

B.TECH.

THEORY EXAMINATION (SEM-IV) 2016-17
ELECTROMECHANICAL ENERGY CONVERSION-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-phase, 50 Hz, 16-pole 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 per 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 1.5Ω 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?