Total No. of Questions : 10] [Total No. of Printed Pages : 4

Roll No. .....

EX–503

B. E. (Fifth Semester) EXAMINATION, Dec., 2011

(Electrical and Electronics Engg. Branch)

ELECTRICAL MACHINE – II

(EX – 503)

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 35

Note : Attempt any *one* question from each Unit. Each question carries equal marks.

Unit – I

1. (a) Derive the expression for e. m. f. of an alternator. Explain clearly the meaning of :

   (i) distribution factor

   (ii) coil span factor

   Give the expression for them.

   (b) A 2-MVA, 3-phase, 8-pole alternator runs at 750 r. p. m. in parallel with other machines on 6000 V bus bars. Find the synchronizing power on full load at power factor 0·8 lagging per mechanical degree of displacement and corresponding synchronizing torque. The synchronizing reactance of machine is 6 ohm per phase.

P. T. C.

2. (a) Write short notes on the following :

(i) two phase rotating field

(ii) three phase rotating field

State how the direction of rotation of rotating magnetic field may be changed.

(b) A 4-pole a. c. machine has a 3-phase winding wound in 60 slots. The coils are short pitched in such a way that if one coil side lies in slot number 1, the other side of same coil lies in slot number 13. Calculate the winding factor for :

(i) fundamental and

(ii) third order harmonic

Unit – II

3. (a) Explain the slip test of synchronous machine. How can we measure the direct axis and quadrature axis reactance for synchronous machine ?

(b) What do you mean by Hunting ? How can we reduce the hunting of a synchronous machine ?

4. (a) What conditions must be fulfilled before an alternator can be connected to an infinite bus ? Explain the reasons of parallel operation of electrical machine.

(b) Two identical three-phase alternators are coupled in parallel to a load of 1500 kW of 11000 V, power factor 0·8 lagging. The synchronous reactance of each machine is 60 ohm per phase, and resistance 2·8 ohm per phase. The power supplied by each machine being maintained the same. The excitation of each machine is adjusted such a way that its armature current is 45 A lagging. Calculate :

(i) the armature current of the second alternator.

(ii) power factor at which each alternator operates.

Unit – III

5. (a) Explain the principle of operation of a 3-phase synchronous machine.

   (b) A 3-phase, 11 kV star connected synchronous motor taken 50 A input current. The effective resistance and reactance per phase are 1 ohm and 30 ohm respectively. Calculate induced e. m. f. for (i) a power factor of 0·8 leading and (ii) power supplied by the motor.

6. (a) What is V-curves of a synchronous motor ? What are the main characteristics of the synchronous motor ?

   (b) A 3-phase synchronous motor of 8000 W at 1100 V has synchronous reactance of 8 ohm per phase. Find the minimum current and corresponding induced e. m. f for full load condition. The efficiency of machine is 0·8. Neglect armature resistance.

Unit – IV

7. (a) What is generalized model of rotating electrical machine ? How are the various winding of a machine represented by primitive machine ?

   (b) Write the voltage equation for Kron's primitive machine in matrix form. What observations are made from the impedance matrix of this machine ?

8. (a) Obtain identical transformations for current and voltage from rotating balanced 3-phase to rotating balanced 2-phaser winding.

   (b) What is meant by Power Invariance ? What is the advantage of having power invariance during the transformation ?

P. T. O.

Unit – V

9. (a) Explain the double field revolving theory for single-phase induction machine.

(b) A 220 V single-phase induction machine gave the following test results :

Block rotor test : 120 V, 9·6 A, 460 W

No-load test : 220 V, 4·6 A, 125 W

The stator winding resistance is 1·5 ohm, and during the block rotor test, the stator winding is open. Determine the equivalent circuit parameter. Also find the core, friction and wind age losses.

10. (a) Explain construction, working and use of a reluctance motor.

(b) Explain the principle of operation of a linear induction motor. Draw its characteristics. State its important applications.