

Dec.-23-0410

EE-401 (Electrical Machine-II)

B.Tech. 4th (CBCS)

Time : 3 Hours

Max. Marks : 60

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

**Note :** Attempt Five questions in all, selecting One question each from section A, B, C & D. Section E is compulsory. Use of non-programmable calculator is allowed. Assume any missing data.

#### SECTION - A

- (a) A 3-phase induction motor is wound for 6 poles and is supplied for 50 Hz system. Calculate: (i) Rotor speed when slip is 5% (ii) Rotor frequency when rotor runs at 800 r.p.m. (5)
- (b) Explain how the double cage induction motor develops high torque at starting and give good running performance. (5)
2. Explain the no load and blocked rotor test on a 3-phase induction motor. How are the parameters of equivalent circuit determined from the tests? (10)

#### SECTION - B

3. A 240 V, 50 Hz, 4 pole single phase induction motor has the following equivalent circuit impedances:

$$R_{1m}=11.4\Omega, R_{2'}=14.5\Omega$$

$$X_{1m}= 13.8\Omega, X_{2'} = 14.4\Omega, X_m = 270\Omega$$

$$\text{Mechanical and core losses}=32 \text{ W}$$

Calculate a) Total Series impedance, b) Power Factor, c) Output Power and d) Efficiency **Here**,  $R_{1m}$ =Resistance of Main stator winding,  $X_{1m}$ = Leakage reactance of main stator winding,  $R_{2'}$ =Standstill rotor resistance referred to the main stator winding,  $X_{2'}$ =Standstill rotor leakage reactance referred to the main stator winding,  $X_m$ =Magnetizing reactance. (10)

4. Explain the working principle with neat sketches of:
  - a. Split phase single phase induction motor.
  - b. Capacitor start single phase induction motor. (2×5=10)

#### SECTION - C

5. Explain the terms coil-span factor and distribution factor in connection with alternator armature windings and deduce the emf equation of an alternator incorporating the effects of these factors. (10)
6. Describe the construction of a three phase synchronous alternator. What are the different types of rotor constructions, explain with diagrams? (10)

#### SECTION - D

7. Explain the effect of varying excitation on armature current and power factor in a synchronous motor. (10)
8. Why is synchronous motor not self-starting? What methods are generally used to start the synchronous motors? (10)

#### SECTION - E (Compulsory)

9. Explain the following:
  - (i) Define the term voltage regulation of synchronous generator.

- (ii) What are the conditions necessary for paralleling alternator?
- (iii) What is a synchronous compensator?
- (iv) What are the causes of hunting in synchronous motors?
- (v) Briefly explain armature reaction in synchronous machines.
- (vi) List the methods for starting of three phase squirrel cage induction motor. Which type of starter is used for both small and medium sized motors?
- (vii) Explain the condition for obtaining maximum torque of three phase induction motor.
- (viii) What is meant by slip energy recovery?
- (ix) What is a forward and backward rotating fields of a single phase induction motors?
- (x) Compare a single phase induction motor with a 3 phase induction motor. (10×2=20)