May - June - 2011

[3963] – 263

T.E. (Electrical) (Semester – I) Examination, 2011
ELECTRICAL MACHINES – II
(2008 Pattern) (New)

Time: 3 Hours Max. Marks: 100

Instructions : *1) Answer 3 questions from Section **I** and 3 questions from Section **II**.*

*2) Answers to the **two** Sections should be written in **separate** books.*

*3) **Neat** diagrams must be drawn **wherever** necessary.*

*4) **Use** of logarithmic tables, Slide rule, Mollier charts, electronic pocket calculator and steam tables is **allowed**.*

*5) Assume suitable data, **if necessary**.*

SECTION – I

1. a) Define voltage regulation for an alternator at full load. Is voltage regulation necessary ? **6**

b) A 15 KVA, 440V, 50Hz, 3-phase star connected synchronous generator has the DCC as given below.

I_f (A)	1.6	3.5	5	9	12	16
Voc (line, volts)	160	320	440	555	610	640

With full load zero power factor, the excitation required is 16A to produce 550V of terminal voltage. At short circuit 5A excitation is required to have full load current. Determine the voltage regulation for full load 0.8 p.f. lagging. **10**

OR

P.T.O.

2. a) For a 5 MW, 11kV generator, out of the armature and the field winding which one should be rotary and which one stationary ? **6**

   b) What method should be used to determine armature leakage voltage drop and armature reaction mmf ? **6**

   c) Define short circuit ratio. Is it related to X_d. **4**

3. a) Draw vector diagram using Blondel's two reaction theory for a salient pole synchronous generator and find voltage regulation. **10**

   b) Explain characteristics of synchronous motor at constant excitation and variable load. **6**

OR

4. a) Two identical 3-phase alternators work in parallel and supply a total load of 1500 kW at a p.f. of 0.867 lagging. Each machine supplies half the total power. The synchronous reactance of each is 50Ω per phase and resistance is 4Ω per phase. The field excitation of first machine is so adjusted that its armature current is 50A lagging. Determine the armature current of second alternator and the generated voltage of first machine. **8**

   b) Derive expression for the synchronizing power per mechanical degree deviation of the rotor of a three phase generator working in parallel with infinite bus-bars and supplying lagging current. **8**

5. a) Why V/f method of speed control is preferred in the industry ? Is it necessary to keep the V/f ratio constant. Show the torque Vs slip characteristics for different frequencies. **12**

   b) As per IS : 325 write down name of the tests under

   a) Routine test and b) Type test. **6**

OR

6. a) What tests are required to be performed on a synchronous induction motor to determine the centre and radius of its circle diagram when working as synchronous motor with a constant d.c. excitation ? **10**

   b) Write in detail the operation of 3-phase induction motor as an induction generator. **4**

   c) Compare 3 phase synchronous motor with 3-phase synchronous induction motor. **4**

SECTION – II

7. a) Draw and explain vector diagram for compensated ac series motor. **8**

   b) The following data refer to a 240V, 2-pole uncompensated series motor when run on a 50 Hz 1-phase supply.

   Applied voltage = 240V, Input current = 1.5A, Input power = 198.75 W, field winding resistance = 8.8 Ω, armature resistance = 4.2 Ω, speed = 4800 rpm, the number of turns on field winding is 300 and the number of armature conductor is 1200. Leakage reactance drop is 20% of total reactive drop in the motor. Determine (i) induced voltage in armature (ii) field flux per pole (iii) armature flux per pole. **8**

OR

8. a) Compare uncompensated ac series motor with compensated single phase series motor. **8**

   b) Write procedure for plotting circle diagram for series motor. **8**

9. a) Write in detail the construction and operation of variable reluctance stepper motor. **8**

   b) What are causes of harmonic production in 3- phase induction motor ? Explain crawling phenomenon in induction motor. **8**

OR

10. a) Explain the construction and working principle of brushless d.c.motor. **8**

b) List the methods to reduce harmonic effect in induction motor. Explain any one method in detail. **8**

11. a) Explain the cross-field theory applied to single phase induction motor. **8**

b) The following data pertains to a 230V, 50 Hz capacitor-start single phase induction motor at standstill.

Main winding alone = 100V, 2A, 40W

Starting winding alone = 80V, 1A, 50W.

Determine the value of capacitance for determining the maximum starting torque. **10**

OR

12. a) A 230 V, 50 Hz, 4-pole, class A, 1-ph I.M. has the following parameters at an operating temperature of 63°C. $r_{1m} = 2.51\,\Omega$, $r_2' = 7.81\,\Omega$, $x_m = 150.88\,\Omega$, $x_{1m} = 4.62\,\Omega$, $x_2' = 4.62\Omega$.

Determine the main winding current and power factor when the motor is running at a ship if 0.05 at the specified temperature of 63°C. **10**

b) Explain in detail, the tests to be conducted on single phase induction motor to determine the equivalent circuit parameters. Plot the equivalent circuit for the motor showing the parameters determined. **8**
