Course Code	PEC1EE802			Semester	EIGHTH
Category	Professional Elective Course				
Course Title	HVDC				
Scheme & Credits	L	T	P	Credits	Max Marks: 100
	2	1	0	3	
Prerequisites	Nil				

Course Objectives:

1. Understand the advantages of dc transmission over ac transmission.
2. Understand the operation of Line Commutated Converters and Voltage Source Converters.
3. Understand the control strategies used in HVDC transmission systems.
4. Understand the improvement of power system stability using an HVDC system.

Unit	Topic	No. of Hours
I	Introduction to HVDC and comparison with AC transmission, HVDC Operation-Converters and Inverters	7
II	Motor drive technologies,Energy Source Technologies, Battery Charging Technologies, Vehicle to Grid, Electric Vehicle Subsystems & configurations, Hybrid Electric Vehicle Subsystems, Hybrid Subsystems & modes of operations	10
III	Introduction to vehicle dynamics and Tractive effort,Vehicle dynamics & dynamic equation, dynamic equation variable Fte	9
IV	Storage for EVs,Fundamentals of EV Battery Pack design and battery management system,	8
V	EV Motors and Controllers: Fundamentals and Design,Vehicle Accessories	8
Total No. of Hours		**42**

Textbooks :

S. No	Name of Book	Author	Publisher
1	HVDC Power Transmission Systems,	K.R. Padiyar	New Age International
2	Power System Stability and control	Prabha Kundur	Tata McGraw-Hill

Course Code	**PEC2EE802**			**Semester**	**EIGHTH**
Category	**Professional Elective Course**				
Course Title	**Electric Vehicles**				
Scheme & Credits	**L**	**T**	**P**	**Credits**	**Max Marks: 100**
	2	**1**	**0**	**3**	
Prerequisites	**Nil**				

Course Objectives:

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

Unit	Topic	No. of Hours
I	Introduction to Electrical Vehicles, Historical background, benefits of using Electric Vehicles, overview of types of Electric vehicles & its challenges,	7
II	Motor drive technologies,Energy Source Technologies, Battery Charging Technologies, Vehicle to Grid, Electric Vehicle Subsystems & configurations, Hybrid Electric Vehicle Subsystems, Hybrid Subsystems & modes of operations	10
III	Introduction to vehicle dynamics and Tractive effort,Vehicle dynamics & dynamic equation, dynamic equation variable Fte	9
IV	Storage for EVs, Fundamentals of EV Battery Pack design and battery management system,	8
V	EV Motors and Controllers: Fundamentals and Design, Vehicle Accessories	8
Total No. of Hours		**42**

Textbooks :

S. No	Name of Book	Author	Publisher
1	Modern Electric, Hybrid Electric, and Fuel Cell Vehicles	Ehsani Mehrdad, Yimin Gao, Ali Emadi	CRC press
2	Electric Powertrain: Energy Systems, Power Electronics and Drives for Hybrid,Electric and fuel cell vehicles	John G. Hayes and A. Goodarzi	Wiley Publication

Course Code	PEC3EE802			Semester	EIGHTH
Category	Professional Elective Course				
Course Title	Smart Grids				
Scheme & Credits	L	T	P	Credits	Max Marks: 100
	2	1	0	3	
Prerequisites	Power System				

Course Objectives:

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

Unit	Topic	No. of Hours
I	Introduction to Smart Grid, Architecture of Smart Grid System,Standards for Smart Grid System, Elements and Technologies of Smart Grid System	9
II	Distributed generation resources, wide area monitoring system,Phasor estimation,Digital relays for smart grid protection	9
III	Islanding Detection Techniques, Smart Grid Protection,Modelling of Storage Devices, Modelling of DC Smart Grid components	7
IV	Operation and control of AC Microgrid,Operation and control of DC Microgrid,Operation and control of AC-DC hybrid Microgrid	8
V	Demand side management. of Smart Grid, Demand response analysis of Smart Grid,Energy Management, Design of Smart grid,System Analysis of AC/DC Smart Grid	9
Total No. of Hours		**42**

Textbooks :

S. No	Name of Book	Author	Publisher
1	Smart power grids	A Keyhani, M Marwali	
2	Computer Relaying for Power Systems	ArunPhadke	
3	Microgrids Architecture and control	Nikos Hatziargyriou	
4	Renewable Energy Systems	Fang Lin Luo, Hong Ye	

Course Code	PEC1EE803			Semester	EIGHTH
Category	Professional Elective Course				
Course Title	High Voltage Engineering				
Scheme & Credits	L	T	P	Credits	Max Marks: 100
	2	1	0	3	
Prerequisites	Nil				

Course Objectives:

1. To get introduced to high voltage engineering
2. To understand different high voltage measurements and the necessary instruments

Unit	Topic	No. of Hours
I	CONDUCTION AND BREAKDOWN IN GASES: Gases as insulators, ionization, current growth,Townsend's criterion for breakdown, electro-negative gases, Paschen's Law, Streamer breakdown mechanism, corona discharges, post breakdown phenomena, practical considerations in using gases for insulating materials.	8
II	CONDUCTION AND BREAKDOWN IN LIQUID DIELECTRICS: Classification of liquid dielectrics, conduction and breakdown in pure liquids and in commercial liquids.	4
III	BREAKDOWN IN SOLID DIELECTRICS: Intrinsic breakdown, electromechanical breakdown, thermal breakdown, breakdown of solid dielectrics in practice, breakdown of composite insulation, solid dielectric used in practice.	5
IV	APPLICATIONS OF INSULATING MATERIALS IN DIFFERENT ELECTRICAL APPARATUS: Applications in power transformers, rotating machines, circuit breakers, cables, power capacitors, electronic equipment.	3
V	GENERATION OF HIGH VOLTAGES AND CURRENTS: Generation of high d.c. and a.c. voltages, generation of impulse voltages and currents.	7
VI	MEASUREMENT OF HIGH VOLTAGES AND CURRENTS: Measurement of high d.c., a c. and impulse voltages, Measurement of high d.c., a.c and impulse currents.	5
VII	NON DESTRUCTIVE TESTING: Measurement of d.c. resistivity, dielectric constant and loss factor, partial discharge measurement.	4
VIII	TESTING OF ELECTRICAL APPARATUS: Testing of insulators, bushings, isolators, circuit breakers, cables, transformers and surge diverters.	3
Total No. of Hours		**39**

Textbooks :

S. No	Name of Book	Author	Publisher
1	High Voltage Engineering Fundamentals	E. Kuffel, W.S Zaengl	Newnes
2	High Voltage Engineering	M.S. Naidu, V. Karamraju	Tata McGraw-Hill
3	High voltage test techniques	Dieter kind, Kurt Feser.	Newnes
4	An Introduction to High Voltage Engineering	Subir Ray	Prentice Hall of India

Course Code	**PEC2EE803**			**Semester**	**EIGHTH**
Category	**Professional Elective Course**				
Course Title	**Restructuring of Power Systems**				
Scheme & Credits	**L**	**T**	**P**	**Credits**	**Max Marks: 100**
	2	**1**	**0**	**3**	
Prerequisites	**Nil**				

Course Objectives:

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

Unit	Topic	No. of Hours
I	Introduction to restructuring of the power industry.Fundamentals of Economics.	7
II	The Philosophy of Market Models.Transmission Congestion Management.	10
III	Locational Marginal Prices (LMP) and Financial Transmission Rights (FTR). Ancillary Service Management.	11
IV	Pricing of transmission network usage and loss allocation.Market power and generators bidding.	10
V	Reforms in the Indian power sector.	9
Total No. of Hours		**42**

Textbooks :

S. No	Name of Book	Author	Publisher
1	Fundamentals of Power System economics	Daniel Kirschen and Goran Strbac	John Wiley & Sons
2	Operation of restructured power systems	Kankar Bhattacharya, Jaap E. Daadler, Math H.J Bollen, Kluwer	Academic Pub.

Course Code	**PEC3EE803**			**Semester**	**EIGHTH**
Category	**Professional Elective Course**				
Course Title	**Power System Dynamics & Stability**				
Scheme & Credits	**L**	**T**	**P**	**Credits**	**Max Marks: 100**
	2	**1**	**0**	**3**	
Prerequisites	**Power System**				

Course Objectives:

1. Understand the problem of power system stability and its impact on the system.
2. Analyse linear dynamical systems and use of numerical integration methods.
3. Model different power system components for the study of stability.
4. Understand the methods to improve stability.

Unit	Topic	No. of Hours
I	Introduction to Power System Stability, Analysis of Dynamical Systems	10
II	Modeling of a Synchronous Machine, Modeling of Excitation and Prime Mover Systems	12
III	Modeling of Transmission Lines and Loads	8
IV	Stability Issues in Interconnected Power Systems, Power System Stability Analysis Tools	12
V	Enhancing System Stability	4
Total No. of Hours		**42**

Textbooks :

S. No	Name of Book	Author	Publisher
1	Power System Stability and Control,	P.Kundur	McGraw Hill Inc
2	Power System Dynamics & Stability	P.Sauer & M.A.Pai	Prentice Hall
3	Power System Dynamics, Stability & Control	K.R.Padiyar	B.S. Publications,

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Course Code	**PEC4EE803**			**Semester**	**EIGHTH**
Category	**Professional Elective Course**				
Course Title	**Advanced Power System Analysis**				
Scheme & Credits	**L**	**T**	**P**	**Credits**	**Max Marks: 100**
	2	**1**	**0**	**3**	
Prerequisites	**Nil**				

Course Objectives:

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 rank the contingencies

Unit	Topic	No. of Hours
I	Revision of Newton Raphson, Gauss Siedel method, Fast decoupled load flow.	6
II	DC power flow : Single phase and three phase, AC-DC load flow, DC system model, Sequential Solution Techniques,Extension to Multiple and Multi-terminal DC systems, DC convergence tolerance, Test System and results.	10
III	Fault Studies, Analysis of balanced and unbalanced three phase faults, fault calculations.	8
IV	System optimization, strategy for two generator systems, generalized strategies,effect of transmission losses, Sensitivity of the objective function, Formulation of optimal power flow, solution by Gradient method-Newton's method.	9
V	State Estimation, method of least squares, statistics, errors, estimates, test for bad data, structure and formation of Hessian matrix, power system state estimation.	9
Total No. of Hours		**42**

Textbooks :

S. No	Name of Book	Author	Publisher
1	Power System Analysis	Grainger, J.J. and Stevenson, W.D.	Tata McGraw hill
2	Computer analysis of power systems	Arrillaga, J and Arnold, C.P.	John Wiley and Sons
3	Computer Techniques in Power System Analysis	Pai, M.A.	Tata McGraw hill

Course Code	**PCC-EE804L**			**Semester**	**EIGHTH**
Category	**Professional Core Course**				
Course Title	**Advanced Power System Simulation and Scripting Lab**				
Scheme & Credits	**L**	**T**	**P**	**Credits**	**Max Marks: 100**
	0	**0**	**4**	**2**	
Prerequisites	**Nil**				

S.No.	**Experiment**
1	Power Simulation and Scripting; SimPowerSystems™Models
2	Models of Power Circuit Devices in SimPowerSystems™; Measuring and Control Blocks
3	SimPowerSystems™ Simulation of Power Electronics Devices
4	SimPowerSystems™ Simulation of Electric Machine and Electric Drive Simulation
5	SimPowerSystems™ Simulation of Electric Power Production and Transmission Simulation
6	SimPowerSystems™ Simulation of the Renewable Electrical Sources and Wind Generators
7	Power System Scripting in Python/MATLAB
8	Power Flow Analysis
9	Optimal Power Flow Analysis
10	Time Domain Analysis: Numerical Integration and Transient Computation
11	Challenges of Scripting for Power System Education

Course Code	PSIEE805			Semester	EIGHTH
Category	Project work, Seminar and Internship				
Course Title	Industrial Training & Viva				
Scheme & Credits	L	T	P	Credits	Max Marks: 100
	0	0	0	1	

S.No.	Practical /Industrial Training/Internship
1	The students have to undergo a minimum four week practical training/internship /industrial training in any relevant industrial organization during winter vacations. The students will be asked to submit a practical training report (one copy per student) in a group. These reports will be evaluated in partial fulfilment for the award of the degree of Bachelors of Technology in their respective branches of study.

Course Code	PSIEE806			Semester	EIGHTH
Category	Project, Seminar and Internship				
Course Title	Major Project				
Scheme & Credits	L	T	P	Credits	Max Marks: 100
	0	0	16	8	
Prerequisites	Nil				

S.No.	PROJECT DESCRIPTION
1	In the final project, the students are required to extend the pre-project work for the final submission of the course. The final project work is to be carried out in the last semester of their respective fields of study. The supervisors will guide the students from the beginning of the pre-project in 7th semester to its accomplishment as a final project in the 8th semester. The students will be asked to submit a project report in a group. These reports will be evaluated in partial fulfilment for the award of the degree of bachelors of Technology in their respective branches of study.