B.TECH.

THEORY EXAMINATION (SEM–IV) 2016-17

ELECTROMECHANICAL ENERGY CONCERSION-II

Time : 3 Hours *Max. Marks : 100*

Note : Be precise in your answer. In case of numerical problem assume data wherever not provided.

SECTION – A

1. Answer the following: **10 x 2 = 20**

(a) What are the advantages of having field winding on the rotor and armature winding on the stator in case of synchronous machines?

(b) What do you mean by synchronous reactance?

(c) Define "cogging" phenomenon in induction motor.

(d) Why is synchronous motor not self-starting?

(e) Differentiate between Squirrel-cage rotor and wound rotor type Induction motors.

(f) Define "distribution factor" and "pitch factor".

(g) Draw the power flow diagram for three phase induction motor.

(h) Why starters are necessary for starting induction motors.

(i) Why does a three-phase induction motor always run at less than the synchronous speed?

(j) Calculate the stepping angle for a three-phase, 24-pole permanent magnet stepper motor.

SECTION – B

2. Attempt any five of the following questions: **5 x 10 = 50**

(a) Discuss the constructional features of synchronous machine. Also derive an expression for generated emf for an alternator.

(b) A 1500 kVA, 3-phase, star connected 6.6 kV, 8-pole, 50 Hz synchronous generator has a reactance of 0.6 pu and negligible resistance. Calculate the synchronizing power per mechanical degree at full load and 0.8 power factor lagging.

(c) Derive an expression for the active power for a salient pole synchronous machine. Also compare the salient and non salient pole synchronous machines.

(d) Explain the principle of operation of three-phase induction motor. Also draw the typical torque-speed characteristic of a three-phase induction motor illustrating the stable and un stable regions.

(e) A 746 kW, 3-phae, 50 Hz, 16-ple induction motor has a rotor impedance of (0.02+j0.15) ohm at standstill. Full load torque is obtained at 360 rpm. Calculate

(i) The speed at which maximum torque occurs

(ii) The ratio of full load to maximum torque

(iii) The external resistance pr phase to be inserted in the rotor circuit to get maximum torque at starting.

(f) Write short note on the following:

(i) DOL starter for three phase induction motor.

(ii) Pole changing method of speed control of three phase induction motors.

(g) Using double revolving field theory, explain why a single phase induction motor is not self starting? Name the methods to make a single phase induction motor self starting.

(h) A 230 V, single phase induction motor gave the following results:

Blocked Rotor test: 120 V, 9.6 A, 460 W

No-load Test: 230V, 4.6 A, 125 W.

Stator winding resistance is 1.5 Ω and during the blocked rotor test, auxiliary winding is open. Determine the equivalent circuit parameters.

SECTION – C

Attempt any two of the following questions: **2 x 15 = 30**

3. (a) Explain the effect of varying excitation in a synchronous generator connected to the infinite bus-bar.

(b) Explain the working of deep-bar and double-cage rotor induction motors.

4. (a) A 400 V, 6-pole, 50 Hz, 3-phase induction motor develops shaft torque of 120 Nm at a rotor frequency of 1.5 Hz. Calculate

(i) Shaft power and mechanical power developed if the mechanical torque lost in friction and windage is 8 Nm.

(ii) Rotor ohmic loss (iii) Power input to motor

(iv) The motor efficiency in case total stator loss is 500 W

(b) What are the effects of space harmonics on 3-phase induction motor performance/

5. (a) Explain the parallel operation of alternators and also discuss the process of synchronism.

(b) What do you understand by hunting of a synchronous machine? What are its causes and effects?