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 Control and 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):

A graduate of Power System Control & Automation will be able to

1	The graduate will be able to acquire in depth knowledge in the area of power system control and automation
2	The graduate will attain the ability to think critically and analyze complex engineering problems related to power system control and automation
3	The graduate will obtain the capability of problem solving and original thinking to arrive at feasible and optimal solutions considering societal and environmental factors
4	The graduate will be able to extract information through literature survey and apply appropriate research methodologies, techniques and tools to solve power system problems.
5	The graduate will be able to use the state-of-the-art tools for modelling, simulation and analysis of problems related to power systems
6	The graduate will attain the capability to contribute positively to collaborative and multidisciplinary research to achieve common goals
7	The graduate will demonstrate knowledge and understanding of power system engineering and management principles and apply the same for efficiently carrying out projects with due consideration to economical and financial factors.
8	The graduate will be able to communicate confidently, make effective presentations and write good reports with engineering community and society
9	The graduate will recognize the need for life-long learning and have the ability to do it independently
10	The graduate will become socially responsible and follow ethical practices to contribute to the community for sustainable development of society
11	The graduate will be able to independently observe and examine critically the outcomes of his actions and reflect on to make corrective measures subsequently and move forward positively by learning through mistakes

Course Outcome Versus **Program Outcomes:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO-1	M	M	M	M	M	W	W	W	W	W	W
CO-2	M	M	M	M	M	W	W	W	W	W	W
CO-3	M	M	S	M	S	W	W	W	W	W	W
CO-4	M	M	S	M	S	W	W	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-1	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-1	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-1	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-2	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-2	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-2	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 of a sep. excited DC motor	CO-3	Obtain the transfer function of a separately excited DC motor under steady state and transient states.	▫ Lecture ▫ Discussion	Mid-Test 2 (Week 18) Seminar (Week 11)
12	Mathematical model of a DC series motor, shunt motor- linearization techniques for small perturbations	CO-3	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-4	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-4	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-4	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-4	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**				