INSTITUTE	**FACULTY OF TECHNOLOGY**
PROGRAM	**MASTER OF TECHNOLOGY in ELECTRICAL ENGINEERING**
SEMESTER	**2**
COURSE TITLE	**SPECIAL MACHINES FOR ELECTRIC VEHICLES**
COURSE CODE	**01EV1207**
COURSE CREDITS	**4**

Objective:

1 The objective of the course is to explore different machines for electric propulsion system of electric vehicle.

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

1 Differentiate among different special machines for electric vehicle application
2 Evaluate the performance of special machines for EVs
3 Determine the special machine and their drive requirement for EV application
4 Analyze the performance of multiphase machine for EVs

Pre-requisite of course: Electrical Machines

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	2	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
1	**Permanent Magnet (PM) Brushless Motor Drives** Structure of PM Brushless Machines, Principle of PM Brushless Machines, Modeling of PM Brushless Machines, Inverters for PM Brushless Motors Motor Control,, Design Criteria of PM Brushless Motor Drives for EVs,, Design Examples of PM Brushless Motor Drives for EVs,, Application, Advantages and Limitations for EVs.	6
2	**Switched ReluctanceMotor drive:** Structure of SR Machines, Principle of SR Machines,, SR Converters Topologies, SR Motor Control,, Design Criteria of SR Motor Drives for EVs,, Examples of SR Motor Drives for EVs,, Application, Advantages and Limitations for EVs.	8

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Contents : Unit	Topics	Contact Hours
3	**Stator-PM Motor Drives** Doubly-Salient PM Motor Drives, Flux-Reversal PM Motor Drives,, Flux-Switching PM Motor Drives,, Hybrid-Excited PM Motor Drives, Flux-Mnemonic PM Motor Drives, Design Criteria of Stator-PM Motor Drives for EVs,, Application, Advantages and Limitations for EVs.	10
4	**Magnetic-Geared Motor Drives** Principle of MG Machines, Modeling of MG Machines,, Inverters for MG Motors, MG Motor Control,, Design Criteria of MG Motor Drives for EVs,, Application, Advantages and Limitations for EVs	6
5	**Advanced Magnetless Motor Drives** Introduction of Advanced Magnetless technology, Synchronous Reluctance Motor Drives, Doubly-Salient, DC Motor Drives, Flux-Switching DC Motor Drives,, Design Criteria of Advanced Magnetless Motor Drives for EVs,, Application, Advantages and Limitations for EVs.	6
6	**Multiphase Motor Drives** Multiphase Induction Motor drives – principle, operation and control,, Multiphase PMSM machine – principle, operation and control,, Fault tolerant operation of multiphase drives	6
Total Hours		**42**

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	**Experiment No. 01** Switched Reluctance Motor design simulation using COMSOL multiphysiscs.	4
2	**Experiment No. 02** Switched Reluctance Motor design simulation using ANSYS Maxwell	4
3	**Experiment No. 03** Switched Reluctance Motor Speed Control Simulation using MATLAB	4
4	**Experiment No. 04** Calculation of Design parameters of PM Brushless Motor Drives for EVs	4
5	**Experiment No. 05** Permanent Magnet Synchronous Motor Drive Simulink Simulation (PMSM control) FOC method	4
6	**Experiment No. 06** Permanent Magnet DC (PMDC) Motor design and simulation using ANSYS Maxwell (RMXprt) Software	4

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Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
7	**Experiment No. 07** Calculation of Design parameters of Stator-PM Motor Drives for EVs	4
Total Hours		**28**

Textbook :

1 Modern Electric, Hybrid Electric and Fuel cell vehicles: Fundamentals, Theory and Design, Mehrdad Ehsani, Yimin Gao, Sebatien Gay and Ali Emadi, CRC Press, 2004

2 Electric Vehicle Technology – Explained, James Larminie and John Loury,, John Wiley & Sons Ltd, 2003

3 Electric and Hybrid – Electric Vehicles, Ronald K Jurgen, SAE, 2002

4 Light Weight Electric/Hybrid Vehicle Design, Ron Hodkinson and John Fenton, Butterworth – Heinemann, 2001

5 Electric and Hybrid Vehicles- Design Fundamentals, Iqbal Husain, CRC Press, 2011

References:

1 Electric Vehicle Battery Systems, Electric Vehicle Battery Systems, Sandeep Dhameja, Butterworth – Heinemann, 2002

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember / Knowledge	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Higher order Thinking / Creative**
5.00	10.00	15.00	30.00	20.00	20.00

Instructional Method:

1 The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc

2 The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and classroom.

3 Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

4 Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory

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Supplementary Resources:

1 https://www.mdpi.com/journal/machines/special_issues/KU5426H041

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