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**Question Paper Code : 90516**

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Fourth Semester

Electrical and Electronics Engineering

EE 8401 — ELECTRICAL MACHINES-II

(Regulations 2017)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define voltage regulation of an alternator.
2. State the use of slip test on an alternator.
3. Mention the applications of synchronous motor.
4. Compare the synchronous motor with induction motor.
5. What is cogging in induction motor? How can it be overcome?
6. A 4 pole, 3 phase induction motor runs at 1440 rpm on a 50 Hz supply. Find the slip speed and slip.
7. What is voltage/frequency method and write its necessity?
8. Define slip power in an induction motor.
9. Draw the equivalent circuit of a single phase induction motor.
10. Define step angle.

PART B — (5 × 13 = 65 marks)

11. (a) (i) Derive the expression for EMF induced in a three phase alternator. (7)
- (ii) A three phase, star connected, 16 pole alternator has 192 slots with 8 conductors/slot, coil span = 160 electrical degrees, speed of alternator = 375 rpm, flux/pole = 55 mwb. Calculate the phase and line voltages. (6)

Or

- (b) (i) What is armature reaction in three phase alternator and explain its effects at different power factor on synchronous machine. (7)
- (ii) Write the conditions and methods used for connecting two alternators in parallel. With neat diagram, explain any one method in detail. (6)
12. (a) (i) Discuss the principle of operation of a three phase synchronous motor with neat diagrams. (7)
- (ii) Derive the expression for power developed in a three phase synchronous motor. (6)

Or

- (b) Describe the effect of varying excitation on armature current and power factor with relevant phasor diagrams and write the inference. (13)
13. (a) With neat sketches, explain the construction and principle of operation of a three phase induction motor. (13)

Or

- (b) (i) Deduce the power stages in a three phase induction motor. (7)
- (ii) The power input to a three phase induction motor is 60 kW, the stator losses are 1 kW. Find the mechanical power developed and rotor copper loss per phase of the motor is running with a slip of 3%. (6)
14. (a) (i) With neat diagrams explain the working of auto transformer starter for a three phase induction motor. (7)
- (ii) Describe the rotor resistance starter of a slip ring induction motor with diagram. (6)

Or

- (b) With neat sketches, discuss the slip power recovery scheme of three phase induction motor. Enumerate its merits and demerits. (13)

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15. (a) Explain the double field revolving theory for operation of single phase induction motor and how the motor is started. (13)

Or

- (b) (i) Draw and explain the concept of linear induction motor. (7)  
(ii) Explain the principle of operation of AC series motor with neat sketch. (6)

PART C — (1 × 15 = 15 marks)

16. (a) (i) Derive the expression for the torque developed in a three phase induction motor and deduce the condition for maximum starting torque. (8)  
(ii) Discuss the complete torque – speed characteristics of three phase induction motor and explain the four quadrant operation of the motor. (7)

Or

- (b) (i) Draw and explain the approximate equivalent circuit of a three phase induction motor. (8)  
(ii) A 3 phase, star connected 450 V, 50 Hz, 4 pole induction motor has the following per phase parameters in ohms, referred to the stator.  
 $R_1 = 0.15 \Omega, X_1 = 0.45 \Omega, R_2 = 0.12 \Omega, X_2 = 0.45 \Omega, X_m = 28.5 \Omega$  Compute the stator current and power factor when the motor is operated at rated voltage and frequency with  $S = 0.04$ . (7)