

Kadi Sarva Vishvavidyalaya, Gandhinagar
Bachelor of Engineering (Electrical Engineering Syllabus)
B.E Semester: VIth (EE)
Subject Name & Code: Electrical Machine-III (EE-602)

A. Course Objective:

- To present a problem oriented knowledge of special Electrical Machines.
- To focus on the study of single phase ac electrical motors.
- To address the underlying concepts & methods behind several Electrical Engineering machines.
- To focus on testing of DC machines & Induction machines.

B. Teaching / Examination Scheme

SUBJECT		Teaching Scheme				Total Credit	Evaluation Scheme					Total Marks
		L	T	P	Total		THEORY		IE	CIA	PR. / VIVO	
CODE	NAME	Hrs	Hrs	Hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	
EE-602	Electrical Machine-III	4	0	2	6	5	3	70	30	20	30	150

C. Detailed Syllabus

1. **Single phase A. C. motors:** Introduction, Double field revolving theory, Cross Field theory, Equivalent circuit of 1-phase induction motor, Starting and types of single phase motors: Split phase, Resistance start, Capacitor start Motor, Capacitor start & Capacitor run induction motor, Shaded pole induction motor, Permanent Capacitor Motor, Commutator Motors, Universal Motors, Repulsion Motors, Speed Control Of single phase motor, Starting & running performance of 1-phase induction Motor, Losses and efficiency of single phase induction motor. Fractional horse power motors.
2. **Special Machines:** Schrage Motor, Osno Motor, Phase Advancer, Hysteresis motor, Reluctance motor, Permanent Magnet (PM) synchronous motors, Axial flux PM machines and Doubly salient PM machines. Switched Reluctance Motor: General construction, working and applications. Stepper motor: General construction, working and applications. Induction Regulator, AC & DC Servo motors. Principle of Amplidyne and Metadyne, Electrical Welding Generator, Series Boosters, Dynamotors, Printed Circuit Motors, Brushless DC motors, Synchros.
3. **Testing of Machines :** Testing Of DC Machines: Power Losses & efficiency of DC Machines, Brake Test, Swinburn Test, Hopkinson's Test, Field Test, Retardation Test, Load Test, Heat Run Test, Testing of Induction Motor.
4. **Performance of Induction machine:** Control of Induction motor Starting of induction motor, Various types of automatic starters, Effect Of harmonics, Harmonic Torques, Crawling and Cogging, Speed control of induction motors: Control from stator side, control from rotor side, Testing Of induction Motor as per BIS

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D. Lesson Planning

SR No.	No. of Hours	% Weight age in Exam	Topic
1	04	30	Introduction, Double field revolving theory, Cross Field theory, Equivalent circuit of 1-phase induction motor, Starting and types of single phase motors: Split phase, Resistance start, Capacitor start Motor
2	07		Capacitor start & Capacitor run induction motor. Shaded pole induction motor, Permanent Capacitor Motor, Commutator Motors, Universal Motors, Repulsion Motors.
3	08		Speed Control Of single phase motor, Starting & running performance of 1-phase induction Motor, Losses and efficiency of single phase induction motor. Fractional horse power motors.
4	06	40	Scharge Motor, Osnos Motor, Phase Advansor, Hysteresis motor, Reluctance motor, Permanent Magnet (PM) synchronous motors, Axial flux PM machines and Doubly salient PM machines.
5	08		Switched Reluctance Motor: General construction, working and applications. Stepper motor: General construction, working and applications. Induction Regulator, AC & DC Servo motors.
6	08		Principle of Amplidyne and Metadyne, Electrical Welding Generator, Series Boosters, Dynamotors, Printed Circuit Motors, Brushless DC motors, Synchros.
6	04	30	Testing Of DC Machines: Power Losses & efficiency of DC Machines, Brake Test, Swinburn Test, Hopkinson's Test, Field Test, Retardation Test, Load Test, Heat Run Test. Testing of induction motor.
7	07		Control of Induction Motor: Starting of induction motor, various types of automatic starters, Effect Of harmonics.
8	08		Harmonic Torques, Crawling and Cogging, Speed control of induction motors: Control from stator side, control from rotor side, Testing Of induction Motor as per IS.
TOTAL	60	100%	

E. Instructional Method & Pedagogy

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lecture may be conducted with the aid of multi-media projector, black board, OHP etc. & equal weightage should be given to all topics while teaching and conduction of all examinations.
- Attendance is compulsory in lectures and laboratory, which may carry five marks in overall evaluation.
- One/Two internal exams may be conducted and total/average/best of the same may be converted to equivalent of 30 marks as a part of internal theory evaluation.

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- Assignment based on course content will be given to the student for each unit/topic and will be evaluated at regular interval. It may carry an importance of ten marks in the overall internal evaluation.
- Surprise tests/Quizzes/Seminar/Tutorial may be conducted and having share of five marks in the overall internal evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concept being taught in lectures.
- Experiments shall be performed in the laboratory related to course contents.

Suggested List of Experiments

1. Brake Test on D.C. Shunt Motor.
2. Swinburn Test on D.C. Shunt Generator.
3. Hopkinson's Test on D.C. Shunt Machine.
4. Field Test on D.C. Series Machine.
5. Retardation Test on Series Motor.
6. Hysteresis Motor&it's applications.
7. Permanent Magnet (PM) synchronous motor &it's applications.
8. Switched Reluctance Motor&it's applications.
9. Stepper motor & it's applications..
10. Testing of induction machine.

F. Students Learning Outcomes

- The student can be acquired the basic knowledge of special electrical machines thus being prepared to pursue any area of engineering spectrum in depth as desired.
- The students will be able to effectively employ electrical systems and lead the exploration of new applications and techniques for their use.

G. Recommended Study Materials

• **Text &Reference Books:**

- 1. Electrical Machines. by Nagarath &Kothari, TMH Publications
- 2. Electrical Technology Vol II. B. L. Theraja ,S .Chand Publications
- 3. Performance and Design of A.C. machines by M. G. Say
- 4. Electrical Machines by P S Bhimbra
- 5. Electrical Machines by J. B. Gupta, Kataria Pub
- 6. Electrical Machines by S K Bhattacharya, TMH Pub.