BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: M. Tech **SEMESTER : III**
BRANCH: MECH **SESSION : MO/2025**

SUBJECT: EE585 HYBRID ELECTRIC VEHICLE

TIME: 3 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q.1(a)	Define hybrid electric vehicle (HEV)? Discuss the advantages, limitations and challenges of HEV?	[5]	I	II
Q.1(b)	Provide different types of HEV drivetrain architecture? Explain the basic working principle of all different types of HEV drivetrains with block diagrams.	[5]	I	II
Q.2(a)	What do you mean by maximum tractive effort in vehicle dynamics? Derive the expressions for the maximum tractive effort for front wheel drive considering uphill motion of vehicle. Use standard notations for all vehicle related parameters.	[5]	II	III
Q.2(b)	Describe the important performance parameters for any vehicle and derive the expressions of any two performance parameters using the resistance forces and standard tractive force developed. Use standard notations.	[5]	II	III
Q.3(a)	Draw a sketch of a 4 stroke, spark ignited (4S, SI) IC engine and show all the components. Also, explain its working principle with proper sketch.	[5]	III	IV
Q.3(b)	Draw the P-V (pressure vs volume) curve in 4S, SI IC engine. Establish the relation between the engine torque and mean effective pressure.	[5]	III	IV
Q.4(a)	Draw a block diagram of general configuration of electric vehicle (EV) and show all electrical, mechanical and control links.	[5]	IV	V
Q.4(b)	For a pure EV application, an electric motor of 60 kW power rating having maximum speed of 5000 RPM is required. Draw the torque-speed and power-speed characteristics for the motor indicating peak torque, base speed for three different x values (where x is the speed ratio) as x=2, 4, 6. What arrangements in transmission need to be done in the vehicle having motor with x=2 to achieve similar wheel torque characteristics as the vehicle having motor with x=6 (single gear system).	[5]	IV	V
Q.5(a)	Explain different possible modes of operation in series hybrid electric vehicle drivetrain with appropriate block diagram. Mention the components of series HEV drivetrain which are not present in parallel HEV drivetrain.	[5]	V	III
Q.5(b)	Discuss the torque coupling in HEV with block diagram to show the configuration. Also, draw the generic characteristics of tractive effort vs speed for torque-coupled HEV, where IC engine with 3 gears and electric motor with one gear having x=4 are used.	[5]	V	IV

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