

GUJARAT TECHNOLOGICAL UNIVERSITY
B. E. - SEMESTER – III • EXAMINATION – WINTER 2012

Subject code: 130904**Date: 05-01-2013****Subject Name: Electrical Machine-I****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) A 4-pole, long-shunt lap wound generator supplies 25 kW at a terminal voltage of 500 V. The armature resistance is 0.03Ω , series field resistance is 0.04Ω and shunt field resistance is 200Ω . The brush drop may be taken as 1V. Determine the e.m.f. generated. Also calculate the No. of conductors if the speed is 1200 r.p.m. and flux per pole is 0.02 Weber. Neglect armature reaction. **07**
- Q.2** (a) 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**
- (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) Discuss the conditions to be satisfied for a self-excited generator. **07**
- Q.3** (a) State types of 3-phase induction motor. Explain the speed torque characteristic of a 3-phase induction motor with necessary diagram. **07**
- (b) A 500 V, 25 hp, dc shunt motor takes 2.4 A while running light. The field and armature resistances are 650Ω and 0.57Ω respectively. Calculate full load efficiency, assuming a brush drop of 2 V. **07**
- OR**
- Q.3** (a) State the type of three phase induction motor. Explain how rotor rotates when three phase induction motor is connected across three phase supply & Define Slip. **07**
- (b) A 3-phase, 50 Hz, 500V Induction motor with 6 poles gives an output of 20 Kw at 950 rpm with a power factor of 0.8. The mechanical losses are equal to 1 Kw. Calculate for this load (i) slip (ii) rotor copper loss (iii) input if the stator losses are 1500 W (iv) line current **07**
- Q.4** (a) State types of 3-phase induction motor. Explain the speed torque characteristic of a 3-phase induction motor with necessary diagram. **07**
- (b) The open circuit & short circuit tests on 10 KVA 200/400V, 50Hz transformer gives following results:
OC test: $V_{oc} = 200V$, $I_{oc} = 1.3 A$, $W_{oc} = 120W$
(HV side open) **07**

SC test: $V_{sc} = 22 \text{ V}$, $I_{sc} = 30 \text{ A}$, $W_{sc} = 200 \text{ W}$

(supply was on HV side)

Find parameters of equivalent circuit as referred to LV winding.

OR

Q.4 (a) Explain the direct load test for determination of voltage regulation and efficiency of transformer with necessary diagram. **07**

(b) The maximum efficiency of a 500 KVA, 3300/500 V, 50 Hz, single phase transformer is 97% and occurs at 75% of full load, unity power factor. If the impedance is 10%, calculate the regulation at full load and 0.8 lagging pf. **07**

Q.5 (a) Explain the difference between cylindrical and salient pole rotors used in large alternator. Define (1) pitch factor (2) Distribution factor (3) form factor. **07**

(b) Define Voltage regulation of alternator. State various methods to find voltage regulation and Explain any one method in detail. **07**

OR

Q.5 (a) A 4 pole, 50 Hz, star connected alternator has a flux per pole of 0.12 Wb. It has 4 slot per pole per phase and conductor per slots being 4. If the winding coil span is 150° , find the emf. **07**

(b) Explain synchronization of alternators. Which conditions must be satisfied for proper synchronization of 3-phase alternators? **07**
