Hall Ticket No | | | | | | | | | | | Question Paper Code: AEE004

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Four Year B.Tech III Semester End Examinations (Supplementary) - January, 2019

Regulation: IARE – R16

DC MACHINES AND TRANSFORMERS

Time: 3 Hours **(EEE)** **Max Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT – I

1. (a) With a neat sketch explain the single excited magnetic field system in electromechanical energy conversion systems. **[7M]**

   (b) The λ-i characteristics of singly excited electromagnet is given by i=|2|λ2x2 for 0<i<4A, 0<x<10 cm. If the air gap is 5cm and a current of 3 A is flowing in the coil, calculate i)Field energy ii) Co-energy iii) Mechanical force on the moving part. **[7M]**

2. (a) Describe the flow of energy in electromechanical devices. **[7M]**

   (b) The field winding of a DC electromagnet is wound with 960 turns and has resistance of 50 ohms. The exciting voltage is 230V and the magnetic flux linking the coil is 5 mWb. Find the self inductance of the coil and energy stored in the magnetic field. **[7M]**

UNIT – II

3. (a) Explain the construction of DC generators with a neat sketch. **[7M]**

   (b) A separately excited DC generator when running at 1000 rpm supplied 200A at 125 V. What will be the load current when the speed drops to 800 rpm if I_f is unchanged? Given that armature resistance is 0.04 Ω and brush drop of 2 V. **[7M]**

4. (a) Explain in detail about commutation and list out any two methods of improving commutation in detail with a neat sketch. **[7M]**

   (b) A 4 pole lap wound DC shunt generator has a useful flux/pole of 0.6 Wb. The armature winding consists of 200 turns, each turn having a resistance of 0.003 Ω. Calculate the terminal voltage when running at 1000 rpm if armature current is 45 A. **[7M]**

UNIT – III

5. (a) Explain the importance of back emf. Derive an expression for the torque produced by DC motor. **[7M]**

   (b) A DC shunt motor drives a centrifugal pump whose torque varies as the square of the speed. The motor is fed from a 200V supply and takes 50A when running at 1000rpm. Estimate the resistance to be inserted in the armature circuit in order to reduce the speed to 800rpm? The armature and field resistance of the motor are 0.1 Ω and 100 Ω respectively. **[7M]**

6. (a) Explain the operation of 3 point starter with a neat sketch, and what are disadvantages of it. **[7M]**

   (b) A 440 V DC shunt motor takes a current of 3 A at no-load. The armature resistance including brushes is 0.3 Ω and the field current is 1 A. Compute the output and efficiency when the input current is 20 A. **[7M]**

UNIT – IV

7. (a) Discuss the construction details of a transformer. Mention how hysteresis and eddy current losses are minimized. **[7M]**

   (b) The following results were obtained from tests on 30 KVA, 3000/110 V, single phase transformer
   O.C. test: 3000 V, 0.5 A, 350 W
   S.C. test: 150 V, 10 A, 500 W
   Estimate the efficiency of the transformer at full load with 0.8 lagging power factor. **[7M]**

8. (a) Explain the need for parallel operation of single phase transformers. Deduce expressions for the load shared by two transformers in parallel when no load voltages of these transformers are equal? **[7M]**

   (b) Two transformers A and B are joined in parallel to the same load. Determine the current delivered by each transformer, given open circuit emf 230V for A and 240 V for B. Equivalent leakage impedance in terms of the secondary (0.1+j1)Ω for A and (0.2+j2)Ω for B. The load impedance is (10+j5)Ω. **[7M]**

UNIT – V

9. (a) Discuss the star – delta, delta – delta connections of 3-phase transformer with relevant relations among the voltages and currents. **[7M]**

   (b) A 3-phase step down transformer is connected to 6.6 KV mains and takes 10 A. Calculate the secondary line voltage and line current for the (i) ΔΔ (ii) Y Y (iii) Δ Y and (iv) Y Δ connections. The ratio of turns per phase is 12 and neglect no load losses. **[7M]**

10. (a) Explain in detail about the phase conversion using two single phase transformers. **[7M]**

    (b) A balanced three phase, 100 W load at 400 V and 0.8 power factor lagging is to be obtained from a balanced two phase 1100 V lines. Determine the KVA rating of each unit of the scott connected transformers. **[7M]**

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