

B. Tech 5th Semester Examination

Electrical Machine-II (NS)

EE-311

Time : 3 Hours

Max. Marks : 100

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 sections A, B, C and D. Section-E is compulsory.

SECTION - A

1. (a) Derive the condition for maximum torque of a three phase induction motor under running condition. (6)
- (b) Discuss any two methods for speed control of 3-phase squirrel cage induction motor. (6)
- (c) A 25 HP, 400 V, 4-pole, 50 Hz squirrel cage induction motor with mesh connected stator takes a full load current of 37.5 A and has a slip of 4%. The impedance per phase is 2.8Ω . Calculate the starting current and starting torque, if motor is started by (i) direct switching, (ii) a star-delta starter and (iii) an auto transformer with 65 % tapping. (8)
2. (a) Correlate the operation of a transformer and induction motor. (6)
- (b) Explain the following starters used for starting a three phase induction motor:
 - (i) auto-transformer starter
 - (ii) star-delta starter (10)

- (c) A three phase, six pole, 50 Hz induction motor has a slip of 4% when the output is 20 kW. The frictional loss is 250 W. Calculate (a) the rotor speed and (b) the rotor copper loss. (4)

SECTION - B

3. (a) Discuss the phenomena of Cogging or magnetic locking and Crawling in induction motor. (8)
- (b) Discuss the construction, operation and characteristics of the following:
 - (i) Repulsion motor.
 - (ii) Servo motor. (12)
4. (a) Using double field revolving theory, compose why a single phase induction motor is not self-starting. Also obtain the equivalent circuit of single phase induction motor with necessary equations. (14)
- (b) Explain the circuit diagram of an induction motor. What information does it convey? (6)

SECTION - C

5. (a) A three phase 16 pole alternator has a star-connected winding with 144 slots and 10 conductors per slot. The flux per pole is 0.04 Wb and is sinusoidally distributed. The speed is 375 rpm. Find frequency, phase e.m.f. and line e.m.f. The coil span is 160° electrical. (10)
- (b) What are the advantages of connecting alternators in parallel? What are the conditions needs to be fulfilled for the parallel operation of alternators? (6)
- (c) What are the advantages of stationary armature and rotating field in an alteranator? (4)

[P.T.O.]

6. (a) A three-phase star connected alternator, driven at 1000 rpm is required to generate a line voltage of 440 V at 50 Hz on open-circuit. The stator has 2 slots per pole per phase and 4 conductors per slot. Calculate (a) the number of poles and (b) the useful flux. (10)
- (b) Describe the construction and principle of operation of salient pole alternator with a neat sketch. (10)

SECTION - D

7. (a) Derive the mechanical power developed per phase of a synchronous motor. (8)
- (b) The full load current of a 3.3 kV, star connected synchronous motor is 160 A at 0.8 p.f. lagging. The resistance and synchronous reactance of the motor are 0.8Ω and 5.5Ω per phase respectively. Calculate the excitation e.m.f, torque angle, efficiency and shaft output of the motor. Assume the mechanical stray load loss to be 30 kW. (12)
8. (a) Draw the simplified equivalent circuit of synchronous motor and examine the effect of loading in synchronous motor at various power factors with help of phasor diagrams. (12)
- (b) A 6600V, 3 phase, star connected synchronous motor draws a full load current of 80A at 0.8pf leading. The armature resistance is 2.2Ω and reactance of 22Ω per phase. If the stray losses of the machine are 3200 W. Find (i) E.m.f. induced (ii) Output power (iii) Efficiency of the machine. (8)

SECTION - E

9. Attempt all questions.
- (a) Compare squirrel cage rotor and slip ring rotor in 3-phase inductor motor.
- (b) Why the air gap between stator core and rotor of an induction motor is made very small?

- (c) Demonstrate why the stator core of induction motor made of silicon content steel stamping.
- (d) Name the motor being used in ceiling fans.
- (e) Why single phase induction motor is not self-starting? Name any one method of starting.
- (f) List the various methods to determine the voltage regulation.
- (g) Give the reason why two reaction theory is applied only to salient pole machines.
- (h) Define synchronizing torque.
- (i) Define hunting.
- (j) Tell the need for starters in synchronous motors.

(2×10=20)