BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION MO/2023)

CLASS: B.TECH.   SEMESTER : 7th
BRANCH: EEE   SESSION : MO/2023

SUBJECT: EE629 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

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			CO	BL
Q.1(a)	Define rolling resistance and grading resistance.	[2]	CO1	BL1
Q.1(b)	Show power flow in series-parallel configurations of Hybrid Electric Vehicles (HEV) with the help of a block diagram in all modes of operation.	[3]	CO1	BL1
Q.2(a)	Compare the impact of HEV and Internal combustion Engines on the environment.	[2]	CO2	BL2
Q.2(b)	Describe each component of the mechanical power train of HEV	[3]	CO2	BL2
Q.3(a)	Calculate the vehicle's rotating speed (Nw) where the gear ratio of the transmission is 2.5, and the gear ratio of the final drive is 2. The output speed from the power plant of the vehicle is 1000rpm.	[2]	CO3	BL3
Q.3(b)	Apply Newton's Second Law to obtain the dynamic equation of vehicle speed (V), if its mass is M_v, the rolling friction coefficient is f_r, the slope angle of the road is α, and the perpendicular height of the center of gravity of the vehicle is h_g.	[3]	CO3	BL3
Q.4(a)	Analyze the role of longitudinal and lateral slip on variation of tractive effort coefficient using slip vs. tractive effort characteristics.	[2]	CO4	BL4
Q.4(b)	Analyze the power train tractive effort on vehicle speed in order to derive the relationship between tractive effort F_t and torque T_w transmitted on the wheel of radius r_d from the power plant. Assume that the gear ratio of the transmission is i_g, the gear ratio of the final drive is i_0, and the efficiency of the driveline is η_t. The torque provided by the power plant is T_p	[3]	CO4	BL4
Q.5(a)	Decide whether an IC engine with higher specific fuel consumption is better for obtaining higher fuel-to-heat conversion efficiency. Justify with proper reasoning.	[2]	CO5	BL5,BL6
Q.5(b)	Design pressure vs. volume curve of an IC engine in the case where the pressure in the induction stroke is greater than the pressure in the exhaust stroke in a four-stroke engine.	[3]	CO5	BL5,BL6