Motilal Nehru National Institute of Technology Allahabad

DEPARTMENT OF ELECTRICAL ENGINEERING

End semester Examination, 2016-2017

B. Tech (EED-IVth Semester)

SUBJECT: **Basics of Electrical Machine (EE-1401)**

Duration: 3 hrs. **Maximum Marks: 60**

Instructions: Answer all the questions

Take necessary assumptions, if required

1.

a) What is meant by commutation in dc machines? Differentiate between good commutation and bad commutation. Enumerate the mechanical and electrical conditions leading to poor commutation in DC machines. (4)

b) A 220 V DC series motor has armature and field resistances of 0.15 Ω and 0.10 Ω respectively. It takes a current of 30 A from the supply while running at 1000rpm. If a diverter resistance of 0.2 Ω is connected across the field coil of the motor, calculate the new steady state armature current and the speed. Assume the load torque remains constant. (4)

2.

a) Explain how the efficiency of a DC machine can be found out without actually loading the machine. (4)

b) A dc generator is connected to a 220 V dc mains. The current delivered by the generator to the mains is 100 A. The armature resistance is 0.1 Ω. The generator is driven at a speed of 400 rpm. Calculate (a) the induced emf (b) the electromagnetic torque (c) the mechanical power input to the armature neglecting iron, windage and friction losses (d) the power input and output of the armature when the speed drops to 350 rmp. State whether the machine is generating or motoring. Assume constant flux. (4)

3.

a) How would the main pole tips be constructed to minimize the effect of armature reaction on the main field? If the brushes are shifted in the direction of rotation, the flux per pole is reduced in a generator. Explain. What would happen if the brushes are given a backward shift in a generator? (4)

b) A 3-phase step down transformer is connected to 6.6 kV mains and takes 10 Amps. Calculate the secondary line voltage and line current for the (i) Δ / Δ (ii) Y/Y (iii) Δ / Y and (iv) Y/ Δ connections. The ratios of turns per phase is 12 and neglect no load losses. (4)

4.

a) A 5 kVA, 200 V/ 100 V, 50 Hz, single phase ideal two winding transformer is used to step up a voltage of 200 V to 300 V by connecting it like an auto transformer. Show the connection diagram to achieve this. Calculate the maximum kVA that can be handled by the autotransformer (without over loading any of the HV and LV coil). How much of this kVA is transferred magnetically and how much is transferred by electrical conduction. (4)

b) Explain the various methods of speed control of DC motor. Also mention the limitations of each method. (4)

5.

a) What is the requirement of starter in a dc machine? What is the limitation of 3-point starter and how it is overcome by using a 4-point starter? Explain. (5)

b) Three, 50 kVA, 500/100 V single phase, 50 Hz transformers are connected in delta-delta manner. The total load connected is 80 kVA. Due to some fault, one transformer is removed and the other two is operated in open delta manner. Calculate the maximum power this new connection can take. (3)

6.

a) Differentiate between Lap winding and wave winding through suitable connection of each. (3)

b) A 400V DC shunt generator has a full load current of 200 A. The resistance of the armature and field windings are 0.06 Ω and 100 Ω respectively. The stray losses are 2000 W. Find the Kw output of prime mover when it is delivering full load and find the load for which the efficiency of the generator is maximum. (5)

7. Answer the following: (4x3=12)

a) Explain the function of interpoles and compensating winding in a DC machine.

b) What do you mean by rotating magnetic field (r.m.f)? Prove that the magnitude of r.m.f is constant and it rotates at synchronous speed.

c) Explain the Scott connection for the conversion from three-phase to two-phase supply.