Con. 10112–13. **GS–7194**

(3 Hours) **[Total Marks : 100**

N.B. (1) Question No. 1 is **compulsory**.
(2) Solve any **four** questions out of the **remaining** questions.
(3) Assume **suitable** data if **necessary**.

1. (a) Explain the effect of change in frequency or the core loss in 1-ϕ transformer. **5**
   (b) Explain why DC series motor is never started on no-load. **5**
   (c) Describe the principle of energy conversion from consideration of various energies involved. Develop the model of an electromechanical energy conversion device. **5**
   (d) What do you mean by leakage flux and how to minimize it ? **5**

2. (a) What do you mean by an ideal transformer ? How practical transformer defers from ideal transformer ? Also draw and explain phasor diagram of a 1-ϕ transformer for inductive load condition. **10**
   (b) Develop the equivalent circuit of a 1-ϕ transformer using O·C and S·C test. **10**

3. (a) Explain in details armature reaction in DC machines. State the methods to minimize its effect. **10**
   (b) A 4 pole, 220 V, DC series motor has wave wound armature with 960 conductors. Flux per pole is 20 mWb. When motor is drawing 50A, iron and friction losses amount to 1 kW. Armature and series field resistances are 0·2 Ω each. Calculate speed, shaft torque and output at the shaft. Also find efficiency if the rotational losses equal to 300 watts. **10**

4. (a) A transformer is rated at 100 kVA. At full load its copper loss is 1200 W and its iron loss is 960 W. Calculate :— **10**
      (i) efficiency at full load, 0·8 pf lagging
      (ii) maximum efficiency at 0·85 pf lagging
      (iii) regulation at half load, 0·8 pf lagging.
   (b) Explain parallel operation of two 1-ϕ transformer. **10**

5. (a) Explain necessity of starter in DC motor and hence explain 3 point starter with disadvantages. **10**
   (b) The Hopkinson's test on two shunt machine gave the following results for full load. **10**

      Line voltage = 250 V, Current taken from supply
      System excluding field current = 50A
      Motor armature current = 380 A
      Field currents = 5A and 4·2 A.

      Calculate efficiency of both machine armature resistance of each machine is 0·2Ω.

6. (a) Explain the phenomenon of commutation in DC machines and methods to minimize it. **10**
   (b) Starting from energy balance equation, obtain expression for electromagnetic torque for doubly excited system in terms of angular rate of change of self and mutual inductances of stator and rotor windings. **10**

7. Write short notes on (any **two**) :— **20**
   (a) Back to back test on transformer
   (b) Methods of speed control of DC machines
   (c) Copper saving in autotransformer, advantages, disadvantages and its applications.