

Subject Code: 1ET4030401	Subject Title: Electrical Machine - II
Pre-Requisite	--

RATIONALE:

Poly-phase (mainly 3 phase) transformers are widely employed in power grids and transmissions lines starting from generating station till the consumer end. Every generating stations uses alternators for electricity generation. Induction motors (As synchronous motors) and Synchronous motors are widely used in industries, farms and domestic applications. It is therefore must for electrical engineers to have knowledge and skills required to operate and maintain 3 phase transformers, induction motors, synchronous motors and alternators. This course attempts to develop these skills into the students.

COURSE OBJECTIVE:

1. Understand about the Three phase Induction motors (Squirrel & Slip-ring)
2. Understand about the Three Phase Transformers
3. Understand about the Different Types of Three Phase motor starters.
4. Familiar with Different Parts of Three phase Induction Motors & Alternators.
5. Understand the concept of Electromagnetic Induction, Fleming's Right & Left Hand rule.
6. Understand about the Different Test Perform on the three phase Transformer
7. Able to Calculate the Different Parameters of Three phase Induction Motor by Circle diagram
8. Understand about the Different parts of Synchronous motor
9. Understand about the Different types of single phase Induction motors
10. Understand the Concept by Calculation on Transformer & Induction motors.

TEACHING AND EVALUATION SCHEME:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)			
Lecture	Tutorial	Practical	Credit	Theory		Practical	
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment
4	-	4	6	60	40	40	60

DETAILS OF COURSE CONTENTS:

Sr. No	Topic and Subtopic	Total Hours	Weightage %
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1	POLY PHASE TRANSFORMERS Comparison of three phase transformer with bank of three single phase transformers, Arrangement of Core and windings in transformer, use of tap changer. Types of losses in transformers. Construction - Accessories of 3 phase transformer: Main tank, bushings, conservator with breather, oil level gauge, radiators, buchholz relay, explosion vent, temperature indicators, junction box Star delta connections and vector groups, Cooling of transformer: Natural cooling, Forced cooling, Parallel operation – Essential and desirable Conditions, Maintenance of different types of transformers	08	15
2	POLY PHASE INDUCTION MOTOR Construction, types - Squirrel cage - Single and double cage, Wound rotor, Working principle with Torque-slip curve, equivalent circuit and phasor diagram, Torque equation, Starting, running and condition for the maximum torque Necessary and types of starters- DOL, Star delta, autotransformer type and rotor resistance starter. No load test and Blocked rotor test, Losses and efficiency, Power stages, Speed control of squirrel cage and slip-ring induction motor, Maintenance of different types of induction motors	16	25
3	ALTERNAOR Principle, working and construction of Alternator, e.m.f. equation, Equivalent circuit and phasor diagram, Voltage regulation by synchronous impedance method, OC, SC characteristics, Synchronization of alternator with bus infinite busbar, Cooling system of alternator, Maintenance of different types of alternators	12	20
4	SYNCHRONOUS MOTOR Principle of working of synchronous motor, starting methods of synchronous motor, Equivalent circuit and phasor diagram, Effect of change in excitation, 'V'- curves, Synchronous condenser, Hunting and its prevention, Difference between synchronous motor & Induction motor, Maintenance of	08	15

	synchronous motors		
5	SINGLE PHASE INDUCTION MOTORS Why single phase I.M. is not self starting, Two field rotating theory, Working of different types of single- phase induction motors, Fractional horse power motors, Speed torque characteristics Maintenance of different types of single phase motors	08	15
6	SPECIAL MACHINES Stepper motor, Brushless DC motor, Schrage motor, Servomotor	04	10

COURSE OUTCOME:

After successful completion of the course, student will be able to

- Know various transformer accessories.
- Know 3 phase induction motor principle and related theories.
- Know alternator and related theories.
- Know synchronous motor and related theories.
- Know 1 phase induction motor and related theories.

LIST OF PRACTICAL:

- 1 To identify different parts of three phase dismantled transformer.
- 2 To Perform the parallel operation of two 3 phase Transformer.
- 3 To perform direct load test on three phase induction motor and find its efficiency at Various load condition.
- 4 To perform no load test and blocked rotor test on three phase induction motor and Construct its circle diagram and find out its various performance parameters.
- 5 To study about different type of three phase Induction Motor Starter.
- 6 To perform direct loading test on alternator and find out voltage regulation of it.
- 7 To find out voltage regulation of alternator by synchronous impedance method for Unity, lagging and leading power factor.
- 8 Find out voltage regulation of alternator by ampere turn method for Unity, lagging and leading power factor.
- 9 To study about Synchronizing of Alternator with Bus-Bar.
- 10 To list & explain various starting methods of synchronous motor & applying one of them to start the synchronous motor.

- 11 Construct V-curves of synchronous motor at different load conditions to see the effect of variation of excitation

LIST OF REFERENCE

1. B.L. Thereja, A text book of Electrical Technology, Volume-II
2. J.B. Gupta, Electrical Machines(AC & DC Machines)