

Course code.	Course Name	L-T-P - Credits	Year of Introduction
EE311	ELECTRICAL DRIVES & CONTROL FOR AUTOMATION	3-0-0-3	2016
<b>Prerequisite : Nil</b>			
<b>Course Objectives</b>			
<ol style="list-style-type: none"> <li>To understand the basic concepts of different types of electrical machines and their performance.</li> <li>To know the different methods of starting D.C motors and induction motors.</li> <li>To introduce the controllers for automation</li> </ol>			
<b>Syllabus</b>			
DC Machines, transformers, three phase induction motor, single phase induction motor, stepper motor, controllers for automation.			
<b>Expected outcome .</b>			
The students will be able to			
<ol style="list-style-type: none"> <li>Select a drive for a particular application based on power rating.</li> <li>Select a drive based on mechanical characteristics for a particular drive application.</li> <li>Discuss the controllers used for automation</li> </ol>			
<b>Text Books:</b>			
<ol style="list-style-type: none"> <li>Kothari D. P. and I. J. Nagrath, Electrical Machines, Tata McGraw Hill, 2004.</li> <li>Nagrath .I.J. &amp; Kothari .D.P, Electrical Machines, Tata McGraw-Hill, 1998</li> <li>Richard Crowder, Electrical Drives and Electromechanical systems, Elsevier, 2013</li> <li>Mehta V. K. and R. Mehta, Principles of Electrical and Electronics, S. Chand &amp; Company Ltd., 1996.</li> <li>Theraja B. L. and A. K. Theraja, A Text Book of Electrical Technology, S. Chand &amp; Company Ltd., 2008.</li> <li>Vedam Subrahmaniam, Electric Drives (concepts and applications), Tata McGraw- Hill, 2001</li> </ol>			
<b>References:</b>			
<ol style="list-style-type: none"> <li>H.Partab, Art and Science and Utilisation of electrical energy, Dhanpat Rai and Sons, 1994</li> <li>M. D.Singh, K. B. Khanchandani, Power Electronics, Tata McGraw-Hill, 1998</li> <li>Pillai.S,K A first course on Electric drives, Wiley Eastern Limited, 1998</li> </ol>			
<b>Course Plan</b>			
Module	Contents	Hours	Sem. Exam Marks
I	DC Machines-principle of operation-emf equation-types of excitations. Separately excited, shunt and series excited DC generators, compound generators. General idea of armature reaction, OCC and load characteristics - simple numerical problems.	6	15%
II	Principles of DC motors-torque and speed equations-torque speed characteristics- variations of speed, torque and power with motor current. Applications of dc shunt series and compound motors. Principles of starting, losses and efficiency – load test- simple numerical problems.	6	15%
<b>FIRST INTERNAL EXAMINATION</b>			
III	Transformers – principles of operations – emf equation- vector	7	15%

	diagrams- losses and efficiency – OC and SC tests. Equivalent circuits- efficiency calculations- maximum efficiency – all day efficiency – simple numerical problems. Auto transformers constant voltage transformer- instrument transformers.		
<b>IV</b>	Three phase induction motors- slip ring and squirrel cage types- principles of operation – rotating magnetic field- torque slip characteristics- no load and blocked rotor tests. Circle diagrams- methods of starting – direct online – auto transformer starting	7	15%
<b>SECOND INTERNAL EXAMINATION</b>			
<b>V</b>	Single phase motors- principle of operation of single phase induction motor – split phase motor – capacitor start motor- stepper motor- universal motor Synchronous machines types – emf equation of alternator – regulation of alternator by emf method. Principles of operation of synchronous motors- methods of starting- V curves- synchronous condenser	8	20%
<b>VI</b>	Stepper motors: Principle of operation, multistack variable reluctance motors, single-stack variable reluctance motors, Hybrid stepper motors, Linear stepper motor, comparison, Torque-speed characteristics, control of stepper motors Controllers for automation, servo control, Digital controllers, Advanced control systems, Digital signal processors, motor controllers, Axis controllers, Machine tool controllers, Programmable Logic Controllers	8	20%
<b>END SEMESTER EXAM</b>			

**QUESTION PAPER PATTERN:**

**Maximum marks: 100**

**Time: 3 hrs**

The question paper should consist of three parts

**Part A**

There should be 2 questions each from module I and II

Each question carries 10 marks

Students will have to answer any three questions out of 4 (3X10 marks =30 marks)

**Part B**

There should be 2 questions each from module III and IV

Each question carries 10 marks

Students will have to answer any three questions out of 4 (3X10 marks =30 marks)

**Part C**

There should be 3 questions each from module V and VI

Each question carries 10 marks

Students will have to answer any four questions out of 6 (4X10 marks =40 marks)

Note: in all parts each question can have a maximum of four sub questions