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Question Paper Code : 41035

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2024.

Fourth Semester

Electrical and Electronics Engineering

EE 3405 — ELECTRICAL MACHINES – II

(Regulations 2021)

Time : Three hours　　　　Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. List the different methods of determining voltage regulation of synchronous generator.

2. Why an alternator is rated in kVA and not in kW?

3. Recall the hunting effect in synchronous motor operation.

4. How the direction of rotation of three phase synchronous motor is reversed?

5. A 12-pole, 3-phase alternator driven at a speed of 500 RPM supplies power to an 8-pole, 3-phase induction motor. If the slip of the motor, at full-load is 3%, Calculate the full-load speed of the motor.

6. Write the equation for starting torque of three phase induction motor.

7. List the advantages of slip power recovery schemes.

8. Mention the methods of speed control from rotor side of induction motor.

9. State the starting methods of single phase induction motor.

10. A four-stack VR stepper motor has a step angle of 1.8°. Find the number of its rotor and stator teeth.

PART B — (5 × 13 = 65 marks)

11. (a) Discuss the EMF method of determining regulation of a synchronous generator. (13)

Or

(b) Explain the construction and working principle of synchronous generator in detail, with neat diagrams. (13)

12. (a) Explain in detail the effect of excitation on armature current and power factor (V curve and inverted V curve) of a synchronous motor. (13)

Or

(b) A 75-kW, 400-V, 4-pole, 3-phase star connected synchronous motor has a resistance and synchronous reactance per phase of 0.03 ohm and 0.4 ohm respectively. Compute for full-load 0.8 p.f. lead the open circuit E.M.F per phase and mechanical power developed. Assume an efficiency of 92.5%. (13)

13. (a) A 1100–V. 50-Hz delta-connected induction motor has a star-connected slip–ring rotor with a phase transformation ratio of 3.8. The rotor resistance and standstill leakage reactance are 0.011 ohm and 0.24 ohm per phase respectively. Neglecting stator impedance and magnetising current determine, (13)

(i) the rotor current at start with slip-rings shorted (1)

(ii) the rotor power factor at start with slip-rings shorted (3)

(iii) the rotor current at 4% slip with slip-rings shorted (3)

(iv) the rotor power factor at 4% slip with slip-rings shorted (3)

(v) the external rotor resistance per phase required to obtain a starting current of 100 A in the stator supply lines. (3)

Or

(b) (i) Derive the equation for torque under starting and running condition. (7)

(ii) Explain the torque-slip characteristics of induction motor with neat sketches. (6)

14. (a) Discuss in detail about the various speed control methods of induction motor from stator side. (13)

Or

(b) Explain the operation of Static Scherbius and Static Kramer system along with merits and demerits compared to conventional system. (13)

15. (a) Explain the constructional features and working principle of hysteresis motor and AC series motor with neat diagrams. (13)

Or

(b) Why single phase induction motors are not self-starting? Discuss the working of capacitor-start, capacitor-run and shaded pole type induction motor. (13)

PART C — ($1 \times 15 = 15$ marks)

16. (a) A 3-phase, star-connected alternator supplies a load of 10 MW at 0.86 p.f lagging and at 11 kV (terminal voltage). Its resistance is 0.11 ohm per phase and synchronous reactance 0.66 ohm per phase. Calculate the line value of E.M.F generated.

Or

(b) A 400 V, 3-phase, 50 Hz, 4-pole, star-connected induction-motor takes a line current of 10 A with 0.85 p. f. lagging. Its total stator losses are 5% of the input. Rotor copper losses are 4 % of the input to the rotor, and mechanical losses are 3% of the input of the rotor. Calculate

(i) slip and rotor speed, (5)

(ii) torque developed in the rotor, and (5)

(iii) shaft-torque. (5)