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Question Paper Code : 21401

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2013.

Fifth Semester

Electrical and Electronics Engineering

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

(Regulation 2008/2010)

(Common to PTEE 2302 Electrical Machines II for B.E. (Part-Time)
Fourth Semester Electrical and Electronics Engineering – Regulation 2009)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the types of synchronous machines with respect to its rotor construction?

2. State the conditions to be satisfied for parallel operation of alternators.

3. What are V curves?

4. What are the starting methods of synchronous motor?

5. Define slip of three phase induction motor.

6. State the condition of maximum torque developed in three phase induction motor.

7. What are the different methods of speed control employed in three phase cage induction motor?

8. Why it is objectionable to start large three phase induction motor by switching it directly on the line?

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) Describe the POTIER method of determining the regulation of an alternator. (8)

(ii) A 3.3 kV alternator gave the following results :

Field current (A) :	16	25	37.5	50	70
OC voltage (kV) :	1.55	2.45	3.3	3.75	4.15

A field current of 18 A is found to cause the full load current to flow through the winding during short circuit test. Predetermine the full load voltage regulation at (1) 0.8 pf lag and (2) 0.8 pf lead by MMF method. (8)

Or

(b) (i) Describe the slip test for finding X_d and X_q. (8)

(ii) Two similar, 3 phase alternators work in parallel and deliver a total real power of 1800 kW at 11 kV and at 0.85 pf lagging to the load. Each alternator initially supplied half the load power. The excitation of the first alternator is then increased such that its line current becomes 60 A lagging. Find the line current delivered by the second alternator. (8)

12. (a) Draw and explain the current loci of synchronous motor for (i) constant power input and (ii) constant excitation. Also obtain the minimum and maximum excitation for given mechanical power. (16)

Or

(b) (i) Derive the expression for power developed in a synchronous motor. Also find the condition for maximum power developed. (8)

(ii) A 6 pole, 3 phase, star connected synchronous motor has synchronous impedance of $(0.5 + j8.0)\ \Omega$ per phase. When operating on 2.2 kV, 50 Hz bus bars, its field current is such that the induced emf is 1.8 kV. Calculate the maximum torque that can be developed at this excitation condition. (8)

13. (a) (i) Derive the torque-slip characteristics of 3 phase induction motor and explain. (8)

(ii) The real power input to a 415 V, 50 Hz, 6 pole, 3-phase induction motor running at 970 rpm is 41 kW. The input power factor is 0.9. The stator losses amount to 1.1 kW and the mechanical losses total 1.2 kW. Calculate the line current, slip, rotor copper loss, mechanical power output and efficiency. (8)

Or

(b) (i) Show how a 3 phase induction motor can be represented by an approximate equivalent circuit. (8)

(ii) Explain with necessary diagrams the principle of operation and characteristics of the double cage induction motor. (8)

14. (a) (i) With a help of neat sketch, describe the principle of working of a Star-Delta starter for an induction motor. (8)

(ii) Explain the principle of cascade connection of induction motor. (8)

Or

(b) (i) Describe in detail the slip power recovery scheme of three phase induction motor. (8)

(ii) With the aid of diagrams, explain the principle of the following methods of speed control of a three phase induction motor (1) variable frequency (2) pole changing. (8)

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, 50 Hz supply. (8)

Or

(b) Explain the operation and constructional features of

(i) Capacitor start single phase induction motor

(ii) AC series motor. (16)
