SCHEME OF COURSE WORK

Course Details:

Course Title	**: DYNAMICS OF ELECTRICAL MACHINES**		
Course Code	**: 13EE2213**	**L P C**	**: 4 0 3**
Program:	**: M.Tech.**		
Specialization:	**: Power System and Control Automation**		
Semester	**: II**		
Prerequisites	**: Electrical Machines**		
Courses to which it is a prerequisite	**: -----**		

Course Outcomes (COs):

At the end of the course, a student will be able to**:**

CO1	Derive Kron's Primitive machine as an unified electrical machine model
CO2	Derive the mathematical model and control a 3- phase Induction motor
CO3	Analyze asymmetrical 2-phase induction motor
CO4	Derive the mathematical model of a separately excited DC motor and DC Series motor
CO5	Analyze a three phase synchronous machine under transient conditions

Program Outcomes (POs):

PO1	The graduate will be a professional workforce in the areas of "Static Power Electronics Converters", "Power Electronic Converter fed Electrical Drives" and "Power Quality".
PO2	Apply soft computing techniques for Power Electronic Systems and Electric Drives
PO3	Understand large scale Power Electronic Converter Systems, Electric Drives and issues involved through Modeling, Analysis and Simulation
PO4	Apply present day techniques and tools to solve Power electronic and electric drives problems relevant to India and other countries
PO5	Use state-of-the-art simulation tools such as PLEXIM, SABER, OPAL-RT Lab, DSPACE, MULTISIM, LABVIEW and other Tools
PO6	Contribute positively to collaborative and multidisciplinary research to achieve common goals
PO7	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
PO8	Communicate confidently, make effective presentations and write good reports to engineering community and society
PO9	Recognize the need for life-long learning and have the ability to do it independently
PO10	Acquire knowledge on social issues and shall contribute to the community for sustainable development
PO11	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	M	M	S	M	M	W	M	W	W	W	W
CO-2	M	M	S	M	M	W	M	W	W	W	W
CO-3	M	M	S	M	S	W	M	W	W	W	W
CO-4	M	M	S	M	S	W	M	W	W	W	W
CO-5	M	M	S	M	S	W	M	W	W	W	W

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

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

Teaching-Learning and Evaluation

Week	TOPIC / CONTENTS	Course Outcomes	Sample questions	Teaching-Learning Strategy	Assessment Method & Schedule
1	Basic Two-pole machine representation of commutator machines, 3-ph synchronous machine with and without damper bars	CO-1	Explain the basic two-pole machine representation using Kron's Primitive machine.	▫ Lecture ▫ Discussion	Mid-Test 1 (Week 9) Seminar (Week 1)
2	3-ph induction machine, Kron's primitive machine-voltage, current and torque equations	CO-1	Using Kron's primitive Machine model, derive the voltage equations for a three Induction machine.	▫ Lecture ▫ Discussion	Mid-Test 1 (Week 9) Seminar (Week 2)
3	Real time model of a two phase induction machine transformation to obtain constant matrices-thee phase to two phase transformation- power equivalence	CO-1	Explain the concept of power invariance while transforming three phase to two phase.	▫ Lecture ▫ Problem solving	Mid-Test 1 (Week 9) Seminar (Week 3)
4	Generalized model in arbitrary reference frame- Electromagnetic torque – Derivation of commonly used induction machine models	CO-2	Explain the generalized model in arbitrary reference frame theory applied to three phase induction machine.	▫ Lecture ▫ Discussion	Mid-Test 1 (Week 9) Seminar (Week 4)
5	Stator reference frame model- Rotor reference frame model- Synchronously rotating frame model- Equations in flux linkages - per unit model	CO-2	Obtain Synchronously rotating reference frame model equations for an induction machine	▫ Lecture ▫ Discussion ▫ Problem solving	Mid-Test 1 (Week 9) Seminar (Week 5)
6	Dynamic Simulation- Small signal equations of induction machine – derivation DQ flux linkage model derivation – control principle of Induction machine	CO-2	Explain the principle of control of induction machine.	▫ Lecture ▫ Discussion	Mid-Test 1 (Week 9) Seminar (Week 6)
7	Analysis of symmetrical 2 phase induction machine-voltage and torque Equations. unsymmetrical 2 phase induction machine voltage and torque equations	CO-3	Identify the voltage equations for symmetrical 2 phase induction machine.	▫ Lecture ▫ Discussion	Mid-Test 1 (Week 9) Seminar (Week 7) Assignment (Week 6-7)
8	analysis of steady state operation of unsymmetrical 2 phase induction machine	CO-3	Identify the voltage equations for unsymmetrical 2 phase induction machine.	▫ Lecture ▫ Discussion	Mid-Test 1 (Week 9) Seminar (Week 8)
9	**Mid-Test 1**				
10	single phase induction motor - Cross field theory of single-phase induction machine	CO-4	Explain the concept of Cross field theory of single phase induction machine	▫ Lecture ▫ Discussion	Mid-Test 2 (Week 18) Seminar (Week 10)
11	Mathematical model of a sep. excited DC motor- steady state and transient analysis - Transfer function	CO-4	Obtain the transfer function of a separately excited DC motor under steady state	▫ Lecture ▫ Discussion	Mid-Test 2 (Week 18) Seminar

	of a sep. excited DC motor		and transient states.		(Week 11)
12	Mathematical model of a DC series motor, shunt motor- linearization techniques for small perturbations	CO-4	Explain the linearization technique used for small perturbations for a separately excited DC motor.	▫ Lecture ▫ Discussion	Mid-Test 2 (Week 18) Seminar (Week 12)
13	Synchronous machine inductances – voltage equations in the rotor's DQ0 reference frame- electromagnetic torque-current in terms of linkages	CO-4	Obtain the expression for torque using rotor reference frame for synchronous motor.	▫ Lecture ▫ Discussion	Mid-Test 2 (Week 18) Seminar (Week 13)
14	Dynamic performance of synchronous machine,	CO-5	Explain dynamic performance of Synchronous machine	▫ Lecture ▫ Discussion	Mid-Test 2 (Week 18) Seminar (Week 14)
15	three-phase fault , comparison of actual and approximate transient torque characteristics	CO-5	Explain three phase fault on a synchronous machine using equal area criteria.	▫ Lecture ▫ Discussion	Mid-Test 2 (Week 18) Seminar (Week 15) Assignment (Week 14-15)
16	Equal area criteria- simulation of three phase synchronous machine	CO-5	Explain the concept of Equal area criteria for a sudden change in the input torque.	▫ Lecture ▫ Demonstration	Mid-Test 2 (Week 18) Seminar (Week 16)
17	modeling of PMSM. Revision	CO-5	Identify the equations governing PMSM for the modeling.	▫ Lecture ▫ Demonstration	Mid-Test 2 (Week 18) Seminar (Week 17)
18	**Mid-Test 2**				
19/20	**END EXAM**				