Total No. of printed pages = 3

EE 1817 OE 34

05/01/2023

Roll No. of candidate | | | | | | | | | | |

2022

B.Tech. 7th Semester End-Term Examination

ELECTRICAL AND HYBRID VEHICLES

(New Regulation w.e.f. 2017 - 2018)

New Syllabus w.e.f. 2018 - 2019)

Full Marks – 70 Time – Three hours

The figures in the margin indicate full marks for the questions.

Question No.1 is compulsory. Answer any *four* from the rest.

1. Fill in the blanks: (10 × 1 = 10)

   (a) A battery has low _____ and high_____.

   (b) The SOC of a battery is 60%. The DOD of the battery is _____.

   (c) Quick charging of a battery is possible for batteries having _____ specific power.(high/Low).

   (d) TATA Nexon EV uses_____ drive for rotation of wheels.

   (e) _____ reduces life of Li-ion batteries.

   (f) From where tractive effort is generated in electric vehicle?

   (i) Battery (ii) Converter (iii) Driving shaft (iv) Motor

   (g) Grade ability is defined as the maximum _____ angle that the vehicle can overcome in the whole speed range.

   (i) Grade (ii) Raise (iii) Slope (iv) Plane

[Turn over

(h) When a vehicle goes up or down a slope, its weight produces a component force that is always directed

(i) Upwards (ii) Downwards (iii) Left ways (iv) Right ways

(i) HEVs are now classified into series hybrid, parallel hybrid, series-parallel hybrid and _____.

(j) The permanent magnet materials currently used for electric motors

(i) Alnicos (ii) Ceramics (iii) Rare earth materials (iv) All the above

2. (a) Draw a general lay out of an EV and discuss the transmission characteristics. (8)

(b) Classify and explain the different energy management strategies. (7)

3. (a) A 12V battery pack is connected to series R_L load with L=100mH. The battery pack has rated capacity of 120Ah. At t=0 switch is closed and the battery begins to discharge. Calculate and plot battery discharge current i(t), if the steady state discharge is C/5. Neglect voltage drop. Calculate and plot SoC, assuming that t=0, the battery is charged to rated capacity. Calculate the time according to 70% DoD, assume t >>100 ms. (8)

(b) Draw the typical torque Vs speed envelope curves of drive train motors and show the continuous, intermittent and peak overload ratings. (7)

4. (a) Discuss in detail about the control of permanent magnet motor drives. (8)

(b) Dissect the configuration and control of Switched reluctance motor. (7)

5. (a) Classify and explain the different energy management strategies. (7)

(b) Draw six different configurations of drive trains in electric vehicles. Briefly explain each configuration. (8)

6. (a) Explain fuel cell and flywheel as energy source elements in electric and hybrid electric vehicle. (8)

(b) State and explain the dynamic equation of vehicle motion. (7)

7. (a) A DC separately excited motor is powered by a dc to dc converter from a 600 volts dc source. The armature resistance is 0.05 Ω. The back emf constant of the motor is 1.527 V/A rad/sec. The average armature current is 250 amps. The field current is 2.5 amps. The armature current is continuous and has negligible ripple. If the duty cycle of the converter is 60%, determine (i) the input power from the source, (ii) the equivalent input resistance of the dc -dc converter drive, (iii) the motor speed, and (iv) the developed torque. (10)

(b) Discuss the issues of energy management strategies. (5)