

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-III • EXAMINATION – WINTER • 2014

Subject Code: 130904

Date: 30-12-2014

Subject Name: Electrical Machines - I

Time: 02.30 pm - 05.00 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)** Explain construction and working principle of dc generator. **07**
(b) Explain torque-current, speed-current and speed-torque characteristic of dc shunt and series motor. **07**
- Q.2 (a)** What is the critical field resistance of a dc shunt generator? Explain voltage build up process of dc shunt generator. **07**
(b) Explain the necessity of starter in a dc motor? Explain three-point starter with neat sketch. **07**
- OR**
- (b)** A 500 V dc shunt motor takes 4 A on no load. The armature resistance including that of brushes is 0.2Ω and the field current is 1 A. Estimate output and efficiency when the input current is (a) 20 A (b) 100 A **07**
- Q.3 (a)** Explain synchronous impedance method of determining voltage regulation of an alternator. **07**
(b) Explain the difference between cylindrical and salient pole rotor used in large alternator. Also explain pitch factor and distribution factor. **07**
- OR**
- Q.3 (a)** Explain necessary conditions required for parallel operation of two synchronous generator. **07**
(b) The following test results are obtained on a 6,600 V alternator: **07**
Open-circuit voltage: 3,100 4,900 6,600 7,500 8,300
Field current (amps): 16 25 37.5 50 70
A field current of 20 A is found necessary to circulate full-load current on short-circuit of the armature. Calculate the full-load voltage regulation at 0.8 p.f(lag) by M.M.F. method. Neglect resistance and leakage reactance.
- Q.4 (a)** Explain torque-slip characteristic of three phase induction motor. **07**
(b) Explain working principle of three phase induction motor. also derive expression for the frequency of rotor current in an induction motor. **07**
- OR**
- Q.4 (a)** Define slip. Explain different method used for measurement of slip of an induction motor. **07**
(b) A 12-pole ,3-phase ,600 V , 50 Hz , star-connected , induction motor has rotor-resistance and stand-still reactance of 0.03 and 0.5 ohm per phase respectively. Calculate (a) Speed of maximum torque (b) the ratio of full-load torque to maximum torque, if the full-load speed is 495 rpm. **07**
- Q.5 (a)** Explain open circuit and short circuit test of single phase transformer **07**
(b) Two single phase transformers with equal turns have impedances of $(0.5+j3)$ ohm and $(0.6+j10)$ ohm with respect to the secondary. If they operate in parallel, determine how they will share a total load of 100 KW at p.f. 0.8 lagging. **07**

OR

- Q.5 (a)** What is an autotransformer and derive an expression for saving in conductor material in an autotransformer over a two-winding transformer **07**
- (b)** Consider a 20 KVA, 2200/220 V, 50 Hz transformer. The O.C./S.C. test results are as follows **07**
- | | | | | |
|------------|-------|--------|-------|------------|
| O.C. test: | 220 V | 4.2 A | 148W | (l.v.side) |
| S.C.test: | 86 V | 10.5 A | 360 W | (h.v.side) |
- Determine the voltage regulation at full load 0.8 p.f.lagging
