Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

End - Term Examinations – MAY/ JUNE 2025

Date: 03-06-2025 **Time:** 09:30 am – 12:30 pm

School: SOE	**Program:** B.Tech.,(EEE)	
Course Code: EEE3027	**Course Name:** Electric Vehicle Technology	
Semester: VI	**Max Marks**: 100	**Weightage**: 50%

CO - Levels	CO1	CO2	CO3	CO4	CO5
Marks	26	24	26	24	-

Instructions:

(i) Read all questions carefully and answer accordingly.

(ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2marks. **10Q x 2M=20M**

1.	List out the factors which contributes the most to vehicle aerodynamic drag?	**2 Marks**	**L1**	**CO1**
2.	Which of the following factors contributes to reducing vehicle rolling Resistance?	**2 Marks**	**L1**	**CO1**
3.	A vehicle requires a power output of 20 kW to maintain a speed of 25 m/s. Calculate the total resistive force acting on the vehicle.	**2 Marks**	**L1**	**CO1**
4.	What are the different types of electric vehicle (EV) configurations?	**2 Marks**	**L1**	**CO2**
5.	What is the speed ratio, if base speed is 1500rpm and maximum speed is 6000rpm and suggest the suitable motor	**2 Marks**	**L1**	**CO2**
6.	A BLDC motor operates at a peak back EMF of 150 V and peak current of 10 A. What would be the maximum torque if the torque constant is 0.6 Nm/A.	**2 Marks**	**L1**	**CO3**
7.	List two challenges faced while using induction motors in Electric Vehicle Applications	**2 Marks**	**L1**	**CO3**

8.	Why are permanent magnet synchronous motors (PMSM) favored for premium electric vehicles? Give two reasons.	**2 Marks**	**L1**	**CO3**
9.	What are the primary components of an electrochemical battery?	**2 Marks**	**L1**	**CO4**
10.	An EV consumes 180 Wh/km on average. If the battery capacity is 50 kWh, estimate the driving range in kilometers.	**2 Marks**	**L1**	**CO4**

Part B

Answer the Questions. **Total Marks 80M**

11.	**a.**	Compute Forces due to drag, rolling resistance, and gradient for the following vehicles assuming ρ = 1.2 (kg/m^3) and θ = 8°. For the three vehicles given in the table, Compute Aerodynamic drag at velocity v_1 and v_2; also find rolling resistance at two velocities.	**20 Marks**	**L3**	**CO1**

Vehicle	GVW (kg)	C_D	Area (sqm)	μ	v1 (kmph)	v2 (kmph)	Tyre radius (m)
2-wheeler	200	0.9	0.6	0.015	30	80	0.28
3-wheeler	600	0.45	1.6	0.015	30	80	0.2

Or

12.	**a.**	Discuss the major environmental impacts of modern transportation systems.	**10 Marks**	**L2**	**CO1**
	b.	Discuss the impact of EV battery charging stations on power quality. Explain issues such as voltage fluctuations, harmonic distortion, and grid stability	**10 Marks**	**L2**	**CO1**

13.	**a.**	Summarize the working principle of Series, Parallel and Series-parallel Hybrid Electric Drive Trains configuration.	**20 Marks**	**L2**	**CO2**
		Or			
14.	**a.**	Explain the concept of energy consumption measured in electric vehicles and its factors influence.	**10 Marks**	**L2**	**CO2**
	b.	Explain with the neat block diagrams of possible EV configurations.	**10 Marks**	**L2**	**CO2**

15.	**a.**	Describe in detail the construction and torque production process of a Permanent Magnet Synchronous Motor (PMSM), with a focus on its application in two-wheeler and three-wheeler electric vehicles.	**20 Marks**	**L2**	**CO 3**

		Explain the following in detail: i) The working principle of a PMSM, supported by neat, labeled diagrams. ii) The speed–torque characteristics relevant to traction applications. iii) Key equations governing back EMF generation, electromagnetic torque production, and electronic commutation. iv) Practical insights highlighting the advantages of using PMSMs in electric mobility solutions.			
		Or			
16.	**a.**	An electric bus uses a three-phase, 4-pole squirrel cage induction motor for propulsion. The motor operates from a 400 V, 50 Hz inverter supply. The motor parameters are: • Stator resistance, R_1=0.6Ω • Rotor resistance referred to stator, R_2'=0.4Ω$R2'$=0.4Ω • Stator leakage reactance, X_1=1.8Ω • Rotor leakage reactance referred to stator, X_2'=1.8Ω • Magnetizing reactance, X_m=60Ω At a load torque corresponding to a slip of 5%, calculate the following: (a) Compute the synchronous speed and the rotor speed. (4 marks) (b) Draw the approximate equivalent circuit of the motor referred to the stator side. (4 marks) (c) Calculate the input impedance of the motor. (4 marks) (d) Find the input current drawn by the motor. (4 marks) (e) Estimate the air-gap power and the developed mechanical power by the motor. (4 marks)	**20 Marks**	**L3**	**CO 3**

17.	**a.**	A two-wheeler electric scooter is designed with a continuous motor rating of 4 kW and a maximum speed of 60 km/h. It uses a 48 V battery system, and the manufacturer wants a minimum runtime of 2.5 hours at an average load of 60% of the motor's rated power. Battery parameters: • Nominal voltage = 48 V • Target Depth of Discharge = 85% (a) Compute the average power consumption of the motor during operation. (3 marks) (b) Estimate the total energy requirement for 2.5 hours of continuous use. (5 marks) (c) Calculate the minimum battery capacity (in Ah) required to meet this energy requirement considering the DoD. (5 marks)	**20 Marks**	**L3**	**CO 4**

		(d) Find the number of series and parallel connections required if each battery module is rated at 12 V, 20 Ah. (5 marks) (e) Briefly explain why DoD should not be 100% in battery pack design. (2 marks)			
		Or			
18.	**a.**	Discuss the different battery balancing techniques used in BMS for electric vehicles along with the following i. Need for battery balancing in EV applications (4 marks) ii. Working of passive balancing technique with diagram (6 marks) iii. Working of active balancing technique with diagram (6 marks) iv. Comparison between passive and active balancing — advantages and disadvantages (4 marks)	**20 Marks**	**L2**	**CO 4**