Q. P. Code : 21838

(3 Hours) (Total Marks : 80)

Please check whether you have the right question paper.

N.B.:
1) **Questions No.1** is **compulsory**.
2) Attempt **any three** from the remaining **Questions No.2** to **No.6**.
3) **Illustrate answer** with **diagrams** wherever **necessary**.

1. Attempt **any four** : **(20)**
   a) Explain the use commutator and brushes in DC machine.
   b) Explain in brief the principle of Electromechanical Energy conversion.
   c) Draw and explain Torque-stepping rate characteristics of stepper motor.
   d) How back emf makes DC motor as a self-regulating machine?
   e) What is the necessity of starter in DC motor?

2. a) A ring has diameter of 21 cm and cross sectional area of 10 cm^2. The ring is made up **(10)** of semicircular sessions of cast iron and cast steel, with each joint having reluctance equal to an air gap of 0.2 mm. Find the ampere turns required to produce a flux of 8×10^{-4} Wb. The relative permeability of cast steel and cast iron are 800 and 166 respectively. Neglect fringing and leakage effect.
   b) Derive the expression for torque developed in doubly excited magnetic field. **(10)**

3. a) Explain the armature reaction in DC generator and hence explain how to minimize **(10)** armature reaction.
   b) A 220 V, 970 RPM, 100 A DC separately excited motor has an armature resistance of **(10)** 0.05 Ω. It is braked by plugging from an .initial speed of 1000 RPM.
   Calculate : i) Resistance to be placed in armature circuit to limit braking current to twice the full load value, ii) Braking torque, iii) Torque when speed has fallen to zero.

4. a) Explain the process of commutation and hence mention the methods to improve **(10)** commutation.
   b) Two identical DC shunt machines when tested by Hopkinson's test gave the following **(10)** results :
   Field currents are 2.5A and 2 A.
   Line voltage is 220V
   Line current (including both the field currents) is 10 A
   Motor armature current is 73A
   The armature resistance of each machine is 0.05 ohms
   Calculate the efficiency of both the machines.

5. a) Explain the Variable Reluctance Stepper Motor (VRSM). **(10)**
   b) A 200 V, 10.5 A, 2000 rpm DC shunt motor has the armature and field resistances of **(10)** 0.5 Ω and 400 Ω respectively. It drives a load whose torque is constant at rated motor torque. Calculate the motor speed if the source voltage drops to 175 V.

6. a) Explain retardation test for determination of moment of inertia of DC motor. **(10)**
   b) Derive the torque speed relation and explain speed-torque characteristic for DC series **(10)** and shunt motor.