NIRMA UNIVERSITY

Institute:	**Institute of Technology**
Name of Programme:	**M. Tech. in Electrical Engineering (Electric Vehicular Technology)**
Semester:	**II**
Course Code:	**3EE32D12**
Course Title:	**Design of Advanced Electric Motors**
Course Type:	(□ Core/ □ Value Added Course / **√ Department Elective** / □ Institute Elective/ □ University Elective/ □ Open Elective / □ Any other)
Year of Introduction:	**2022 – 23**

L	T	Practical component				C
		LPW	PW	W	S	
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Course Learning Outcomes (CLOs):

At the end of the course, the students will be able to -

1. understand and apply design aspects of advanced electrical motors **(BL3)**
2. select appropriate materials for design of advanced electrical motors **(BL5)**
3. design advanced electrical motors **(BL6)**
4. estimate and analyze performance of advanced electrical motors **(BL4)**

Syllabus: Teaching Hours: 30

UNIT-1: Permanent Magnet Brushless Motor Design **18**

General introduction, review of basic equations of Back emf & torque, sizing rules, design constraints, selection of design variables, calculation of main dimensions, stator design, selection of air-gap length, selection of permanent magnet materials, rotor design, performance estimation based on design details, application of superior magnetic materials, design modification for performance improvement, concept of FE analysis, magnetostatics and time varying load in motor design, case studies.

UNIT-2: Switched Reluctance Motor Design **12**

General introduction, review of basic equations of inductances & inductance profile, design considerations, selection of design variables, sizing rules, calculation of main dimensions, stator design, selection of air-gap length, rotor design, performance prediction based on design details, performance improvement with design modifications, case studies.

Self-Study:

Around 10% of the questions will be asked from self study contents.

Laboratory Work:

This shall consist of minimum 8 design/simulation exercises based on the above syllabus.

Suggested Readings:

1. Miller T. J. E., Brushless Permanent Magnet and Reluctance Motor Drives, Clarendon Press
2. D. C. Hanselman, Brushless Permanent Magnet Motor Design, McGraw Hill.
3. J.R.Hendershot, Design of Brushless Permanent Magnet Motors, Magna Physics Publications
4. R. Krishnan, Permanent Magnet Synchronous and Brushless DC Motor Drives, CRC Press
5. R. Krishnan, Switched Reluctance Motor Drives, CRC Press
6. Recent papers from reputed journals.

Suggested List of Experiments (not restricted to the following):
(Only for Information)

1. Sizing of permanent magnet brushless motor.
2. To estimate performance of permanent magnet brushless motor based on design details.
3. To validate design of permanent magnet brushless motor design with simulation exercise (04 hours).
4. To analyze effect of pole shaping on back emf profile of permanent magnet brushless motor.
5. Sizing of switched reluctance motor (04 hours).
6. To estimate performance of switched reluctance motor based on design details.
7. To validate design of switched reluctance motor design with simulation exercise (04 hours).
8. To analyze effect of rotor pole arc variation on torque profile of switched reluctance motor.
9. To perform FE analysis for permanent magnet brushless motor and validate the performance and design aspects of motor (04 hours).

L = Lecture, T = Tutorial, P = Practical, C = Credit

w.e.f. academic year 2022 - 23 and onwards