INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
B.Tech III Semester End Examinations (Regular) - December, 2017
Regulation: IARE – R16
DC MACHINES AND TRANSFORMERS
(Electrical and Electronics Engineering)

Time: 3 Hours   **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) Draw and explain the general block diagram representation of an electromechanical energy conversion device. **[7M]**
   (b) An inductor of resistance 4 ohm and inductance 2H is switched on to a voltage source which varies linearly from zero to 8 V in 2 sec and stays constant. Find energy stored in inductor **[7M]**
   (i) during the 2 sec period
   (ii) after all the transients are over.

2. (a) Write short notes on forces and torque in magnetic system and derive the expression for magnetic force in singly excited system. **[7M]**
   (b) Explain the energy and forces in a multi excited magnetic field systems with necessary assumption. **[7M]**

UNIT – II

3. (a) Derive an expression for induced emf in a D.C. Generator. **[7M]**
   (b) In a 120 V compound generator, the resistances of the armature, shunt and series winding are 0.06 Ω, 25 Ω and 0.04 Ω respectively. The load current is 100 A at 120V. Find the induced emf and the armature current when the machine is connected as **[7M]**
   i) long shunt and as
   ii) short shunt. Neglect brush contact drop and ignore armature reaction.

4. (a) What is armature reaction? What are the effects of armature reaction? How the armature reaction is minimized? **[7M]**
   (b) Two shunt generators, each with a no-load voltage of 125 V are running parallel. Their external characteristics can be taken as straight lines over their operating ranges. Generator No. 1 is rated at 25 kW and its full load voltage is 119 V, generator No. 2 is rated at 200 kW at 116 V. Calculate the bus bar voltage when the total load is 3500 A. How is the load divided between the two? **[7M]**

UNIT – III

5. (a) Explain with a neat sketch, how speed control of a d.c. shunt motor can be achieved by Ward Leonard control system. **[7M]**

   (b) A 220 V DC series motor is running at a speed of 800 rpm and draws 100 A. Calculate at what speed the motor will run when developing half the torque. Total resistance of the armature and field is 0.1 ohm. Assume that the magnetic circuit is unsaturated. **[7M]**

6. (a) Explain the Hopkinson's test to determine efficiency of dc machines. **[7M]**

   (b) A 4 Pole dc series motor has flux per pole is 4×10^{-3} Ia wb where Ia is the armature current. The motor drives a fan requiring 40 Nm at 1000 rpm. The wave connected armature has 480 conductors and its resistance is 1 ohm. Determine armature current and motor speed if it is fed from 230 v DC mains. **[7M]**

UNIT – IV

7. (a) Draw and explain the phasor diagrams of a power transformer under full load lagging and leading power factor conditions. **[7M]**

   (b) The voltage per turn of a single phase transformer is 1.1 V. When the primary winding is connected to a 220V, 50 Hz AC supply, the secondary voltage is found to be 500V. Find **[7M]**
   (i) primary and secondary turns
   (ii) core area if the maximum flux density is 1.1 T.

8. (a) What is Sumpner's test? Draw a circuit diagram to conduct this test and explain its principle. **[7M]**

   (b) The following test results were obtained in a 250/500V transformer. **[7M]**
   O.C Test (LV side): 250V, 1A, 80W.
   S.C Test (HV side):20V, 12A, 100W
   Determine (i) the circuit constants
   (ii) The efficiency when the output is 10A at 500V and 0.8 power factor lagging.

UNIT – V

9. (a) With neat circuit and phasor diagrams, explain the operation of Y-Y and Y-Δ connections. **[7M]**

   (b) Two transformers connected in open delta supply a 400 KVA balanced load operating at 0.866 p.f (lag). The load voltage is 440 V. What is the **[7M]**
   i) KVA supplied by each transformer
   ii) KW supplied by each transformer

10. (a) What are the advantages and disadvantages of auto transformer over two winding transformer. **[4M]**

   (b) Two T scott connected transformers are used to supply a balanced load of 100 KVA at 400 V from a balanced 11 KV 3 phase supply. Determine **[10M]**
   i) Current and voltage rating of each transformer coil
   ii) KVA rating of the main and teaser transformers.

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