SCHEME OF COURSE WORK

Course Details:

Course Title	**: MODELING AND SIMULATION OF POWER ELECTRONIC SYSTEMS**		
Course Code	**: 15EE2213**	**L P C**	**3 0 3**
Program:	**: M. Tech**		
Specialization:	**: Power Electronics & Drives**		
Semester	**: II SEM**		
Prerequisites	**: Power Electronics**		
Courses to which it is a prerequisite	**: ---------------------**		

Course Outcomes (COs): At the end of the course students will be able to:

1	Derive a mathematical model of Power Electronic Devices and Understand computer simulation techniques widely used for Power electronic Converters
2	Derive a mathematical model and Simulate AC-DC Converters.
3	Derive a mathematical model and Simulate DC-DC Converters.
4	Differentiate and describe the various simulation methods of analysis of power electronic systems
5	Design & implementation of different types of algorithms for power electronic systems

Programme Outcomes:

1.	Develop in depth knowledge in the areas of “Static Power Electronics Converters”, “Power Electronic Converter fed Electrical Drives” and “Power Quality”
2.	Apply soft computing techniques for Power Electronic Systems and Electric Drives
3	Understand large scale Power Electronic Converter Systems, Electric Drives and issues involved through Modeling, Analysis and Simulation using LabVIEW- Multisim software
4.	Apply present day techniques and tools to solve Power electronic and electric drives problems relevant to India and other countries
5.	Use state-of-the-art simulation tools such as PLEXIM, SABER, OPAL-RT Lab, DSPACE, MULTISIM, LABVIEW and other tools
6	Contribute positively to collaborative and multidisciplinary research to achieve common goals
7	Demonstrate knowledge and understanding of power engineering and management principles and apply the same for efficiently carrying out projects with due consideration to economical and financial factors
8	Communicate confidently, make effective presentations and write good reports to engineering community and society
9	Recognize the need for life-long learning and have the ability to do it independently
10	Acquire knowledge on social issues and shall contribute to the community for sustainable development
11	Predict and examine critically the outcomes of actions, apply corrective measures subsequently and move forward positively through a self corrective approach

Course Outcome versus **Program Outcomes:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	S	S	S	M	S	M					
CO-2	S	S	S	M	S	M					
CO-3	S	S	S	M	S	M					
CO-4	S	S	S	M	S	M					
CO-5	S	S	S	M	S	M					

S - Strongly correlated, *M* - *Moderately* correlated, *Blank* - *No correlation*

Assessment Methods:	Assignment / Quiz / Seminar / Case Study / Mid-Test / End Exam

Teaching-Learning and Evaluation Process

Week	TOPIC / CONTENTS	Course Outcomes	Sample questions	TEACHING-LEARNING STRATEGY	Assessment Method & Schedule
1	**UNIT-I:INTRODUCTION AND REVIEW OF MODELING OF POWER ELECTRONIC DEVICES:** Overview and modeling of Power Electronic (PE) devices: Diodes, Thyristors, IGBTs, MOSFET;	CO1	Give the overview on different power Electronic devices.	Lecture Discussion	Mid-1 (week-9) Seminar (week-1)
2	Comparison of switching characteristics of various devices, Transient and Steady state behaviour of PE devices	CO1	Compare the switching characteristics of various power semi-conductor devices	Computer aided modeling	Mid-1 (week-9) Seminar (week-2)
3	**COMPUTER SIMULATION OF PE CONVERTERS:** Challenges in Computer Simulation, Solution techniques for time domain simulation	CO1	What are the challenges in Computer Simulation and the need for model independent simulation environment	Lecture Discussion	Mid-1 (week-9) Seminar (week-3)
4	Widely used circuits and / or system oriented simulators. Choice of simulator(s).	CO1	What are the widely used circuits and / or system oriented simulators for PE related problems	Lecture on Discussion	Mid-1 (week-9) Seminar (week-4)
5	**UNIT-II: SIMULATION OF AC/ DC CONVERTERS:** Modeling of controlled and uncontrolled ac/ dc converters	CO2	Perform simulation of AC-DC Converters feeding R, R-L, and R-L-E loads	Lecture followed by hands on experience using Labview -Multisim	Mid-1 (week-9) Seminar (week-5)
6	single-phase & 3- phase ac/dc converters	CO2	Perform simulation of 1-phase and 3-phase AC-DC Converters feeding R, R-L, and R-L-E loads	Lecture	Mid-1 (week-9) Seminar (week-6)

7	Other topologies for ripple current minimization and power factor improvement	CO2	Mention the topology changes needed to minimize the ripple current ad also mention the topologies for improve power factor	Lecture Discussion	Mid-1 (week-9) week-7)
8	**UNIT-III: SWITCH-MODE DC / DC POWER SUPPLIES:** Modeling & Simulation of Buck & Boost converters	CO3	Perform simulation of BUCK Converters. Perform simulation of BOOST converter	Lecture followed by hands on experience using Labview -Multisim	Mid-1 (week-9) Seminar (week-8)
9	MID - I				
10	Modeling & Simulation of Buck-Boost, Cuk converters and Full bridge dc/dc Converters	CO3	Perform simulation of BUCK-BOOST converter. Perform simulation of CUK and Full bridge dc-dc converter.	Lecture Discussion	Mid-2 (week-9) Seminar (week-9)
11	**UNIT-IV: SEQUENTIAL METHOD OF SIMULATION OF POWER ELECTRONIC SYSTEMS:** Decoupled and Coupled Power Electronic Systems; Analysis of Decoupled Systems: Analysis of chopper fed DC motor	CO4	Briefly explain coupled and decoupled analysis of power electronic converters	Lecture followed by hands on experience using Labview -Multisim	Mid-2 (week-9) Seminar (week-10)
12	Analysis of Inverter fed Induction Machine; Analysis of coupled systems: Synchronous Machine fed from a naturally commutated inverter	CO4	Explain the analysis of Inverter fed Induction Machine; Analysis of coupled systems: Synchronous Machine fed from a naturally commutated inverter	Lecture followed by hands on experience using Labview -Multisim	Mid-2 (week-9) Seminar (week-11)
13	Induction machine fed from a forced commutated current source inverter; computer aided analysis of machine-converter group	CO4	Explain the analysis of Induction machine fed from a forced commutated current source inverter; computer aided analysis of machine-converter combination	Lecture followed by hands on experience using Labview -Multisim	Mid-2 (week-9) Seminar (week-12)
14	**UNIT-V: ADVANCED TECHNIQUES: EFFICIENT COMPUTATION OF STEADY STATE PERIODIC SOLUTIONS:** Definition of steady state computation problem – Newton-Raphson Method, Gradient Method, E-Algorithm for computation of steady-state solution;	CO5	Explain different types of algorithms for steady state solution in power electronics	Lecture Discussion	Mid-2 (week-9) Seminar (week-13)

15	Computation of Steady-state solution in power electronic systems	CO5	Explain how to compute steady state solution in power electronic systems	Lecture Discussion	Mid-2 (week-9) Seminar (week-14)
16	Computer aided implementation of steady-state of an AC Regulator feeding RL Loads, Computation of steady-state solution of HVDC Systems,	CO5	Explain computation of steady-state of an AC Regulator, Computation of steady-state solution of HVDC Systems	Lecture Discussion	Mid-2 (week-9) Seminar (week-15)
17.	**MID - II**				
18 &19	**END EXAM**				