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Question Paper Code : 40572

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2025.

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. Write the advantages of short pitched coil.
2. Write the significance of capability curves.
3. List the applications of a 3 ϕ synchronous motor.
4. What is hunting and how is it prevented?
5. Compare squirrel cage induction motor with slip ring induction motor.
6. What is induction generator and justify why is it always connected with grid?
7. Write the drawback of stator voltage control method and identify the load which is suitable for this method.
8. List the types of starters used for 3 ϕ induction motor.
9. Draw the equivalent circuit of a 1 ϕ induction motor.
10. Determine the step angle of a single stack, 4 phase, 6 pole VR stepper motor.

PART B — ($5 \times 13 = 65$ marks)

11. (a) (i) Derive the emf equation of a 3ϕ delta connected alternator. (7)
- (ii) Calculate the RMS value of induced emf per phase of 10 pole, 3ϕ , 50 Hz alternator with 2 slots per pole per phase and 4 conductors per slot in two layers. The coil span is 150. The flux per pole is 0.12 wb. (6)

Or

- (b) (i) Describe how the direct and quadrature axis reactances of a salient pole synchronous machine can be estimated by slip test. (7)
- (ii) Discuss the parallel operation of two alternators with identical speed-load characteristics. (6)
12. (a) With sketches, explain the construction and principle of operation of a 3ϕ synchronous motor. Also discuss different methods of starting of 3ϕ synchronous motor.

Or

- (b) (i) Describe in detail the effect of varying excitation on stator current and power factor of synchronous motor. (7)
- (ii) Calculate the maximum power delivered by 1500 Kw, 3 phase, star connected, 4 Kv, 48 pole, 50 Hz synchronous motor, with synchronous reactance of 4Ω per phase and unity power factor. (6)
13. (a) (i) Explain the construction and operating principle of a 3ϕ induction motor. (7)
- (ii) Draw and explain the speed – torque characteristics of a 3ϕ induction motor. (6)

Or

- (b) (i) Explain in detail about the construction of circle diagram of an induction motor. (7)
- (ii) The power input to the rotor of a 415 V, 50 Hz, 4 pole, 3ϕ induction motor is 55 kW. The frequency of rotor induced emf is 2 Hz. Find (1) the slip (2) Rotor speed (3) Rotor copper loss and (4) Mechanical power developed. (6)
14. (a) (i) Describe the necessity of V/f control in 3ϕ induction motor and explain. (7)

- (ii) Determine the starting torque of an induction motor in terms of full load torque when started by means of an autotransformer with 50% tapping. The short circuit current of the motor at normal voltage is five times the full load current and the full load slip is 5%. (6)

Or

- (b) With sketches, describe the working of slip power recovery scheme (Static Kramer system) of a 3 ϕ wound rotor induction motor.
15. (a) With double field revolving theory, explain that the 1 ϕ induction motor has no starting torque. Explain the principle of operation of any one type of 1 ϕ induction motor.

Or

- (b) With sketches, describe the construction principle and characteristics of
- (i) AC series motor
- (ii) Variable Reluctance stepper motor. (6 + 7)

PART C — (1 × 15 = 15 marks)

16. (a) (i) Derive the torque expression of a 3 ϕ induction motor and obtain and analyse the condition for maximum starting torque. (8)
- (ii) A 3 ϕ , 400/200 V, star-star connected wound rotor induction motor has 0.06 Ω rotor resistance and 0.3 Ω stand still reactance per phase. Find the additional resistance required in the rotor circuit to make the starting torque equal to maximum torque of the motor. (7)

Or

- (b) (i) Analyze the effects of armature reaction in a 3 ϕ alternator. (8)
- (ii) Two 20 MVA, 3 ϕ alternators operate in parallel to supply a load of 35 MVA at 0.8 PF lagging. If the output of one machine is 25 MVA at 0.9 PF lagging. What is the output and power factor of the other machine? (7)

