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Question Paper Code : 60507

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016.

Fifth Semester

Electrical and Electronics Engineering

EE 2302/EE 52/EE 1301/10133 EE 505 — ELECTRICAL MACHINES — II

(Regulations 2008/2010)

(Common to PTEE 2302/10133 EE 505 — Electrical Machines II for B.E. (Part – Time) Fourth Semester – Electrical and Electronics Engineering – Regulations 2009/2010)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Distinguish the use of salient pole and round rotor synchronous machines.

2. Draw typical open circuit and short circuit characteristics of synchronous machine.

3. What is meant by hunting of a synchronous motor?

4. What are the uses of damper winding in synchronous motor?

5. How the direction of rotation of a three—phase induction motor can be — reversed?

6. What is an induction generator?

7. What is the effect of increasing the rotor resistance on starting current and torque?

8. List out the methods of speed control of cage type 3Φ induction motor.

9. Draw the torque slip characteristics of single phase induction motor.

10. What will be the direction of rotation of a shaded pole single phase induction motor?

PART B — (5 × 16 = 80 marks)

11. (a) (i) Explain the EMF and MMF method of evaluating the synchronous reactance.

(ii) A 220 V, 50 Hz, 6-pole star connected alternator with ohmic resistance of 0.06 ohm per phase, gave the following data for open-circuit, short-circuit and full load zero-power-factor characteristics. Find the percentage voltage regulation at full-load current of 40A at power-factor of 0-8 lag by (1) emf method (2) mmf method and (3) zpf method. Compare the results so obtained.

Field current, A	0.20	0.40	0.60	0.80	1.00	1.20
Open-circuit voltage, Emf in V	29.0	58.0	87.0	116	146	172
Short-circuit current, Lsc in A	6.6	13.2	20.0	26.5	32.4	40.0
Z.p.f. terminal voltage in V	–	–	–	–	–	0
Field current, A	1.40	1.80	2.20	2.60	3.00	3.40
Open-circuit voltage, Emf in V	194	232	261.5	284	300	310
Short-circuit current, Lsc in A	46.3	59.0	–	–	–	–
Z p.f terminal voltage in V	29	88	140	177	208	230

Or

(b) (i) Derive an expression for real and reactive power outputs of asynchronous generator. (10)

(ii) Illustrate a method for determining the direct and quadrate axis reactances of a salient pole synchronous generator. (6)

12. (a) The synchronous reactance per phase of a 3-phase, star connected 6600 V synchronous motor is 20 Ω. For a certain load the input is 900 kW at normal voltage and the induced line emf is 8500 V. Determine the line current and power factor. (16)

Or

(b) (i) Explain V curves and inverted V curves of a synchronous motor. (8)

(ii) Draw and explain the equivalent circuit and phasor diagram of a cylindrical rotor synchronous motor operating at different power factors. (8)

13. (a) (i) Deduce and discuss the equivalent circuit of 3 Φ induction motor. (8)

(ii) Explain with neat diagram, the constructional features and working principle of a 3Φ induction motor. (8)

Or

(b) Sketch and explain the torque slip characteristics of the 3 Φ cage and slip-ring induction motors. Show the stable region in the graph. (16)

14. (a) (i) State the different methods of starting of 3—phase induction motor and discuss in detail any two methods. (8)

(ii) With aid of diagrams explain the principle of the following methods of speed control of a 3—phase induction motor.

(1) variable Frequency

(2) cascade connection. (8)

Or

(b) (i) Describe a starter suitable for a 3—phase slip—ring induction motor. (6)

(ii) Determine approximately the starting torque of an induction motor in terms of full load torque when started by

(1) Star—delta starter and

(2) Auto—starter with 50% tapping. The short circuit current of the motor at normal voltage is 5 times the full load current and the full load slip is 4%. (10)

15. (a) (i) Using double revolving field theory explain why a single phase induction motor is not self starting. (8)

(ii) The equivalent impedances of the main and auxiliary windings in a capacitor motor are $(15 + j\ 22.5)\ \Omega$ and $(50 + j\ 120)\ \Omega$ respectively, while the capacitance of the capacitor is 12 μF. Determine the line current at starting on a 230 V, 50Hz supply. (8)

Or

(b) Explain the operation and constructional features of

(i) Capacitor start single phase induction motor

(ii) AC series motor. (16)

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