

(Following Paper ID and Room No. to be filled in your

Answer Book)

Paper ID : 121521

Roll No.

B.Tech.

(SEM. V) THEORY EXAMINATION, 2015-16

ELECTROMECHANICAL ENERGY CONVERSION-II

Time:3 hours]

[Total Marks:100

**SECTION-A**

1. Attempt all parts. All parts carry equal marks. Write answer of each part in short : (2×10=20)
  - (a) Why the power factor of the lightly loaded induction machine is quite low?
  - (b) What do you understand by the term cogging?
  - (c) Calculate the speed in rpm of a 6 pole induction motor which has a slip of 6% at full load with a supply frequency of 50.Hz. What will be the speed of a 4 pole alternator supplying the motor?
  - (d) Give application areas of the cylindrical and salient pole type synchronous machine.

(1)

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synchronous machines?

- (i) State some important application of the stepper motors.
- (ii) How will you reverse the direction of rotation of the single phase Induction motor?

#### SECTION-B

**Note:** Attempt any five questions from this section.

(10×5=50)

2. Show that in a 3 phase induction motor :

$$\frac{\tau_{max}}{\tau_{fl}} = \frac{1}{2} \frac{p^2 + s^2}{sfl^2}$$

$$\text{where } \beta = \frac{R_2}{X_{20}}$$

(2)

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3.

From the first principles derive the equivalent circuit of a three phase induction motor. How the mechanical load is separated from rotor copper loss in the equivalent circuit.

4.

Explain the operating principle and constructional aspects of Deep Bar and Double cage Induction motor. Explain how these motors can give higher starting torque in comparison to the conventional design.

5.

Explain the phenomenon of armature reaction when alternator is delivering a load current at purely leading and purely lagging power factor. Also derive the EMF equation of an alternator.

(3)

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EXCITATION. LINE CURRENT RESISTANCE USING VOLTAGE

8. Why single phase induction motor is not self started?  
Discuss the different methods of starting a 1-phase Induction motor.

9. A 230 V, 50Hz, 4-pole single-phase induction motor has the following equivalent circuit impedances:

$$R_{im} = 2.2 \text{ ohm}, X_{im} = 3.1 \text{ ohm}, R_2' = 4.5 \text{ ohm}, X_2' = 2.6 \text{ ohm}, X_M = 80 \text{ ohm}$$

Friction, windage and core loss=40W.

For a slip of 0.03 pu, calculate:

- Input current
- Power factor

(4)

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TURNS IN PRACTICE WITH OTHER INDUCTION MOTORS

- synchronous reactance is 20% Find for (a) No-Load (b) Full load at p.f. 0.8 lagging, synchronizing power per unit mechanical angle of face displacement and calculate the synchronizing torque if mechanical displacement is 0.5 degree.

11. (a) What are the effects of space harmonics in 3 phase induction motors?

- (b) The stand still impedances of outer and inner cages of a double cage induction motors are  $(2+j1.2)\Omega$  and  $(0.5+j3.5)\Omega$  respectively. Determine the slip at which the 2 cages develop equal torques.

(5)

P.T.O.

12. Discuss the construction details of the following :

- a) Stepper Motors
- b) Universal Motors
- c) Shaded Pole type Induction Motors

—x—

(6)