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

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

B.Tech III Semester End Examinations (Supplementary) - January/February, 2018

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) What do you mean by energy balance? Briefly explain. **[7M]**

   (b) A coil of an electromagnetic relay is associated with a magnetic circuit whose reluctance is given by (a + bx). Where a and b are positive constants decided by the details of the magnetic circuit, in which x is the length of the air gap between fixed and movable members. If the coil is connected to an a.c. source where voltage is described by v = $V_m sinwt$. Find the expression for the average force on armature, with airgap held constant at x. **[7M]**

2. (a) Derive an expression for the force acting on a plunger for a singly excited magnetic field system. **[7M]**

   (b) Explain with a block diagram, the principle of electro mechanical energy conversion. **[7M]**

UNIT – II

3. (a) With a neat diagram, give the constructional features of a D.C. Machine. Explain the functions of each part. **[7M]**

   (b) A 4 pole D.C. generator with 1200 conductors generates 250 Volts on open circuit, when driven at 500 rpm. The pole shoes have a bore of 35 cm and the ratio of pole-arc to pole pitch is 0.7, while the length of the pole shoe is 20 cm. Find the mean flux density in the airgap. **[7M]**

4. (a) Explain the parallel operation of DC shunt generators. **[7M]**

   (b) Two DC shunt generators are rated 230 kw and 150 kW at 400 V and their full load voltage drops are 3% and 6% respectively. They are excited to no load voltages of 410 V and 420 V respectively. How will they share a load of 1000 A and determine the corresponding bus voltage? **[7M]**

UNIT – III

5. (a) Discuss the methods for speed control of a DC Series motor. **[7M]**

   (b) A 250 V DC shunt motor has an armature resistance of 0.5 ohm and a field resistance of 250 ohm. When driving a constant torque load of 600 rpm, the motor draws 21 A. What will be the new speed of the motor if an additional 250 ohm resistance is inserted in the field circuit? **[7M]**

6. (a) Explain the necessity of starter. With a neat sketch explain the working of three point starter. **[7M]**

   (b) A 220 V, DC machine has an armature resistance of 0.5 ohms. If the full load armature current is 20 A, find the induced emf when the machine acts as **[7M]**

   i. Generator

   ii. Motor

UNIT – IV

7. (a) Draw the complete phasor diagram for an actual transformer on load, when the load power factor is lagging. **[7M]**

   (b) A single phase transformer has a core whose cross sectional area is 150 cm^2 and operates at a maximum flux density of 1.1 Wb/m^2 from a 50 Hz supply. If the secondary winding has 66 turns, determine the output in KVA when connected to a load of 4 ohms impedance. Neglect any voltage drop in the transformer. **[7M]**

8. (a) Obtain an expression for load sharing of two single phase transformers with unequal voltage ratio. **[7M]**

   (b) A load of 100 KVA is to be supplied at 460 volts from 2,300 V supply mains by an auto transformer. Determine the current and voltage rating for each of the two windings. What would be the KVA rating of the transformer, if it were used as a two winding transformer. **[7M]**

UNIT – V

9. (a) Explain about different connections of a 3 phase transformers. **[7M]**

   (b) An industrial load takes 100 A at 0.8 power factor lagging from a 3 phase 11000/400 V, 50 Hz star/delta transformer. Calculate **[7M]**

   i. power consumed by load

   ii. KVA rating of transformer

   iii. phase and line currents on both HV and LV sides.

10. (a) Compare bank of three 1 phase transformer and a three phase transformer. **[7M]**

    (b) A 3 phase step down transformer is connected to 6.6KV mains and takes 10A. The ratio of turns per phase is 12. Neglect losses. Calculate the secondary line voltage, line current and output for the following connections: **[7M]**

    i. Δ/Δ

    ii. Y/Y

    iii. Δ/Y

    iv. Y/Δ

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