Ds of Rahi

4/5/23 (M)

Roll No.:.....

National Institute of Technology, Hamirpur (HP)

Name of the Examination: B.Tech. End Semester May, 2023

Branch :Electrical Engineering **Semester** :Fourth

Course Name :Electrical Machines-I **Course Code** : EE-221

Time: 3 Hours **Maximum Marks: 50**

Note: Attempt all the questions. Marks allotted for each question are given in bracket. Assume missing data if any suitably.

1. (a) State the importance of testing of a transformer. Explain short circuit test on a transformer, information it conveys and also state the precautions while performing short circuit test. (5)
   (b) The emf per turn for a single phase 2310V/220V, 50 Hz, transformer is approximately 13 volts. Calculate (a) The no. of turns in the primary and secondary winding, (b) the net cross-sectional area of the core for a maximum flux density of 1.4T. (5)

2. (a) Briefly explain the mechanism of production of torque in 3-phase induction motors. Also state, why three phase induction motors are called self-starting. (5)
   (b) Derive an expression for emf induced in electrical machines. State the effect of chording and distributed winding on the emf induced and advantages of the same. (5)

3. (a) State the power flow stages involved in an electromechanical energy conversion process with diagrams in both generator and motor. Also state various losses in rotating electrical machines and suggest the techniques used to minimize them. (5)
   (b) A 3-phase induction motor runs at a speed of 1485 rpm at no load and at 1350 rpm at full load when supplied from a 50 Hz, 3-phase supply. Determine: (i) no. of poles in the motor (ii) % slip at no load and at full load (iii) frequency of rotor currents at no load and at full load. (iv) what is the speed at both no load and full load of: (a) the rotor field wrt rotor conductors (b) the rotor field wrt the stator and (c) the rotor field wrt the stator field? (5)

4 (a) Explain the construction of a DC machine with the help of a neat diagram and also clearly mention the material and function of each part of the machine. (5)
   (b) A 4-pole, DC machine has a lap connected armature having 60 slots and eight conductors per slot. The flux per pole is 30 mwb. If the armature is rotated at 1000 RPM, determine the emf available across its armature terminals. Also calculate the frequency of emf in the armature coils. (5)

5. (a) Explain armature reaction in DC machines, its impacts on the performance of a machine and state the means to neutralize these effects of armature reaction. (5)
   (b) A 200 V shunt motor has armature resistance of 0.1 Ohm, field resistance of 240 Ohms and rotational losses of 236 watts. On full load, the line current is 9.8 A with the motor running at 1450 RPM. Calculate: (i) the mechanical power developed (ii) the power output (iii) the load torque and (iv) the efficiency at full load. (5)