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. [8]
   (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 ***