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Question Paper Code : 91444

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2014.

Fifth Semester

Electrical and Electronics Engineering

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

(Regulation 2008/2010)

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

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. What are the essential elements for generating emf in alternators?

2. Two reaction theory is applied only to salient pole machines. State the reason.

3. What is meant by 'synchronous condenser'?

4. What could be the reasons if a 3-phase synchronous motor fails to start?

5. Define 'slip' of an induction motor.

6. What are the merits and demerits of double squirrel cage induction motors?

7. What type of protection is provided in the starter meant for 3-phase induction motors?

8. While controlling the speed of an induction motor, how is super-synchronous speed achieved?

9. How is the direction of rotation of a single phase induction motor reversed?

10. What is the principle of reluctance motor?

PART B — (5 × 16 = 80 marks)

11. (a) (i) Develop the formula for the induced emf in an alternator. (6)

(ii) Describe the method of determining the voltage regulation of an alternator by synchronous impedance method. (10)

Or

(b) (i) Describe the salient constructional features of ac generators driven by (1) diesel engines. (2). steam engines. (12)

(ii) A 3-phase star-connected salient pole synchronous generator is driven at a speed near synchronous with the field circuit open, and the stator is supplied from a balanced 3-phase supply. Voltmeter connected across the line gave minimum and maximum readings of 2800 volts and 2820 volts. The line current fluctuated between 360 A and 275 A. Find the direct and quadrature-axis reactances per phase. Neglect armature resistance. (4)

12. (a) (i) Explain V curves as applied to synchronous motors. (6)

(ii) Describe the different methods of starting a synchronous motor. (10)

Or

(b) (i) A 3-phase, star-connected synchronous motor rated at 187 kVA, 2300 V, 47 A, 50 Hz, 187.5 rpm has an effective resistance of 1.5 Ω and a synchronous reactance of 20 Ω per phase. Determine the internal power developed by the motor when it is operating at rated current and 0.8 power factor leading. (6)

(ii) What are 'constant excitation circles and constant power circle' for a synchronous motor? How are they derived? (10)

13. (a) (i) Explain the working principle of a 3-phase induction motor. (8)

(ii) Draw and explain the slip-torque characteristics of a typical 3-phase induction motor. Mark the starting torque and maximum torque regions on the diagram so drawn. (8)

Or

(b) (i) An induction motor has an efficiency of 0.9 when the shaft load is 45 kW. At this load, stator ohmic loss and rotor ohmic loss each is equal to the iron loss. The mechanical loss is one-third of the no-load losses. Neglect ohmic losses at no-load. Calculate the slip. (8)

(ii) Describe the principle of operation of synchronous induction motor. (8)

14. (a) (i) A 3-phase 440 V distribution circuit is designed to supply not more than 1200 A. Assuming that a 3-phase squirrel cage induction motor has full-load efficiency of 0.85 and a full- load power factor of 0.8 and that the starting current at rated voltage is 5 times the rated full-load current, what is the maximum permissible kW rating of the motor if it is to be started using an auto-transformer stepping down the voltage to 80%? (4)

(ii) With neat diagrams. explain the slip-power recovery schemes as applied to wound-rotor induction motors. (12)

Or

(b) (i) With the help of a neat diagram, explain the working of a star-delta starter for a three-phase induction motor. (10)

(ii) Describe the method of speed control of a 3-phase squirrel cage induction motor by changing the number of stator poles and state the applications of this method. (6)

15. (a) (i) Derive the equivalent circuit of a single phase induction motor with the help of double field revolving theory. (8)

(ii) Explain the no-load test and blocked rotor test for obtaining the equivalent circuit parameters of a single phase induction motor. (8)

Or

(b) (i) Explain the constructional details, principle of operation and the applications of Hysteresis motor. (10)

(ii) What modifications have to be done on a DC series motor to make it to work with single phase AC supply? State the applications of AC series motors. (6)
