

22EEHO305		TESTING OF ELECTRIC VEHICLES		SEMESTER			
PREREQUISITES		CATEGORY		PEC	Credit		C
Electrical Machines and Power Electronics		Hours/Week		L	T	P	TH
				3	0	0	3
Course Objectives:							
1.	To know various standardization procedures						
2.	To learn the testing procedures for EV & HEV components						
3.	To know the functional safety and EMC						
4.	To realize the effect of EMC in EVs						
5.	To study the effect of EMI in motor drives and in DC-DC converter system						
UNIT I	EV STANDARDIZATION			9	0	0	9
Introduction - Current status of standardization of electric vehicles, electric Vehicles and Standardization - Standardization Bodies Active in the Field – Standardization activities in countries like Japan. The International Electro Technical Commission - Standardization of Vehicle Components.							
UNIT II	TESTING OF ELECTRIC MOTORS AND CONTROLLERS FOR ELECTRIC AND HYBRID ELECTRIC VEHICLES			9	0	0	9
Test Procedure Using M-G Set, electric motor, controller, application of Test Procedure, Analysis of Test Items for the Type Test - Motor Test and Controller Test (Controller Only). - Test Procedure Using Eddy Current Type Engine Dynamometer, Test Strategy, Test Procedure, Discussion on Test Procedure. Test Procedure Using AC Dynamometer.							
UNIT III	FUNDAMENTALS OF FUNCTIONAL SAFETY AND EMC			9	0	0	9
Functional safety life cycle - Fault tree analysis - Hazard and risk assessment – software development - Process models - Development assessments - Configuration management - Reliability - Reliability block diagrams and redundancy - Functional safety and EMC - Functional safety and quality - Standards - Functional safety of autonomous vehicles.							
UNIT IV	EMC IN ELECTRIC VEHICLES			9	0	0	9
Introduction - EMC Problems of EVs, EMC Problems of Motor Drive, EMC Problems of DC-DC Converter System, EMC Problems of Wireless Charging System, EMC Problem of Vehicle Controller, EMC Problems of Battery Management System, Vehicle EMC Requirements.							
UNIT V	EMI IN MOTOR DRIVE AND DC-DC CONVERTER SYSTEM			9	0	0	9
Overview -EMI Mechanism of Motor Drive System, Conducted Emission Test of Motor Drive System, IGBT EMI Source, EMI Coupling Path, EMI Modelling of Motor Drive System. EMI in DC-DC Converter, EMI Source, The Conducted Emission High-Frequency, Equivalent Circuit of DC-DC Converter System, EMI Coupling Path							
Total (45L+0T) = 45 Periods							

Reference Books:	
1.	Handbook of Automotive Power Electronics and Motor Drives, Ali Emadi, Taylor & Francis, 2005, 1 st Edition.
2.	Electromagnetic Compatibility of Electric Vehicle, Li Zhai, Springer 2021, 1 st Edition.
3.	EMC and Functional Safety of Automotive Electronics, Kai Borgeest, IET 2018, 1 st Edition.
4.	EMI/EMC Computational Modeling Handbook, Druce Archambeault, Colin Branch, Omar M. Ramachi, Springer 2012, 2 nd Edition.
5.	Automotive EMC, Mark Steffika, Springer 2013, 1 st Edition.
6.	Electric Vehicle Systems Architecture and Standardization Needs, Reports of the PPP European Green Vehicles Initiative, Beate Müller, Gereon Meyer, Springer 2015, 1 st Edition.

Course Outcomes:			Bloom's Taxonomy Mapped
Upon completion of this course, the students will be able to:			
CO1	:	To describe the status and other details of standardization of EVs	L1: Remembering
CO2	:	To illustrate the testing protocols for EVs and HEV components	L2: Understanding
CO3	:	To analyze the safety cycle and need for functional safety for EV	L4: Analyzing
CO4	:	To analyze the problems related with EMC for EV components.	L4: Analyzing
CO5	:	To evaluate the EMI in motor drive and DC-DC converter system.	L5: Evaluating

COURSE ARTICULATION MATRIX

COs/ POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3
CO1	3	1	1				2						3		2
CO2	3	1	1				1						3		2
CO3	3	1	1				2						3		2
CO4	3	1	1				1						3		2
CO5	3	1	1				2						3		3
Avg	3	1	1	0	0	0	1.6	0	0	0	0	0	3	0	2.2

3/2/1-indicates strength of correlation (3- High, 2-Medium, 1- Low)