

Total No. of Questions : 8]

SEAT No. :

PB-3718

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[6261]-128

**S.E.(Automobile & Mechanical/Mechanical Sandwich)  
ELECTRICAL AND ELECTRONICS ENGINEERING  
(2019 Pattern) (Semester - III) (203156)**

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.
- 2) Figures to the right indicate full marks.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Assume suitable data, if necessary.
- 5) Use of non-programmable calculator is allowed.

- Q1)** a) Derive the emf equation of a DC machine; mentioning about all the parameters involved. [6]
- b) A 250 V, 4 pole lap wound DC shunt motor takes no-load current of 4 A when running at 1200 rpm. The resistance of armature winding is  $0.1 \Omega$  and shunt field winding is  $125 \Omega$ . The brush drop is 2 V. If it takes current of 61 A on full-load, calculate its full-load speed. Assume that the flux gets weakened by 5% on full-load condition due to armature reaction. [6]
- c) How is the direction of rotation of a DC shunt motor reversed? Discuss the concept of load torque and hence explain the dynamics of motor and load combination briefly. [6]

OR

- Q2)** a) Explain the following methods of controlling speed of a DC shunt motor; mentioning each of their application: [6]
- i) Flux control method
  - ii) Armature voltage control method
- 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) Explain regenerative braking in a DC shunt motor with the help of neat diagrams. Also enlist any two applications of regenerative braking. [6]

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- Q3)** a) Differentiate between squirrel cage and slip ring type induction motors; mentioning significant points. [6]
- b) A 4 pole, 50 Hz, three phase induction motor has rotor resistance and reactance of  $0.025 \Omega$  and  $0.1 \Omega$  respectively. Determine [6]
- synchronous speed
  - the speed and the corresponding slip at which maximum torque occurs
  - the additional resistance per phase that must be connected in series with the rotor to obtain maximum torque at starting
  - the value of slip at which maximum torque occurs and corresponding speed if an external resistance of  $0.025 \Omega$  is connected in series with the rotor.
- c) Describe in brief the voltage control method for the speed control of a three phase induction motor. [5]

OR

- Q4)** a) Derive the generalised torque equation of a three phase induction motor and hence obtain the condition for maximum torque. [6]
- b) The useful full load torque of a three phase, 6 pole, 50 Hz induction motor is  $162.84 \text{ N-m}$ . The rotor is running at a speed of  $970 \text{ rpm}$ . Calculate [6]
- motor output
  - copper losses in rotor
  - % efficiency of the motor, if mechanical torque lost in windings and friction is  $20.36 \text{ N-m}$  and stator losses are  $830 \text{ W}$ .
- c) Draw a neat sketch and explain the operation of a Direct On Line (DOL) type starter used for starting a three phase induction motor. [5]

- Q5)** a) Elaborate the functioning of main subsystems of an Electric Vehicle (EV). [6]
- b) Discuss the major challenges faced by EV Technology for its growth. [6]
- c) Explain the impact made by usage of EVs on power grid. [6]

OR

- Q6)** a) Define Electric Vehicle (EV). State its types and explain any one type of EV. [6]
- b) Explain configuration of Series Hybrid Vehicle and state its advantages and disadvantages. [6]
- c) Explain Vehicle to Grid (V2G) Technology with the help of block diagram. [6]
- Q7)** a) Elaborate construction and working of Lithium Iron Phosphate (LFP) battery. [6]
- b) Explain use of a supercapacitor in an EV; stating its necessity and advantages. [6]
- c) Explain Vehicle Battery Management System (BMS) with the help of block diagram. [5]

OR

- Q8)** a) Elaborate the factors used in selection of energy storage devices in case of EVs. [6]
- b) Explain characteristics and speed control of BLDC motor. [6]
- c) Discuss the working of hydrogen fuel cell and its suitability in EVs. [5]

