DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

COURSE PLAN – PART I			
Course Title	SYNCHRONOUS AND INDUCTION MACHINES LABORATORY		
Course Code	EELR14	No. of Credits	2
Course Code of Co-requisite subject(s)	EEPC18		
Course Code of Pre-requisite subject(s)	DC MACHINES AND TRANSFORMERS LABORATORY		
Session	January 2019	Section (if, applicable)	A
Name of Faculty	Mr. M. Arumugaraj	Department	EEE
Email	arumugaraj@nitt.edu	Telephone No.	8838368879
Course Type	✓ Core course ☐ Elective course		

Syllabus (approved in BoS)

List of experiments

- Load test on three-phase induction motor
- No-load and blocked rotor test on three-phase induction motor
- Load test on grid connected induction generator
- Load test on self-excited induction generator
- Load test on single-phase induction motor
- Regulation of three-phase alternator by E.M.F and M.M.F methods
- Load test on three-phase alternator
- Synchronization of three-phase alternator with infinite bus bar
- V and inverted V-curves of synchronous motor
- Speed Control on three-phase induction motor
- Mini-project

COURSE OBJECTIVES

The main objective of the course is to give the students an insight into the constructional details of the induction and synchronous machines with a view of better understanding of their working principles. The course also equips the students to test

and evaluate the performance of induction and synchronous machines by conducting appropriate experiments.

COURSE OUTCOMES (CO)

Course Outcomes	Aligned Programme Outcomes (PO)
1. Estimate or test the performance of induction and synchronous machines by conducting suitable experiments and report the results.	PO_1, PO_2, PO_8 – PO_{14}
2. Experiment and analyze the speed control techniques for three-phase induction motors.	PO_1, PO_2, PO_8 – PO_{14}
3. Evaluate the different modes of operating the induction generators and justify their usage in wind power generation.	PO_1, PO_2, PO_8 – PO_{14}
4. Experiment synchronization of alternators and power exchange with the grid to get convinced with their usage at conventional power generation stations.	PO_1, PO_2, PO_8 – PO_{14}
5. Develop simulation models and prototype modules in view of implementing any control technique upon Single-phase and three-phase induction motors for various applications.	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.	I week of January (7^{th} – 11^{th}) **1 hr**	Introduction to the course and flexible mode of course delivery	**Discussion in class**
2.	II week of February (11^{th} – 15^{th})	Load test on three phase induction motor	**Experimental analysis**
3.	II week of February (11^{th} – 15^{th})	No-load and Blocked rotor test on three phase induction motor – determination of machine parameters	**Experimental analysis**
4.	III week of February (18^{th} – 22^{nd})	Speed control of a three-phase induction motor – Rotor resistance control for slip ring induction motor	**Demonstration by students**
5.	IV week of February (25^{th} Feb – 1^{st} March)	Speed control of a three-phase induction motor – V/F characteristics	**Study experiment in Siemens Centre of Excellence in Manufacturing**
6.	IV week of February (25^{th} Feb – 1^{st} March)	Star – Delta starter based starting of three phase induction motor	**Demo experiment in Siemens Centre of Excellence in Manufacturing**
7.	IV week of February (25^{th} Feb – 1^{st} March)	Starter software based forward, reverse and braking operations of a three phase induction motor	**Demo experiment in Siemens Centre of Excellence in Manufacturing**
8.	I week of March (4^{th} – 8^{th})	**Assessment 1**	**Report submission and viva for all three phase induction motor based experiments**
9.	II week of March (11^{th} – 15^{th})	Load test on grid connected induction generator	**Experimental analysis**

10	III week of March (18^{th} – 22^{nd})	Single phase induction motor – different connections in practical applications	**Demonstration by students**
11	III week of March (18^{th} – 22^{nd})	Synchronization of three phase alternator with infinite bus bar	**Demonstration by students**
12	IV week of March (25^{th} – 29^{th})	Load test and voltage regulation of three phase alternators	**Experimental analysis**
13	I week of April (1^{st} – 5^{th})	V and inverted V curves – synchronous motor	**Experimental analysis**
14	II week of April (8^{th} – 12^{th})	**Assessment 2**	**Report submission and viva for three phase synchronous machine experiments**
15	III week of April (15^{th} – 19^{th})	**Assessment 3**	**Mini – project Group activity**
16	IV week of April (22^{nd} – 26^{th})	**Assessment 4**	**End Semester examination**

COURSE ASSESSMENT METHODS

S. No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Report on the experiments	I week of March (4^{th} – 8^{th})	2 sessions	25
2	Report on the experiments	II week of April (8^{th} – 12^{th})	2 sessions	25
3	Mini-project Group activity	III week of April (15^{th} – 19^{th})	4 sessions	20
4	Final Assessment	IV week of April (22^{nd} – 26^{th})	3 hrs	30

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

MODE OF CORRESPONDENCE (email/ phone etc)

Email : provided above

ATTENDANCE

1. All the students are expected to attend all the laboratory sessions.
2. Students who are absent for regular laboratory sessions have to take steps to redo the particular experiments by their own efforts and no extra laboratory sessions would be arranged.
3. At least 75% attendance in each course is mandatory.
4. A maximum of 10% shall be allowed under On Duty (OD) category.
5. Students with less than 65% of attendance shall be prevented from writing the final assessment and shall be awarded 'V' grade.

COMPENSATION ASSESSMENT

Compensatory assignments would be framed according to the time frame available and the assessment task missed by the students.

ACADEMIC HONESTY & PLAGIARISM

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 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: arumugaraj@nitt.edu for any academic related issues (including sharing of study materials) with respect to this course.

FOR APPROVAL

Course Faculty	CC-Chairperson	HoD / EEE
[M. ARUMUGARAJ]	25/1/19 [Dr. M. P. SELVAN]	[Dr. S. SUDHA]