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Question Paper Code : 80568

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2024.

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. Why stationery armature is preferred in alternators?

2. Define direct axis and quadrature axis reactance.

3. State the operating power factor of a synchronous motor?

4. What are the methods of starting synchronous motor?

5. A three-phase, 8-pole induction motor is supplied from a 60 Hz. 400 V supply. Calculate.

   (a) the synchronous speed, and

   (b) the speed of the rotor when the slip is 2 per cent.

6. A three-phase, 6-pole, 50 Hz induction motor develops maximum torque at 940 rpm. The rotor reactance at stand still per phase is 0.1 Ω. What is the frequency of rotor currents at 940 rpm.

7. What are the different types of starters for three phase induction motor?

8. Mention the different modes of operation of a three phase induction motor.

9. Mention the types of single phase induction motors.

10. Compare forward and backward rotating magnetic field.

PART B — (5 × 13 = 65 marks)

11. (a) A 500 kVA, three-phasc, star-connected alternator has a rated line-to-line terminal voltage of 3300 V. The resistance and synchronous reactance per phase are 0.3 and 4.0 W respectively. Calculate the voltage regulation at full load 0.8 power-factor lagging. (13)

Or

(b) The no-load test performed on a 1000 kVA, 3000 V, 50Hz, three-phase star connected alternator gave the following readings:

I_f(A)	15	30	50	75	90	120	150
V/ph (V)	345	690	1200	1675	1900	2130	2200

The effective armature resistance is 0.25 ohms.

When short-circuit test was conducted, a field current of 50 A was required to circulate the full-load current. Determine the percentage voltage regulation of the alternator on full-load at 0.8 lagging power factor by mmf method. (13)

12. (a) A 3-phase synchronous motor of 10kW at 1100 V has synchronous reactance of 8 Ohms per phase. Find the minimum current and the corresponding induced emf for full-load condition, The efficiency of the machine is 0.8. Neglect armature resistance. (13)

Or

(b) The excitation corresponding to no-load voltage of a 3-phase synchronous motor running at 1500 rpm is kept constant. Determine the power input, power factor and torque developed for an armature current of 200 A if the synchronous reactance is 5 Ohms per phase and armature resistance is neglected. (13)

13. (a) The impedance of the rotor circuit at standstill of a 1000 HP, 3-phase, 16-pole induction motor is (0.02 +j 0.15) ohm. It develops full-load torque at 360 rpm what will be.

(i) The ratio of maximum to full load torque;

(ii) The speed at maximum torque;

(iii) The rotor resistance to be added to get maximum starting torque. (4+4+5)

Or

(b) The power input to a three-phase induction motor is 50 kW and the corresponding stator losses are 2 kW. Calculate (i) the total mechanical power developed and the rotor I^2R-loss when the slip is 3 per cent, (ii) the output horse power of the motor if the friction and windage losses are 1.0 kW, and (iii) efficiency of the motor. (5+4+4)

14. (a) The ratio of maximum torque to full-load torque in a 3-phase squirrel cage induction motor is 2.5. Calculate the ratio of starting torque to full load torque for (i) direct-on-line starting; (ii) star-delta starting; and (iii) autotransformer starting with tapping at 75 per cent. (4+5+4)

Or

(b) Explain speed control methods of induction motor by changing the poles using the cascade method. (6+7)

15. (a) Explain the procedure to draw the equivalent circuit of single phase induction motor. (13)

Or

(b) A single-phase induction motor draws a current of 0.5 A at 230 V and 0.6 lagging p.f. If it runs at a speed of 100 radian per second and develops an output torque of 0.3 Nm. Find its output power and efficiency. (13)

PART C — (1 × 15 = 15 marks)

16. (a) A 4-pole 25 kVA, 400 V, 50Hz, three-phase star connected synchronous generator gave the following test data.

Field current If (A)	2	4	6	8	10	12	14	16
No-load terminal voltage, (V)	138	277	355	415	468	502	533	554
Zero power factor load terminal voltage (V)	-	-	0	108	218	295	346	415

Determine the voltage regulation at full-load 0.8 power factor lagging by Potier triangle method. The armature resistance is 0.2 ohms. (15)

Or

(b) The following readings were obtained when no-load and blocked rotor tests were performed on a 3-phase 400 V, 14.9 kW induction motor:

No-load test: 400 V, 1250 W, 9 A

Blocked rotor test: 150 V, 4000 W, 38 A

Find full-load current and power factor of the motor Using circle diagram. (7+8)