

NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE PLAN – PART I			
Course Title	AC MACHINES		
Course Code	EE202	No. of Credits	4
Course Code of Pre-requisite subject(s)	EE201 DC Machines and Transformers		
Session	Jan. 2018	Section	B
Name of Faculty	Dr. S. Senthil Kumar	Department	Electrical and Electronics Engineering
Email	senthhilanitha@gmail.com	Telephone No.	0431-2503251
Name of Course Coordinator(s) (if, applicable)			
E-mail			Telephone No.
Course Type	<input checked="" type="checkbox"/> Core course <input type="checkbox"/> Elective course		
Syllabus (approved in BoS)			
Alternators – construction, principle and types - armature reaction - load characteristics – voltage regulation - two reaction theory.			
Synchronous motors - Synchronous machines on infinite bus bars - phasor diagram - V and inverted V curves - current - Hunting and its suppression - starting methods.			
Polyphase induction motors - construction, principle and types equivalent circuit – circle diagram - starting and speed control -Induction generators.			
Single phase induction motors - construction, principle and types - double revolving field theory – equivalent circuit.			
Permanent magnet brushless motors – construction, principle and types - principle of operation – phasor diagram - torque equation.			
COURSE OBJECTIVES			
This course provides a basic understanding of AC machinery fundamentals, machine parts and helps to gain the skills for operating AC machines. The course also equips			

students with ability to understand and analyse the phasor diagrams and equivalent circuits of AC Induction and Synchronous Machines.

COURSE OUTCOMES (CO)

Course Outcomes	Aligned Programme Outcomes (PO)
On completion of the course the students will be able to	
1. Understand the constructional details and principle of operation of AC Induction and Synchronous Machines.	PO ₁ , PO ₂ , PO ₈ – PO ₁₄
2. Understand and appraise the principle of operation and performance of PMSM machines.	PO ₁ , PO ₂ , PO ₈ – PO ₁₄
3. Analyze the performance of the AC Induction and Synchronous Machines using the phasor diagrams and equivalent circuits.	PO ₁ , PO ₂ , PO ₈ – PO ₁₄
4. Select appropriate AC machine for any application and appraise its significance.	PO ₁ , PO ₂ , PO ₈ – PO ₁₄

COURSE PLAN – PART II

COURSE OVERVIEW

Most industries today are being equipped with electrical drives and locomotives thanks to the easy controllability and modular structure. This creates an urge among the electrical engineers to know about the basics of electrical machines in particular ac machines since they are used in most industrial drives. These electric drives are well known for the flexible and effective controllability. Hence it also becomes important to know about the methods of implementing various speed control techniques and braking mechanisms for these machines.

Such requirements have motivated to frame this course as core course for electrical engineering students. This course syllabus has been framed such that the initial topics deal with the constructional details and working principle of the rotating ac machines and upon completion would help the students to choose appropriate machine for various industrial applications. After designing any machine, it becomes inevitable to validate the design and hence an appropriate model for any machine becomes necessary. Hence equivalent circuit model is also being given focus in this course and further analysis of the performance of the machine is also given focus.

Hence on completion of this course a B.Tech. Student upon graduating as Electrical Engineer would have a basic knowledge on choice of appropriate ac machine drive for various industrial applications with appropriate control strategy.

COURSE TEACHING AND LEARNING ACTIVITIES

S. No.	Week/Contact Hours	Topic	Mode of Delivery
--------	--------------------	-------	------------------

1.	II week of January (8 th) 1 hr	Introduction to the course and flexible mode of course delivery	Lecture
2.	II week of January (8 th) 1 hr	Introduction to Polyphase induction motors	Lecture <i>Chalk and talk using board</i>
3.	II week of January (9 th – 13 th) 3 hrs	Development of three phase revolving flux in a three phase machine	Lecture <i>Chalk and talk using board</i>
4.	II week of January (9 th – 13 th) 1 hr	Principle of operation of a three-phase induction motor, Construction and types of three phase induction motor	Lecture <i>Chalk and talk using board</i>
5.	III week of January (16 th – 20 th) 2 hrs		
6.	III week of January (16 th – 20 th) 2 hrs	No-load operation and torque development	Lecture <i>Chalk and talk using board</i>
7.	III week of January (16 th – 20 th) 2 hrs	Starting of three phase induction motor and constructional details on rotor types and windings	Laboratory class - demo
8.	IV week of January (23 rd – 27 th) 2 hrs	Torque equations and factors influencing torque development – no-load operation	Lecture <i>Chalk and talk using board</i>
9.	IV week of January (23 rd – 27 th) 2 hrs	Load operation and load torque development	Lecture <i>Chalk and talk using board</i>

10.	IV week of January (23 rd – 27 th) 2 hrs	Torque equations and formulae relating various parameters	Lab schedule Lecture <i>Chalk and talk using board</i>
11.	V week of January (30 th Jan – 3 rd Feb) 2 hrs	Factors influencing torque development – power stages in three phase induction motor	Lecture <i>Chalk and talk using board</i>
12.	V week of January (30 th Jan – 3 rd Feb) 2 hrs	Torque – slip characteristics of a three phase induction motor	Lecture <i>Chalk and talk using board</i>
13.	V week of January (30 th Jan – 3 rd Feb) 2 hrs	Numericals related to three phase induction motor	Tutorials
14.	II week of February (6 th – 10 th) 2 hrs	Equivalent circuit representation of a three phase induction motor	Lecture <i>Chalk and talk using board</i>
15.	II week of February (6 th – 10 th) 2 hrs	Performance analysis and load characteristics of a three-phase induction motor	Lecture <i>Chalk and talk using board</i>
16.	II week of February (6 th – 10 th) 1 hr	Assessment 1	Technical quiz / Problem solving
17.	III week of February (13 th – 17 th) 2 hrs	No-load and Blocked rotor operation of a three phase induction motor – determination of machine parameters	Lecture <i>Chalk and talk using board</i>
18.	III week of February (13 th – 17 th) 2 hrs	Performance analysis of a three phase induction motor – circle diagram	Lecture <i>Chalk and talk using board</i>

19.	IV week of February (20 th – 24 th) 2 hrs	Starting methods of a three-phase induction motor	Lecture <i>Chalk and talk using board</i>
20.	IV week of February (20 th – 24 th) 1 hr	Speed control of a three-phase induction motor	Flip Class Discussion on 90 mins lecture video
21.	IV week of February (20 th – 24 th) 2 hrs	Assessment 2	Problem solving
22.	V week of February (27 th Feb – 3 rd March) 2 hrs	Braking methods for a three-phase induction motor	Lecture <i>Chalk and talk using board</i>
23.	II week of March (6 th – 10 th) 2 hrs	Induction generator – types and principle of operation	Lecture <i>Chalk and talk using board</i>
24.	II week of March (6 th – 10 th) 2 hrs	Induction generator – equivalent circuit and phasor diagram	Lecture <i>Chalk and talk using board</i>
25.	III week of March (13 th – 17 th) 2 hrs	Double field revolving theory	Lecture <i>Chalk and talk using board</i>
26.	III week of March (13 th – 17 th) 2 hrs	Principle of operation of single phase induction motor and its types	Lecture <i>Chalk and talk using board</i>
27.	IV week of March (20 th – 24 th) 2 hrs	Equivalent circuit analysis and formulae related to single phase induction motor	Lecture <i>Chalk and talk using board</i>
28.	IV week of March (20 th – 24 th) 2 hrs	Load characteristics and torque-slip characteristics of a single phase induction motor	Lecture <i>Chalk and talk using board</i>

29.	V week of March (27 th – 31 st) 2 hrs	Numericals related to three phase induction motor	Tutorials
30.	V week of March (27 th – 31 st) 1 hr	Assessment 3	Technical quiz / Problem solving
31.	I week of April (3 rd – 7 th) 2 hrs	Alternators – construction, principle and types	Lecture <i>Chalk and talk using board</i>
32.	II week of April (10 th – 14 th) 2 hrs	Alternators – armature reaction	Lecture <i>Chalk and talk using board</i>
33.	II week of April (10 th – 14 th) 2 hrs	Load characteristics and voltage regulation	Lecture <i>Chalk and talk using board</i>
34.	III week of April (17 th – 21 st) 2 hrs	Synchronization of alternators with grid, Synchronous motors – principle of operation and starting methods	Flip Class Discussion on lecture video
35.	III week of April (17 th – 21 st) 2 hrs	Phasor diagram - V and inverted V curves - Hunting and its suppression	Lecture <i>Chalk and talk using board</i>
36.	IV week of April (24 th – 29 th) 3 hrs	Permanent magnet brushless motors – construction, principle and types – principle of operation – phasor diagram - torque equation	Industrial Lecture

37.	IV week of April (24 th – 29 th) 1 hr	Assessment 4	Technical quiz
38.	IV week of April (24 th – 29 th) 4 hrs	Assessment 5	Group Activity
39.	I week of May (1 st – 5 th) 2 hrs	Assessment 6	End semester exam - Descriptive type

COURSE ASSESSMENT METHODS

S. No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Technical quiz	II week of February (6 th – 10 th)	1 hr	10%
		V week of March (27 th – 31 st)	1 hr	10%
		IV week of April (24 th – 29 th)	1 hr	10%
				Total = 30%
2	Problem solving	IV week of February (20 th – 24 th)	2 hrs	10%
		I week of April (3 rd – 7 th)	2 hrs	10%
				Total = 20%
3	Group Activity	IV week of April (24 th – 29 th)	4 hrs	10%
4	End Semester Exam	I week of May (1 st – 5 th)	2 hrs	40%
CPA	Compensation Assessment (Written Test)	4 th week of April 2018	1 Hour	Please refer course policy for more details

COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)

Feedback from the students during class committee meetings
Anonymous feedback through questionnaire

COURSE POLICY (preferred mode of correspondence with students, policy on attendance, compensation assessment, , academic honesty and plagiarism etc.)

MODE OF CORRESPONDENCE (email/ phone etc)

1. All the students are advised to check their NITT WEBMAIL regularly. All the correspondence (schedule of classes/ schedule of assessment/ course material/ any other information regarding this course) will be done through their webmail.
2. Queries (if required) may be emailed to me / contact me during 4.00 pm to 5.00 pm on Monday and Friday with prior intimation for any clarifications.

ATTENDANCE

1. Attendance will be taken by the faculty in all the contact hours. Every student should maintain minimum 75 % physical attendance in these contact hours to attend the end semester examination.
2. Any student, who fails to maintain 75% attendance needs to appear for the compensation assesemnt (CPA). Student who scores more than 60 % marks in the CPA will be eligible for attending the end semester examination.
3. Students not having 75% minimum attendance at the end of the semester and also fail in CPA (scoring less than 60%) will have to RE DO the course.

COMPENSATION ASSESSMENT

1. If any student is not able to attend any one of the assessments (from assessment 1 to 5) due to genuine reasons, student is permitted to attend the compensation assessment (CPA) with 10% weightage (10 marks).

ACADEMIC HONESTY & PLAGIARISM

1. All the students are expected to be genuine during the course work. Taking of information by means of copying simulations, assignments, looking or attempting to look at another student's paper or bringing and using study material in any form for copying during any assessments is considered dishonest.
2. Tendering of information such as giving one's program, simulation work, assignments to another student to use or copy is also considered dishonest.
3. Preventing or hampering other students from pursuing their academic activities is also considered as academic dishonesty.
4. Any evidence of such academic dishonesty will result in the loss of marks on that assessment. Additionally, the names of those students so penalized will be reported to the class committee chairperson and HoD for necessary action.
5. Students who honestly producing ORIGINAL and OUTSTANDING WORK will be REWARDED.

ATTENDANCE

4. Attendance will be taken by the faculty in all the contact hours. Every student should maintain minimum 75 % physical attendance in these contact hours to attend the end semester examination.
5. Any student, who fails to maintain 75% attendance needs to appear for the compensation

- assessemnt (CPA). Student who scores more than 60 % marks in the CPA will be eligible for attending the end semester examination.
6. Students not having 75% minimum attendance at the end of the semester and also fail in CPA (scoring less than 60%) will have to RE DO the course.

ACADEMIC HONESTY & PLAGIARISM

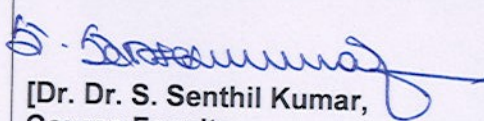
6. All the students are expected to be genuine during the course work. Taking of information by means of copying simulations, assignments, looking or attempting to look at another student's paper or bringing and using study material in any form for copying during any assessments is considered dishonest.
7. Tendering of information such as giving one's program, simulation work, assignments to another student to use or copy is also considered dishonest.
8. Preventing or hampering other students from pursuing their academic activities is also considered as academic dishonesty.
9. Any evidence of such academic dishonesty will result in the loss of marks on that assessment. Additionally, the names of those students so penalized will be reported to the class committee chairperson and HoD for necessary action.
10. Students who honestly producing ORIGINAL and OUTSTANDING WORK will be REWARDED.

COURSE POLICY

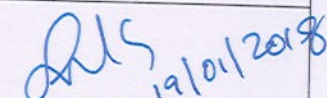
1. All the students are expected to attend all the contact hours. Anyhow attendance is not expected for discussion classes on video lectures.
2. Students who fall short of 50% attendance to the contact hours are not eligible to appear for the final written examination of 40% weightage.
3. No retest will be conducted for those students who are being physically absent for any of the evaluation / assessment methods. Anyhow flexibility is given to the students to fix the date for each mode of evaluation convenient to all the students. In case of emergency, the student may submit compensatory assignments on submission of appropriate documents as proof. Compensatory assignments would be framed according to the time frame available and the assessment task missed by the students.
4. Relative grading with a passing minimum is as per our institute norms.
5. In case of any student found guilty indulging in any mal practice, he/she will be awarded no marks in that particular assessment. If found using mobile phones or any other gadgets for any mal-practice during the final written examination, the answer sheet of the student will not be evaluated and will be awarded ZERO marks in the final written examination.

ADDITIONAL COURSE INFORMATION

FOR APPROVAL


[Dr. Dr. S. Senthil Kumar,
Course Faculty


CC-Chairperson
19/01/18


HoD/Dept. of EEE
19/01/2018