

Total No. of Questions : 8]

SEAT No. :

P-1615

[Total No. of Pages : 3

[6002]-245

**S.E. (Automobile & Mechanical/Mechanical SW)  
Electrical and Electronics Engineering  
(2019 Pattern) (Semester - III) (203156)**

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Attempt Question 1 or 2, 3 or 4, 5 or 6, 7 or 8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data, if necessary.

- Q1)** a) Derive the emf equation of a DC machine and hence write the voltage equation of a DC shunt motor. [6]
- b) A 200 V, 4 pole lap wound DC shunt motor has 800 conductors on its armature. The resistance of armature winding is  $0.5 \Omega$  and that of shunt field winding is  $200 \Omega$ . The motor takes current of 21 A and flux per pole is 30 mWb. Find the speed and gross torque developed in motor. [6]
- c) What is braking in a motor? Explain regenerative braking of DC shunt motor with the help of neat diagrams. [6]

OR

- Q2)** a) Mention the factors on which speed of a DC motor depends. Explain any one method of speed control of DC shunt motor. [6]
- b) A 250 V DC shunt motor runs at 1000 rpm at no load and takes 8 A. The armature and shunt field resistances are  $0.2 \text{ Ohm}$  and  $250 \text{ Ohm}$  respectively. Calculate the speed of motor while taking 50 A current from supply under certain load. Assume the flux and brush contact drops to be constant. [6]
- c) Draw and explain the characteristics of a DC shunt motor. [6]

P.T.O.

- Q3)** a) Derive the expression for torque developed in a three phase induction motor under running conditions. Hence state the equation for maximum torque developed. [6]
- b) The power input to a 500V, 50Hz, 6-pole, 3-phase induction motor running at 975 rpm is 40 kW. The stator losses are 1kW and the friction windage losses are 2 kW. Calculate : [6]
- Rotor copper loss
  - Shaft output
  - Efficiency of motor
- c) Draw the torque-slip characteristic curve for a slip ring induction motor. Hence show the effect of increase in rotor resistance value on this curve. [5]

OR

- Q4)** a) Distinguish between squirrel cage and slip ring induction motors. [6]
- b) A 3300V, 10 pole, 50 Hz three phase star connected slip ring induction motor has rotor resistance per phase as  $0.015 \Omega$  and rotor reactance per phase at standstill as  $0.25 \Omega$ . If the motor runs at 2.5 % slip on full load, find : [6]
- speed of the motor
  - speed at which the torque will be maximum
  - ratio of maximum torque to full load torque.
- c) Explain V/f control method for controlling speed of three phase induction motor. [5]

- Q5)** a) Define Electric Vehicle (EV). Draw the block diagram of EV structure and explain the function of components in it. [6]
- b) Differentiate between Hybrid EV and Plug-in EV. [6]
- c) Elaborate the impact of usage of EV on power grid. [6]

OR

- Q6)** a) State and explain the components and subsystems of Hybrid Electric Vehicle (HEV). [6]
- b) Explain the configuration of a Series-Parallel Hybrid EV. [6]
- c) Draw and explain Vehicle to Grid (V2G) technology with the help of suitable block diagram. [6]

- Q7)** a) Write voltage, specific energy, C-rate, cycle life, thermal runaway and applications of NMC battery. [6]
- b) Draw the block diagram of Battery Management System (BMS) and explain the working of it. [6]
- c) What is a supercapacitor? How can it be useful in the making of Electric Vehicles? [5]

OR

- Q8)** a) Explain the operation of a three phase induction motor drive for an EV with the help of a block diagram. [6]
- b) State merits and demerits of LMO Battery. [6]
- c) Explain the working of hydrogen fuel cell. [5]

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