Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

B.E. Sem-III Regular / Remedial Examination December 2010

Subject code: 130904

Subject Name: Electrical Machines-1

Date: 16 /12/ 2010 **Time: 10.30 am – 01.00 pm**

Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Classify the dc machine based on (i) Excitation and (ii) Connections. Derive the expression of e.m.f. developed in a DC generator. **07**

(b) Calculate the flux per pole required on a 55 kW, 400 V, 8-pole, 600 r.p.m. dc shunt generator with 256 conductors arranged in a lap-connected winding. The armature resistance is 0.15 ohm, the shunt field resistance is 200 ohm and there is total brush contact drop is 2 V on full load. **07**

Q.2 **(a)** Discuss the conditions to be satisfied for a self-excited generator. **07**

(b) Why is a starter required in a dc shunt motor? Explain the working of 3-point starter with the help of a neat diagram. **07**

OR

(b) Derive the expression of armature torque developed in a dc motor using normal notations. Draw the speed-torque characteristics of shunt, series and compound motors. **07**

Q.3 **(a)** State the advantages and limitations of Swinburne's test. **07**

A 220 V, dc shunt motor at no-load takes a current of 2.5 A. The resistances of the armature and shunt field are 0.8 ohm and 200 ohm respectively. Estimate the efficiency of the motor when input current is 25 A.

(b) State types of 3-phase induction motor. Explain the speed torque characteristic of a 3-phase induction motor with necessary diagram. **07**

OR

Q.3 **(a)** Discuss the effect of variations in voltage and frequency on the performances of a 3-phase induction motor. **07**

A 4-pole, 50 Hz, induction motor has a slip ring rotor with a resistance and standstill reactance of 0.04 ohm and 0.2 ohm per phase respectively. Find the amount of resistance to be inserted in each rotor phase to obtain full load torque at starting. The slip at full load is 3%.

(b) Induction motor can never run at its synchronous speed. Justify. Discuss various methods to measure its slip. **07**

Q.4 **(a)** What is the importance of an iron core in a transformer? Draw the (i) Vector diagram at no-load and on-load and (ii) Equivalent circuit of a 1-phase transformer. **07**

(b) Obtain the equivalent circuit of a 200/400 V, 50 Hz, 1-phase transformer from the following test data: **07**

O.C. test	200 V	0.7 A	70 W	(On l.v. side)
S.C. test	15 V	10 A	85 W	(On h.v. side)

Also calculate the % regulation when delivering 5 kW at 0.8 p.f. lagging.

OR

Q.4 **(a)** What is the need of parallel operation of transformers? Discuss the conditions to be satisfied before connecting two 1-phase transformers in parallel. **07**

(b) With reference to a transformer, discuss (i) Auto transformer (ii) All day efficiency (iii) Condition for maximum efficiency. **07**

Q.5 **(a)** Define (i) Short pitch factor and (ii) Distribution factor of an Alternator. Derive the e.m.f. equation of an Alternator. **07**

(b) A 3-phase, 10-pole, star-connected alternator runs at 600 r.p.m. It has 120 stator slots with 8 conductors in series. Determine the phase and line e.m.f. if the flux per pole is 56 mWb. Consider coil span to be 150^0. **07**

OR

Q.5 **(a)** Define (i) Voltage regulation of an Alternator and (ii) Synchronisation of alternators. Which conditions must be satisfied for proper synchronization of 3-phase alternators? **07**

(b) A 100 kVA, 3000 V, 50 Hz, 3-phase, star-connected alternator has effective armature resistance of 0.2 ohm. The field current of 40 A produces short-circuit current of 200 A and an open-circuit e.m.f. of 1040 V (line value). Calculate the full load voltage regulation at 0.8 p.f. lagging and 0.8 p.f. leading. **07**

****