Hall Ticket No | | | | | | | | | | | Question Paper Code: AEEC07

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal-500043, Hyderabad

B.Tech III SEMESTER END EXAMINATIONS (REGULAR/ SUPPLEMENTARY) - FEBRUARY 2024

Regulation: UG20

DC MACHINES AND TRANSFORMERS

Time: 3 Hours (ELECTRICAL AND ELECTRONICS ENGINEERING) Max Marks: 70

Answer ALL questions in Module I and II
Answer ONE out of two questions in Modules III, IV and V
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

MODULE – I

1. (a) List the important characteristics of DC generators. Explain the construction and various parts of DC generator with neat sketch. [BL: Understand| CO: 1|Marks: 7]

   (b) An 8-pole DC shunt generator with 778 wave-connected armature conductors and running at 500 RPM supplies a load of 12.5 Ω resistance at terminal voltage of 50 V. The armature resistance is 0.24 Ω and the field resistance is 250 Ω. Find the armature current, the induced EMF and the flux per pole. [BL: Apply| CO: 1|Marks: 7]

MODULE – II

2. (a) Explain the concept of back EMF in DC motors and mention its significance. [BL: Understand| CO: 2|Marks: 7]

   (b) A DC series motor takes 40 A at 220 V and runs at 800 RPM. If the armature and field resistance are 0.2Ω and 0.1Ω respectively and the iron and friction losses are 0.5 kW, find the torque developed in the armature. What will be the output of the motor? [BL: Apply| CO: 2|Marks: 7]

MODULE – III

3. (a) Illustrate speed control methods available for DC shunt motors with neat sketch. [BL: Understand| CO: 3|Marks: 7]

   (b) A 250 V DC shunt motor has armature resistance of 0.25 ohm, on load it takes an armature current of 50 A and runs at 750 RPM. If the flux of motor is reduced by 10% without changing the load torque, find the new speed of the motor? [BL: Apply| CO: 3|Marks: 7]

4. (a) Demonstrate Swinburne's test to obtain the efficiency when running as motor and generator with a suitable circuit diagram. [BL: Understand| CO: 4|Marks: 7]

   (b) In a brake test the effective load on the branch pulley was 38.1 kg. The effective diameter of the pulley is 63.5 cm and speed 12 RPS. If the motor takes 49 A at 220 V, calculate the output power and the efficiency at this load. [BL: Apply| CO: 4|Marks: 7]

MODULE – IV

5. (a) Classify the types of single-phase transformers. Obtain the expression for EMF equation of a single-phase transformer. [BL: Understand| CO: 5|Marks: 7]

(b) A 25-kVA transformer has 500 turns on the primary and 50 turns on the secondary winding. The primary is connected to 3000-V, 50-Hz supply. Find the full-load primary and secondary currents, the secondary EMF and the maximum flux in the core. Neglect leakage drops and no-load primary current. [BL: Apply| CO: 5|Marks: 7].

6. (a) Outline the procedure for conducting the open circuit test for a single-phase transformer to find the no-load losses with neat circuit. [BL: Understand| CO: 5|Marks: 7]

   (b) A 100-kVA lighting transformer has a full-load loss of 3 kW, the losses being equally divided between iron and copper. During a day, the transformer operates on full-load for 3 hours, one half-load for 4 hours, the output being negligible for the reminder of the day. Calculate the all-day efficiency. [BL: Apply| CO: 5|Marks: 7]

MODULE – V

7. (a) Describe the working principle of star-star connection of three-phase transformer with neat circuit diagram. [BL: Understand| CO: 6|Marks: 7]

   (b) A balanced 3-phase load of 150 kW at 1000 V, 0.866 lagging power factor is supplied from 2000 V, 3-phase mains through single-phase transformers (assumed to be ideal) connected in

   i) Delta-delta

   ii) Vee-Vee.

   Find the current in the windings of each transformer and they operate in each case?

   [BL: Apply| CO: 6|Marks: 7]

8. (a) Elucidate the construction and working principle of on load tap changer with neat sketch.

   [BL: Understand| CO: 6|Marks: 7]

   (b) Two transformers are required for a Scott connection operating from a 440-V, 3-phase supply for supplying two single-phase furnaces at 200 V on the two-phase side. If the total output is 150 kVA, calculate the secondary to primary turn ratio and the winding currents of each transformer.

   [BL: Apply| CO: 6|Marks: 7]

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