NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE OUTLINE TEMPLATE			
Course Title	AC MACHINES		
Course Code	EEPC17	No. of Credits	4
Department	Electrical and Electronics Engineering	Faculty	Dr. S. Senthil Kumar
Pre-requisite Course	DC MACHINES AND TRANSFORMERS		
Course Coordinator	Dr. S. Senthil Kumar		
E-mail	dcmteeebsection@gmail.com	Telephone No.	0431 – 2503261
Course Type	Core course		

COURSE OVERVIE

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 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 PMBLDC 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 TEACHING AND LEARNING ACTIVITIES

S. No.	Week / Contact Hours	Topic	Mode of Delivery (online)
1.	Week -1 29th – 31st December 2021, **2 hrs**	Introduction to the course and flexible mode of course delivery Introduction to Polyphase induction motors Development of three phase revolving flux in a three-phase machine	**Lecture** PPT / Doc. Camera / Digital Board

2.	Week -2 3rd – 7th January 2022, **4 hrs**	Principle of operation of a three-phase induction motor, Construction and types of three phase induction motor. No-load operation and torque development	**Lecture** PPT / Doc. Camera / Digital Board
3.	Week -3 10th – 13th January 2022, **4 hrs**	Starting of three phase induction motor and constructional details on rotor types and windings Torque equations and factors influencing torque development – no-load operation Load operation and load torque development Torque equations and formulae relating various parameters	**Lecture** PPT / Doc. Camera / Digital Board
4.	Week - 4 17th – 21st January 2022, **4 hrs**	Factors influencing torque development – power stages in three phase induction motor Torque – slip characteristics of a three-phase induction motor	**Lecture** PPT / Doc. Camera / Digital Board
5.	Week - 5 24th – 28th January 2022, **3 hrs**	Equivalent circuit representation of a three-phase induction motor Problems related to three phase induction motor	**Lecture** PPT / Doc. Camera / Digital Board
6.	Week - 6 31st January – 4th February 2022, **4 hrs**	Performance analysis and load characteristics of a three-phase induction motor No-load and Blocked rotor operation of a three-phase induction motor – determination of machine parameters	**Lecture** PPT / Doc. Camera / Digital Board
7.	Week - 7 7th – 11th February 2022, **4 hrs**	Performance analysis of a three-phase induction motor – circle diagram Starting methods of a three-phase induction motor	**Lecture** PPT / Doc. Camera / Digital Board

		Speed control of a three-phase induction motor **Assessment - 1**	
8.	Week - 8 14th – 18th February 2022, **4 hrs**	Braking methods for a three-phase induction motor Induction generator – types and principle of operation Induction generator – equivalent circuit and phasor diagram	**Lecture** PPT / Doc. Camera / Digital Board
9.	Week - 9 21st – 23rd February 2022, **3 hrs**	Double field revolving theory Principle of operation of single-phase induction motor and its types Equivalent circuit analysis and formulae related to single phase induction motor	**Lecture** PPT / Doc. Camera / Digital Board
10.	Week - 10 1st -4th March 2022, **3 hrs**	Load characteristics and torque-slip characteristics of a single-phase induction motor Problems related to three phase induction motor	**Lecture** PPT / Doc. Camera / Digital Board
11.	Week - 11 7th – 11th March 2022, **4 hrs**	Alternators – construction, principle and types Alternators – construction, principle and types Alternators – armature reaction Problems related to Alternators **Assessment – 2**	**Lecture** PPT / Doc. Camera / Digital Board
12.	Week - 12 14th– 17thMarch 2022, **4 hrs**	Load characteristics and voltage regulation Synchronization of alternators with grid, Problems related to Alternators	**Lecture** PPT / Doc. Camera / Digital Board
13.	Week - 13 21st– 25thMarch 2022, **4 hrs**	Synchronous motors – principle of operation and starting methods Phasor diagram - Problems	**Lecture** PPT / Doc. Camera / Digital Board

14.	Week - 14 28th March– 1st April 2022, **4 hrs**	V and inverted V curves - Hunting and its suppression - Problems	**Lecture** PPT / Doc. Camera / Digital Board
15.	Week - 15 4th – 8th April 2022, **4 hrs**	Permanent magnet brushless motors – construction, principle and types – principle of operation – phasor diagram Permanent magnet brushless motors - torque equation	**Lecture** PPT / Doc. Camera / Digital Board
16.	Week - 16 11th – 13th April 2022, **4 hrs**	**Assessment – 3**	Seminar / case study / Assignments /Projects
17.	Week – 17,18 18th – 25th April 2022, **2 hrs**	Final Assessment for Theory Courses starts **Assessment - 4**	End semester exam - Descriptive type

COURSE ASSESSMENT METHODS

S. No.	Mode of Assessment	Week/Date	Duration	% Weightage
1.	**Assessment -1**	Week - 7 9th – 11th February 2022	**2 hrs**	**20%**
2.	**Assessment -2**	Week - 11 7th – 8th March 2022	**2 hrs**	**20%**
3.	**Assessment -3** **Group Activity**	Week - 16 3rd – 7th April 2022		**20%**
4.	Compenasation Test	Week - 15 7th – 8th April 2022	**2 hrs**	**20%**
5.	**Assessment - 4** **End Semester Exam**	Week – 17,18 18th – 25thApril 2022	**2 hrs**	**40%**

ESSENTIAL READINGS : Textbooks, reference books Website addresses, journals, etc

1. M. G. Say, 'Performance and design of Alternating Current Machines', John Wiley and Sons Publications, 3rd Edition ,1983.
2. Dr. P.S. Bhimbra, 'Electrical Machinery', Khanna Publications, 7th Edition, 2007.
3. Nagrath, I.J.and Kothari, D.P., 'Electrical Machines', Tata McGraw Hill Education Private Limited Publishing Company Ltd., 4th Edition, 2010.
4. Arthur Eugene Fitzgerald and Charles Kingsley, 'Electric Machinery', Tata McGraw Hill Education Publications, 6th Edition, 2002.
5. Miller, T.J.E., 'Brushless Permanent Magnet and Reluctance Motor Drives', Clarendon Press-Oxford, 1989.
6. Parkar Smith, N.N., 'Problems in Electrical Engineering', CBS Publishers and Distributers, 9th Edition, 1984.

COURSE EXIT SURVEY

1. Students' feedback through class committee meetings
2. Feedback questionnaire from students – twice during the semester
3. Feedback from students on Course Outcomes at the end of the semester

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. 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.
3. Relative grading with a passing minimum is as per our institute norms.
4. 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

1. The Course Coordinator is available for consultation during the time intimated to the students then and there.
2. All correspondence will be sent to the webmail id of the students alone. Hence all students are advised to check their webmail ids regularly.
3. The students will communicated through the email id: dcmteecbsection@gmail.com for any academic related issues (including sharing of study materials) with respect to this course.

MODE OF CORRESPONDENCE (email/ phone etc)

dcmteecbsection@gmail.com / 0431 – 2503261

ATTENDANCE POLICY (A uniform attendance policy as specified below shall be followed)

- **At least 75% attendance in each course is mandatory.**
- **A maximum of 10% shall be allowed under On Duty (OD) category.**
- Students with **less than 65% of attendance** shall be prevented from writing the final assessment and **shall be awarded 'V' grade.**

ACADEMIC DISHONESTY & PLAGIARISM

- Possessing a mobile phone, carrying bits of paper, talking to other students, copying from others during an assessment will be treated as punishable dishonesty.
- Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
- The departmental disciplinary committee including the course faculty member, PAC chairperson and the HoD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty. The report shall be submitted to the Academic office.

FOR APPROVAL

Dr. S. Senthil Kumar,		**HoD/Dept. of EEE**
Course Faculty	**CC-Chairperson**	(I/c) 05/01/2022

Guidelines

a) The number of assessments for any theory course shall range from 4 to 6.

b) Every theory course shall have a final assessment on the entire syllabus with at least 30% weightage.

c) One compensation assessment for absentees in assessments (other than final assessment) is mandatory. Only genuine cases of absence shall be considered.

d) The passing minimum shall be as per the regulations.

B.Tech. Admitted in				P.G.
2018	2017	2016	2015	
35% or (Class average/2) whichever is greater.		(Peak/3) or (Class Average/2) whichever is lower		40%

e) Attendance policy and the policy on academic dishonesty & plagiarism by students are uniform for all the courses.

f) Absolute grading policy shall be incorporated if the number of students per course is less than 10.

g) Necessary care shall be taken to ensure that the course plan is reasonable and is objective.