	0	40	60	3
		1852303	Dynamics Of Linear Systems	3	0	0	40	60	3
2	OE	1871304	Business Analytics	3	0	0	40	60	3
		1871305	Industrial Safety	3	0	0	40	60	3
		1871306	Operations Research	3	0	0	40	60	3
		1871307	Cost Management of Engineering Projects	3	0	0	40	60	3
		1871308	Composite Materials	3	0	0	40	60	3
		1871309	Waste to Energy	3	0	0	40	60	3
3	Major Project	1852310	Phase - I Dissertation	0	0	20	100	-	10
			Total	6	0	20	180	120	16

IV SEMESTER

S. No.	Course	Course Code	Course Name	L	T	P	IM	EM	C R
1	Major Project	1852401	Phase - II Dissertation	0	0	32	50	50	16
		Total		0	0	32	50	50	16

Audit course I & II

S. No.	Course Code	Course Name
1	1870A01	English for Research Paper Writing
2	1870A02	Disaster Management
3	1870A03	Sanskrit for Technical Knowledge
4	1870A04	Value Education
5	1870A05	Constitution of India
6	1870A06	Pedagogy Studies
7	1870A07	Stress Management by Yoga
8	1870A08	Personality Development through Life Enlightenment Skills

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Subject Code	Core /Elective	Course Name	L	T	P	IM	EM	CR
1852101	Core 1	Power System Analysis	3	0	0	40	60	3

Course Objectives

Students will be able to:

1. Study various methods of load flow and their advantages and disadvantages.
2. Understand how to analyze various types of faults in power system.
3. Understand power system security concepts and study the methods to
4. rank the contingencies.
5. Understand need of state estimation and study simple algorithms for state estimation.
6. Study voltage instability phenomenon.

Course Outcomes

Students will be able to:

1. Able to calculate voltage phasors at all buses, given the data using various methods of load flow and fault currents in each phase
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.

UNIT-I

Load flow: Overview of Newton-Raphson, Gauss-Seidel, Fast-decoupled methods, convergence properties, sparsity techniques. Control of Voltage profile: Control by generators- Control by VAR generators – control by transformers. Load flow under power electronic control: AC-DC load flow – Converter model – Solution technique – Sequential method.

UNIT-II

Fault Analysis: Symmetrical-internal voltages of loaded machines under fault conditions-Short circuit of a synchronous machine – symmetrical components- sequence networks of synchronous machine, transmission line, transformer – unsymmetrical faults -open conductor faults.

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UNIT-III

Security Analysis: Factors affecting power system security- contingency analysis – over view of security analysis – Linear sensitivity factors: Generation shift factors, line outage distribution factors – AC power flow methods – Contingency selection.

UNIT-IV

State Estimation: Introduction to State Estimation, Least Squares Estimation and Weighted Least Squares Estimation, State Estimation in AC Network, Orthogonal Decomposition, Detection and Identification of Bad measurements, Network Observability and Pseudo – measurements.

UNIT-V

Voltage Stability: Basic concepts related to voltage stability- definition - classification – voltage collapse – P-V & Q-V curve – voltage stability analysis: – prevention of voltage collapse.

Text Books:

1. J.J. Grainger & W.D.Stevenson, "Power System Analysis", McGraw Hill, 2003.
2. A.J. Wood, "Power Generation, Operation and Control", John Wiley, 1994.
3. I.J. Nagrath, D.P. Kothari, "Modern Power System Analysis", TMH Publications.

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Subject Code	Core /Elective	Course Name	L	T	P	IM	EM	CR
1852102	Core 2	POWER SYSTEM DYNAMICS-I	3	0	0	40	60	3

Course Objectives

Students will be able to: Study of system dynamics and its physical interpretation, Development of mathematical models for synchronous machine, Modeling of induction motor

Course Outcomes

Students will be able to:

1. Understand the modelling of synchronous machine in detail.
2. Carry out simulation studies of power system dynamics using MATLAB-SIMULINK.
3. Carry out stability analysis with and without power system stabilizer
4. Understand the load modelling in power system

UNIT-I

Modeling of Synchronous Machine: Synchronous machine – Park's Transformation-analysis of steady state performance, per - unit quantities-Equivalent circuit of synchronous machine.

UNIT-II

Steady State Analysis: Voltage, Current and Flux Linkage relationships, Steady state equivalent circuit, Formulation of State Space Model.

UNIT-III

Sub-Transient and transient inductance and Time Constants, Synchronous Machines Simplified model.

UNIT-IV

Excitation System: Effects of Excitation system, PSS-Block Diagram, System State matrices (Type Systems).

UNIT-V

Modeling of Induction Motors: Basic Equations, d-q Transformations, Steady State Characteristics, Equivalent Circuits, Effect of rotor resistance, Modelling of Prime Movers.

Text Books:

1. P.M. Anderson & A.A. Fouad, "Power System Control and Stability", IEEE Press.
2. Power system Stability and Control, P. Kundur, TMH.
3. Power system Analysis and Design, William D Stevenson, John J Grainger, TMH.

Reference Books:

1. Power Systems Dynamics and Stability, M.A.Pai- PHI Publications.
2. Power system dynamics, K.R. PADIYAR - B.S. Publications.

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Subject Code	Core /Elective	Course Name	L	T	P	IM	EM	CR
1852103	PE 1	Renewable Energy Systems	3	0	0	40	60	3

Course Objectives

Students will be able to:

1. To learn various renewable energy sources.
2. To gain understanding of integrated operation of renewable energy sources.
3. To understand Power Electronics Interface with the Grid.

Course Outcomes

Students will be able to:

1. Knowledge 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.

Unit - I

Introduction, Distributed Vs Central Station Generation, Various non - Conventional energy sources, availability, classification merits and demerits.

Unit - II

Introduction to solar Energy Theory of Solar Cells, Solar cell materials, Solar Cell array, solar radiation, Flat Plate Collectors, Focussing Plate Collectors, Solar Thermal Power Plants.

Unit - III

Introduction to wind energy, wind power and its Sources, Site Selection, criterion, Classification of rotors, wind characteristics, Performance and limitations of energy conversion Systems.

Unit - IV

Resources of geothermal energy, Thermo dynamics of geothermal energy conversion electrical conversion, non - electrical Conversion, environmental considerations.

Unit - V

Tidal and wave energy - Principle of working, Performance and limitations. Biomass energy- Availability of biomass and its Conversion Theory.

Fuel Cells-Working Principle, types of Fuel Cells, Performance and limitations.

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", July2011, Wiley –IEEE Press.
3. Loi Lei Lai, Tze Fun Chan, "Distributed Generation: Induction and Permanent Magnet Generators",October 2007, Wiley-IEEE Press.
4. Roger A.Messenger, Jerry Ventre, "Photovoltaic System Engineering", 3rd Ed, 2010.
5. James F.Manwell, Jon G.McGowan, Anthony L Rogers, "Wind energy explained: Theory Design and Application", John Wiley and Sons 2nd Ed, 2010.

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Subject Code	Core /Elective	Course Name	L	T	P	IM	EM	CR
1852104	PE 1	Smart Grid	3	0	0	40	60	3

Course Objectives

Students will be able to:

1. Understand concept of smart grid and its advantages over conventional grid.
2. Know smart metering techniques.
3. Learn wide area measurement techniques.
4. Understanding the problems associated with integration of distributed generation & its solution through smart grid.

Course Outcomes

Students will be able to:

1. Understand 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 sub-stations, distributed generation and wide area measurements.
4. Come up with smart grid solutions using modern communication technologies.

Unit - I

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.

Unit - II

Introduction to Smart Meters, Real Time Pricing, 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.

Unit - III

Geographic Information System (GIS)-Intelligent Electronic Devices(IED) & their application for monitoring & protection, Smart storage like Battery, SMES, Wide Area Measurement System(WAMS)-Phase Measurement Unit(PMU).

Unit - IV

Concept of micro-grid, need & applications of micro-grid, formation of micro-grid, Issues of inter-connection, protection & control of micro-grid.-Thin film solar cells, Variable speed wind generators, fuel-cells, micro-turbines.

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Unit - V

Advanced Metering Infrastructure (AMI), Home Area Network(HAN),- Neighborhood 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).

Reference 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.
3. JanakaEkanayake, Nick Jenkins, KithsiriLiyanage, "Smart Grid: Technology and Applications",Wiley 2012.
4. Stuart Borlase, "Smart Grid: Infrastructure, Technology and solutions", CRC Press.
5. A.G.Phadke, "Synchronized Phasor Measurement and their Applications", Springer.

Subject Code	Core /Elective	Course Name	L	T	P	IM	EM	CR
1852105	**PE 1**	**Wind and Solar Systems**	3	0	0	40	60	3

Course Objectives

1. To get exposure to wind and solar systems
2. To understand the factors involved in installation and commissioning of a Solar or Wind plant.
3. Learning the dynamics involved when interconnected with power system grid

Course Outcomes

Students will be able to:

1. Understand the importance of energy growth of the power generation from the renewable energy sources and participate in solving these problems.
2. Gain the knowledge of the physics of wind power and solar power generation and all associated issues so as to solve practical problems.
3. Gain 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

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UNIT-I

Historical development and current status: Introduction – historical background – current status of wind power worldwide – status of wind turbine technology.

Characteristics of wind power generation – basic integration issues: consumer requirements – requirements from wind farm operators – the integration issues.

UNIT – II

Generators and Power Electronics for wind turbines: generator concepts – power electronic concepts – power electronic solutions in wind farms.

Power quality standards of wind turbines: Power Quality characteristics of wind turbines – Impact on voltage quality.

Technical regulations for inter connections: overview of technical regulations – comparison of technical regulations.

UNIT- III

Isolated systems with wind power: isolated power systems – overview of wind – diesel power systems – wind power impact on power quality.

Reactive power capability and voltage control: Relevance and design paradigm – Reactive power capability of a wind turbine – model based design of voltage control systems for wind power plants.

Economic aspects: introduction – costs for network connection and network upgrading – System operation costs in a deregulated market.

UNIT – IV

Impacts of wind power on power system stability: Power system stability and security – rotor angle stability – voltage stability – frequency stability – dynamic behavior of wind power plants.

Solar energy: merits, demerits – thermal applications.

UNIT- V

Concentrating collectors - devices for thermal collection & storages – Thermal energy storage: sensible heat storage, latent heat storage, Thermo chemical storage - solar pond: principle of working – description.

Text Books

1. Wind power in Power Systems by Thomas Ackerman, John Willy & Sons ltd.
2. Solar Energy by K. Sukhatme & S.P. Sukhatme, TMH, 2nd Edition.

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Subject Code	Core /Elective	Course Name	L	T	P	IM	EM	CR
1852106	PE 2	Electric Power Distribution System	3	0	0	40	60	3

Course Objectives

Students will be able to:

1. Learning about power distribution system
2. Learning of SCADA System
3. Understanding Distribution Automation

Course Outcomes

Students will be able to:

1. Gain knowledge in power distribution systems.
2. Study of Distribution automation and its applications.
3. Learn SCADA system.
4. Apply AI Techniques to DA.

UNIT-I

Electricity Forecasting: Power loads – connected loads – short term load forecasting - long term load forecasting – distribution of power- Distributed energy supply system – technological forecasting.

UNIT-II

Distribution Automation: need for distribution automation – characteristics of distribution system – distribution automation- feeder automation – communication requirements for DA-Remote Terminal Unit.

UNIT- III

SCADA System: Introduction- block diagram –components of SCADA – functions of SCADA – SCADA applied to DA – Advantages of DA through SCADA – Requirements and feasibility – DA Integration Mechanisms – Communication protocols in SCADA systems.

UNIT-IV

Remote Metering: Background for Automatic Meter Reading(AMR) for utility – Components of AMR systems – communication methods used for meter reading – AMR system – services and functions - Planning for AMR implementation -Optimal Switching Device placement in Radial distribution system – sectionalizing switches.

UNIT –V

AI Techniques Applied to DA: Introduction – general techniques description – genetic algorithm and its implementation – steps followed in simple Genetic algorithm – Application of GA to DA. Energy Management – Need Based Energy Management- Demand Side management -Urban and Rural Distribution Systems: Urban Distribution – Rural distribution systems.

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

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Subject Code	Core /Elective	Course Name	L	T	P	IM	EM	CR
1852107	PE2	Mathematical Methods for Power Engineering	3	0	0	40	60	3

Course Objectives:

Students will be able to:

1. Understand the relevance of mathematical methods to solve engineering problems.
2. Understand how to apply these methods for a given engineering problem.

Course Outcomes:

Students will be able to:

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

Unit I

Vector spaces, Linear transformations, Matrix representation of linear transformation, Eigen values and Eigen vectors of linear operator.

Unit II

Linear Programming Problems, Simplex Method and Duality. Non Linear Programming problems.

Unit III

Unconstrained Problems, Search methods, Constrained Problems.

Unit IV

Lagrange method, Kuhn-Tucker conditions, Random Variables, Distributions.

Unit V

Independent Random Variables, Marginal and Conditional distributions, Elements of stochastic processes.

References

1. Kenneth Hoffman and Ray Kunze, "Linear Algebra", 2nd Edition, PHI, 1992.
2. Hillier F S and Liebermann G J, "Introduction to Operations Research", 8th Edition, McGraw Hill, 2009.

3. A Papoulis, S. Unnikrishna pillai, "Probability, Random Variables and Stochastic Processes", 4rd Edition, McGraw Hill., 2002.
4. S.S. Rao, Engineering Optimization Theory and Practice ' Third Enlarges Edition, New age international publishers, 2013.
5. Irwin Miller and Marylees Miller, John E. Freund's "Mathematical Statistics", 6th Edn, PHI, 2002.
6. J. Medhi, "Stochastic Processes", New Age International, New Delhi., 1994

Subject Code	Core /Elective	Course Name	L	T	P	IM	EM	CR
1852108	PE 2	Electrical & Hybrid Vehicles	3	0	0	40	60	3

Course Objectives

Students will be able to:

1. To understand upcoming technology of hybrid system.
2. To understand different aspects of drives application.
3. Learning the electric Traction.

Course Outcomes

Students will be able to:

1. Acquire knowledge about fundamental concepts, principles of hybrid and electric vehicles.
2. Analyze and design of hybrid and electric vehicles.
3. To learn electric drive in vehicles / traction.

Unit - I

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, Mathematical models to describe vehicle performance.

Unit - II

Basic concept of hybrid traction, Introduction to various hybrid drive-train topologies, Power flow control in hybrid drive-train topologies, Fuel efficiency analysis.

Unit - III

Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives and drive system efficiency.

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Unit - IV

Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics devices, Selecting the energy storage technology, Communications, supporting subsystems.

Unit - V

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.

Reference Books

1. Sira -Ramirez, R. Silva Ortigoza, "Control Design Techniques in Power Electronics Devices", Springer.
2. Siew-Chong Tan, Yuk-Ming Lai, Chi Kong Tse, "Sliding Mode Control of Switching Power Converters".

Subject Code	Core /Elective	Course Name	L	T	P	IM	EM	C R
1800109	--	**Research Methodology and IPR**	0	0	4	40	60	2

Course objective:

- To provide a perspective on research to the scholars so as to broaden their conceptions of what research involves.
- To impart knowledge on techniques related to research such as problem formulation, literature survey, information retrieval, use of statistical techniques, writing of research reports and evaluation To expose the scholars ethics in research and Intellectual Property Rights

Course Outcomes:

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

- Understand research problem formulation.
- Analyze research related information
- Follow research ethics
- Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
- Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.

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- Understand that IPR protection provides an incentive to inventors for further research work
- and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits

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.

Unit 2

Effective literature studies approaches, Plagiarism and Research ethics

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.

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.

Unit 5

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

Text Books:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students".
2. Wayne Goddard and Stuart Melville, "Research Methodology: an Introduction".
3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners".

References:

1. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd,2007.
2. Mayall, "Industrial Design", McGraw Hill, 1992.
3. Niebel, "Product Design", McGraw Hill, 1974.
4. Asimov, "Introduction to Design", Prentice Hall, 1962.

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II Sem M.Tech

Subject Code	Core /Elective	Course Name	L	T	P	IM	EM	CR
1852201	Core 3	Digital Protection of Power System	3	0	0	40	60	3

Course Objectives

1. Study of numerical relays
2. Developing mathematical approach towards protection
3. Study of algorithms for numerical protection

Course Outcomes

Students will be able to:

1. Learn the importance of Digital Relays
2. Apply Mathematical approach towards protection
3. Learn to develop various Protection algorithms

Unit - I

Introduction: Evolution of Digital Relays from Electromechanical Relays, Performance and Operational Characteristics of Digital Protection.

Unit - II

Mathematical Background to Protection Algorithms: Finite Difference Techniques, Interpolation Formulas: Forward, Backward and Central Difference Interpolation, Numerical Differentiation, Curve Fitting and Smoothing, Least Squares Method, Fourier analysis, Fourier series and Fourier Transform, Walsh Function Analysis.

Unit - III

Basic Elements Of Digital Protection: Signal Conditioning: transducers, Surge Protection, Analog Filtering, Analog Multiplexers, Conversion Subsystem 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.

Unit - IV

Sinusoidal Wave Based Algorithms: Sample and First Derivative (Mann and Morrison) algorithm. Fourier and walsh based Algorithms.

Fourier Algorithm: Full Cycle Window algorithm, Fractional Cycle Window algorithm. Walsh Function Based Algorithm. Least Squares based algorithms. Differential Equation Based Algorithms.

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Unit - V

Travelling Wave based Techniques: Digital Differential Protection of Transformers. Digital Line Differential Protection. Recent Advances in Digital Protection of Power Systems.

Reference 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.
3. Gerhard Zeigler, "Numerical Distance Protection", Siemens Publicis Corporate Publishing, 2006.
4. S.R.Bhide "Digital Power System Protection" PHI Learning Pvt.Ltd.2014.

Subject Code	Core /Elective	Course Name	L	T	P	IM	EM	CR
1852202	**Core 4**	**Power System Dynamics-II**	3	0	0	40	60	3

Course Objectives

1. Study of power system dynamics
2. Interpretation of power system dynamic phenomena
3. Study of various forms of stability

Course Outcomes

Students will be able to:

1. Gain valuable insights into the phenomena of power system including obscure ones.
2. Understand the power system stability problem.
3. Analyze the stability problems and implement modern control strategies. Simulate small signal and large signal stability problems

UNIT-I

Basic Concepts and Definitions: Concept of State, Eigen values, Eigen Vectors, Representation of State space. Small signal stability of single machine connected to infinite bus system.

UNIT-II

Effect of Damper,Flux Linkage Variation and Effect of AVR on Synchronizing and Damping Torque Components, Block diagram.

UNIT-III

Large Signal Rotor Angle Stability, Mitigation Using Power System Stabilizer, Multi-Machine Stability.

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UNIT-IV

Dynamic Analysis of Voltage Stability- Modeling requirements, Static and Dynamic analysis, Voltage Collapse.

UNIT-V

Frequency Stability: Automatic Generation Control Models-Primary Speed Control and Supplementary Control, Implementation of AGC, Functional Block Diagram.

Text Book:

1. P.M. Anderson and A.A. Fouad, "Power System Control And Stability", IEEE Press.
2. Power System Stability and Control, P.Kundur, TMH.
3. Power System Analysis and Design, William D Stevenson, John J Grainger, TMH.
4. Power Systems Dynamics and Stability, M.A.Pai- PHI Publications.

Subject Code	Core /Elective	Course Name	L	T	P	IM	EM	CR
1852203	PE-3	Restructured Power Systems	3	0	0	40	60	3

Course Objectives

Students will be able to:

1. Understand what is meant by restructuring of the electricity market.
2. Understand the need behind requirement for deregulation of the electricity market.
3. Understand the money, power & information flow in a deregulated power system.

Course Outcomes

Students will be able to:

1. Understand various types of regulations in power systems.
2. Identify the need of regulation and deregulation.
3. Define and describe the Technical and Non-technical issues in Deregulated Power Industry.
4. Identify and give examples of existing electricity markets.
5. Classify different market mechanisms and summarize the role of various entities in the market

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UNIT I

Deregulation of Electric Utilities: Introduction – Traditional central utility model, reform motivations, separation of ownership and operation, competition and direct access in the electricity market, independent system operator (ISO), retail electric providers, different experiences.

UNIT II

Competitive Wholesale Electricity Markets & Transmission Open Access: Introduction, ISO, wholesale electricity market characteristics, market model, challenges, trading arrangements, the pool and bilateral trades, multi lateral trades.

UNIT III

Transmission Cost Allocation Methods: Introduction - Postage Stamp Rate Method - Contract Path Method - MW-Mile Method – Unused Transmission Capacity Method - MVA-Mile method – Comparison of cost allocation methods.

UNIT IV

Market Power & Ancillary Services Management: Introduction - Different types of market Power – Mitigation of Market Power – Examples - Introduction – Reactive Power as an Ancillary Service – a Review – Synchronous Generators as Ancillary Service Providers.

UNIT V

Available Transfer Capability (ATC) : Transfer Capability Issues – ATC – TTC – TRM – CBM Calculations – Calculation of ATC based on power flow - Introduction – Electricity Price Volatility Electricity Price Indexes – Challenges to Electricity Pricing – Construction of Forward Price Curves – Short-time Price Forecasting.

Text Books:

1. Power System Restructuring and Deregulation, Loi Lei Lai, John Wiley & Sons Ltd., England, 2001.
2. Operation of Restructured Power System, Kankar Bhattacharya, Math H.J. Boller and Jaap E. Daalder Kulwer Academic Publishers, 2001.
3. Restructured Electrical Power Systems, Mohammad Shahidehpour and Muwaffaq alomoush, Marcel Dekker, Inc., 2001.

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Subject Code	Course /Elective	Course Name	L	T	P	IM	EM	CR
1852204	PE 3	Energy Auditing and Management	3	0	0	40	60	3

Course Objectives

Students will be able to:

1. To understand the need for energy auditing.
2. Understanding of various loads involved based on power consumption for auditing to know about different audit instruments used in practice.

Course Outcomes

Students will be able to:

1. Acquire the background required for engineers to meet the role of energy managers and to acquire the skills and techniques required to implement energy management.
2. Identify and quantify the energy intensive business activities in an organization.
3. Able to perform basic energy audit in an organization.

UNIT - I

System approach and End use approach to efficient use of Electricity-Electricity tariff types-Energy auditing: Types and objectives - audit instruments-ECO assessment and Economic methods-Specific energy analysis-Minimum energy paths-consumption models-Case study.

UNIT - II

Electric motors-Energy efficient controls and starting efficiency-Motor Efficiency and Load-Load Matching and selection of motors-Variable speed drives; Pumps and Fans-Efficient Control strategies - Optimal selection and sizing-Transformer Loading/Efficiency analysis-Reactive Power management-Capacitor-Sizing-Degree of Compensation-Capacitor-losses-Location-Placement-Maintenance,-Case-study.

UNIT - III

Peak Demand controls- Methodologies-Types of Industrial loads-Optimal Load scheduling-case study-Lighting- Energy efficient light sources-Energy conservation in Lighting Schemes-Electronic ballast-Power quality issues-Luminaries, case study.

Unit - IV

Cogeneration-Types and Schemes-Optimal operation of cogeneration plants-case study-Electric loads of Air conditioning &Refrigeration-Energy conservation measures- Cool storage-Types-Optimal operation case study.

UNIT - V

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Electric water heating-Geysers-Solar Water Heaters-Power Consumption in Compressors-Energy conservation measures-Electrolytic Process-Computer Controls- software-EMS.

Reference Books

1. Anthony J. Pansini, Kenneth D. Smalling, .Guide to Electric Load Management., Pennwell Pub; (1998).
2. Howard E. Jordan, .Energy-Efficient Electric Motors and Their Applications., Plenum Pub Corp; 2ndedition (1994).
3. Giovanni Petrecca, Industrial Energy Management: Principles and Applications., The Kluwerinternational series -207,1999.
4. Handbook on Energy Audit and Environment Management, Y P Abbi and Shashank Jain, TERI, 2006.
5. Handbook of Energy Audits Albert Thumann, William J. Younger, Terry Niehus, 2009.

Subject Code	Core /Elective	Course Name	L	T	P	IM	EM	CR
1852205	**PE 3**	**Power Apparatus Design**	3	0	0	40	60	3

Course Objectives

Students will be able to:

1. Study the modelling analysis of rotating machine.
2. Learning electromagnetic energy conversion
3. To know about rating of machines.

Course Outcomes

Students will be able to:

1. To give a systematic approach for modeling and analysis of all rotating machines under both transient and steady state conditions with the dimensions and material used
2. Ability to model and design all types of rotation machines including special machines

UNIT-I

The Design problem – Introduction, design specifications, limitations in design, Modern trends in design of electrical machines.

Thermal state in electrical Machines – Salient features of heating curves – cooling of rotating machines – Methods of cooling - cooling system - Induced & forced ventilation, Radial and Axial Ventilation - Cooling of turbo alternators: Hydrogen cooling, Direct cooling, Air cooled. - Types of Duties and Ratings.

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UNIT - II

Design of transformers – Types of transformer – core construction, output equation, principle of design of core, windings, yoke main dimensions (H & W) for single phase: core type, shell type. 3-phase – core type transformers estimation of no load current of transformer.

Temperature rise of transformer- Design of tank with tubes.

UNIT III

General concepts of rotating machines – Output equation of dc machines, ac machines, separation of D & L, choice of specific loadings.

Design of D.C machines – Choice of no. of poles, selection of no. of armature slots, choice of winding, estimation of conductor cross section of armature, design of field systems: tentative design of field winding of dc machines.

UNIT IV

Design of 3-phase induction motor – Separation of D & L, Choice of Ampere conductors and B_{av}.

Stator design – Selection of no of stator slots, turns per phase, design of conductor cross section.

Rotor design - Selection of no of rotor slots, principles of design of squirrel cage rotor, design of slip ring rotor.

Relation between D&L for best power factor – Methods of improving Starting Torque - Losses & Efficiency.

UNIT V

Design of synchronous machines – Separation of D & L, choice of Ampere conductors & B_{av} - Short Circuit Ratio (SCR) and its significance.

Armature design – choice of no. of stator (Armature) slots, turns/phase, conductor cross section for both salient pole and cylindrical pole machines.

Introduction to computer aided design – different approaches.

Reference Books

1. Sawhney. A. K., "A course in Electrical Machine Design", Dhanpat Rai & Co.
2. Clayton. A. E. & NN Hancock, "The performance and design of Direct Current machines", CBS publishers & Distributors.

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Subject Code	Core /Elective	Course Name	L	T	P	IM	EM	CR
1852206	PE 4	SCADA Systems and Applications	3	0	0	40	60	3

Course Objectives

Students will be able to:

1. To understand what is SCADA and its functions.
2. To know various communication used in SCADA.
3. To get an insight into its application.

Course Outcomes

Students will be able to:

1. Understand the basic tasks of Supervisory Control Systems (SCADA) as well as their typical applications.
2. Acquire knowledge about SCADA architecture, various advantages and disadvantages of each system.
3. Gain knowledge about single unified standard architecture IEC 61850.
4. Learn about SCADA system components: remote terminal units, PLCs, intelligent electronic devices, HMI systems, SCADA server.
5. Learn and understand about SCADA applications in transmission and distribution sector, industries etc.

Unit - I

Introduction to SCADA-Data acquisition systems-Evolution of SCADA-Communication technologies.

Unit - II

Monitoring and supervisory functions-SCADA applications in Utility Automation-Industries SCADA.

Unit - III

SCADA System Components-Schemes- Remote Terminal Unit (RTU)-Intelligent Electronic Devices (IED)-Programmable Logic Controller (PLC)-Communication Network, SCADA Server, SCADA/HMI Systems.

Unit - IV

SCADA Architecture-Various SCADA architectures, advantages and disadvantages of each System-Single unified standard architecture -IEC 61850.

Unit - V

SCADA Communication-various industrial communication technologies-wired and wireless methods and fiber optics-SCADA Applications: Utility applications.

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Reference 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, 60870.5 and Related Systems", Newnes Publications, Oxford, UK, 2004.
3. William T. Shaw, "Cyber security for SCADA systems", Penn Well Books, 2006.
4. David Bailey, Edwin Wright, "Practical SCADA for industry", Newnes, 2003.
5. Michael Wiebe, "A guide to utility automation: AMR, SCADA, and IT systems for electric power", Penn Well 1999.

Subject Code	Core /Elective	Course Name	L	T	P	IM	EM	CR
1852207	PE 4	Power Quality	3	0	0	40	60	3

Course Objectives:

Students will be able to:

1. Understand the different power quality issues to be addressed.
2. Understand the recommended practices by various standard bodies like IEEE, IEC, etc on voltage & frequency, harmonics.
3. Understanding STATIC VAR Compensators.

Course Outcomes: -

Students will be able to:

1. Acquire knowledge about the harmonics, harmonic introducing devices and effect of harmonics on system equipment and loads.
2. Develop analytical modeling skills needed for modeling and analysis of harmonics in networks and components.
3. Understand active power factor correction based on static VAR compensators and its control techniques.
4. Analyze series and shunt active power filtering techniques for harmonics.

Unit - I

Introduction-power quality-voltage quality-overview of power quality Phenomena-classification of power quality issues-power quality measures and standards-flicker factor transient phenomena-occurrence of power quality problems.

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Unit - II

Harmonics-individual and total harmonic distortion-RMS value of a harmonic waveform-Triplex harmonics-important of 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.

Unit - III

Modeling 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.

Unit - IV

Power factor improvement- Passive Compensation-Passive Filtering, Harmonic Resonance-Active Power Factor Correction- 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.

Unit - V

Dynamic Voltage Restorers for sag , swell and flicker problems.

Grounding and wiring introduction-grounding requirements-reasons for grounding

Reference Books:

1. G.T. Heydt, "Electric power quality", McGraw-Hill Professional, 2007.
2. Math H. Bollen, "Understanding Power Quality Problems", IEEE Press, 2000.
3. J. Arrillaga, "Power System Quality Assessment", John wiley, 2000.
4. J. Arrillaga, B.C. Smith, N.R. Watson & A. R.Wood ,"Power system Harmonic Analysis", Wiley, 1997.

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Subject Code	Core /Elective	Course Name	L	T	P	IM	EM	CR
1852208	PE 4	AI Techniques	3	0	0	40	60	3

Course Objectives

Students will be able to:

1. Understanding fuzzy logic, ANN
2. Understanding GA & EP

Course Outcomes

Students will be able to:

1. Learn the concepts of biological foundations of artificial neural networks.
2. Learn Feedback networks and radial basis function networks and fuzzy logics.
3. Identifications of fuzzy and neural network.
4. Acquire the knowledge of GA.

UNIT I

Artificial Neural Networks: Basics of ANN - Comparison between Artificial and Biological Neural Networks – Basic Building Blocks of ANN – Artificial Neural Network Terminologies – McCulloch Pitts Neuron Model – Learning Rules, Perceptron Networks – Back Propagation Neural Networks – Associative Memories Radial Basis Function Networks.

UNIT II

Fuzzy Logic: Classical Sets – Fuzzy Sets – Fuzzy Properties and Operations – Fuzzy Logic System – Fuzzification –Defuzzification – Membership Functions- Knowledge Representation and Inference Mechanism – Fuzzy Rule base – Fuzzy Logic Controller Design.

UNIT III

Fuzzy Neural Network- System Identification using Fuzzy and Neural Network.

UNIT IV

Genetic algorithm- Reproduction cross over, mutation- Introduction to evolutionary program.

UNIT V

Neural Network Applications to Electrical Load Forecasting, Control systems, Fuzzy Logic Implementation for Induction Motor Control. Automatic Voltage Regulator-GA Applications.

Text Books:

1. J M Zurada , "An Introduction to ANN",Jaico Publishing House.

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2. Simon Haykins, "Neural Networks", Prentice Hall.
3. Timothy Ross, "Fuzzy Logic with Engg.Applications", McGraw. Hill.
4. Driankov, Dimitra, "An Introduction to Fuzzy Control", Narosa Publication.
5. Golding, "Genetic Algorithms", Addison-Wesley Publishing Com.

Reference Books:

1. Introduction to Fuzzy Logic using MATLAB by S. N. Sivanandam, S. Sumathi and S. N. Deepa, Springer International Edition, 2013.
2. Intelligent System – Modeling, Optimization & Control by Yung C. Shin and Chengying Xu, CRC Press, 2009.
3. Introduction to Neural Networks using MATLAB by S. N. Sivanandam, S. Sumathi and S. N. Deepa, Tata McGraw Hill Edition, 2006.
4. Fuzzy Logic with Engineering Applications by Timothy J. Ross, WILEY India Edition, 3rd Edition, 2012.

Subject Code	Core /Elective	Course Name	L	T	P	IM	EM	CR
1852209	Core 5	Mini Project with Seminar	0	0	4	100	--	2

Course objective:

Students will be able to:

- acquire practical knowledge within the chosen area of technology for project development
- identify, analyze, formulate and handle programming projects with a comprehensive and systematic approach
- contribute as an individual or in a team in development of technical projects.
- develop effective communication skills for presentation of project related activities

Course Outcomes:

At the end of the course:

1. Students will get an opportunity to work in actual industrial environment if they opt for internship.
2. In case of mini project, they will solve a live problem using software/analytical/computational tools.
3. Students will learn to write technical reports.
4. Students will develop skills to present and defend their work in front of technically qualified audience.

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Students can take up small problems in the field of design engineering as mini project. It can be related to solution to an engineering problem, verification and analysis of experimental data available, conducting experiments on various engineering subjects, material characterization, studying a software tool for the solution of an engineering problem etc.

Subject Code	Core /Elective	Course Name	L	T	P	IM	EM	CR
1852210	LAB3	**Power Systems Lab - II**	0	0	4	50	50	2

Any **Eight** of the following experiments has to be carried out.

1. Characteristics of over current relay.
2. Characteristics of Directional Over Current Relay
3. Testing of Relay
4. Characteristics of differential current relay.
5. Over voltage/under voltage relay.
6. Negative sequence relay.
7. Voltage & Current control of 220kV transmission line.
8. Study of rooftop solar system.
9. Field visit to wind generation system.
10. Study of Bio-mass generation plant.

Subject Code	Core /Elective	Course Name	L	T	P	IM	EM	CR
1852211	LAB4	**Power Systems Simulation Lab - II**	0	0	4	50	50	2

Any Eight of the following experiments has to be carried out.

1. Single Area Load Frequency Control with and without PI controller.
2. Two area load frequency control system.
3. Simulation of swing equation.
4. Simulation of AVR system.
5. Simulation of Excitation system stabilizer.
6. Simulation of FACTS controllers.
7. Simulation of Power Quality problems.
8. Three -phase fully controlled rectifiers.
9. Three- phase inverter with PWM controller.
10. Buck & Boost converters for power system applications.

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M.Tech III-Sem

Subject Code	Core /Elective	Course Name	L	T	P	IM	EM	CR
1852301	PE 5	Power System Transients	3	0	0	40	60	3

Course Objectives

Students will be able to:

1. Learn the reasons for occurrence of transients in a power system.
2. Understand the change in parameters like voltage & frequency during transients.
3. To know about the lightning phenomenon and its effect on power system.

Course Outcomes

Students will be able to:

1. Gain knowledge of various transients that could occur in power system and their mathematical formulation.
2. Ability to design various protective devices in power system for protecting equipment and personnel.
3. Coordinating the insulation of various equipments in power system.
4. Modeling the power system for transient analysis.

UNIT I

Simple switching transients: Circuit closing transients, recovery transients initiated by removal of short circuit, double frequency transient damping, resistance switching, load switching.

Abnormal switching transients: Normal & abnormal switching transients, current suppression, capacitance switching, transformer magnetizing in rush current.

UNIT -II

Modelling of power apparatus of their transient conditions: Transformer model for switching on open circuit , Internal model for transformer, Modelling of transformer for transfer of surges, modeling of generators, modeling of motors, modeling of overhead transmission lines and cables

UNIT III

Lighting, physical phenomena of lighting, interaction between lighting and power system, influence of tower footing resistance and earth resistance.

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Insulation co-ordination, strength of insulation, Hierarchy of insulation co-ordination, test voltage waveforms and transient ratings, approaches to insulation co-ordination.

UNIT-IV

Travelling waves on transmission line: circuits with distributed parameters - Wave equation - Reflection & refraction - behaviour of travelling waves at the line terminations- lattice diagrams - Attenuation & distortion - Multi conductor system and velocity wave.

UNIT-V

Protection of system against Transient over voltages: Protection of transmission line against lighting, lighting shielding of substations, lighting arresters, surge arresters, surge capacitors and reactors, Surge protection of rotating machines.

Text Books:

1. Allan Greenwood, "Electrical transients in Power System", Wiley & Sons Inc. New York, 1991.

Subject Code	Core /Elective	Course Name	L	T	P	IM	EM	CR
1852302	PE 5	Industrial Load Modeling and Control	3	0	0	40	60	3

Course Objectives

Students will be able to:

1. Understand the energy demand scenario.
2. Understand the modeling of load and its ease to study load demand industrially.
3. Analyze Electricity pricing models.
4. Study Reactive power management in Industries.

Course Outcomes

Students will be able to:

1. Gain knowledge about load control techniques in industries and its application.
2. Learn different types of industrial processes and optimize the process using tools like LINDO and LINGO
3. Apply load management to reduce demand of electricity during peak time
4. Apply different energy saving opportunities in industries

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Unit - I

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.

Unit - II

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.

Unit - III

Reactive power management in industries-Controls-power quality impacts Application of filters Energy saving in industries.

Unit - IV

Cooling and heating loads, load profiling, Modelling- Cool storage, Types-Control strategies, optimal operation, and Problem formulation- Case studies.

Unit - V

Operating and control strategies, Power Pooling- Operation models, Peak load saving, Constraints Problem formulation- Case study, Integrated Load management for Industries.

Reference Books:

1. C.O. Bjork "Industrial Load Management - Theory, Practice and simulations", Elsevier, the Netherlands, 1989.
2. C.W. Gellings and S.N. Talukdar, Load management concepts. IEEE Press, New York, 1986, pp. 3-28.
3. Y. Manichaikul and F.C. Schweppe ," Physically based Industrial load", IEEE Trans. on PAS, April 1981.
4. H. G. Stoll, "Least cost Electricity Utility Planning", Wiley Inter science Publication, USA, 1989.
5. I.J. Nagarath and D.P. Kothari, .Modern Power System Engineering., Tata McGraw Hill publishers, NewDelhi, 1995.
6. IEEE Bronze Book- "Recommended Practice for Energy Conservation and cost effective planning in Industrial facilities", IEEE Inc, USA.

Subject Code	Core /Elective	Course Name	L	T	P	IM	EM	C R
1852303	PE 5	Dynamics of Linear Systems	3	0	0	40	60	3

Course Objectives

Students will be able to:

1. To understand the linear system and its functions.
2. To understand the stability analysis of linear systems and implement the same in MATLAB.

Course Outcomes

Students will be able to:

1. Learn linear system modelling, analysis and design so as to obtain the ability to apply the same to engineering problems in a global perspective.
2. Gain knowledge on carrying out detailed stability analysis of both linear and nonlinear systems.
3. Design observers and controllers for linear systems.
4. Analyse and design pole placement method using MATLAB.

Unit- I

Introduction Concept of State, State Variables and State Model, State model for Linear Continuous Time Systems, transfer function and transfer function matrix, MATLAB programs.

Unit- II

Solving the time invariant state equation methods-exponential Laplace for homogeneous and non-homogeneous state equations

Unit- III

Controllability, complete controllability of continuous time systems observability complete observability of continuous time systems principle of duality.

Unit- IV

The introduction to the design pole placement method, problems in MATLAB. State observers, full order- minimum order.

Unit-V

Lyapunov stability analysis, introduction, Lyapunov stability criterion, direct method of lyapunov and the linear systems.

Text Books:

1. Thomas Kailath, "Linear Systems", Prentice Hall Inc., Englewood Cliffs, N.J. 1980.
2. K. Ogata, "State Space Analysis of Control Systems", Prentice Hall Inc., Englewood Cliffs, N.J., 1965.

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3. K. Ogata, "Modern Control Engineering, (second edition)", Prentice Hall Inc., Englewood Cliffs, N.J., 1990.
4. M. Gopal, "Digital Control and State Variable Methods", Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997.
5. C.T. Chen, "Linear System Theory and Design", New York: Holt Rinehart and Winston, 1984.
6. R.C. Dorf, and R. T. "Bishop, Modern Control Systems", Addison Wesley Longman Inc., 1999.

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OPEN ELECTIVES

Subject Code	Core /Elective	Course Name	L	T	P	IM	EM	CR
1871304	OE	Business Analytics	3	0	0	40	60	3

Course objective

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.
5. Use decision-making tools/Operations research techniques.
6. Mange business process using analytical and management tools.
7. Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.

Course Outcomes

1. Students will demonstrate knowledge of data analytics.
2. Students will demonstrate the ability of think critically in making decisions based on data and deep analytics.
3. Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.
4. Students will demonstrate the ability to translate data into clear, actionable insight

Unit1: 9hrs

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.

Unit 2: 8 hrs

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.

Unit 3: 9hrs

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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.

Unit 4: 10hrs

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, verbooking Model, Cash Budget Model.

Unit 5: 8hrs

Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making.

Unit 6: 4hrs

Recent Trends in: Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

Reference Books:

1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press.
2. Business Analytics by James Evans, persons Education.

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Subject Code	Core /Elective	Course Name	L	T	P	IM	EM	CR
1871305	OE	Industrial Safety	3	0	0	40	60	3

Unit-I

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 fire fighting, equipment and methods.

Unit-II

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.

Unit-III

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.

Unit-IV

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 equipments 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.

Unit-V

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. Steps/procedure for periodic and preventive

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K.S.R.M. College of Engineering
Kadapa -516003.

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

Reference:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

Subject Code	Core /Elective	Course Name	L	T	P	IM	EM	CR
1871306	OE	Operations Research	3	0	0	40	60	3

Course Outcomes:

The student should 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.

Unit 1

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

Unit 2

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming

Unit 3

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

Unit 4

Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

Unit 5

Competitive Models,Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

References Books

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008.

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K.S.R.M. College of Engineering
Kadapa -516003.

2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
3. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008.
4. Hitler Libermann Operations Research: McGraw Hill Pub. 2009.
5. Pannerselvam, Operations Research: Prentice Hall of India 2010.
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010.

Subject Code	Core /Elective	Course Name	L	T	P	IM	EM	CR
1871307	OE	Cost Management & Engineering Projects	3	0	0	40	60	3

Unit-I

Introduction and Overview of the Strategic Cost Management Process Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

Unit II

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

Unit III

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.

Unit IV

Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis.

Unit V

Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

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Kadapa -516003.

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

References Books:

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of CostAccounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

Subject Code	Core /Elective	Course Name	L	T	P	IM	EM	CR
1871308	OE	Composite Materials	3	0	0	40	60	3

UNIT–I

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.

UNIT – II

Reinforcements: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT – III

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.

UNIT–IV

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.

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UNIT – V

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.

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.

References:

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.

Subject Code	Core /Elective	Course Name	L	T	P	IM	EM	CR
1871309	OE	Waste to Energy	3	0	0	40	60	3

Unit-I

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

Unit-II

Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

Unit-III

Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

Unit-IV

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

Unit-V

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production -

Urban waste to energy conversion - Biomass energy programme in India.

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

Subject Code	Core /Elective	Course Name	L	T	P	IM	EM	C R
Major Project	1852310	**Dissertation (Phase-I)**	0	0	20	100	--	10

Course Outcomes:

1. At the end of the course:
2. Students will learn to survey the relevant literature such as books, national/international refereed journals and contact resource persons for the selected topic of research.
3. Students will be able to use different experimental techniques.
4. Students will be able to use different software/ computational/analytical tools.
5. Students will be able to design and develop an experimental set up/ equipment/testing.
6. Students will be able to conduct tests on existing set ups/equipments and draw logical conclusions from the results after analyzing them.
7. Students will be able to either work in a research environment or in an industrial environment.

Syllabus Contents:

The Project Work will start in semester III and 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. Seminar should be based on the area in which the candidate has undertaken the dissertation work as

HEAD
Department of Electrical & Electronics Engineering
K.S.R.M. College of Engineering
Kadapa -516003

per the common instructions for all branches of M. Tech. 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 Head and PG coordinator. The candidate has to be in regular contact with his guide and the topic of dissertation must be mutually decided by the guide and student.

Subject Code	Core /Elective	Course Name	L	T	P	IM	EM	CR
1852401	Major Project	Dissertation (Phase – II)	0	0	32	50	50	16

At the end of the course:

1. Students will develop attitude of lifelong learning and will develop interpersonal skills to deal with people working in diversified field will.
2. Students will learn to write technical reports and research papers to publish at national and international level.

Students will develop strong communication skills to defend their work in front of technically qualified audience.

Syllabus Contents:

It is a continuation of Project work started in semester III. He has to submit the report in prescribed format and also present a seminar. 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 Head and PG coordinator. The candidate has to be in regular contact with his guide.

AUDIT COURSES (1 &2)

ENGLISH FOR RESEARCH PAPER WRITING (1870A01)

Course objectives:

1. Students will be able to:
2. Understand that how to improve your writing skills and level of readability
3. Learn about what to write in each section

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Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission

UNIT - I

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.

UNIT - II

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

UNIT - III

Review of the Literature, Methods, Results, Discussion, Conclusions, the Final Check.

UNIT - IV

key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature

UNIT - V

skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

Reference Book:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books).
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press.
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book.
4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011.

DISASTER MANAGEMENT (1870A02)

Course Objectives:

Students will be able to

1. learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
2. critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
3. develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.

4. critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in

UNIT - I

Introduction to Disaster: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

UNIT - II

Repercussions of Disasters and Hazards: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem.

Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

UNIT - III

Disaster Prone Areas in India: Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards With Special Reference to Tsunami; Post-Disaster Diseases and Epidemics.

UNIT - IV

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

UNIT - V

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

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

Reference Books:

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

&Deep Publication Pvt. Ltd., New Delhi.

SANSKRIT FOR TECHNICAL KNOWLEDGE (1870A03)

Course Objectives:

1. To get a working knowledge in illustrious Sanskrit, the scientific language in the world.
2. Learning of Sanskrit to improve brain functioning.
3. Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power.
4. The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature.

Course Outcomes

Students will be able to

1. Understanding basic Sanskrit language
2. Ancient Sanskrit literature about science & technology can be understood
3. Being a logical language will help to develop logic in students

UNIT – I

Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences

UNIT - II

Order, Introduction of roots, Technical information about Sanskrit Literature

UNIT - III

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

Reference Books:

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

VALUE EDUCATION (1870A04)

Course Objectives

Students will be able to

1. Understand value of education and self- development
2. Imbibe good values in students
3. Let the should know about the importance of character

Course outcomes

Students will be able to

1. Knowledge of self-development

2. Learn the importance of Human values
3. Developing the overall personality

UNIT - I

Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles.
Value judgments.

UNIT - II

Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature, Discipline

UNIT - III

Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labor. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature.

UNIT - IV

Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence ,Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively.

Reference Book:

1. Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi.

CONSTITUTION OF INDIA (1870A05)

Course Objectives:

Students will be able to:

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. To address the role of socialism in India after the commencement of the Bolshevik.
4. Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Course Outcomes:

Students will be able to:

1. Discuss the growth of the demand for civil right s in India for the bulk of

Indians before the arrival of Gandhi in Indian politics.

2. Discuss the intellectual origins of the frame work of argument that informed the conceptualization of social reforms leading to revolution in India.
3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
4. Discuss the passage of the Hindu Code Bill of 1956.

UNIT - I

History of Making of the Indian Constitution: History, Drafting Committee, (Composition & Working),

Philosophy of the Indian Constitution: Preamble Salient Features.

UNIT - II

Contours of Constitutional Rights & Duties: Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT - III

Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

UNIT - IV

Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat., Elected officials and their roles, CEO Zila Pachayat: Position and role.

Block level: Organizational Hierarchy (Different departments),

Village level: Role of Elected and Appointed officials, Importance of grass root democracy

UNIT - V

Election Commission:

Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners.

State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

Reference Books:

1. The Constitution of India, 1950 (Bare Act), Government Publication.

2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

PEDAGOGY STUDIES (1870A06)

Course Objectives:

Students will be able to:

1. Review existing evidence on the review topic to inform programme design and policy making undertaken by the DFLD, other agencies and researchers.
2. Identify critical evidence gaps to guide the development.

Course Outcomes:

Students will be able to understand:

1. What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
2. What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
3. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

UNIT - I

Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology, Theories of learning, Curriculum, Teacher education., Conceptual framework, Research questions., Overview of methodology and Searching

UNIT - II

Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, teacher education.

UNIT - III

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

UNIT - IV

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

UNIT - V

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Research gaps and future directions: Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact.

Reference Books:

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

STRESS MANAGEMENT BY YOGA (1870A07)

Course Objectives

1. To achieve overall health of body and mind
2. To overcome stress

Course Outcomes:

Students will be able to:

1. Develop healthy mind in a healthy body thus improving social health also
2. Improve efficiency

UNIT - I

Definitions of Eight parts of yog. (Ashtanga)

UNIT - II

Yam and Niyam. Do`s and Don't's in life. Ahinsa, satya, astheya, bramhacharya and aparigraha, Shaucha, santosh, tapa, swadhyay, ishwarpranidhan.

UNIT - III

Asan and Pranayam, Various yog poses and their benefits for mind & body, Regularization of breathing techniques and its effects, Types of pranayam.

Reference Books:

1. 'Yogic Asanas for Group Tarining-Part-I" : Janardan Swami Yogabhyasi Mandal, Nagpur.

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Kadapa -516003.

2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda,
3. Advaitashrama (Publication Department), Kolkata

PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS (1870A08)

Course Objectives

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

Course Outcomes

Students will be able to

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

UNIT - I

Neetisatakam-Holistic development of personality, Verses- 19,20,21,22 (wisdom), Verses-29,31,32 (pride & heroism), Verses- 26,28,63,65 (virtue), Verses- 52,53,59 (dont's), Verses-71,73,75,78 (do's).

UNIT - II

Approach to day to day work and duties. Shrimad Bhagwad Geeta : Chapter 2-Verses 41, 47,48, Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35, Chapter 18-Verses 45, 46, 48.

UNIT - III

Statements of basic knowledge. Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68, Chapter 12 -Verses 13, 14, 15, 16,17, 18, Personality of Role model. Shrimad Bhagwad Geeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42, Chapter 4-Verses 18, 38,39, Chapter18 – Verses 37,38,63

Reference Books:

1. "Srimad Bhagavad Gita" by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata
2. Bhartrihari's Three Satakam(Niti-sringar-vairagya) by P.Gopinath, Rashtriya, Sanskrit Sansthanam, New Delhi

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Kadapa -516003.

Detailed Course Structure & Syllabus

B. Tech - I Semester (Theory - 4, Lab - 3)

S. No.	Subject Code	SUBJECT	SC	L	T	P	IM	EM	CR
1	1821101	Mathematics-I	BSC	3	1	0	30	70	4
2	1823102	Engineering Chemistry	BSC	3	1	0	30	70	4
3	1824103	English	HSMC	2	0	0	30	70	2
4	1805104	Programming for Problem Solving	ESC	3	0	0	30	70	3
5	1823107	Chemistry Lab	BSC	0	0	3	50	50	1.5
6	1805108	Programming for Problem Solving Lab	ESC	0	0	4	50	50	2
7	1824109	English Lab	HSMC	0	0	2	50	50	1
Total				11	02	09	270	430	17.5

B. Tech - II Semester (Theory - 4, Lab - 3)

S. No.	Subject Code	SUBJECT	SC	L	T	P	IM	EM	CR
1	1821201	Mathematics-II	BSC	3	1	0	30	70	4
2	1822203	Engineering Physics	BSC	3	1	0	30	70	4
3	1802206	Basic Electrical Engineering	ESC	3	1	0	30	70	4
4	1803207	Engineering Graphics & Design	ESC	1	0	4	50	50	3
5	1822208	Engineering Physics Lab	BSC	0	0	3	50	50	1.5
6	1802210	Basic Electrical Engineering Lab	ESC	0	0	2	50	50	1
7	1803211	Workshop on Manufacturing Practices	ESC	1	0	4	50	50	3
Total				11	03	13	290	410	20.5

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B. Tech., I Semester

Course Title	Mathematics -I				B. Tech. EEE I Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1821101	Basic Sciences (BSC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	1	--	4	30	70	100
Mid Exam Duration : 2Hrs						End Exam Duration : 3Hrs		

Course Objectives: The objective of the course is to learn the essential tool of matrices in a comprehensive manner, the convergence of series, maxima and minima of a function and the radius of curvature, the Jacobians and extrema of a function, evaluate the definite integrals, Beta and Gamma functions. Apply Fourier series in engineering problems.

Course Outcomes: On successful completion of this course, the students will be able to,

CO 1	Apply the essential tool of matrices in a comprehensive manner.
CO 2	Describe the convergence of series.
CO 3	Classify the functions of several variables which is useful in optimization techniques.
CO 4	Define Beta and gamma functions and solve definite integrals.
CO 5	Determine the Fourier series of the functions.

UNIT I

Matrices: Basic definitions of Symmetric, skew-symmetric and orthogonal matrices, Elementary transformations, Rank, Echelon form, Normal form, System of linear equations, Eigen values and Eigenvectors for real matrices, Cayley-Hamilton theorem, Diagonalization of matrix by an orthogonal transformation.

UNIT II

Sequences and series: Convergence of sequences and series, Comparison test, p-test, D'Alembert's ratio test, Cauchy's root test. Power series, Series for exponential, trigonometric and logarithmic functions.

UNIT III

Differential Calculus: Taylor's and Maclaurin's series, Maxima and minima of single variable, Curvature: Curvature of a curve, Curvature of a circle, the Radius of a curvature, Centre of Curvature, Equation to the circle of curvature.

UNIT IV

Multivariable Calculus: Functions of two or more variables, Partial derivatives, Total derivative, Jacobians, Maxima and minima of functions of two variables, Lagrange's method of undetermined multipliers.

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UNIT V

Integral Calculus: Evaluation of definite integrals, Beta and Gamma functions and their properties. Fourier series: Half range Fourier sine and cosine expansions – Parseval's theorem.

Text Books:

1. Higher Engineering Mathematics, Dr. B.S. Grewal, Khanna Publishers-43 edition 2014.
2. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Publications, 9th edition- 2013.
3. Calculus and Analytic geometry, G.B. Thomas and R.L. Finney, Pearson, 9th Edition, Reprint, 2002.
4. Introductory Linear Algebra with applications, Kolman, Bernard Hill, David R

Reference Books:

1. Higher Engineering Mathematics, B.V. Ramana, Mc. Graw Hill Education (India) Pvt. Ltd, New Delhi, 11th Edition, Reprint 2010.
2. Linear Algebra: A Modern Introduction, D Poole, 2nd Edition, Brooks/Cole, 2005.
3. A Text Book of Engineering Mathematics, N.P. Bali and Manish Goyal, Lakshmi Publications, Reprint 2008.
4. Advanced Engineering Mathematics, Greenberg Michael D, Cengage Publishers.

B. Tech., I Semester

<table>
<tr><td>Course Title</td><td colspan="5">Engineering Chemistry</td><td colspan="3">B. Tech. EEE I Sem</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/ Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">1823102</td><td rowspan="2">Basic Sciences (BSC)</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>1</td><td>--</td><td>4</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td colspan="6">Mid Exam Duration : 2Hrs</td><td colspan="3">End Exam Duration : 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives: The objective of the course is to learn the fundamentals of chemistry and then build an interface of theoretical concepts with their industrial! Engineering applications.</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to,</td></tr>
<tr><td>CO 1</td><td colspan="8">Analyze microscopic chemistry in terms of atomic and molecular orbitals and properties of complexes.</td></tr>
<tr><td>CO 2</td><td colspan="8">Rationalize periodic properties such as ionization potential, electro negativity and oxidation states.</td></tr>
</table>

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CO 3	**Illustrate** the concept of various intermolecular interactions, Properties of metals, water, thermodynamic considerations& application of Nernst equation
CO 4	**Distinguish** the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques.
CO 5	**Remember** the major chemical reactions that are used in the synthesis and stereochemistry of molecules

UNIT I

Atomic and molecular structure: Schrodinger wave equation. Particle in a box (one dimensional) and their applications .Molecular orbitals of diatomic molecules and plots of the multicenter orbital's. Equations for atomic and molecular orbital. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties .Band structure of solids and the role of doping on band structures.

UNIT II

Periodic properties: Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electro-negativity, polarizability, oxidation states, coordination numbers and geometries, hard, soft acids and bases.

UNIT III

Intermolecular forces: Ionic, dipolar and van De r Waals interactions. Equations of state of real gases and critical phenomena.

Use of free energy in chemical equilibria: Thermodynamic functions: Introduction, define energy, entropy, Free energy. Free energy and emf. Cell potentials, Nernst equation and applications. Water chemistry-types of water and Boiler troubles. Corrosion-types of corrosion and factors influencing corrosion.

UNIT IV

Spectroscopic techniques and applications: Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules.

UNIT V

Stereochemistry: Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis of Cyclohexane.

Simple Organic Reactions:

Introduction to reactions involving Substitution (SN^1 & SN^2), Addition Reactions involving C=C (Markovnikov Reaction) & C=O, (Grignardreagent),Elimination (E_1&E_2) Oxidation (Baeyer villiger reaction), Reduction (Clemmensen reduction).

Text Books:

1. A Textbook of Engineering chemistry by Shashi Chawla, Dhanpat Rai & Co publications
2.Atkins' Physical Chemistry, Peter Atkins, Julio de Paula and James Keeler, Oxford University Press, 2010.
3. An Introduction to Electrochemistry, Glasstone, Arihant Publications.
4. Organic chemistry by Clayden and Warren, Oxford publications

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Reference Books:

1. Textbook of Engineering Chemistry, Jain and Jain, DhanpatRai& Co publications, 2013
2. New Concise Inorganic Chemistry, 5th Edition, J. D. Lee, Oxford University Press, 2008.
3. Principles of Instrumental Analysis, 6th edition, Douglas A. Skoog, Cengage Publications.
4. Advanced Inorganic Chemistry, Cotton F Albert, Wilkinson Geoffrey, Prism Publications

B. Tech., I Semester

<table>
<tr><td>Course Title</td><td colspan="5">English</td><td colspan="3">B. Tech. EEE I Sem</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">1824103</td><td rowspan="2">Humanities & Social Sciences (HSMC)</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>2</td><td>0</td><td>--</td><td>2</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration : 2Hrs</td><td colspan="4">End Exam Duration : 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives: The objective of the course is to learn the receptive (listening and reading) as well as productive and interactive (speaking and writing) skills by incorporating a comprehensive, coherent and integrated approach that improves the learners' ability to effectively use English language in academic/ workplace contexts.</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to,</td></tr>
<tr><td>CO 1</td><td colspan="8">Describe the classification of words, sentences and their usages in sentences.</td></tr>
<tr><td>CO 2</td><td colspan="8">Understand the difference between spoken and written English.</td></tr>
<tr><td>CO 3</td><td colspan="8">Analyze the rules in language for changing the form of sentences.</td></tr>
<tr><td>CO 4</td><td colspan="8">Illustrate the factors that influence grammar and vocabulary in speaking and writing</td></tr>
<tr><td>CO 5</td><td colspan="8">Classify the parts of speech, tenses and sentence structures</td></tr>
</table>

UNIT I

Vocabulary Building:

The concept of Word Formation
Root words from foreign languages and their use in English
Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives
Synonyms, antonyms
Idioms and phrases.

UNIT II

Basic Writing Skills

Sentence Structures
Use of phrases and clauses in sentences
Importance of proper punctuation
Creating coherence

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Organizing principles of paragraphs in documents
Techniques for writing precisely

UNIT III

Transformation

Interchange of parts of speech
Active voice and Passive voice
Direct and Indirect speech
Degrees of comparison
Simple, compound and complex sentences

UNIT IV

Identifying Common Errors in Writing

Subject-Verb agreement
Noun-pronoun agreement
Misplaced modifiers
Articles
Prepositions
Redundancies
Clichés
Tenses

UNIT V

Reading and Writing Practices

Comprehension
Précis Writing
Essay writing

Text Books:

1. Practical English Usage. Michael Swan. OUP. 1995.
2. Remedial English Grammar. F.T. Wood. Macmillan. 2007.
3. On Writing Well. William Zinsser. Harper Resource Book 2001.
4. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
5. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
6. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press.

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B. Tech., I Semester

Course Title	Programming for Problem Solving				B. Tech. EEE I Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1805104	Engineering Sciences (ESC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	--	--	3	30	70	100
Mid Exam Duration : 2Hrs						End Exam Duration : 3Hrs		

Course Objectives: The objective of the course is to learn the problem-solving through 'C' programming,

Course Outcomes: On successful completion of this course, the students will be able to,

CO 1	Understand the basics of computer system and C programming.
CO 2	Analyze a given problem and develop an algorithm to solve the problem.
CO 3	Apply proper branching and loop constructs to solve a complex problem.
CO 4	Understand the concepts of arrays and strings to solve real time applications.
CO 5	Apply modular approaches for solving complex problems.
CO 6	Illustrate memory optimization for solving real world problems using structures and Unions.

UNIT I

Introduction to Computers: Introduction, computer hardware and software, creating and running programs, software development life cycle, algorithms, flowcharts.

Introduction to C programming: Overview of C, structure of a C program, variables, constants, data types, identifiers, keywords, Input/output statements in C, programming examples.

UNIT II

Operators and Expressions:

Operators, expressions, precedence and associatively, evaluating expressions, type conversion, typedef, enumerations.

Decision making statements: if statement, if-else statement, nested if-else statement, switch statement.

Loops in C and Jumping statements: while loop, for loop, do-while loop, nested for loops, break, continue and goto statements.

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UNIT III

Arrays and its applications: Introduction, Declaration and initialization of 1D and 2D arrays. Bubble (exchange) sort, selection sort, linear search, binary search.

Strings: Definition, declaration and initialization of strings, string I/O functions, string handling functions, array of strings (table of strings).

UNIT IV

Functions: Introduction, Category of Functions, Parameter Passing methods, Storage Classes, Recursive Function.

Pointers: Understanding pointers, declaring and initialization of pointer variable, accessing the address of variables, accessing a variable through its pointer, chain of pointers.

UNIT V

Structures and union: Introduction, defining a structure, declaring structure variable, structure initialization, accessing members of structure, copying and comparing structure variables, structures within structures, array of structures, and introduction of union.

Text Books:

1. E. Balagurusamy, Programming in ANSI C, Fifth Edition, McGraw-Hill.
2. Rema Theraja, Programming in C, second edition, Oxford.

References:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.
2. R.G. Dromey, How to solve it by Computer, Pearson.
3. Yashavant Kanetkar, Let us C, 15th edition, BPB Publications.
4. Dr. P. ChennaReddy, Computer Fundamentals and C Programming, Second Edition.

B. Tech., I Semester

Course Title	Chemistry Lab					B. Tech. EEE I Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1823107	Basic Sciences (BSC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		--	--	3	1.5	50	50	100
						End Exam Duration : 3Hrs		
Course Objectives: The objective of the course is to have exposure on various experimental skills of chemistry like Water, polymers, colligative properties and conductometry. Also, the student is exposed to various tools like Analytical Balance, Viscometer, conductometer, etc..								
Course Outcomes: On successful completion of this course, the students will be able to,								

CO 1	**Find** the cell constant and Conductance of solutions
CO 2	**Evaluate** molecular/system properties such as surface tension, viscosity, redox potentials, Colligative properties etc.
CO 3	**Analyze** the acid value in oil
CO 4	**Determine** the quantity of water sample by estimation of hardness of water, chloride content, DO, etc.,
CO 5	**Demonstrate** the process of Adsorption, Partition co-efficient& Chemical oscillations

List of Experiments (Any 10)

1. Estimation of Hardness of Water present in the given water sample by EDTA method.
2. Determination of surface tension and viscosity.
3. Determination of chloride content of water.
4. Colligative properties using freezing point depression.
5. Estimation of Dissolved Oxygen present in given water sample by Winkler's method.
6. Potentiometers - determination of Redox potentials and emfs.
7. Synthesis of a polymer/drug.
8. Saponification/acid value of oil.
9. Determination of cell constant and conductance of solutions.
10. Chemical oscillations- Iodine clock reaction.
11. Determination of the partition coefficient of a substance between two immiscible liquids.
12. Adsorption of acetic acid by charcoal.

Text Books:

1. Laboratory Manual Engg. Chemistry, Anupma Rajput, Dhanpat Rai & Co.
2. Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham et.al., Pearson Education, Sixth Edition,.

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B. Tech., I Semester

Course Title	Programming for Problem Solving Lab				B. Tech. EEE I Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1805106	Engineering Sciences (ESC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		--	--	4	2	50	50	100
						End Exam Duration : 3Hrs		

Course Objectives: The objective of the course is to develop readable and efficient 'C' programs for computational problems by using operators, conditional and iterative statements to solve real complex problems.

Course Outcomes: On successful completion of this course, the students will be able to,

CO 1	Analyze given problem and develop an algorithm.
CO 2	Implement Code and debug programs in C language using various constructs.
CO 3	Choose proper C language constructs to solve complex problems.
CO 4	Organize and implement heterogeneous data in efficient memory utilization.

1. **DOS commands, Algorithms, Flowcharts and sample C programs**
   - Practice DOS commands necessary for design of C programs
   - Design and develop algorithms and flowcharts for simple and logical problems
   - If the total selling price of 15 items and total profit earned on them is input through the keyboard.
   - Write a C program to find the cost price of one item, Ramesh's basic salary is input through the keyboard. His dearness allowance is 40% of basic salary and house rent allowance is 20% of basic salary. Write a C program to calculate his gross salary
   - The distance between the two cities (in km) is input through the keyboard. Write a 'C' program to convert and print the distance in meters, centimeters, inches and feet.
   - Write a program to take input of name, roll no and marks obtained by a student in 5 subjects each have its 100 full marks and display the name, roll no with percentage score secured.

2. **Problems involving if-then-else structures**
   - Write a C program to find out whether a given number is an even number or odd number.
   - Write a C program to check whether a given year is a leap year or not.
   - Design and develop an algorithm that takes three coefficients (a, b, and c) of a Quadratic equation ($ax2+bx+c=0$) as input and compute all possible roots. Implement

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a C program for the developed algorithm and execute the same to output the possible roots for a given set of coefficients with appropriate messages.

- If the ages of Ramesh, Suresh and Mahesh are input through the keyboard, write a C program to determine the youngest of the three.
- A character is entered through keyboard. Write a C program to determine whether the character entered is a capital letter, a small case letter, a digit or a special symbol using if- else and switch case. The following table shows the range of ASCII values for various characters.

Character	ASCII Values
A – Z	65 – 90
a – z	97 – 122
0 – 9	48 – 57
Special symbols	0 – 47, 58 – 64, 91 – 96, 123 – 127

- A library charges fine for every book returned late. For the first five days the fine is 50 paisa, for 6-10 days fine is one rupee and above 10 days fine is 5 rupees. If you return the book after 30 days your membership will be cancelled. Write a C program to accept the number of days that the member is late to return the book and display the fine or appropriate message.
- Write a C program which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +, -, *, /, % and use switch statement).

3. **Problems involving Looping statements**
   - If the sum of the cubes of each digit of a number is equal to the number itself, then the number is called Armstrong number. (for example, 153 = 13+53+33). Design and develop an algorithm to find whether a given number is Armstrong number or not. Implement a C program for the developed algorithm.
   - Design and develop an algorithm to find the square root of a given number *N*. Implement a C program for the same and execute for all possible inputs with appropriate messages. **Note: Don't use library function *sqrt(n)*.**
   - If a number and its reversed number are same then the number is called as palindrome number. Design and develop an algorithm to check whether a given number is palindrome or not. Implement a C program for the same.
   - Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
   - Write a C program to evaluate the sin(x) function series

$$\sin x = \frac{x}{1!} - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + - - -$$

   - **Fibonacci Sequence: Fibonacci sequence** is defined as follows:

     The first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a program to generate the first N terms of the sequence.

4. **Arrays**
   - Write a C program to find the smallest and largest number in a given array.
   - Write a C program to find the frequency of a particular number in a list of integers
   - Write a C program to sort the list of elements using

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Kadapa-516

a) Bubble Sort b) Selection sort.

- Write a C program to search for an element in a list of elements using
  a) Linear search b) Binary search
- Write a C program to find the transpose of a matrix
- Write a C program to read two matrices and perform the following operations
  a) Addition of two matrices b) Multiplication of two matrices

Additional Problems on arrays

1. **Partitioning an array** - Given a randomly ordered array of n elements, write a C program to partition the elements into two subsets such that elements $\leq X$ are in one subset and elements $\geq X$ are in another subset.
2. **Finding the kth smallest element** - Given a randomly ordered array of n elements, write a C program to determine the kth smallest element.
3. **Array order reversal** - Write a C program to rearrange the elements in an array so that they appear in reverse order.

5. **Strings**
   1. If a string and its reversed string are same then the string is called palindrome string. Design and develop an algorithm to check whether a given string is a palindrome or not and implement a C program for the same.
   2. Write a C program to sort the names of students in a class in alphabetical order.
   3. Write a C program to read two strings and perform the following operations without using built string library functions.
      a. String length
      b. String reversing
      c. Comparison of two strings
      d. Concatenation of two strings

6. **Functions and Recursion**
   1. Write a C program to swap the contents of two variables using
      a) Call by value
      b) Call by reference.
   2. Write a C program using recursion to
      - Find the factorial of a given number
      - Print the Fibonacci series up to a given number.
      - Find the GCD of two integers.

7. **Structures:**
   Write a C program to define a structure with the following members. Roll No., Name, and marks in Sub1, Sub2, and Sub3. Read the n students records and find the total marks of each student and print the result in the following format.

Roll No	Name	Sub1	Sub2	Sub3	Total marks	result
189Y1A0501	Kavya	80	70	75	225	Distinction

8. **Files**: Write a C program to copy the contents of one file to another file

Text Books:

1. Yashavant Kanetkar, Let us C, 15th edition, BPB publications.
2. E. Balagurusamy, Programming in ANSI C, Fifth Edition, McGraw-Hill.
3. R.G. Dromey, How to solve it by Computer, Pearson.

B. Tech., I Semester

Course Title	English Lab					B. Tech. EEE I Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1824107	Humanities & Social Sciences (HSMC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		--	--	2	1	50	50	100
						End Exam Duration : 3Hrs		

Course Objectives: The objective of the course is to

- facilitate computer-assisted multi-media instruction enabling individualized and independent language learning.
- sensitize the students to the nuances of English speech sounds, word accent, intonation and rhythm.
- bring about a consistent accent and intelligibility in students' pronunciation of English by providing an opportunity for practice in speaking.
- improve the fluency of students in spoken English and neutralize their mother tongue.
- train students to use language appropriately for public speaking, group discussions and influence interviews.

Course Outcomes: On successful completion of this course, the students will be able to,

CO 1	Describe objects, places and persons.
CO 2	Understand the listening process and answer the questions related to it.
CO 3	Analyze phonetics with examples.
CO 4	Illustrate different modes of communication skills.
CO 5	Classify LSRW skills.

1. Oral Communication
   (This unit involve interactive practice sessions in Language Lab)
   - Listening Comprehension------ Language Lab
   - Pronunciation, Intonation, Stress and Rhythm------ Language Lab
   - Everyday Situations: Conversations and Dialogues ------ Communication Lab
   - Communication at workplace -------Communication Lab
   - Interviews -------Communication Lab
   - Formal Presentations ------ Communication Lab

Suggested Software:

1. Cambridge Advanced Learners' English Dictionary with CD.

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B. Tech., II Semester

Course Title	Mathematics - II				B. Tech. EEE II Sem		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
1821201	Basic Sciences (BSC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	1	--	4	30	70	100
Mid Exam Duration : 2Hrs					End Exam Duration : 3Hrs		

Course Objectives: The objective of the course is to learn first order differential equations, linear differential equations with constant coefficients, laplace transforms in engineering problems, evaluate multiple integrals, understand vector calculus concepts and their applications.

Course Outcomes: On successful completion of this course, the students will be able to,

CO 1	Solve the first order differential equations.
CO 2	Solve linear differential equations with constant coefficients.
CO 3	Apply Laplace Transforms in engineering problems.
CO 4	Evaluation of multiple integrals.
CO 5	Understand Vector Calculus concepts and their applications.

UNIT I

First order ordinary differential equations: Linear, Bernoulli equations, Exact and equations reducible to Exact. Applications: Orthogonal trajectories, Newton's law of cooling, Law of natural growth and decay.

UNIT II

Ordinary differential equations of higher order: Linear differential equations of second and higher order with constant coefficients – R.H.S term of the type eax, sinax, cosax, polynomials in x, eax V(x), xV(x) – Method of variation of parameters

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UNIT III

Laplace transforms: Laplace transforms of standard functions – Properties of Laplace Transforms – Transforms of derivatives and integrals– Evaluation of integrals by Laplace transforms – Laplace transform of periodic functions. Convolution theorem. Inverse Laplace Transforms – Applications of Laplace transforms to ordinary differential equations.

UNIT IV

Multiple Integrals: Evaluation of double integrals in Cartesian coordinates and polar coordinates – Change of variables in double integrals – Change the order of integration in double integrals – Evaluation of triple integrals in Cartesian and polar coordinates – Change of variables in triple integrals.

UNIT V

Vector calculus: Vector differentiation: Scalar point function - Vector point function – Vector operator Del – Gradient – Divergence – Curl. Vector integration: Line, Surface and Volume integrals. Green's theorem in a plane, Stoke's theorem and Gauss-divergence theorems (Statements only). Applications of Green's, Stoke's and Gauss divergence theorem.

Text Books:

1. Higher Engineering Mathematics, Dr. B.S. Grewal, Khanna Publishers-43 edition 2014.
2. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Publications, 9th edition- 2013
3. Calculus and Analytic geometry, G.B. Thomas and R.L. Finney, Pearson, 9th Edition, Reprint, 2002.
4. Advanced Calculus, Widder V David, Pearson Publishers

Reference Books:

1. Higher Engineering Mathematics, B.V. Ramana, Mc. Graw Hill Education (India) Pvt. Ltd, New Delhi, 11th Edition, Reprint 2010.
2. A Text Book of Engineering Mathematics, N.P. Bali and Manish Goyal, Lakshmi Publications, Reprint 2008.
3. Advanced Engineering Mathematics, Greenberg Michael D, Cengage Publishers.
4. Advanced Engineering Mathematics, Neil Opeter V

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B. Tech., II Semester

Course Title	Engineering Physics				B. Tech. EEE II Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1822202	Basic Sciences (BSC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	1	--	4	30	70	100
Mid Exam Duration : 2Hrs						End Exam Duration : 3Hrs		

Course Objectives: The objective of the course is to learn theoretical and mathematical aspects of interference and diffraction of light for testing of materials, mechanics of particles & rigid body, principles and laws of mechanics in physics to understand the types of motion, concepts of solids and semiconductors.

Course Outcomes: On successful completion of this course, the students will be able to,

CO 1	**Describe** a mathematical wave equation using the principles of waves and oscillations
CO 2	**Apply** the knowledge of Sciences to solve engineering problems by using Interference and Diffraction techniques.
CO 3	**Identify** the working elements of different lasers and applications.
CO 4	**Understand** the fundamental concepts of Quantum Mechanics
CO 5	**Explain** about the solids and different types of semiconductor materials of carrier concentration.

UNIT I

Waves: Introduction, Simple harmonic motion, Characteristics of simple harmonic motion, energy of simple harmonic motion, Principle of superposition of waves, Linear superposition of two waves of the same frequency. Damped harmonic oscillations, Energy and power dissipation in damped harmonic oscillations, forced harmonic oscillations, Resonance.

UNIT II

Wave Optics: Introduction, Huygens, Principle, Superposition of waves, Young's double slit experiments, expression for fringe width, interference in thin film by reflection, Newton's rings experiment, Diffraction, Fraunhofer diffraction due to a single slit and diffraction grating (N-Slits).

UNIT III

Lasers: Introduction to lasers, characteristics of laser, interaction of radiation with matter-spontaneous and stimulated emission, Einstein's coefficients; population inversion,

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excitation mechanisms, types of lasers: Solid-state lasers – Nd-YAG laser, Gas lasers - He-Ne Laser, Semiconductor p-n junction diode laser, Applications of lasers.

UNIT IV

Quantum Mechanics & Wave Equations: Introduction, Wave nature of matter, Uncertainty principle, Time dependent and time independent Schrodinger equations for wave function, Physical significance of wave function, Schrodinger equations for one dimensional particle ina box.

UNIT V

Solids & Semiconductors: Introduction to solids and semiconductors. Free electron theory of metals (drift velocity and electrical conductivity), Fermi energy level, Kronig-Penney model and origin of energy bands, band structure of metals, semiconductors, and insulators. Direct and indirect band gap semiconductors, Intrinsic and extrinsic semiconductors, Dependence of the Fermi level on carrier- concentration and temperature (equilibrium carrier statistics), diffusion and drift, p -n junction.

Text Books:

1. Theory of Vibrations with Applications — W.T. Thomson.
2. Engineering Physics by K. Thygarajan, Tata McGraw-Hill Publishing Co., New Delhi.

References:

1. Engineering Mechanics - Dynamics, 7th Edition J.L. Meriam.
2. An Introduction to Mechanics – D. Kleppner & R. Kolenkow

B. Tech., II Semester

<table>
<tr><td>Course Title</td><td colspan="4">Basic Electrical Engineering</td><td colspan="3">B. Tech. EEE II Sem</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">1802203</td><td rowspan="2">Engineering Sciences (ESC)</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>3</td><td>1</td><td>--</td><td>4</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration : 2Hrs</td><td colspan="3">End Exam Duration : 3Hrs</td></tr>
<tr><td colspan="8">Course Objectives: The objective of the course is to learn the basic concepts of DC and AC circuits, Network Theorems applied to DC circuits, Magnetic Circuits & Graph Theory.</td></tr>
<tr><td colspan="8">Course Outcomes: On successful completion of this course, the students will be able to,</td></tr>
<tr><td>CO 1</td><td colspan="7">Understand the basic fundamentals of DC circuits, network reduction techniques, theorems, dual & duality networks and graph theory.</td></tr>
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K.S.R.M. College of Engineering
Kadapa -516003.

CO 2	Understand the basic fundamentals of AC circuits, magnetic circuits.
CO 3	Determine currents, voltage using mesh and nodal analysis, maximum power, O.C voltage and S.C currents, average and RMS values for different waveforms.
CO 4	Obtain self and mutual inductances for magnetic circuits, incidence matrix, Cutset and tie set matrices for planar networks.

UNIT I

DC Circuits: Electrical circuit elements (R, L and C), voltage and current sources – source transformation, network reduction techniques for simple Series & Parallel networks ,Y/Δ Transformation, Kirchhoff's current and voltage laws, Mesh and Nodal analysis of simple circuits with DC -Problems.

UNIT II

Network Theorems: Thevenin's & Norton's, Superposition and Maximum power transfer theorems for DC excitation.

UNIT III

AC Circuits: RMS, Average Values, Form factor Peak factor for different periodic waveforms -Problems. Phase and Phase difference, Phasor and j- notation. Concept of Impedance, Admittance, Reactance, Susceptance, Active Power, Reactive Power, Apparent Power and power factor. Response of R, L & C elements for Sinusoidal Excitations, Steady State Analysis of RL, RC and RLC series & parallel circuits for sinusoidalexcitations –sample Problems

UNIT IV

Magnetic Circuits: Concept of self & mutual inductances, Dot Convention, Problems, Coefficient of coupling, Composite Magnetic circuit, analysis of Series and Parallel Magnetic Circuits, Duality and dual Circuits, problems.

UNIT V

Network Topology: Definition – Graph, tree, Co-tree, Incidence Matrix, Tie-Set & Cut – Set Matrices for Planar networks, Formulation of equilibrium equations based on graph theory, problems.

Text Books:

D.P. Kothari and I.J. Nagrath, "Basic Electrical Engineering", TataMcGraw-Hill, 2010.
D.C. Kulshreshtha, "Basic Electrical Engineering", McGraw-Hill, 2009.
L.S. Bobrow,, "Fundamentals of Electrical Engineering", OxfordUniversity Press, 2011.

References:

1. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
2. V.D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India,1989.
3. Electrical Circuits – N. Sreenivasulu – Reem Publications.
4. Chakarabarthi "Circuit Theory", Dhanapath Roy & Co.

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B. Tech., II Semester

Course Title	Engineering Graphics & Design				B. Tech. EEE II Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1803204	Engineering Sciences (ESC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		1	--	4	3	50	50	100
						End Exam Duration : 3Hrs		

Course Objectives:

Traditional Engineering Graphics: Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

Computer Graphics: Engineering Graphics Software; Spatial Transformations; Orthographic Projections; Model Viewing; Coordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; SurfaceModeling; Solid Modeling; Introduction to Building Information Modeling (BIM) (Exceptthe basic essential concepts, most of the teaching part can happen concurrently in thelaboratory)

Course Outcomes: On successful completion of this course, the students will be able to,

CO 1	Understand CAD drafting and editing tools along with page templates ,title block & print settings.
CO 2	Understand basic theory of projections related to points, lines, planes and solids in different orientations and drafting them in CAD software.
CO 3	Describe the geometric details of engineering objects & become familiar with AutoCad, 2D, 3D drawings.
CO 4	Analyze various sectional views and isometric drawings with 3D tools.

UNIT I

Overview of CAD: Listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), Status Bar, Different methods of zoom as used in CAD, Select and erase objects,copy,move, scaling objects,mirror,rotate,offset,polar array, rectangular Array.

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UNIT II

Customization & CAD Drawing: Consisting of set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning; Orthographic, constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods , Applying various ways of drawing circles; Annotations, layering & other functions, Diagrams for practice covering drafting and editing commands.

UNIT III

Introduction to Engineering drawing: Principles of Engineering Graphics and their significance, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and In volute.

UNIT IV

Projection of Points, Lines and Solids: Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes **Projections of Regular Solids:** Projections of solids inclined to both planes. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.

UNIT V

Sections and Sectional Views of Right Angular Solids: Sections of Prism, Cylinder, Pyramid and Cone and representation of hatching for various sectional views in CAD Development of surfaces of Right Regular Prism, Pyramid, Cylinder and Cone.

Isometric & Orthographic Projections: Principles of Isometric projection – Isometric Scale, Isometric Views, Orthographic projection and isometric projection techniques with 3d commands, Boolean operations (Union, Region, subtract etc…,) Representation of orthographic projections with viewports, Ucs orientation for representing dimensions for isometric diagrams, scaling

Text Books:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House.
2. Narayana, K.L. & P. Kannaiah (2012), 5th Edition, Text book on Engineering Drawing, Scitech Publishers.
3. Engineering Drawing +Auto CAD Paper back by K. Venugopal, New age publishers,3rd Edition , 2011.

4. References:

1. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics,
2. Pearson Education.
3. Agrawal B. & Agrawal C.M. (2012), Engineering Graphics, TMH Publication.
4. Engineering Drawing with an Introduction to Auto CAD by Dhananjay Jolhe, McGraw-hill Edition.
5. Corresponding set of CAD Software Theory and User Manuals.

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B. Tech., II Semester

Course Title	Engineering Physics Lab				B. Tech. EEE II Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1822208	Basic Sciences (BSC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		--	--	3	1.5	50	50	100
						End Exam Duration : 3Hrs		

Course Objectives: The objective of the course is to explore the application of interference and diffraction, concept of energy gap, B-H curve, and synthesis of nano material by performing their experiments. Measurement of magnetic field and studying resonance using LCR circuit.

Course Outcomes: On successful completion of this course, the students will be able to,

CO 1	Operate various optical and electronic instruments.
CO 2	Evaluate the acceptance angle of an optical fiber and numerical aperture..
CO 3	Plots the intensity of the magnetic field of circular coil carrying current with distance
CO 4	Apply the concepts of interference and diffraction to determine various parameters
CO 5	Estimate wavelength of laser and particles size using laser.

List of Experiments:

1. Determination of wavelengths of various colours of mercury spectrum using diffraction grating in normal incidence method.
2. Determination of dispersive power of the prism.
3. Rigidity Modulus- Torsional Pendulum.
4. Study of resonance effect in series and parallel LCR circuit.
5. Determination of thickness of thin object by wedge method.
6. Determination of radius of curvature of lens by Newton's Rings.
7. Laser: Determination of wavelength using diffraction grating.
8. Energy gap of a semiconductor using p-n junction diode.
9. Hysteresis: B-H curve.
10. Magnetic field along the axis of a current carrying coil – Stewart and Gee's method.
11. Frequency of the tuning fork - Melde's apparatus.
12. Spring constant - Coupled Pendulums.

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K.S.R.M. College of Engineering
Kadapa -516003.

B. Tech., II Semester

Course Title	Basic Electrical Engineering Lab					B. Tech. EEE II Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1802206	Engineering Sciences (ESC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		--	--	2	1	50	50	100
						End Exam Duration : 3Hrs		

Course Objectives: The objective of the course is to determine resistance, inductance, capacitance, active, reactive, apparent power for RL, RC, RLC series and parallel circuits. Verification of Kirchhoff's laws and network theorems for DC excitation.

Course Outcomes: On successful completion of this course, the students will be able to,

CO 1	Understand the Kirchhoff's laws theoretically and practically for any given circuit.
CO 2	Determine R,L & C parameters for a given RLC series circuit and value of 'K' for single phase transformer.
CO 3	Determine the active, reactive and apparent power for RL, RC and RLC circuits.
CO 4	Apply theorems for a given DC circuits and verify theoretically & practically.

List of Experiments

1. Determination of values of R, L and C parameters of a given RLC series circuit
2. Verification of KCL & KVL
3. Verification of Superposition Theorem
4. Verification of Thevenin's Theorem
5. Verification of Norton's Theorem
6. Verification of Maximum Power Transfer Theorem
7. Determination of Active, Reactive & Apparent Power for RL Series & Parallel Circuit
8. Determination of Active, Reactive & Apparent Power for RC Series & Parallel Circuit
9. Determination of Active, Reactive & Apparent Power for RLC Series Circuit
10. Determination of Coefficient of Coupling for Single Phase Transformer

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B. Tech., II Semester

Course Title	Workshop & Manufacturing Practices					B. Tech. EEE II Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1803207	EngineeringSciences (ESC)	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		1	--	4	3	50	50	100
						End Exam Duration : 3Hrs		

Course Objectives: The objective of the course is to understand the basic knowledge of workshop practice and safety, use of different hand tools and other instruments like hack saw, jack plane, chisels etc. and operations like marking, cutting etc., different types of manufacturing/fabrication processes and develop a skill in dignity of labour, precision, safety at work place, team working and development of right attitude.

Course Outcomes: On successful completion of this course, the students will be able to,

CO 1	Understand the knowledge of the dimensional accuracies and tolerances applicable for different manufacturing processes.
CO 2	Identify different manufacturing processes which are commonly employed in the industry.
CO 3	Gain practical knowledge by doing house wiring such as connecting one lamp with one switch, connecting two lamps with one switch, connecting a fluorescent tube, Series wiring.

List of Experiments

1. **Machine Shop** - Step Turning Operation, Taper Turning Operation
2. **Fitting Section** - Square Fitting, Steeped Fitting
3. **Carpentry Section** - Tee Halving Joint, Dovetail Tee Halving Joint
4. **House Wiring Section** - To Control Two Lamps By One Single Way Switch(In Series), To Control Two Lamps By One Single Way Switch(Parallel)
5. **Welding Section** - Single V Butt Joint, Lap Joint
6. **Foundry Section** - Single Piece Square Pattern, Single Piece Round Pattern
7. **Sheet metal Section** - Square Try, Cylinder

Text books:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., —Elements of Workshop Technology‖, Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Rao P.N., —Manufacturing Technology‖, Vol. I and Vol. II, Tata McGraw-Hill House,2017.

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Kadapa -516003

References:

1. Kalpakjian S. and Steven S. Schmid, —Manufacturing Engineering and Technology‖,4th edition, Pearson Education India Edition, 2002.
2. Gowri P, Hariharan and A. Suresh Babu, Manufacturing Technology – I PearsonEducation, 2008.
3. Roy A. Lindberg, —Processes and Materials of Manufacture‖, 4th edition, PrenticeHall India, 1998.

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Kadapa -516003.

B.Tech – VII Semester

S. No.	Subject Code	SUBJECT	SC	L	T	P	IM	EM	CR
1	1525701	Management Science	HS	3	1	0	30	70	3
2	1502702	Advanced Control Systems	PJ	3	1	0	30	70	3
3	1502703	HVDC Transmission	PJ	3	1	0	30	70	3
4	1502704	Switch Gear & Protection	PJ	3	1	0	30	70	3
5	1502705	Electrical Distribution Systems	PJ	3	1	0	30	70	3
6		**CBCC-III**							
	1502706	High Voltage Engineering	PJ	3	1	0	30	70	3
	1502707	Power Quality	PJ	3	1	0	30	70	3
	1502708	Switch Mode Power Converters	PJ	3	1	0	30	70	3
7	1514709	Micro Processors & Micro Controllers Lab	PJ	0	0	3	50	50	2
8	1502710	Power Systems Simulation Lab	PJ	0	0	3	50	50	2
Total				20	06	06	280	520	22

B.Tech – VIII Semester

S. No.	Subject Code	SUBJECT	SC	L	T	P	IM	EM	CR
1	1502801	Utilization of Electrical Power	PJ	3	1	0	30	70	3
2	1502802	FACTS	PJ	3	1	0	30	70	3
3	1502803	Electrical Machine Design	PJ	3	1	0	30	70	3
4		**CBCC-IV**							
	1502804	Special Electrical Machines	PJ	3	1	0	30	70	3
	1502805	Energy Auditing and Demand Side Management	PJ	3	1	0	30	70	3
	1502806	Reliability Engineering & Applications to Power Systems	PJ	3	1	0	30	70	3
5	1502807	Seminar	PJ	0	0	-	100	-	2
6	1502808	Project Work	PJ	0	0	-	50	50	12
Total				12	4	0	270	330	26

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K.S.R.M. College of Engineering
Kadapa -516003.

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1525701	PJ	Management Science	3	1	0	30	70	3

Objectives

1. Provide a basic understanding of management science including analytical problem solving and communications skills.
2. Prepare for practice in a field that sees rapid changes in tools, problems and opportunities.
3. Prepare for graduate study and self-development over an entire career.
4. Provide ability to use the techniques, skills and modern engineering tools necessary for engineering practices.
5. The broad education necessary to understand the impact of engineering solutions in a global and societal context.
6. Background necessary for admission to top professional graduate engineering or business programs.

UNIT- I

Introduction to Management: Concept of Management-Administration, Organization-Functions of Management, Evolution of Management Thought, managerial objectives and social responsibilities of Management. Organization: Principles of Organization-Types of mechanistic and organic structures of organizations.

UNIT – II

Strategic Management: Mission, Goals, Objectives and Programmes, Elements of Corporate Planning Process- SWOT Analysis-Strategy Formulation and Implementation. Plant location and Plant Layout concepts-Production control.

UNIT – III

HRM and Inventory Management: Human Resource Management - Personnel Management and Industrial Relations (PMIR)-Basic functions of Personnel Management, Job Evaluation and Merit Rating-Incentive plans.

Inventory Management: Need for Inventory Control; EOQ, ABC Analysis, Purchase Procedure, Maintaining Store Records.

UNIT-IV

Operations Management: Productivity- Job, Batch and Mass Production-Work Study-Basic procedure involved in Method Study and Work Measurement- Statistical Quality Control: *c* chart, *p* chart, R chart, Acceptance sampling, Deming's contribution to Quality.

UNIT-V

Project Management: Network Analysis to project management- PERT/CPM- Application of network techniques to engineering problems- Cost Analysis-Project Crashing.

Text Books

1. Aryasri: Management Science, TMH, 2008.

Reference Books

1. Koontz&Weihrich: Essentials of Management,6/e,TMH,2005
2. Kanishka Bedi: Production and Operations Management, Oxford University Press, 2004
3. Parnell: Strategic Management, Biztantra, 2003.
4. LS Srinath: PERT/CPM, Affiliated East-West Press, 2005

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1502702	PJ	Advanced Control Systems	3	1	0	30	70	3

Objective:

This subject deals with state space, describing function, phase plane and stability analysis including controllability and observability.

Course Outcomes: On successful completion of this course, the students will be able to	
CO1	Know the principles and functions of management
CO2	Understand the various concepts, approaches and theories of management in the real situation.
CO3	Compare and contrast organization structure designs and charts diligently with theoretical learning concepts
CO4	To be aware of the role, functions and functioning of human resource department of the organizations.
CO5	Understand and Analyze the latest and contemporary developments in the field of management.
CO6	Analyze the concept of strategic planning and implementation and apply on the decisions in strategic management.

UNIT – I

Linear System Design: Introduction of compensating networks – Lead, Lag, lead – lag cascade compensation in time domain –P, PI and PID controllers design using Bode plot and root locus techniques.

UNIT – II

State variable descriptions: Concepts of State, State variables, State vector, State space model, representation in state variable form, phase variable representation – Diagonalization – Canonical variable representation.

Controllability and Observability: Definition of controllability – Controllability tests for continuous Linear time Invariant systems – Definition of Observability – Observability tests for continuous Linear time Invariant systems.

UNIT – III

Time Response of Linear System: Introduction – Solution of state equations – State Transition matrix – Pole placement by state feedback – Full order and reduced order observers.

UNIT – IV

Non-Linear Systems: Introduction – common physical non-linearities, Singular points, Basic concepts of phase plane method, construction of phase trajectories by phase plane method. Basic concepts and derivation of describing functions. Stability analysis by describing function method.

UNIT – V

Stability: Introduction – Equilibrium points – Stability concepts and definitions – Stability in the sense of Liapunov stability of linear system – Methods of constructing Liapunov functions for Non – linear system – Krasovskii's method – Variable gradient method.

Text Books:

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1. Modern Control System Theory by M. Gopal, New Age International Publishers, 2nd edition, 1996.
2. Control System Engineering by I. J. Nagarath and M. Gopal, New Age International (P) Ltd.

Reference Books:

1. Modern Control Engineering by K. Ogata, Prentice Hall of India, 3rd Edition, 1998.
2. Systems and Control by Stainslaw, H. Zak, Oxford Press, 2003.
3. Digital Control and State Variable Methods by M. Gopal, TMH, 1997.

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1502703	PJ	High Voltage Dc Transmission	3	1	0	30	70	3

Objective: This subject gives the fundamental concepts of High voltage direct current. It mainly concentrates on converter configuration and analysis for the application of high voltage transmission system.

UNIT-I

D. C. Power Transmission Technology: Introduction- Comparison of AC & DC transmission, Converter station, Description of DC Transmission systems, Choice of voltage level, Modern trends in DC transmission.

UNIT-II

Analysis of HVDC Converters: Pulse number, Choice of converter configuration, valve rating, Transformer, Simplified analysis of graetz-circuit with and without overlap, Rectifier and Inverter waveforms, Converter bridge characteristics.

UNIT – III

Converter and HVDC System Control: Principle of DC link control, Converter control characteristics, System and control hierarchy, Firing angle control, Converter and excitation angle control, Starting and stopping of DC Link , Power Control, Higher level Controllers.

UNIT – IV

Converter Faults: Protection against over currents, over voltages in a converter station, Surge arresters, Protection against over voltages. Smoothing reactor, DC Line, Transient over voltages in DC line, Protection of DC Line, DC breakers.

UNIT – V

Reactive Power Requirements in Steady State: Sources of reactive power, Static var systems, generation of Harmonies, Design of AC filters, DC filters, Carrier frequency and RI Noise.

Course Outcomes:

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

1. Gain knowledge on Converter Circuits.
2. analyze the applications of high voltage transmission system
3. Analyze the protection system for HVDC transmission
4. Design the filters for DC transmission.

Text Books:

1. High Voltage Direct Current Transmission by J. Arilliga 2nd edition, IEE Power and Energy Series.

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Kadapa -516003.

2. High Voltage Direct Current Transmission by K. R. Padiyar, Wiley Eastern Ltd.,1993.
3. Direct current transmission by E. W. Kimbark, Wiley Inter Science New York 1971.

Reference Books:

1. EHVAC, HVDC Transmission and Distribution Engineering by S. Rao, Khanna Publishers, 2001.
2. Power Transmission by Direct Current by E. Uhlamann, Springer – Verlag, Berlin, 1975.

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1502704	PJ	Switch Gear and Protection	3	1	0	30	70	3

UNIT-I

Over Voltages in Power Systems: Cause of over voltages, protection against lightning over voltages, ground wires, counter poises, surge absorbers and surge diverters ,lightning arrestors(valve type),ratings of Lightning arrestors, insulation co-ordination, neutral earthing-types.

UNIT-II

Circuit Breakers: Elementary principles of arc interruption, restriking and recovery voltages, average and maximum RRRV, numerical problems. Current chopping and resistance switching-circuit breaker ratings, auto re-closure and problems. Description and operation of minimum oil circuit breakers, air break circuit breakers, vaccum circuit breakers and sulphur hex fluoride circuit breakers.

UNIT-III

Protective Relays: Basic requirements of a relays, relay terminology, types of relays, electromagnetic relays (attraction type and induction type). Construction and operation of non-directional and directional over current relays, universal torque equation, operating characteristics of impedance, reactance and admittance relays. Principle and operation of differential and percentage differential relays.

Static Relays: Advantages and Dis-advantages, amplitude comparators and phase comparators.

UNIT-IV

Protection of Generators: protection of generators against stator faults, rotor faults and abnormal running conditions, restricted earth fault protection and inter turn fault protection, numerical problems on percentage winding unprotected.

Protection of transformers: percentage differential protection of transformers, numerical problems on design of CT's ratio, Buchholtz relay.

UNIT-V

Protection of Feeders and Lines: Protection of feeders (radial and ring main) using over current relays, protection of transmission lines by three zone protection using distance relays, carrier current protection and protection of bus-bars.

Course Outcomes:

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

1. Gain knowledge on operation of various protective devices.

HEAD
Department of Electrical & Electronics Engineering
K.S.R.M. College of Engineering
Kadapa -516003.

2. Analyze fault current levels for different faults, operating aspects of protective devices
3. Design proper protection scheme for different power system components
4. Acquire skills in evaluating operating parameters of various protecting devices

Text Books:

2. Power System Protection and Switch Gear by Badriram& D. N. Vishwakarma, TMH publishing Company Ltd., 1995.
3. Electrical Power Systems by C. L. Wadhwa, New Age International (P) Limited, 3rd Edition.
4. Power System Protection & Switch Gear by B. Ravindranath& M. Chander, Wiley Eastern Ltd.
5. Switch Gear and Protection by Sunil. S. Rao, Khanna Publishers.

Reference Books:

1. Fundamentals of Power System Protection by Y. G. Paithanakar and S. R. Bhide, PHI, 2nd Edition.
2. Transmission Network Protection by Y. G. Paithankar, Taylor and Francis, 2009.
3. Power System Protection and Switch Gear by BhuvaneshOzq, TMH, 2010.
4. Electrical Power System Protection by C. Christopoulos and A. Wright, Springer International Edition, 2nd Edition.

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1502705	PJ	Electrical Distribution Systems	3	1	0	30	70	3

Objective: This course mainly focuses the distribution end of the power system in which the characteristics of load, classification of distribution systems, substations, automation of the distribution systems are introduced.

UNIT I

Load Modeling and Characteristics: Introduction to Distribution Systems, Load Modeling and Characteristics. Coincidence Factor, Contribution Factor Loss Factor - Relationship between the Load Factor and Loss Factor. Classification of Loads (Residential, Commercial, Agricultural and Industrial) and Their Characteristics.

UNIT II

Classification of Distribution Systems: Classification of Distribution Systems - Comparison of DC Vs AC–comparison of Under-Ground Vs Over - Head Distribution Systems-Requirements and Design Features of Distribution Systems-

Design Considerations of Distribution Feeders: Radial and Loop Types of Primary Feeders,-Voltage Levels, Feeder Loading, Basic Design Practice of the Secondary Distribution System.

Voltage Drop & Current Calculations (Numerical Problems) In D.C. Distributors.

UNIT III

Substations: Location of Substations: Rating of Distribution Substation, Service Area within Primary Feeders. Benefits Derived Through Optimal Location of Substations. Classification

of Substations: Air Insulated Substations - Indoor & Outdoor Substations: Substations Layout Showing the Location of All the Substation Equipment. Bus Bar Arrangements in the Sub-Stations With Relevant Diagrams.

UNIT IV

Power Factor Improvement: Voltage Drop and Power-Loss Calculations: Derivation for Voltage Drop and Power Loss in Lines, Manual Methods of Solution for Radial Networks, Three Phase Balanced Primary Lines.

Causes of Low P. F -Methods of Improving P. F-Phase Advancing and Generation of Reactive KVAR Using Static Capacitors-Most Economical P.F. for Constant KW Load and Constant KVA Type Loads, Numerical Problems.

UNIT V

Distribution Automation: Distribution Automation (DA) – Project Planning – Definitions – Communication – Sensors – Supervisory Control and Data Acquisition (SCADA) – Consumer Information Service (CIS) – Geographical Information System (GIS) – Automatic Meter Reading (AMR) – Automation Systems.

Course Outcomes:

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

1. Gain knowledge on distribution system and its configuration, different types of loads and distribution feeders.
2. Analyze different feeder configurations, bus bar arrangements in substations
3. Design proper rating of capacitor to improve power factor.

Text Books:

1. Electric Power Distribution System, Engineering by TuranGonen, Mc Graw-hill Book Company, 1986.
2. Electric Power Distribution by A. S. Pabla, Tata Mc Graw-hill Publishing Company, 4th edition, 1997.

Reference Books:

2. Electric Power Distribution Automation by Dr. M. K. Khedkar and Dr. G. M. Dhole, University Science Press, 2010.
3. Electrical Power Distribution Systems by V. Kamaraju, Jain Book Depot. 2012.
4. Electrical Power Systems for Industrial Plants by Kamalesh Das, JAICO Publishing House, 2008.
5. Hand Book of Electric Power Distribution by G. Ramamurthy, 2nd Edition, Universities Press, 2009.

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Kadapa -516003.

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1502706	PJ	High Voltage Engineering	3	1	0	30	70	3

(CBCC-I)

Objective:

This subject deals with the detailed analysis of Breakdown occur in gaseous, liquids and solid dielectrics. Information about generation and measurement of High voltage and current. In addition the High voltage testing methods are also discussed.

UNIT – I

Break down mechanism of gases, Liquid and solid insulating materials: Introduction to HV technology, industrial applications of high voltage, electrostatic precipitation, gases as insulating media, collision process, ionization process, Towsend'screteria of breakdown in gases, Paschen's law -Principles of breakdown in solids and liquid dielectrics

UNIT – II

Generation of H.V.D. C. and H.V.A.C voltages: Introduction, need for cascade connection and working of transformer units connected in cascade. Series resonant circuit, principle of operation-Tesla coil-Voltage Double circuit-Cockcroft- Walton type High voltage DC set

UNIT-III

Generation of impulse voltages: introduction to standard lightning and switching impulse voltages-analysis of single impulse generator-expression for output impulse voltage-rating of impulse generator-components of multistage generator – Multistage impulse generator working of Marx Impulse generator-triggering of impulse generator by three electrode gap arrangement-generation of high impulse current.

UNIT-IV

Measurement of high voltages: Electrostatic voltmeter-principle and construction- chubb and fortesue method for HVAC measurement-generating voltmeter-principle and construction-series resistance micro ammeter for HVDC measurements-standard sphere gap measurements of HVAC and HVDC voltages- potential dividers-resistance dividers-capacitance dividers-measurement of high impulse currents-Rogowsky coil.

UNIT – V

High voltage testing of electrical equipment: Dielectric loss and loss angle measurement using Schering bridge-need for discharge detection and PD measurements-Factors affecting discharge detection-discharge detection methods-Testing of insulators, Testing of cables, Testing of bushings, Testing of power capacitor, Testing of power transformers, Testing of circuit breakers.

Course Outcomes:

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

1. Gain knowledge on behaviour of various insulation materials, generation of high voltage and currents
2. Analyze the behaviour of insulation systems, circuits for generation and measurement of high voltages, materials used and measuring methods.

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3. apply a suitable testing method for a high voltage apparatus

Text Books:

1.High Voltage Engineering by M. S. Naidu and V. Kamaraju, TMH Publications, 4th Edition, 2004.

2. High voltage Engineering by C. L. Wadhwa, New Age International (P) Limited, 1997.

Reference Books:

1. High Voltage Engineering: Fundamentals by E. Kuffel, W. S. Zaengl, J. Kuffel by Elsevier, 2nd Edition, 2000.
2. High Voltage Insulation Engineering by Ravindra Arora, Wolfgang Mosch, New Age International (P) Limited, 1995.
3. High Voltage Technology by L. L. Alston, OXFORD University Press, Second Edition, 2009.
4. High Voltage Engineering Problems & Solutions, R. D. Begamudre, New Age International Publishers, First Edition, 2010.

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1502707	PJ	POWER QUALITY	3	1	0	30	70	3

OBJECTIVES: The objectives of this course include:

- To know about introduction on power quality issues.
- To learn about voltage disturbances and power transients that are occurring in power systems.
- To know the concept of harmonics in the system and their effect on different power system equipment.
- To know about different power quality measuring and monitoring concepts.

UNIT I INTRODUCTION

Definition of Power Quality- Power Quality Terminology – Classification of Power Quality Issues-Magnitude Versus Duration Plot - Power Quality Standards(IEEE& IEC) - Responsibilities of The Suppliers and Users of Electric Power-CBEMA and ITIC Curves.

UNIT II TRANSIENTS, SHORT DURATION AND LONG DURATION VARIATIONS

Categories and Characteristics of Electromagnetic Phenomena in Power Systems-Impulsive and Oscillatory Transients-Interruption - Sag-Swell-Sustained Interruption - Under Voltage – Over Voltage–Outage. Sources of Different Power Quality Disturbances- Principles of Regulating the Voltage- Conventional Devices for Voltage Regulation.

UNIT III FUNDAMENTALS OF HARMONICS & APPLIEDHARMONICS

Harmonic Distortion, Voltage Versus Current Distortion, Harmonics Versus Transients, Power System Quality Under Non Sinusoidal Conditions, Harmonic Indices, Harmonic

Sources From Commercial Loads, Harmonic Sources From Industrial Loads. Applied Harmonics: Effects Of Harmonics, Harmonic Distortion Evaluations, Principles of Controlling Harmonics, Devices for Controlling Harmonic Distortion

UNIT-IV POWER QUALITY MONITORING

Power Quality Benchmarking-Monitoring Considerations- Choosing Monitoring Locations-Permanent Power Quality Monitoring Equipment-Historical Perspective of Power Quality Measuring Instruments- Power Quality Measurement Equipment-Types of Instruments-Assessment of Power Quality Measurement Data- Power Quality Monitoring Standards.

UNITV POWER QUALITY ENHANCEMENT USING CUSTOM POWER DEVICES

Introduction to Custom Power Devices-Network Reconfiguring Type: Solid State Current Limiter (SSCL)-Solid State Breaker (SSB) -Solid State Transfer Switch (SSTS) - Compensating Type: Dynamic Voltage Restorer (DVR)-Unified Power Quality Conditioner (UPQC)-Principle of Operation Only

OUTCOMES:

After completion of the course the student will able to:

- Understand the different power quality problems in the power system.
- Know about voltage variations and over voltage transients in the system and also know about the protection of over voltages.
- Under stand the effect of harmonics in the system and about the equipment that are effected from the harmonics.
- Know the concepts on measuring and monitoring issues of power quality.

TEXT BOOKS:

1. Electrical Power Systems Quality, Roger C. Dugan, Mark F. McGranaghan, Surya Santoso, H.Wayne Beaty, 2nd Edition, TMH Education Pvt. Ltd., 2008.
2. Power quality, C. Sankaran, CRC Press, 2002.

REFERENCE BOOKS:

1. Understanding Power quality problems, Math H. J. Bollen IEEE Press, 2007.
2. Power quality enhancement using custom power devices, Arindam Ghosh, Gerard Ledwich, Kluwer academic publishers, 2002.
3. Fundamentals of Electric Power Quality, Surya Santoso, Create Space, 2010.

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K.S.R.M. College of Engineering
Kadapa -516003.

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1502708	PJ	SWITCH MODE POWER CONVERTERS	3	1	0	30	70	3

UNIT I

Non-Isolated DC-DC Converters: Basic Types of Switching Power Supplies – Volt-Sec balance – Non-Isolated Switched-Mode DC-to-DC Converters – Buck Converter – Boost Converter – Buck-Boost Converter – Cuk Converter – SEPIC and Zeta Converters – Comparison of Non-Isolated Switched mode DC-to-DC Converters.

UNIT II

Isolated DC-DC Converters: Need of Transformer Isolations in high frequency Power conversion - Isolated Switched Mode DC-to-DC Converters – Single Switch Isolated DC-to-DC Converters – Forward, Fly back, Push-Pull, Flux Walking Phenomena, Half and Full Bridge Converters – Multi Switch Isolated DC-to-DC Converters –Comparison of Isolated and Non-Isolated Switched Mode DC-to-DC Converters.

UNIT III

Resonant Converters: Classification of Resonant converters-Basic resonant circuits- Series resonant circuit-parallel resonant circuits- Resonant switches, Concept of Zero voltage switching, principle of operation, analysis of M-type and L-type Resonant Buck and boost Converters.

UNIT IV

Dynamic Analysis of DC-DC Converters: Formulation of dynamic equations of buck and boost converters, State-Space Models, Averaged Models, linearization technique, small-signal model and converter transfer functions, Significance of Small Signal Models, Dynamical Characterization.

UNIT V

Controller Design: Review of frequency-domain analysis of linear time-invariant systems, controller specifications, Proportional (P), Proportional plus Integral (PI), Proportional, Integral plus Derivative controller (PID), selection of controller parameters for Isolated and Non-Isolated DC -DC Converters.

Text Books:

1. Introduction to Modern Power Electronics by Andrzej M. Trzynadlowski, 2nd Edition, WILEY-INDIA Edition, 2012.
2. Fundamentals of Power Electronics by Robert Erickson and Dragon Maksimovic, Springer Publications, 2nd Edition, 2001.
3. Fundamentals of Power Electronics by Issa Batarseh, John Wiley Publications, 2009.

Reference Books:

1. Elements of Power Electronics by Philip T.Krein, Oxford University Press, 1997.
2. Power Electronics by L. Umanand, Tata Mc-Graw Hill, 2004.

Course Outcomes:

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

1. Ability to analyze and design switched mode power converters
2. Proper understanding about soft switching and its applications
3. Deep knowledge in pulse width modulated techniques

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1502709	PJ	Micro Processors & Micro Controllers Lab	0	0	3	50	50	2

I. Microprocessor 8086

1. Arithmetic operation – Multi byte addition and subtraction,
2. Multiplication and Division – Signed and unsigned Arithmetic operation, ASCII – arithmetic operation.
3. Logic operations – Shift and rotate – Converting packed BCD to unpacked BCD, BCD to ASCII conversion.
4. By using string operation and Instruction prefix: Move Block, Reverse string, Sorting, Inserting, Deleting, Length of the string, String comparison.
5. Modular Program: Procedure, Near and Far implementation, Recursion.

II. Interfacing

1. 8259 – Interrupt Controller
2. 8279 – Keyboard Display
3. 8255 – PPI.
4. 8251 – USART

III. Micro Controller 8051

1. Reading and Writing on a parallel port
2. Timer in different modes
3. Serial communication implementation
4. Understanding three memory areas of 00 – FF (Programs using above areas)
5. Using external interrupts
6. Programs using special instructions like swap, bit/byte, set/reset etc
7. Programs based on short, page, absolute addressing

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1502710	PJ	Power Systems & Simulation Lab	0	0	3	50	50	2

The following experiments are required to be conducted as compulsory experiments:

1.Power Angle Curve of a synchronous Generator
2. Determination of sequence reactances of 3-Φ Alternator
3. Determination of sequence reactances of 3-Φ Transformer
4. Operating Characteristics of Over Current-Relay
5. Operating Characteristics of Differential Relay
6. Simulation of 220KV Transmission Line
7. Symmetrical Fault Analysis at the Terminals of an Unloaded 3-Φ Alternator
8. Unsymmetrical Fault Analysis at the Terminals of an Unloaded 3-Φ Alternator

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Kadapa -516003.

In addition to the above eight experiments, at least any two of the experiments from the following list are required to be conducted.

9. Simulation of Power Flow Using Gauss-Seidel Method for the 3-Bus System
10. Simulation of Power Flow Using Newton-Raphson Method for the 3-Bus System
11. Simulation of Power Flow Using Fast-Decoupled Method for the 3-Bus System
12. Swing Curves For Different Critical Clearing Times using SIMULINK
13. Economic Load Dispatch For Thermal Plant Simulation
14. Formation of Y-Bus Using MATLAB

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1502801	PJ	Utilization of Electrical Power	3	1	0	30	70	3

Objectives:

It deals with the illumination, Electrical heating, Welding, Electrolytic Process and Electric Traction.

UNIT – I

Illumination: Introduction, terms used in illumination, laws of illumination, polar curves, photometry, integrating sphere, sources of light, discharge lamps, MV and SV lamps – Comparison between tungsten filament lamps and fluorescent tubes- Basic principles of light control- Types of lighting schemes -factory lighting, street lighting and flood lighting.

UNIT-II

Electric Heating & Welding: Advantages and methods of electric heating - types and applications of electric heating equipment- Resistance ovens-induction heating –dielectric heating-Electric welding –resistance welding and arc welding techniques - arc furnaces.

UNIT –III

Electric Drives: Types of Electric drives, Choice of motor, starting and running characteristics, Speed control, temperature rise, particular applications of electric drives, types of industrial loads, continuous, intermittent and variable loads, load equalization.

UNIT –IV

Systems of Electric Traction and Track Electrification: Review of existing electric traction systems in India. Special features of traction motors, methods of electric braking – plugging, rheostatic braking and regenerative braking.

UNIT –V

Mechanism of Train Movement: Speed-time curves for different services – Trapezoidal and quadrilateral speed time curves – Calculations of tractive effort, power, specific energy consumption for a given run, effect of varying acceleration and braking retardation, adhesive weight and coefficient of adhesion.

Course Outcomes:

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

1. Gain knowledge on different types of electric drives, heating, welding and illumination
2. Analyze appropriate drive for the industrial purpose, proper illumination strategy for good lighting system, the traction system for better performance

3. design illumination system for proper lighting.
4. Acquire skills in evaluating the illumination levels, performance of various electrical drives and traction effort.

Text Books:

1. Utilization of Electric energy by E. Openshaw Taylor and V. V. L. Rao, Universities Press, 2009.
2. Art & Science of Utilization of Electrical Energy by H. Partab, Dhanpat Rai & Co, 2004.

Reference Books:

1. Generation, Distribution and Utilization of Electrical energy by C. L. Wadhwa, New Age International (P) Limited, 1997.
2. Utilization of Electrical Power including Electric Drives and Electric Traction by N. V. Suryanarayana, New Age International (P) Limited, 1996.

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1502802	PJ	Flexible Ac Transmission Systems	3	1	0	30	70	3

Objective:

This subject is an extension of previous power system courses. It deals with the detailed analysis of FACTS controllers which are the prime source of enhancement of electrical power generation and its utilities. Also concerns about the different types of FACTS controllers which are having significant applications in utility appliances and control systems.

UNIT I

FACTS Concepts: Transmission interconnections power flow in an AC system, loading capability limits, Dynamic stability considerations, importance of controllable parameters basic types of FACTS controllers, benefits from FACTS controllers.

UNIT II

Voltage Source Converters: Single & three phase full wave bridge Converters -transformer connections for 12 pulse 24 and 48 pulse operation. Three level voltage source converter, pulse width modulation converter, basic concept of current source Converters, and comparison of current source converters with voltage source converters.

UNIT III

Static Shunt Compensation: Objectives of shunt compensation, midpoint voltage regulation voltage instability prevention, improvement of transient stability, Power oscillation damping. Methods of controllable VAR generation, variable impedance type static VAR generators, switching converter type VAR generators, hybrid VAR generators

UNIT IV

SVC and STATCOM: The regulation and slope transfer function and dynamic performance, transient stability enhancement and power oscillation damping operating point control and summary of compensator control.

UNIT V

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Static Series Compensators: concept of series capacitive compensation, improvement of transient stability, power oscillation damping.

Functional requirements, GTO thyristor controlled Series Capacitors (GSC), Thyristor Switched Series Capacitor (TSSC) and Thyristor Controlled Series Capacitor (TCSC) control schemes for GSC, TSSC and TCSC.

Course Outcomes:

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

1. Gain knowledge on Operation of various different types of FACTS controllers, Protection of utility appliances and control systems
2. Analyze Understand the importance of controllable parameters and benefits of FACTS controllers
3. Analyze the functional operation and control of GCSC, TSSC and TCSC.
4. Acquire skills in evaluating FACTS devices are used in electrical power generation and its utilities.

Text Book:

1. Concepts and Technology of Flexible AC Transmission Systems-Understanding FACTS by Narain G. Hingorani and Laszlo Gyuygyi, Standard Publishers Distributors, IEEE Press Publications, 1st Edition, 2001.

Reference Text Books:

1. Thyristor baed FACTS Controllers for Electrical Transmission Systems by R. Mohan Mathur, Rajiv K. Varma, IEEE Press Series on Power Engineering, 2002.
2. Flexible AC Transmission Systems by Yong Hua Song and Alln T Johns, The Institute of Electrical Engineers, London, UK, 1999.

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1502803	PJ	Electrical Machine Design	3	1	0	30	70	3

Objective: This subject introduces the design specifications of Electrical Machines. It deals with basic design considerations of transformers, rotating machines - D.C. Machines, Three phase Induction motors Synchronous machines and Cooling of Machines.

UNIT I

The Design problem – Basic considerations, design specifications, ISI specifications, design constraints, specification of transformers, rotating machines.

Design of transformers – Types of transformer – core construction, output equation, principle of design of core, windings, yoke main dimensions (H & W) for single phase: core type, shell type. 3-phase – core type transformers estimation of no load current of transformer.

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Kadapa -516003.

UNIT II

General concepts of rotating machines – Output equation of dc machines, ac machines, separation of D & L, choice of specific loadings.

Design of D.C machines – Choice of no. of poles, selection of no. of armature slots, choice of winding, estimation of conductor cross section of armature, design of field systems: tentative design of field winding of dc machines.

UNIT III

Design of 3-phase induction motor – Separation of D & L, ranges of Ampere conductors and B_{av}.

Stator design – Selection of no of stator slots, turns per phase, design of conductor cross section.

Rotor design - Selection of no of rotor slots, principles of design of squirrel cage rotor, design of slip ring rotor.

UNIT IV

Design of synchronous machines – Separation of D & L, choice of Ampere conductors &B_{av} - Short Circuit Ratio (SCR) and its significance.

Armature design – choice of no. of stator (Armature) slots, turns/phase, conductor cross section for both salient pole and cylindrical pole machines.

UNIT V

Heating & Cooling of electrical machines: Theory of Solid body heating, heating time constant- cooling time constant, elementary treatment of cooling and heating time curves.

Cooling of machines: Volume of coolant required, types of coolants, cooling methods of transformer- hydrogen cooling, transformer tank design

Course Outcomes:

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

1. Gain the knowledge on various design specifications of Electrical Machines.
2. Estimate the design specifications of DC machines, Transformers, Induction machines and synchronous machines.
3. Analyze the choice between various parameters like type of windings, no.poles, no.of slots etc
4. Analyze the heating and cooling of electrical machines.

Text Books:

2. Electrical machine design by A. K. Sawhney, Dhanpatrai& Sons.
3. Electrical System Design by M. K. Giridharan, I. K. International Publishing House Pvt. Ltd., 2011.
4. Design of Electrical Machines by V. N. Mittle and A. Mittal, Standard Publishers Distributors, 4th Edition, 1998.

Reference Books:

1. Principles of Electrical machine design by M. G. Say & Parker Smith.
2. Electrical machine design by Balbir Singh by Khanna Publishers.

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K.S.R.M. College of Engineering
Kadapa -516003.

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1502804	PJ	Special Electrical Machines	3	1	0	30	70	3

(CBCC-II)

Objective:

This subject deals with the basic principle of operation, working, drive circuits, control circuits and characteristics applications of special electric machines like Linear Induction Motors, Stepper Motors, BLDC motors and Switched Reluctance motors.

UNIT – I

Stepper motors: Construction and operation of Stepper Motors: variables reluctance, permanent magnet, hybrid stepper motors, characteristics of stepper motors.

Drive circuits for Stepper motors: Block diagram of stepper motor controller, logic sequence generator, power drivers, current suppression circuits, and acceleration and deceleration circuits.

UNIT – II

Microprocessor control of stepper motors: Microprocessor based stepper motor controller, PC based stepper motor controller.

Micro-stepping Control of Stepper motors: The micro-stepping principle, advantages of micro stepping, design of basic micro-stepping controller. Applications of stepper motors.

UNIT – III

Switched Reluctance Motor Drives: Types of SR motor, principle of operation, static torque production, energy conversion loop, dynamic torque production

Converter Circuits, Control of SR motors: Current regulation commutation, torque speed characteristics, shaft position sensing.

UNIT –IV

Brushless DC motor: Principle of operation of BLDC motor, square wave permanent magnet brushless motor drives, sine wave permanent magnet brushless DC motor drives, Phasor diagram, torque speed characteristics, controllers for BLDC motors

UNIT –V

Permanent Magnet Synchronous Motor (PMSM)

Construction - Principle of operation - EMF equation of PMSM - torque equation - phasor diagram - control of PMSM: Vector control, Self control, sensorless control, micro processor based control - applications

Course Outcomes:

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

1. Gain knowledge on special types of machines
2. Analyze the construction and operation of various special motors. The drive circuits used for stepper and switched reluctance motor.
3. Design drive circuits for stepper, switched and brushless DC motors.
4. identify a suitable machine for various applications

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Kadapa -516003.

Text Books:

1. Stepper Motors: Fundamentals, Applications, and Design by V. V. Athani, New Age International Publications, 1997.
2. Brushless Permanent-Magnet and Reluctance Motor Drives by TJE Miller Clarendon Press, Oxford.
3. Special Electrical Machines by K. Jagannadhan, PHI publications.

Reference Books:

1. Electrical Machines by R. K. Rajput, Laxmi Publications, 4th Edition.
2. Power Electronics – Converters, Applications & Design by N. Mohan, Undeland& Robbins, Wiley India, Student Edition, 2002.

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1502805	PJ	Energy Auditing & Demand Side Management	3	1	0	30	70	3

Objective:

This subject is an extension of previous power systems and machines courses. It deals with the detailed analysis of energy conservation by various motors and loads. Also concerns about the different types of methods to improve system efficiency by means of power factor improvement and use of quality of conductors.

UNIT – I

Energy Auditing: Energy audit- definitions, concept, types of audit, energy index, cost index, pie charts, Sankey diagrams, load profiles, Energy conservation schemes. Measurements in energy audits, presentation of energy audit results.

UNIT - II

Energy Efficient Motors: Energy efficient motors, constructional details, loss distribution, factors affecting efficiency, characteristics - variable speed, variable duty cycle systems, RMS hp- voltage variation-voltage unbalance- over motoring- motor energy audit.

UNIT – III

Power Factor Improvement: Power Factor – methods of improvement, location of capacitors, pf with non linear loads, effect of harmonics on pf, pf motor controllers.

UNIT – IV

Lighting and Energy Instruments: Good lighting system design and practice, lighting control ,lighting energy audit - Energy Instruments- watt meter, data loggers, thermocouples, pyrometers, lux meters, tongue testers ,application of PLC's.

UNIT – V

Demand Side Management: Introduction to DSM, concept of DSM, benefits of DSM, different techniques of DSM – time of day pricing, multi-utility power exchange model, time of day models for planning.

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Kadapa -516003.

Load management:, load priority technique, peak clipping, peak shifting, valley filling, strategic conservation, energy efficient equipment, a Management and Organization of Energy Conservation awareness Programs.

Course Outcomes:

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

1. Gain knowledge on energy auditing practices, energy conservation schemes,energy indices, graphical representations, energy management concepts characteristics of energy efficient motors, good lighting
2. Analyze various energy instruments such as wattmeter, data loggers,thermocouples, pyrometers, lux meters, tongue testers. payback analysis, depreciation, taxes and tax credit
3. Acquire skills in design for good lighting system.
4. Familiarize demand side management practices.

Text Books:

1. Electrical Power distribution by A. S. Pabla, TMH, 5th edition, 2004.
2. Energy management by W.R. Murphy & G. Mckay Butter worth, Heinemann publications.
3. Energy management hand book by W. C. Turner, John Wiley and Sons.

References:

1. Energy management by Paul o' Callaghan, Mc-graw Hill Book company-1st edition, 1998.
2. Energy efficient electric motors by John. C. Andreas, Marcel Dekker Inc Ltd., 2nd Edition, 1995.
3. Energy management and good lighting practice: Fuel Efficiency- Booklet12 – EEO.
4. Recent Advances in Control and Management of Energy Systems by D. P. Sen, K. R. Padiyar, Indrane Sen, M. A. Pai, Interline Publisher, Bangalore, 1993.
5. Energy Demand – Analysis, Management and Conservation, Ashok V. Desai, Wiley Eastern, 2005.

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1502806	PJ	Reliability Engineering & Applications to Power Systems	3	1	0	30	70	3

UNIT I

Basic probability theory, Distribution & Network Modeling: Basic probability theory-rules for combining probabilities of events, Bernoulli's trials, Probability Density and Distribution Functions, Binomial Distribution- Expected Value and Standard Deviation of Binomial Distribution. Analysis of Series, Parallel, Series – Parallel Networks, Complex Networks – Decomposition Method, Cut set and Tie set methods.

UNIT II

Reliability Functions: Reliability Functions – f(t), R(t), F(t), h(t) and their relationships – Exponential Distribution – Expected Value and Standard Deviation of Exponential

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Distribution – Bath – tub Curve – Reliability Analysis of Series – parallel Networks using Exponential Distribution – Reliability Measures. MTTF, MTTR, MTBF.

UNIT III

Markov Modeling – Markov Chains – Concept of STPM, Evaluations of Limiting State Probabilities – Markov Processes on Components Repairable System – Time Dependent Probability Evaluation using Laplace Transform Approach – Evaluation of Limiting State Probabilities using STPM – Two Component Reliability Models.

Frequency and Duration Concept – Evaluation of Frequency of Encountering State, Mean Cycle Time for One and Two Component Repairable Models – Evaluation of Cumulative Probability and Cumulative Frequency of Encountering of Merged States.

UNIT IV

Generation System Reliability Analysis: Reliability Model of a Generation System, Recursive Relation for Unit Addition and Removal, Load Modeling, Merging of Generation Load Model – Evaluation of Transition Rates for Merged State Model, Cumulative Probability and Cumulative Frequency of Failure Evaluation - LOLP, LOLE, LOEE.

UNIT V

Composite System Reliability Analysis: System and Load Point Reliability Indices, Weather Effects on Transmission Lines, Weighted Average Rate and Markov Model.

Distribution System Reliability Analysis – Basic Techniques, Radial Networks, Evaluation of basic Reliability Indices, Performance Indices, Load Point and System Reliability Indices, Customer Oriented, Load and Energy Oriented Indices.

Course Outcomes:

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

1. Gain knowledge on elements of probability theory and probability distributions, network reduction techniques, markov modeling, frequency and duration techniques, Generation and Load Modeling, Composite System and Distribution System Reliability Indices
2. Analyze the failure rate distributions, different network reduction techniques, methods for identifying critical components, merging of generation with load model, system and load point reliability indices, customer, load and energy oriented indices
3. Apply generation system reliability for calculating cumulative probability & frequency of various combined states distribution system reliability analysis for radial networks to assess the performance of customers.

Text Books:

1. Reliability Evaluation of Engg. System – R. Billinton, R. N. Allan, Plenum Press, New York, Reprinted in India by B. S. Publications, 2006
2. Reliability Evaluation of Power Systems – R. Billinton, R. N. Allan, Plenum Press, New York, Reprinted in India by B. S. Publications, 2006.