

Subject Code	Subject Name	Teaching Scheme (Hrs)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
EXC 406	Electrical Machines	3	--	--	3	--	--	03

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam					
		Test 1	Test 2	Ave. Of Test 1 and Test 2						
EXC 406	Electrical Machines	15	15	15	60	--	-	-	75	

**Course Objective: To understand performance, working of Electrical Machines and their characteristics etc.**

**Expected Outcome:**

5. Students will be able to understand electrical motors and their working principles
6. Students will be able to understand brushless drives
7. Students will be able to understand special types of motors such as stepper motor and applications

Module No.	Unit No.	Contents	Hrs.
<b>1.0</b>		<b>DC Machines</b>	08
	<b>1.1</b>	<b>Construction:</b> principle of working, MMF and flux density waveforms, significance of commutator and brushes in DC machine,	
	<b>1.2</b>	<b>EMF equation:</b> and Torque equation, characteristics of DC Motors,	
	<b>1.3</b>	<b>Starters</b> for shunt and series motors	
	<b>1.4</b>	<b>Speed Control</b> (Armature voltage control and field control using block diagrams)	
<b>2.0</b>		<b>Three phase Induction Motor</b>	08
	<b>2.1</b>	<b>Construction:</b> Working principle of squirrel cage induction motor,	
	<b>2.2</b>	<b>Equivalent circuit:</b> Equivalent circuit development, torque speed characteristics, power stages, no load and blocked rotor test	
	<b>2.3</b>	<b>Speed control:</b> Classify different methods, stator voltage control using Triac, V/f control using converter inverter scheme (only block diagram)	
	<b>2.4</b>	<b>Starting methods:</b> Classification and working of different methods, high torque motors	
<b>3.0</b>		<b>Single phase Induction Motor</b>	04
	<b>3.1</b>	<b>Working Principle:</b> Double field revolving theory	
	<b>3.2</b>	<b>Starting methods:</b> Split phase, capacitor start, capacitor start and run, shaded pole,	
	<b>3.3</b>	<b>Equivalent circuit:</b> Determination of equivalent circuit parameters by no load and block rotor test.	
<b>4.0</b>		<b>Permanent Magnet Synchronous Motors</b>	04
	<b>4.1</b>	Working principle, EMF and torque equations	
<b>5.0</b>		<b>Brushless DC Motors</b>	04

	<b>5.1</b>	Unipolar brushless DC motor, Bipolar brushless DC motor, speed control, important features and applications	
<b>6.0</b>		<b>Stepper Motors:</b>	06
	<b>6.1</b>	Constructional features, working principle	
	<b>6.2</b>	<b>Variable reluctance motor:</b> Single and multi-stack configurations, characteristics, drive circuits	
<b>7.0</b>		<b>Switched Reluctance Motors:</b>	04
	<b>7.1</b>	Constructional features, working principle, operation and control requirements	
		Total	38

**Recommended Books:**

1. Bimbhra P.S., *Electric Machinery*, Khanna Publisher,
2. G.K. Dubey, *Fundamentals of electrical drives*, Narosa Publications
3. Nagrath I.J., Kothari D.P., *Electric Machines*, TMH Publications
4. A.E. Fitzgerald, Kingsly, Stephen., *Electric Machinery*, McGraw Hill
5. M.G. Say and E. O. Taylor, *Direct current machines*, Pitman publication
6. Ashfaq Husain, *Electric Machines*, Dhanpat Rai and co. publications
7. M.V. Deshpande, *Electric Machines*, PHI
8. Smarajit Ghosh, *Electric Machines*, PEARSON

**Internal Assessment (IA):**

Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the test will be considered as final IA marks

**End Semester Examination:**

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. The students need to solve total 4 questions.
- 3: Question No.1 will be compulsory and based on entire syllabus.
- 4: Remaining question (Q.2 to Q.6) will be selected from all the modules.
- 5: Weightage of marks will be as per Blueprint.