

Course Title	Electrical Machine – II
Course Code	EL421
Course Credit	Lecture : 03
	Practical : 01
	Tutorial : 00
	Total : 04

Course Objectives

At the end of this course the student will be able to

- **Describe** construction and operating principle of induction machine and synchronous machine
- **Employ** starting methods and speed control for an induction motor.
- **Explain** conditions and methods for parallel operation of alternators.
- **Compute** various circuit parameters of induction motor and alternator.

Detailed Syllabus

Sr. No.	Name of chapter & details	Hours Allotted
Section – I		
1	Three phase Induction Motor Three phase magnetic field, construction of induction motor, operating principle, torque, torque slip curves, efficiency, equivalent circuit, no-load and blocked rotor test on induction motor, circle diagram.	08
2	Starting, Speed Control and Braking of Three phase Induction motor Starting method-DOL, Star-Delta, Autotransformer, rotor resistance, Speed control-stator voltage control, variable frequency control, and rotor resistance control. Electric braking-Regenerative, Dynamic, Counter current. Effect of harmonics, cogging & crawling, effect of unbalance voltages & frequency variation on operation of I.M.	09
3	Induction Generators Principles of operation, load characteristics, comparison with synchronous generators, load and power factor control, Phasor diagrams, operating characteristics, applications.	04

		Total	21
Section – II			
4	Single phase Induction Motor Principle and operation, Double revolving field theory, Starting methods- split phase, Capacitor start, Two value capacitor, Permanent capacitor and Shaded pole induction motor, Equivalent circuit, Losses and Efficiency, Numerical.	05	
5	Alternators Construction, EMF equation, Winding factor, Pitch factor, Armature reaction, Voltage regulation- EMF, MMF and ZPF method, Slip test for measurement of X_d and X_q , Requirements and conditions for parallel operations, Condition and methods of Synchronization-three lamp method, Synchronoscope.	10	
6	Synchronous Motors Operating principle, Armature reaction, Effect of load, Effect of varying excitation on armature current and power factor, Equivalent circuit and phasor diagram, Synchronous condenser, Synchronous phase modifier, Hunting and its preventions, Starting methods of synchronous motor, V-curve, inverted V-curve.	06	
		Total	21
Instructional Method and Pedagogy			
<ul style="list-style-type: none"> • Lectures will be conducted with the aid of multi-media projector, black board, OHP etc. • Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval. • Surprise tests/Quizzes/Seminar/Tutorials will be conducted. • The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures. • Minimum ten experiments shall be there in the laboratory related to course contents. 			
Reference Books			
<ol style="list-style-type: none"> 1. J B Gupta, “<i>Theory & Performance of Electrical Machines</i>” S. K. Katariya & Sons publication. 2. Kothari. D P and I J Nagrath, ‘<i>Electric Machines</i>’, Tata McGraw-Hill, 3rd Edition 3. Asfaq hussain “<i>Electrical Machines</i>” Dhanpat rai & co, 2nd Edition. 			

School of Engineering
(Electrical Department)

List of Experiments

Subject Code : EL421

Subject Name: Electrical Machine - II

Sr. No	Aim of experiments
1.	To discuss construction of induction motor.
2.	To analyze performance of induction motor using Star – Delta Starter
3.	To analyze performance of induction motor using Direct – Online starter
4.	To examine effect of rotor resistance on the induction motor performance.
5.	To perform load test on 3-phase squirrel cage induction motor.
6.	To perform Brake test on three phase squirrel cage induction motor.
7.	To analyze torque speed characteristics of single phase induction motor.
8.	To examine the resistance split phase method of starting single phase induction motor.
9.	To examine the capacitor run method of starting single phase induction motor.
10.	To examine the capacitor start capacitor run method of starting single phase induction motor.
11.	To Synchronize a two 3 phase Alternator.
12.	To analyze V & Δ Curves of Synchronous Motor.
13.	To perform no load and short circuit test on a three phase alternator.
14.	To evaluate Voltage Regulation Of 3 Phase Alternator By Direct Loading.
15.	To determine the potier reactance and voltage regulation of 3 phase alternator by zero power factor method.