

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION MO/2025)

CLASS: B.TECH
BRANCH: EEE

SEMESTER : VII
SESSION : MO/2025

SUBJECT: EE585 HYBRID ELECTRIC VEHICLE

TIME: 02 HOURS

FULL MARKS: 25

INSTRUCTIONS:

1. The question paper contains 5 questions each of 5 marks and total 25 marks.
 2. Attempt all questions.
 3. The missing data, if any, may be assumed suitably.
 4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates
-

		CO	BL
Q.1(a)	Draw a basic block diagram of hybrid electric vehicle (HEV) powertrain.	[1]	1 II
Q.1(b)	Why HEV technology was first introduced?	[1]	1 I
Q.1(c)	Discuss advantages and limitations of HEV in comparison to IC engine-based vehicle and pure electric vehicle.	[3]	2 II
Q.2(a)	Write different types of resistance forces act on a vehicle during uphill longitudinal motion.	[1]	2 I
Q.2(b)	Explain these resistance forces with appropriate expressions and diagrams. Use standard notations for all vehicle related parameters.	[4]	2 II
Q.3(a)	Draw the ideal torque-speed and power-speed characteristics for vehicle power plant.	[1]	2 I
Q.3(b)	In context to this ideal characteristic, compare the behavior of electric motor and IC engine with appropriate figures and characteristics curves.	[3]	1 IV
Q.3(c)	Mention the difference of transmission arrangements in pure electric vehicle and IC engine-based vehicle.	[1]	2 III
Q.4(a)	Consider a vehicle has transmission with two stage gear and uses tyres of radius R . First and second stages have gear ratio of i_g and i_o respectively. Establish the relation between engine rotational speed in RPM and vehicle speed in kmph.	[3]	2 III
Q.4(b)	For the above vehicle, calculate the maximum force at wheel, if the maximum torque output of engine is T_{e-max} . Assume efficiency of the transmission system to be η .	[2]	2 III
Q.5(a)	Calculate Power required from engine to run a vehicle in downhill longitudinal direction at steady speed of 72 kmph and 4 degree gradient. Use following vehicle parameters: Rolling resistance coefficient = 0.015, kerb weight = 120 kg, payload weight = 90 kg, aerodynamic drag coefficient = 1.5, frontal area = 0.5m ² , air density = 1.25kg/m ³ . Assume zero wind speed and transmission efficiency of 90%. Gravitational acceleration = 9.8m/s ²	[3]	2 III
Q.5(b)	For the above running condition, calculate the power requirement, if wind flows at speed of 6 kmph in the direction of motion.	[2]	2 III

:::::18/09/2025 :::::M