



MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

Paper Code : PE-EE 602A/PE-EEE 602A Electrical And Hybrid Vehicle

UPID : 006610

Time Allotted : 3 Hours

Full Marks :70

The Figures in the margin indicate full marks.

Candidate are required to give their answers in their own words as far as practicable

Group-A (Very Short Answer Type Question)

1. Answer any ten of the following : [1 x 10 = 10]

- (I) What is the role of the DC-to-DC converter in EV/HEV?
- (II) What is the unit of energy of a battery pack?
- (III) What does BMS stand for?
- (IV) What is a hydrogen fuel cell?
- (V) Define aerodynamic drag
- (VI) Define the gear ratio of the gearbox.
- (VII) How is the end of a battery life calculated?
- (VIII) What is regenerative braking in EVs?
- (IX) Among Lead Acid and Lithium Ion batteries, which one has better energy density?
- (X) How vehicle's power is related to its force and velocity?
- (XI) How is torque related to the speed at constant power region of electric motors used in EVs?
- (XII) What is the State of Health (SOH) of a battery?

Group-B (Short Answer Type Question)

Answer any three of the following :

[5 x 3 = 15]

2. Briefly discuss the energy management strategy used for electric vehicle [5]
3. Discuss Thermal Runaway. [5]
4. Write a short note on the rolling resistive force acting on a vehicle. [5]
5. Explain the automatic transmission characteristics (torque-speed-power) of a vehicle. [5]
6. Write a short note on the slip ratio of the vehicle and its importance to the Anti-lock braking system. [5]

Group-C (Long Answer Type Question)

Answer any three of the following :

[15 x 3 = 45]

7. Discuss the configuration and control of the BLDC motor [15]
8. (a) Why is Lithium-ion battery so popular in EV applications? [5]
(b) Discuss the chemistry of Lithium-ion batteries both for charging and discharging cases. [10]
9. (a) With the plot, discuss the speed-torque and speed-power characteristics of a DC motor used in an EV.
(b) Show the initial acceleration phase both for constant speed and constant power case. [7]
10. Write a case study of designing a 30kwh capacity Electric vehicle for a passenger sedan class car with a 150km average range. (Design power train, vehicle mass, etc.) [15]
11. (a) What are the design considerations of Battery Pack development? [5]
(b) Design a Battery Pack of 20Kw-h capacity for EV application using 6v, 5Ah cells in both series and parallel combinations. [10]

*** END OF PAPER ***