Course Code	EEE			
Course Category	Professional Core			
Course Title	Electrical Machines - II			
Weekly Teaching Hrs. and Credits	L	T	Laboratory	Credits
	3	0	2	3 + 0 + 1

Pre-requisites: Basics of electrical machines.

Course Objectives:

1. To understand basics of synchronous machine.
2. To study the construction, working principle and operation of special purpose motors.
3. To analyze the performance of the machines.
4. To design transformer for specific rating.

Course Outcomes: After completion of this course students will be able to

1. Describe fundamental principles and classification of synchronous machine (CL-I).
2. Explain various special purpose motors and its applications (CL-II).
3. Understand the design concepts with specification (CL-II).
4. Determine the performance parameters of transformer (CL-IV).

Course Contents:

Synchronous generator: Details of synchronous machines, emf equation and winding factors, armature reaction and effect of power factor on load angle, determination of voltage regulation – EMF, MMF and ZPF method, parallel operation of alternators.

Synchronous motor: Principle of operation, power flow, equivalent circuit, synchronous motor with different excitation, effect of changing excitation on constant load and effect of increased load with constant excitation, V and inverted V curves, starting methods, hunting effect.

Special motors-I: Linear induction motor: Construction, working, principle and its applications. Servo motor: construction, working and applications. Steeper motor: construction, working of permanent magnet, variable reluctance and hybrid steeper motor.

Special motors-II: Brushless dc motor**:** construction, principle, working, torque speed characteristics and concept of electronic commutation. Switch reluctance motor: Construction, principle, operation, power flow, effects of saturation, performance and torque speed characteristics.

Introduction to machine design: Design factors, limitations in design, modern trends in design, manufacturing techniques. Transformer design: choice of specific loadings, expression for volts/turn, core design, windings design. Design of tank and cooling tubes.

Laboratory Exercises / Practical:

1. Regulation of alternator by direct loading.

2. Regulation of alternator by EMF and MMF method.
3. Determination of X_d and X_q of a salient pole synchronous machine from slip test.
4. Synchronization of alternators using lamp and synchroscope method.
5. Load test on three phase synchronous motor.
6. V curve and inverted V curve of a 3-phase synchronous motor.
7. Performance characteristics of brushless dc motor.
8. Study and testing of switch reluctance motor using MATLAB.
9. Study and testing of stepper motor using MATLAB.
10. Transformer design using FEM method.

Learning Resources:

Text Books:

1. Kothari D.P., and Nagrath I.J., *Electrical Machines*. New Delhi: Tata McGraw Hill Education India Private Limited, 3rd edition, 2004.
2. Venkataratnam. K., *Special Electric Machines.* Boca Raton: CRC Press,4th edition, 2015

Reference Books:

1. T.J.E. Miller, *Brushless Permanent magnet and Reluctance Motor Drives*. Oxford: Clarendon press, Oxford 4th edition, 2016.
2. Fitzgerald A.E, Kingsley C., Umans, S. and Umans S.D., *Electric Machinery*, New York: McGraw Hill, 4th edition, 2016.

Pedagogy:

- Power Point Presentations, Videos
- Co-teaching
- Group Activities

Assessment Scheme:

Class Continuous Assessment (CCA) (60 Marks)

Assignments	Midterm Exam	Class Test	Students Initiatives
20	20	15	5

Laboratory Continuous Assessment (LCA) (50 Marks)

Understanding the Objectives	Understanding of Procedure and Initiatives	Experimental Skills	Oral
5	10	10	25

Term End Examination:

Term end exam of 40 Marks will be based on entire syllabus.

Course Code	EEE2006B			
Course Category	Professional Core			
Course Title	Electrical Machines - II			
Weekly Teaching Hrs. and Credits	L	T	Laboratory	Credits
	3	0	2	3 + 0 + 1

Pre-requisites: Basics of electrical machines.

Course Objectives:

1. To understand basics of synchronous machine.
2. To study the construction, working principle and operation of special purpose motors.
3. To analyze the performance of the machines.
4. To design transformer for specific rating.

Course Outcomes: After completion of this course students will be able to

1. Describe fundamental principles and classification of synchronous machine (CL-I).
2. Explain various special purpose motors and its applications (CL-II).
3. Understand the design concepts with specification (CL-II).
4. Determine the performance parameters of transformer (CL-IV).

Course Contents:

Synchronous generator: Details of synchronous machines, emf equation and winding factors, armature reaction and effect of power factor on load angle, determination of voltage regulation – EMF, MMF and ZPF method, parallel operation of alternators.

Synchronous motor: Principle of operation, power flow, equivalent circuit, synchronous motor with different excitation, effect of changing excitation on constant load and effect of increased load with constant excitation, V and inverted V curves, starting methods, hunting effect.

Special motors-I: Linear induction motor: Construction, working, principle and its applications. Servo motor: construction, working and applications. Steeper motor: construction, working of permanent magnet, variable reluctance and hybrid steeper motor.

Special motors-II: Brushless dc motor**:** construction, principle, working, torque speed characteristics and concept of electronic commutation. Switch reluctance motor: Construction, principle, operation, power flow, effects of saturation, performance and torque speed characteristics.

Introduction to machine design: Design factors, limitations in design, modern trends in design, manufacturing techniques. Transformer design: choice of specific loadings, expression for volts/turn, core design, windings design. Design of tank and cooling tubes.

Laboratory Exercises / Practical:

1. Regulation of alternator by direct loading.
2. Regulation of alternator by EMF and MMF method.
3. Determination of X_d and X_q of a salient pole synchronous machine from slip test.
4. Synchronization of alternators using lamp and synchroscope method.
5. Load test on three phase synchronous motor.
6. V curve and inverted V curve of a 3-phase synchronous motor.

7. Performance characteristics of brushless dc motor.
8. Study and testing of switch reluctance motor using MATLAB.
9. Study and testing of stepper motor using MATLAB.
10. Transformer design using FEM method.

Learning Resources:

Text Books:

1. Kothari D.P., and Nagrath I.J., *Electrical Machines*. New Delhi: Tata McGraw Hill Education India Private Limited, 3rd edition, 2004.
2. Venkataratnam. K., *Special Electric Machines*. Boca Raton: CRC Press,4th edition, 2015

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1. T.J.E. Miller, *Brushless Permanent magnet and Reluctance Motor Drives*. Oxford: Clarendon press, Oxford 4th edition, 2016.
2. Fitzgerald A.E, Kingsley C., Umans, S. and Umans S.D., *Electric Machinery*, New York: McGraw Hill, 4th edition, 2016.

Pedagogy:

- Power Point Presentations, Videos
- Co-teaching
- Group Activities

Assessment Scheme:

Class Continuous Assessment (CCA) (30 Marks)

Assignments	Midterm Exam	Class Test	Students Initiatives
10	15	5	Nil

Laboratory Continuous Assessment (LCA) (30 Marks)

Understanding the Objectives	Understanding of Procedure and Initiatives	Experimental Skills	Oral
5	5	5	15

Term End Examination:

Term end exam of 40 Marks will be based on entire syllabus.

Course Category	**PR**			
Course Title	**Internship**			
Teaching Scheme and Credits	**L**	**T**	**Laboratory**	**Credits**
Weekly load hrs	**0**	**0**	**12**	**0 + 0 + 6**

Course Objectives:

1. To get Industry exposure in the techno-managerial field.
2. To understand the real-life constraints and situation in the industrial scenario.
3. To know the industry standards, practices and techniques.

Course Outcomes: After completion of internship, students will

1. Understand the industry processes and working conditions.
2. Adapt the professionalism and ethics.
3. Develop skills to work in a team and produce output in a limited timeframe.

Course Contents:

Internship: Every student has to undergo internship in an industrial environment or organizations in order to get acquaintance of real-life scenarios and situations. The students should correlate the theoretical and practical studies undertaken in the university with the knowledge they have gained during internship. At the end of the semester, a detailed internship report is to be submitted in professional manner to the university.

Assessment Scheme:

Laboratory Continuous Assessment (LCA) (200 Marks)

Internship Report	Presentation
100	100

https://youtu.be/7sYV3KypcKY -synchronous v curves experiment