NIRMA UNIVERSITY

Institute:	**Institute of Technology**
Name of Programme:	**M. Tech. in Electrical Engineering (Electric Vehicular Technology)**
Semester:	**I**
Course Code:	**6EE101**
Course Title:	**Electric Motors for Vehicle Propulsion**
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**	
3	**0**	**2**	**-**	**-**	**-**	**4**

Course Learning Outcomes (CLOs):

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

1. distinguish constructional and operational aspects of electric motors for vehicle propulsion **(BL2)**
2. analyze characteristics and performance of electric motors for vehicle propulsion **(BL4)**
3. examine properties and characteristics of permanent magnet materials **(BL4)**
4. select appropriate machines based on application requirement **(BL5)**

Syllabus: Teaching Hours: 45

Unit-1: Conventional Electric Motors **07**

DC Motors-construction and operating principle, back emf and types, characteristics, speed control, Three Phase Induction Motors- construction and operating principle, features, concept of slip, torque-speed characteristics, factors affecting motor selection-rating, sizing, duty etc.

Unit-2: Permanent Magnet Brushless Motors **20**

Construction, operating principle & features of permanent magnet brushless (PMBL) motors, types of permanent magnets and properties, effect of temperature on properties of permanent magnets, handling of permanent magnets, types of PMBL motors, magnetic equivalent circuit, derivation of emf and torque equation, types of emf generated, performance characteristics, control of PMBL motors, sources of vibration, factors affecting vibration and its reduction, advancements in topologies & reviews, factors affecting selection, case studies- motor with built-in automatic transmission.

Unit-3: Switched Reluctance Motors **12**

Construction, operating principle and features of switched reluctance motors (SRM), equivalent magnetic circuit, inductance profile, derivation of torque equation and factors affecting torque, selection of pole arcs, performance characteristics, control of SRM, torque ripple and its origin, factors affecting torque ripple, reduction of torque ripple, advancements in topologies & reviews, factors affecting selection, case studies.

Unit-4: Synchronous Reluctance Motors **06**

Construction, operating principle, features, equivalent circuit, vector diagram, topological advancements, case studies.

Self-Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Suggested Readings:

1. E. Fitzgerald, Electric Machinery, TMH Publications
2. P. S. Bhimbra, Electrical Machinery, Dhanpatrai Publishers
3. Miller T. J. E., Brushless Permanent Magnet and Reluctance Motor Drives, Clarendon Press
4. R. Krishnan, Permanent Magnet Synchronous and Brushless DC Motor Drives, CRC Press
5. R. Krishnan, Switched Reluctance Motor Drives, CRC Press
6. Venkatratnam K., Special Electric Machines, CRC Press.
7. Boldea I. and Tutelea L., Reluctance Electric Machines, CRC Press.
8. T. A. Lipo , Analysis of Synchronous Machine by, Taylor & Francis
9. Recent papers from reputed journals.

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

1. To perform and analyze speed control techniques of dc shunt motor.
2. To perform variable frequency control of three phase induction motor.
3. To analyze magnetic circuit of permanent magnet brushless motor.
4. To control the speed of permanent magnet brushless motor (04 hours).
5. To obtain and analyze back emf waveform of permanent magnet brushless motor (04 hours).
6. Demonstration and comparison of radial flux PMBL motor and axial flux PMBL motor.
7. To control speed of permanent magnet dc motor.
8. To analyze magnetic circuit of switched reluctance motor (04 hours).
9. To obtain inductance profile of switched reluctance motor.
10. To verify bidirectional control of variable reluctance motor drive (04 hours).

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