(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2111 Roll No. | | | | | | | | | | |

B.Tech.

(SEM. V) ODD SEMESTER THEORY EXAMINATION 2012-13

ELECTROMECHANICAL ENERGY CONVERSION–II

Time : 3 Hours *Total Marks : 100*

Note :– Attempt **all** questions.

1. Attempt any **four** of the following : **(5×4=20)**

   (a) Why is a rotating field system preferred against a stationary field in a synchronous machine ? A 2-pole alternator rotates at 3000 rpm. What is the frequency of the generated emf ?

   (b) Write the scheme of connections for a 3-phase, 1-layer stator Lap winding of a synchronous machine having 6 poles and 36 slots.

   (c) A 3-phase, 4-pole, star-connected synchronous generator runs at 1500 rpm. The stator has 80 slots and 18 conductors per slot. The flux in the stator yoke is 0.006 Wb. Determine generated phase and line voltages, if the winding factor is 0.96.

   (d) Explain clearly how stator leakage reactance and armature reaction are estimated by Potier's Triangle method.

   (e) Two similar single-phase alternators are running in parallel. Their emfs are 100 V and 105 V respectively and the impedance of each is $(0.2 + j1.0)\ \Omega$. Find the terminal voltage, current and power supplied by each machine to a load impedance of $(2 + j3)\ \Omega$.

(f) What is an Infinite Bus ? An alternator connected to infinite bus is operating at rated load and unity power factor. How its operation shall be affected by increasing the field current in respect of induced emf, torque angle and power factor ?

2. Attempt any **two** of the following : **(2×10=20)**

(a) Discuss Two Reaction Theory. Derive expression of developed power (P_d) for a salient pole synchronous machine ignoring armature resistance and draw power Vs power angle characteristic. Why a salient pole machine is more stable as compared to a cylindrical rotor machine ?

(b) A 20-kw, 400-V, 3-phase, star-connected synchronous motor has per phase impedance of (0.15 + j 0.90) Ω. Determine the induced emf torque angle and mechanical power developed for full load at 0.8 pf lagging. Assume 92% efficiency of the motor. Draw phasor diagram.

(c) Discuss the following :

(i) Starting of synchronous motor

(ii) Hunting and Damping

(iii) Synchronous condenser.

3. Attempt any **two** of the following : **(2×10=20)**

(a) Explain how a Rotating Magnetic Field (RMF) is produced in a 3-phase induction motor. Develop suitable expression.

(b) Derive the expression for developed torque for a 3-phase induction motor and obtain the condition for maximum torque. Obtain the ratio of full load torque to maximum torque. Also draw Torque-slip curves and discuss the effect of rotor resistance.

(c) A 5-kW, 220 V, 50-Hz, 6-pole, 3-phase, star-connected induction motor gave the following Test data :

No-Load Test : 220 V, 6 A, 475 W (Line Values)

Blocked Rotor Test : 110 V, 27 A, 1930 W.

Determine from circle diagram for full load condition the line current, pf, torque, slip and efficiency. Also determine also maximum output, maximum torque and slip for maximum torque. Take stator cu. loss at stand still twice the rotor cu. loss.

4. Attempt any **two** of the following : **(2×10=20)**

(a) Why "Starter" is required to start a 3-phase induction motor ? Name different starting methods and describe star-delta method of starting a squirrel cage induction motor. Determine the ratio of starting to Full Load Torque.

(b) Explain crawling and cogging. A 3-phase, 430 V, 50 Hz, 4-pole squirrel cage induction motor has 24 stator slots and 28 rotor slots. What are possible crawling speeds ?

(c) (i) Compare deep bar induction motor with a double cage induction motor.

(ii) Describe how speed and pf of a slip-ring induction motor be controlled by injecting voltage in the Rotor circuit.

5. Attempt any **two** of the following : **(2×10=20)**

(a) Discuss why single-phase induction motors do not develop a starting torque. Explain with the help of Double Revolving Field Theory. Describe construction and working of a shaded pole motor.

(b) A 220-V, 1-phase induction motor gave the following test results :

Blocked-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 Ω and during the blocked rotor test, the starting winding is open. Determine the equivalent circuit parameters and core, friction and windage losses.

(c) Discuss any **two** of the following :

(i) Repulsion motor

(ii) Universal motor

(iii) Stepper motor.