# SCHEME OF COURSE WORK

**Course Details:**

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| **Course Title** | **: Special Electrical Machines For Industrial Applications** | | |
| **Course Code** | **:15EE1141** | **L T P C** | **: 3 0 0 3** |
| **Program:** | **: B. Tech.** | | |
| **Specialization:** | **Information Technology** | | |
| **Semester** | **: VIII SEM** | | |
| **Prerequisites** | **:** Knowledge of Mathematics, Electric Networks and Electrical Machines. | | |
| **Courses to which it is a prerequisite** | **: --------** | | |

**Course Outcomes (COs): At the end of the course students will be able to:**

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| 1 | Evaluate the Performance of Stepper Motor. |
| 2 | Evaluate the Performance of Switched Reluctance Motor. |
| 3 | Evaluate the Performance of Permanents Magnet Brushless DC Motor. |
| 4 | Evaluate the Performance of Permanents Magnet Synchronous Motors. |
| 5 | Evaluate the Performance of Servo Motor |

**Program Outcomes (POs): The graduate of Electrical and Electronics Engineering will be able to:**

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| 1 | Apply the knowledge of basic sciences and electrical and electronics engineering fundamentals to solve the problems of power systems and drives. |
| 2 | Analyze power systems that efficiently generate, transmit and distribute electrical power in the context of present Information and Communications Technology. |
| 3 | Design and develop electrical machines and associated controls with due considerations to societal and environmental issues. |
| 4 | Design and conduct experiments, analyze and interpret experimental data for performance analysis. |
| 5 | Apply appropriate simulation tools for modeling and evaluation of electrical systems. |
| 6 | Apply the electrical engineering knowledge to assess the health and safety issues and their consequences. |
| 7 | Demonstrate electrical engineering principles for creating solutions for sustainable development. |
| 8 | Develop a techno ethical personality that help to serve the people in general and Electrical and Electronics Engineering in particular. |
| 9 | Develop leadership skills and work effectively in a team to achieve project objectives. |
| 10 | Communicate effectively in both verbal and written form. |
| 11 | Understand the principles of management and finance to manage project in multi disciplinary environments. |
| 12 | Pursue life-long learning as a means of enhancing the knowledge and skills. |

**Course Outcome** versus **Program Outcomes:**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO-1** | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 2 | | | | | | | |
| **CO-2** | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 2 | | | | | | | |
| **CO-3** | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 2 | | | | | | | |
| **CO-4** | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 2 | | | | | | | |
| **CO-5** | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 2 | | | | | | | |

*S* - Strongly correlated, *M* - *Moderately* correlated, *Blank* - *No correlation*

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| **Assessment Methods:** | Assignment / Quiz / Seminar / Case Study / Mid-Test / End Exam |

# Teaching-Learning and Evaluation



| Week | TOPIC / CONTENTS | Course Outcomes | Sample questions | TEACHING-LEARNING STRATEGY | Assessment Method & Schedule |
|---|---|---|---|---|---|
| 1 | **Unit-I Stepper Motors**<br>Stepper motor Constructional features, Principle of operation. | CO1 | 1. Explain the constructional details and working of stepper motor with neat sketch. | ▫ Lecture<br>▫ Discussion<br>▫ Problem Solving | Mid-Test 1 (Week 8)<br>Seminar (Week 1) |
| 2 | Special features of stepper motors, Variable reluctance, Permanent magnet stepping motor. | CO1 | 1. Explain the different types of stepper motor? | ▫ Lecture<br>▫ Discussion<br>▫ Problem solving | Mid-Test 1 (Week 8)<br>Seminar (Week 2) |
| 3 | Torque versus stepping rate characteristics. | CO1 | 1. Explain the torque and speed characteristics of stepper motor? | ▫ Lecture<br>▫ Discussion<br>▫ Problem solving | Mid-Test 1 (Week 8)<br>Seminar (Week 3) |
| 4 | **Unit-II Switched Reluctance Motors**<br>Switched Reluctance Motor Constructional features. | CO2 | 1. Explain the constructional details and working of switched reluctance motor with neat sketch. | ▫ Lecture<br>▫ Discussion<br>▫ Problem Solving | Mid-Test 1 (Week 8)<br>Seminar (Week 4) |
| 5 | Principle of operation, Torque equation, Characteristics. | CO2 | 1. Derive the expression for torque of the switched reluctance motor?<br>2. Explain the performance characteristics of switched reluctance motor? | ▫ Lecture<br>▫ Discussion<br>▫ Problem Solving | Mid-Test 1 (Week 8)<br>Seminar (Week 5) |
| 6 | Control Techniques, and Drive Concept | CO2 | 1. Explain the basic drive concept of switched reluctance motor?<br>2. Explain different control strategies of switched reluctance motor? | ▫ Lecture<br>▫ Discussion<br>▫ Problem Solving | Mid-Test 1 (Week 8)<br>Seminar (Week 6) |
| 7 | **Unit-III Permanent Magnet Brushless Dc (PMBLDC) Motors**<br>Commutation in DC motors, Difference between mechanical and electronic Commutators. | CO3 | 1. Distinguish between the mechanical and electronic Commutators. | ▫ Lecture<br>▫ Discussion<br>▫ Problem Solving | Mid-Test 1 (Week 8)<br>Seminar (Week-7 ) |
| **8** | | | **UNIT I, II AND HALF PAT IN III.** | | |
| 9 | Torque and emf equation, Rotor position sensors. | CO3 | 1. Derive the Torque and emf equations of the PMBL DC Motor?<br>2. What are the different types of Rotor position sensors and explain? | ▫ Lecture<br>▫ Discussion<br>▫ Problem solving | Mid-Test (Week 17)<br>Seminar (Week-9 ) |
| 10 | Multiphase Brushless motor, Square wave permanent magnet brushless motor drives. | CO3 | 1. Explain the different types of PM brushes less DC motors?<br>2. Explain the concept of square wave PM brushless motor drive? | ▫ Lecture<br>▫ Discussion<br>▫ Problem Solving | Mid-Test (Week 17)<br>Seminar (Week-10) |
| 11 | Torque-speed characteristics. | CO3 | 1. Explain the torque and speed characteristics of PMBL DC motor? | ▫ Lecture<br>▫ Discussion<br>Problem Solving | Mid-Test (Week 17)<br>Seminar (Week-11) |
| 12 | **Unit-IV Permanent Magnet Synchronous Motors(PMSM)**<br>Principle of operation, EMF, power input and torque expressions, | CO4 | 1. Explain the principle of operation of PMSM?<br>2. Derive the emf and Torque equations of PMSM? | ▫ Lecture<br>▫ Discussion<br>▫ Problem solving | Mid-Test (Week 17)<br>Seminar (Week-17) |

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| 13 | Phasor diagram, Power Controllers, Torque speed characteristics. | CO4 | 1. Draw and explain the Phasor diagram of PMSM?<br>2. Explain the different types of power controllers for PMSM?<br>3. Draw and explain the Torque and speed characteristics of PMSM? | ▫ Lecture<br>▫ Discussion<br>▫ Problem Solving | Mid-Test (Week 17)<br>Seminar (Week-13 ) |
| 14 | **UNIT-V SERVOMOTORS**<br>Servomotor, Constructional features, Principle of Operation, | CO5 | 1. Explain the constructional details and working principle of servomotors with neat sketch?<br>2. What are the special features of the servo motors? | ▫ Lecture<br>▫ Discussion<br>▫ Problem Solving | Mid-Test (Week 17)<br>Seminar (Week-14 ) |
| 15 | Types, Characteristics, Control strategies. | CO5 | 1. What are the different types of servo motor and explain?<br>2. Draw and explain the performance characteristics of servomotor? | ▫ Lecture<br>▫ Discussion<br>▫ Problem Solving | Mid-Test (Week 17)<br>Seminar (Week-15) |
| 16 | AC tachometers Operating principle, Schematic diagram. | CO5 | 1. Explain the construction and working principle of AC tachometer with neat sketch? | ▫ Lecture<br>▫ Discussion<br>▫ Problem Solving | Mid-Test (Week 17)<br>Seminar (Week-16) |
| 17. | **Mid-Test 2** | | **HALF PART III UNIT, IV, V UNITS.** | | |
| 18. | **Preparation and Practical Examination** | | | | |
| 19,20 | **END EXAM** | | **UNIT I, II, III, IV, V.** | | Assessment will be on all topics at END EXAM |