

Ramgarhia Polytechnic College, Phagwara



Electrical Engineering Department

Head of Department:	S. Jasvir Singh
Name of the Faculty:	Er. Vishal Verma
Discipline:	Electrical Engineering Department
Semester:	5 th
Subject:	Electrical Machine -II
Lesson Plan Duration:	16 Weeks










RATIONALE

Electrical machines is a subject where a student will deal with various types of electrical machines which are employed in industries, power stations, domestic and commercial appliances etc. After studying this subject, an electrical diploma holder must be competent to repair and maintain these machines and give suggestions to improve their performance. Explanation of practical aspects of the subject will make the students capable of performing various tests on the machines as per latest BIS specifications

Learning Outcomes

After undergoing this course, the students will be able to:

- CO1. Demonstrate the constructional features of a synchronous machine and its working as a synchronous motor
- CO2. Operate the synchronous motor as synchronous condenser.
- CO3. Use 3- induction motor in the industry for various operations.
- CO4. Operate and maintain three phase squirrel cage and three phase slip using induction motors.
- CO5. Start and reverse the direction of rotation of three phase induction motors using different types of starters.
- CO6. Conduct speed control of three phase induction motor.
- CO7. Operate and maintain double cage induction motors.
- CO8. Recognize the condition of cogging and crawling in three phase induction motors.
- CO9. Operate different types of single phase induction motors.

PO 	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 							
CO1							
CO2							
CO3							
CO4							
CO5							
CO6							

Syllabus

Units	Details	Hours
1.	<p>Induction Motors</p> <p>1.1 Salient constructional features of squirrel cage and slip ring 3-phase induction motors</p> <p>1.2 Principle of operation, slip and its significance</p> <p>1.3 Locking of rotor and stator fields</p> <p>1.4 Rotor resistance, inductance, emf and current</p> <p>1.5 Relationship between copper loss and the motor slip</p> <p>1.6 Power flow diagram of an induction motor</p> <p>1.7 Factors determining the torque</p> <p>1.8 Torque-slip curve, stable and unstable zones</p> <p>1.9 Effect of rotor resistance upon the torque slip relationship</p> <p>1.10 Double cage rotor motor and its applications</p> <p>1.11 Starting of 3-phase induction motors, DOL, star-delta, auto transformer</p> <p>1.12 Causes of low power factor of induction motors</p> <p>1.13 Testing of 3-phase motor on no load and blocked rotor test and to find efficiency</p> <p>1.14 Speed control of induction motor</p> <p>1.15 Harmonics and its effects, cogging and crawling in Induction Motors.</p>	(36 hrs)
2.	<p>Single Phase Induction Motors</p> <p>2.1 Single phase induction motors; Construction characteristics and applications</p> <p>2.2 Nature of field produced in single phase induction motor</p> <p>2.3 Split phase induction motor</p> <p>2.3.1 Capacitors start and run motor</p> <p>2.3.2 Shaded pole motor</p> <p>2.3.3 Reluctance start motor</p> <p>2.4 Alternating current series motor and universal motors</p> <p>2.5 Single phase synchronous motor</p> <p>2.5.1 Reluctance motor</p> <p>2.5.2 Hysteresis motor</p>	(28 hrs)

Reference Books:

1. Electrical Machines by SK Sahdev, Uneek Publications, Jalandhar
2. Electrical Engineering by JB Gupta, SK Kataria and sons, New Delhi
3. Electrical Engineering by GL Marwaha, Eagle prakashan, Jalandhar City
4. Electrical Machines by Nagrath and Kothari, Tata Mc Graw Hill, New Delhi

Delivery/Instructional Methodologies

Sr.No.	Description
1.	Chalk and Talk
2.	PowerPoint Presentation

Assessment Methodologies

Sr. No.	Description	Type
1.	Student Assignment	Direct
2.	Test	Direct
3.	Board Examination	Direct
4.	Student Feedback	Direct

Gaps in the syllabus - to meet industry/profession requirements

S.NO.	DESCRIPTION	PROPOSED ACTIONS	PO MAPPING
	N/A	N/A	N/A

Topics beyond syllabus/advanced topics

Units	Details	Hours
N/A	N/A	N/A

Web Source References

Sr. No.	URL
1.	https://nptel.ac.in/

Lesson Plan

Week	Theory		Practical	
	Lecture Day		Practical Day	
1 st	1 st	Induction Motors	1.	Study of ISI/BIS code for 3-phase induction motors
	2 nd	Salient constructional features of squirrel cage and slip ring 3-phase induction motors		
	3 rd			
	4 th	Principle of operation, slip and its significance		
2 nd	5 th	Locking of rotor and stator fields	2.	Study of ISI/BIS code for 3-phase induction motors
	6 th			
	7 th			
	8 th	Rotor resistance, inductance, emf and current		
3 rd	9 th	Relationship between copper loss and the motor slip	3.	Perform at least two tests on a 3- phase induction motor as per BIS code
	10 th			
	11 th			
	12 th			
4 th	13 th	Power flow diagram of an induction motor	4.	Perform at least two tests on a 3- phase induction motor as per BIS code
	14 th			
	15 th			
	16 th	Factors determining the torque		

5 th	17 th		5.	Determination of efficiency by (a) no load test and blocked rotor test on an induction motor (b) direct loading of an induction motor (refer BIS code)
	18 th	Torque-slip curve, stable and unstable zones		
	19 th			
	20 th	Effect of rotor resistance upon the torque slip relationship		
6 th	21 st		6.	Determination of efficiency by (a) no load test and blocked rotor test on an induction motor (b) direct loading of an induction motor (refer BIS code)
	22 nd			
	23 rd	REVISION		
	24 th	1st Sessional Test (Tentative)		
7 th	25 th	Double cage rotor motor and its applications	7.	Determination of effect of rotor resistance on torque speed curve of an induction motor
	26 th			
	27 th	Starting of 3-phase induction motors, DOL, star-delta, auto transformer		
	28 th			
8 th	29 th	Causes of low power factor of induction motors	8.	Determination of effect of rotor resistance on torque speed curve of an induction motor
	30 th			
	31 st	Testing of 3-phase motor on no load and blocked rotor test and to find efficiency		
	32 nd			
	33 rd			Observe the performance of a

9 th	34 th	Speed control of induction motor	9.	ceiling fan (I-) induction motor) without capacitor	
	35 th	Harmonics and its effects, cogging and crawling in Induction Motors.			
	36 th				
10 th	37 th	Single Phase Induction Motors	10.	Observe the performance of a ceiling fan (I-) induction motor) without capacitor	
	38 th				
	39 th	Single phase induction motors; Construction characteristics and applications			
	40 th				
11 th	41 st	Nature of field produced in single phase induction motor	11.	To observe effect of change in capacitor on the performance of 1-phase induction motor	
	42 nd				
	43 rd				
	44 th				
12 th	45 th	REVISION	12.	To observe effect of change in capacitor on the performance of 1-phase induction motor	
	46 th				
	47 th				PTM
	48 th				2nd Sessional Test (Tentative)
13 th	49 th	Split phase induction motor Introduction	13.	Revision	
	50 th	Capacitors start and run motor			
	51 st	Shaded pole motor			

	52 nd	Reluctance start motor		
14 th	53 rd	Alternating current series motor and universal motors	14	Revision
	54 th			
	55 th			
	56 th	Single phase synchronous motor-introduction		
15 th	57 th	Reluctance motor	15.	Revision
	58 th			
	59 th			
	60 th	Hysteresis motor		
16 th	61 st	PTM	16.	Revision
	62 nd			
	63 rd	REVISION		
	64 th	3 rd Sessional Test (Tentative)		

NBA has defined the following seven POs for an Engineering diploma graduate:

- i) **Basic and Discipline specific knowledge:** Apply knowledge of basic mathematics, science and engineering fundamentals and engineering specialization to solve the engineering problems.
- ii) **Problem analysis:** Identify and analyze well-defined engineering problems using codified standard methods.
- iii) **Design/ development of solutions:** Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs.
- iv) **Engineering Tools, Experimentation and Testing:** Apply modern engineering tools and appropriate technique to conduct standard tests and measurements.
- v) **Engineering practices for society, sustainability and environment:** Apply appropriate technology in context of society, sustainability, environment and ethical practices.
- vi) **Project Management:** Use engineering management principles individually, as a team member or a leader to manage projects and effectively communicate about well-defined engineering activities.
- vii) **Life-long learning:** Ability to analyze individual needs and engage in updating in the context of technological changes.

Program Specific Outcomes (PSOs)

PSOs are a statement that describes what students are expected to know and be able to do in a specialized area of discipline upon graduation from a program. Program may specify 2-4 program specific outcomes, if required.

These are the statements, which are specific to the particular 11 program. They are beyond POs. Program Curriculum and other activities during the program must help in the achievement of PSOs along with POs.