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B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2021.

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. The value of voltage regulation obtained by EMF method is always higher than the actual value. State the reason for this error.

2. Draw the phasor diagram of salient pole synchronous generator at lagging power factor.

3. How synchronous motor can be used as synchronous condenser?

4. State the uses of damper winding in Synchronous machine. State its location also.

5. What are the advantages of skewing of cage rotor conductors?

6. Define the phenomena, skewing of an induction motor. Also draw the torque-slip characteristic due to fundamental and 7th harmonic fluxes.

7. A 3.7 kW, 3-phase induction motor has a locked rotor current of 5 times the full-load current and the full-load slip is 5%. Find the starting torque as a percentage of full load torque if the motor is started by Star-Delta starter.

8. How is the speed of an induction motor varied by varying the frequency of supply? Mention the advantages of this method.

9. State the application of (a) Capacitor start and run Induction motor and (b) Universal motor.

10. Why capacitors are connected in auxiliary and main winding of a 1-phase Induction motor?

PART B — (5 × 13 = 65 marks)

11. (a) Two generators G1 and G2 are running in parallel at no load. Analyse the sequence of effects when the prime mover input of G2 is increased and hence deduce the importance of synchronising power for satisfactory synchronous operation. Also derive the expression for the Synchronising power. (13)

Or

(b) Explain the synchronous impedance method of predetermining the voltage regulation of an alternator. (13)

12. (a) Explain the effect of varying excitation upon the armature current and power factor of a synchronous motor when the input active power to the motor is maintained constant. Support your answer with relevant phasor diagrams. (13)

Or

(b) A 600 V, 3-phase star connected synchronous motor draws a full load current of 80 A at 0.8 p.f. leading. The armature resistance is 22 Ω and synchronous reactance 22 Ω per phase. If the stray losses of the machine are 3200 W, determine

(i) the emf induced

(ii) the output power and

(iii) the efficiency. (13)

13. (a) Estimate the ratio between maximum and full load torque for a 20 HP, 50 Hz, 3-phase, star connected Induction motor with the following test results:

No load test : 400 V, 9 A, 0.2 pf lagging

Blocked rotor test: 200 V, 50 A, 0.4 pf lagging

Stator resistance per phase: 0.56 Ω. (13)

Or

(b) Derive an expression for torque developed in a 3-phase slip-ring induction motor and explain with the aid of speed-torque curve, the speed control of the motor when (13)

(i) the applied voltage is halved and

(ii) the rotor resistance is doubled.

14. (a) Explain with a neat diagram the electrical braking of three phase Induction motor. (13)

Or

(b) Describe the following methods of speed control for 3-phase induction motor, (i) by changing the applied voltage and (ii) by changing the number of poles. (13)

15. (a) Explain using Double revolving field theory, why a single-phase Induction motor is not self-starting. Also describe starting of single-phase induction motor using shaded pole technique and bring out its salient features and applications. (13)

Or

(b) Explain with a neat diagram, the operation of permanent magnet stepper motor. (13)

PART C — (1 × 15 = 15 marks)

16. (a) A 3-phase slip-ring Induction motor has a star-connected rotor. The rotor emf between slip-rings at standstill is 600 V. The rotor standstill impedance per phase is (0.5 + j 2.5) Ω. Find (i) Rotor current per phase at starting if the slip rings are short circuited (ii) Rotor current per phase at starting if a star connected rheostat of 4 Ω per phase is added to the rotor circuit and (iii) full load rotor current and rotor pf with slip-rings short circuited at 4% slip. (15)

Or

(b) A 1000 kVA, 11 kV, 3-phase, star-connected Alternator has an effective resistance of 2 Ω per phase. The OCC and ZPF lagging characteristic for full-load current are given below. Predetermine the voltage regulation for full-load condition at 0.8 pf lagging by ZPF method. (15)

Field current(A)	20	25	55	70	30
OCC Phase Voltage (V)	3348.6	4041.5	7216.9	7938.6	8660.3
ZPF phase Voltage (V)	0	866.0	4907.5	6062.2	7216.9

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