ELECTRIC MOTORS (Core Subject)
B.E., IV Semester, Electrical and Electronics Engineering [As per Choice Based Credit System (CBCS) scheme]

Course Code	17EE44	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50	Exam Hours	03

Credits - 04

Course Objectives:

- To study the constructional features of Motors and select a suitable drive for specific application.
- To study the constructional features of Three Phase and Single phase induction Motors.
- To study different test to be conducted for the assessment of the performance characteristics of motors.
- To study the speed control of motor by a different methods.
- Explain the construction and operation of Synchronous motor and special motors.

Module-1	**Teaching Hours**
DC Motors: Classification, Back emf, Torque equation, and significance of back emf, Characteristics of shunt, series & compound motors. Speed control of shunt, series and compound motors. Application of motors. DC motor starters – 3 point and 4 point. **Losses and efficiency-** Losses in DC motors, power flow diagram, efficiency, condition for maximum efficiency. ■	**10**
Revised Bloom's Taxonomy Level: L_1 – Remembering, L_2 – Understanding, L_3 – Applying.	
Module-2	
Testing of dc motors: Direct & indirect methods of testing of DC motors-Brake test, Swinburne's test, Retardation test, Hopkinson's test, Field's test, merits and demerits of tests. **Three phase Induction motors: Review of** concept and generation of rotating magnetic field, Principle of operation, construction, classification and types; squirrel-cage, slip-ring (No question shall be set from the review portion). Slip, Torque equation, torque-slip characteristic covering motoring, generating and braking regions of operation, Maximum torque, significance ofslip**.** ■	**10**
Revised Bloom's Taxonomy Level: L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing.	
Module-3	
Performance of three-phase Induction Motor: Phasor diagram of induction motor on no-load and on load, equivalent circuit, losses, efficiency, No-load and blocked rotor tests. Performance of the motor from the circle diagram and equivalent circuit. Cogging and crawling. High torque rotors-double cage and deep rotor bars. Equivalent circuit and performance evaluation of double cage induction motor. Induction motor working as induction generator; standalone operation and grid connected operation**.** ■	**10**
Revised Bloom's Taxonomy Level: L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing.	
Module-4	
Starting and speed Control of Three-phase Induction Motors: Need for starter. Direct on line, Star-Delta and autotransformer starting. Rotor resistance starting. Speed control by voltage, frequency, and rotor resistance methods **Single-phase Induction Motor:** Double revolving field theory and principle of operation. Construction and operation of split-phase, capacitor start, capacitor run, and shaded pole motors. Comparison of single phase motors and applications. ■	**10**
Revised Bloom's Taxonomy Level: L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing.	
Module-5	
Synchronous motor: Principle of operation, phasor diagrams, torque and torque angle, Blondel diagram, effect of change in load, effect of change in excitation, V and inverted V curves.	**10**

Synchronous condenser, hunting and damping. Methods of starting synchronous motors.	

B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE)
CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER -IV

17EE44 ELECTRIC MOTORS (Core Subject) (continued)

Module-5 (continued)		**Teaching Hours**
Other motors: Construction and operation of Universal motor, AC servomotor, Linear induction motor and stepper motors.		
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing.	

Course Outcomes:

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

- Explain the constructional features of Motors and select a suitable drive for specific application.
- Analyze and assess the performance characteristics of DC motors by conducting suitable tests and control the speed by suitable method.
- Explain the constructional features of Three Phase and Single phase induction Motors and assess their performance.
- Control the speed of induction motor by a suitable method.
- Explain the operation of Synchronous motor and special motors.

Graduate Attributes (As per NBA)

Engineering Knowledge,Problem Analysis,Conduct investigations of complex Problems.

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 16 marks.
- There will be 2full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1	Electric Machines	D. P. Kothari, I. J. Nagrath	McGraw Hill	4th edition, 2011
2	Theory of Alternating Current Machines	Alexander Langsdorf	McGraw Hill	2nd Edition, 2001

Reference Books:

3	Electrical Machines, Drives and Power systems	Theodore Wildi	Pearson	6th Edition, 2014
4	Electrical Machines	M.V. Deshpande	PHI Learning	2013
5	Electric Machinery and Transformers	Bhag S Guru at el	Oxford University Press	3rd Edition, 2012
6	Electric Machinery and Transformers	Irving Kosow	Pearson	2rd Edition, 2012
7	Principles of Electric Machines and power Electronics	P.C.Sen	Wiley	2nd Edition, 2013
8	Electric Machines	R.K. Srivastava	Cengage Learning	2nd Edition,2013