K. S. R. M. COLLEGE OF ENGINEERING - KADAPA (AUTONOMOUS)

Course Structure and Syllabus forM. 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	CR
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						
			Total	14	0	8	300	400	18

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

II SEMESTER

S. No.	C /PE/A	Course Code	Course Name	L	T	P	IM	EM	CR
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 with Seminar	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						
			Total	12	0	12	360	340	18

III SEMESTER

S. No.	C /PE/A	Course Code	Course Name	L	T	P	IM	EM	CR
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	CR
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

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.

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.

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:
1. Study of system dynamics and its physical interpretation
2. Development of mathematical models for synchronous machine
3. 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

Modelingof 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.

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.

Subject Code	Core /Elective	Course Name	L	T	P	IM	EM	CR
1852104	PE 1	Smart Grids	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, formationof micro-grid, Issues of inter-connection, protection & control ofmicro-grid.-Thin film solar cells, Variable speedwind generators, fuel-cells, micro-turbines.

Unit - V

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

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.

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.

<u>Text Books</u>:

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.

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. Unnikrishnapillai, "Probability, Random Variables and Stochastic Processes", 4rd Edition, McGraw Hill., 2002.
4. S.S.Rao, Engineering Optimization Theory and Practice ' Third Enlarges Edition, Newage 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, Configurationand control of Switch ReluctanceMotor drives and drive system efficiency.

Unit - IV

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

Unit - V

Introduction to energy management and their strategies used in hybridand electric vehicle, Classification of different energy management strategies, Comparison ofdifferent energy management strategies, Implementation issues ofenergy 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	CR
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 problemformulation.

- Analyze research relatedinformation

- Follow researchethics

- Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, andcreativity.

- 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 inparticular.

- Understand that IPR protection provides an incentive to inventors for further researchwork

- 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.GeographicalIndications.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 & engineeringstudents".
2. Wayne Goddard and Stuart Melville, "Research Methodology: anIntroduction".
3. RanjitKumar, 2nd Edition, "Research Methodology: A Step by Step Guide forbeginners".

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.
5. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age",2016.
6. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand,2008.

Subject Code	Core /Elective	Course Name	L	T	P	IM	EM	CR
1852110	LAB1	Power Systems Lab - I	0	0	4	50	50	2

Any Eight of the following experiments has to be carried out

1. Sequence impedances of synchronous machine
1. Single line to ground fault.
2. Line to line fault
3. Double line to ground fault.
4. Symmetrical fault.
5. Sequence impedances of three phase transformer.
6. Power angle characteristics of salient pole synchronous machine.
7. Ferranti effect and ABCD parameters of 220kV transmission line.
8. Transient& sub-transient reactance's of synchronous machine.
9. Three-phase semi converter.

Subject Code	Core /Elective	Course Name	L	T	P	IM	EM	CR
1852111	LAB2	Power Systems Simulation Lab - I	0	0	4	50	50	2

Any Eight of the following experiments has to be carried out

1. Formation of Y-bus
2. Formation of Z-bus
3. Load flow analysis by Gauss-Seidel Method
4. Load flow analysis by Newton-Raphson Method
5. Load flow analysis by Fast-decoupled Method
6. Small signal stability of Single machine connected to Infinite bus system
7. Transient stability of Multi Machine System
8. Simulation of Static VAR Compensator
9. Short circuit studies
10. Harmonic analysis & tuned filter design to mitigate harmonics

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.

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.

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

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. DaalderKulwer Academic Publishers, 2001.
3. Restructured Electrical Power Systems, Mohammad Shahidehpour and Muwaffaqalomoush, Marcel Dekker, Inc., 2001.

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

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.

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", DhanpatRai& Co.
2. Clayton.A.E. & NN Hancock, "The performance and design of Direct Current machines", CBS publishers & Distributors.

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 variouscommunication 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 eachSystem-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.

Reference Books:

1. Stuart A. Boyer: "SCADA-Supervisory Control and Data Acquisition", Instrument Society ofAmerica Publications,USA,2004.

2. Gordon Clarke, Deon Reynders: "Practical Modern SCADA Protocols: DNP3, 60870.5 andRelatedSystems", Newnes Publications, Oxford, UK,2004.

3. William T. Shaw, "Cybersecurity for SCADA systems", PennWell 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", PennWell 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 qualityPhenomena-classification of power quality issues-power quality measures andstandards-flicker factor transient phenomena-occurrence ofpower quality problems.

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 fluorescentlamps-effect of power system harmonics on power system equipmentand loads.

Unit - III

Modeling of networks and components under non-sinusoidalConditions- transmission and distribution systems-Shunt capacitors-transformers-electric machines-groundsystems -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, HarmonicResonance-Active Power Factor Correction- SinglePhase 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.

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",JaicoPublishing House.
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 ChengyingXu, 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/computationaltools.
3. Students will learn to write technicalreports.
4. Students will develop skills to present and defend their work in front oftechnically qualified audience.

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 anengineering 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.

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.

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.

<u>**Text Books**</u>:

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

Unit - I

Electric Energy Scenario-Demand Side Management-Industrial LoadManagement, Load Curves-Load Shaping Objectives, Methodologies-Barriers

Classification of IndustrialLoads, 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 loadModels,Optimization and control algorithms - Case studies.

Unit - III

Reactive power management in industries-Controls-power quality impactsApplication 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 Interscience 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	CR
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.
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.

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

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.

Subject	Core	Course Name	L	T	P	IM	EM	CR

Code	/Elective							
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 firefighting, 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 treeconcept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic,automotive, thermal and electrical equipmentslike, 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

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.
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 of 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.

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 isostaticpressing.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.

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	Core	Course Name	L	T	P	IM	EM	CR

Code	/Elective							
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 experimentaltechniques.

4. Students will be able to use different software/ computational/analyticaltools.

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 analyzingthem.

7. Students will be able to either work in a research environment or in anindustrialenvironment.

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 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 panelsetby HeadandPGcoordinator.Thecandidatehastobeinregularcontactwithhis 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 fieldwill.
2. Students will learn to write technical reports and research papers to publish at national and internationallevel.

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

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 ofreadability
3. Learn about what to write in eachsection

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

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 possiblybe the first- time submission

Reference Book:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on GoogleBooks).
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge UniversityPress.
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. learnto demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarianresponse.

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 conflictsituations.

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

UNIT - I

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

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 CommunityPreparedness.

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'sParticipation 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 inIndia.

Reference Books:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal bookCompany.

2. Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, NewDelhi.

3. Goel S. L. , Disaster Administration And Management Text And Case Studies" ,Deep &Deep Publication Pvt. Ltd., NewDelhi.

SANSKRIT FOR TECHNICAL KNOWLEDGE(1870A03)

Course Objectives:

1. To get a working knowledge in illustrious Sanskrit, the scientific language in theworld.

2. Learning of Sanskrit to improve brainfunctioning.

3. Learning of Sanskrit to develop the logic in mathematics, science &other subjects enhancing the memorypower.

4. The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancientliterature.

Course Outcomes

Students will be able to

1. Understanding basic Sanskritlanguage
2. Ancient Sanskrit literature about science & technology can beunderstood
3. Being a logical language will help to develop logic instudents

UNIT – I

Alphabets inSanskrit,Past/Present/FutureTense,Simple Sentences

UNIT - II

Order, Introduction ofroots, Technical information about SanskritLiterature

UNIT - III

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

Reference Books:

1. "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, NewDelhi
2. "Teach Yourself Sanskrit" PrathamaDeeksha-VempatiKutumbshastri, Rashtriya Sanskrit Sansthanam, New DelhiPublication
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., NewDelhi.

VALUE EDUCATION(1870A04)

Course Objectives

Students will be able to

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

Courseoutcomes

Students will be able to

1. Knowledge of self-development

2. Learn the importance of Human values

3. Developing the overallpersonality

UNIT - I

Values and self-development –Social values and individual attitudes.Work ethics, Indian vision ofhumanism.Moral and non- moral valuation.Standards andprinciples. Valuejudgments.

UNIT - II

Importance of cultivation ofvalues.Sense ofduty.Devotion,Self-reliance.Confidence, Concentration.Truthfulness,Cleanliness.Honesty, Humanity.Power of faith, NationalUnity.Patriotism.Love for nature,Discipline

UNIT - III

Personality and Behavior Development - Soul and Scientific attitude.Positive Thinking.Integrity and discipline.Punctuality, Love andKindness.Avoid faultThinking.Free from anger, Dignity oflabor.Universal brotherhood and religioustolerance.True friendship.Happiness Vs suffering, love fortruth.Aware of self-destructive habits.Association andCooperation.Doing best for savingnature.

UNIT - IV

Character and Competence –Holy books vsBlindfaith.Self-management and Goodhealth.Science ofreincarnation.Equality, Nonviolence ,Humility, Role ofWomen.All religions and same message.Mind your Mind,Self-control.Honesty, Studyingeffectively.

Reference Book:

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

CONSTITUTION OF INDIA(1870A05)

Course Objectives:

Students will be able to:

1. Understand the premises informing the twin themes of liberty and freedom from acivil rightsperspective.

2. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutionalroleandentitlementtocivilandeconomicrightsaswellastheemergenceof nationhoodintheearlyyearsofIndiannationalism.

3. ToaddresstheroleofsocialisminIndiaafterthecommencementoftheBolshevik.

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 Indianpolitics.

2. Discuss the intellectual origins of the frame work of argument that informed the conceptualization of social reforms leading to revolution inIndia.

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 IndianConstitution.

4. Discuss the passage of the Hindu Code Bill of 1956.

UNIT - I

HistoryofMakingoftheIndianConstitution:History, Drafting Committee, (Composition & Working),

Philosophy of the Indian Constitution:PreambleSalient Features.

UNIT - II

ContoursofConstitutionalRights&Duties:FundamentalRights, Right toEquality, Right toFreedom, Right againstExploitation, RighttoFreedomofReligion, Cultural and EducationalRights, Right to ConstitutionalRemedies, DirectivePrinciplesofStatePolicy, FundamentalDuties.

UNIT - III

Organs ofGovernance:Parliament, Composition, Qualifications andDisqualifications, Powers andFunctions, ExecutivePresident, Governor, Council ofMinisters, Judiciary,AppointmentandTransferofJudges,Qualifications, Powers andFunctions.

UNIT - IV

LocalAdministration:District's Administration head: Role andImportance,Municipalities: Introduction, Mayor and role of Elected Representative, CEO of MunicipalCorporation.Pachayati raj: Introduction, PRI: ZilaPachayat., Elected officials and their roles, CEO ZilaPachayat: Position androle.

Block level: Organizational Hierarchy (Different departments),

Village level: Role of Elected and Appointedofficials,Importance of grass rootdemocracy

UNIT - V

ElectionCommission:

ElectionCommission:RoleandFunctioning.ChiefElectionCommissionerandElectionCommissioners.

StateElectionCommission:RoleandFunctioning.InstituteandBodiesforthewelfareofSC/ST/OBC andwomen.

Reference Books:

1. The Constitution of India, 1950 (Bare Act), GovernmentPublication.
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. Reviewexistingevidenceon thereview topic to informprogrammedesignandpolicy making undertakenbythe DFLD,otheragencies andresearchers.
2. Identifycriticalevidencegapstoguidethedevelopment.

Course Outcomes*:*

Students will be able to understand:

1. What pedagogical practices are being used by teachers in formal and informal classrooms in developingcountries?
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

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 andmind

2. To overcomestress

Course Outcomes*:*

Students will be able to:

1. Develop healthy mind in a healthy body thus improving social healthalso

2. Improve efficiency

UNIT - I

Definitions of Eight parts of yog.(Ashtanga)

UNIT - II

Yam andNiyam. Do`s and Don't's inlife.Ahinsa, satya, astheya, bramhacharya andaparigraha, Shaucha, santosh, tapa, swadhyay,ishwarpranidhan.

UNIT - III

Asan andPranayam, Various yog poses and their benefits for mind & body, Regularization of breathing techniques and itseffects, Types of pranayam.

Reference Books:

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

2. "Rajayoga or conquering the Internal Nature" by SwamiVivekananda,

3. Advaitashrama(Publication Department),Kolkata

PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS**(1870A08)**

Course Objectives

1. To learn to achieve the highest goalhappily

2. To become a person with stable mind, pleasing personality anddetermination

3. To awaken wisdom instudents

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 andprosperity

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 andduties.ShrimadBhagwadGeeta : 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 basicknowledge.ShrimadBhagwadGeeta: Chapter2-Verses 56, 62,68, Chapter 12 -Verses 13, 14, 15, 16,17,18, Personality of Role model. ShrimadBhagwadGeeta: Chapter2- Verses 17, Chapter 3-Verses36,37,42,Chapter 4-Verses 18,38,39, Chapter18 – Verses37,38,63

Reference Books:

1. "Srimad Bhagavad Gita" by Swami SwarupanandaAdvaita Ashram (Publication Department),Kolkata

2. Bhartrihari's Three Satakam(Niti-sringar-vairagya) by P.Gopinath, Rashtriya, Sanskrit Sansthanam, NewDelhi