F 3333 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Seventh Semester

Branch : Electrical and Electronics Engineering

EE 010 702—SYNCHRONOUS MACHINES (EE)

(New Scheme—2010 Admission onwards—Regular/Supplementary)

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 3 *marks.*

1. Mention the advantages of stationary armature.
2. Give the reason for obtaining high value of voltage regulation in EMF method.
3. Why synchronous motor is not self starting ?
4. What is synchronous condenser ?
5. What is exciter response ?

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each question carries 5 *marks.*

6. Define distribution factor and derive an expression for the same.
7. When the load on the alternator is varied, how the terminal voltage is changed ?
8. Derive the synchronising torque equation.
9. Explain power angle characteristics of synchronous generator.
10. Discuss the requirements of excitation system and what is exciter ceiling voltage.

(5 × 5 = 25 marks)

Part C

Answer **all** *questions.*
Each full question carries 12 *marks.*

11. (a) Explain different types of armature windings in alternators. (8 marks)

(b) A 3-phase, 16 pole alternator has star connected armature winding with 144 slots and 10 conductors/slot. The flux per pole is 0.035 Wb sinusoidally distributed and the speed is 375 r.p.m. Find the line e.m.f. generated assuming full pitched coils.

(4 marks)

Or

Turn over

12. (a) A 3-phase, 50 Hz, 10 pole star connected alternator has 2 slots per pole per phase and 4 conductors per slot in two layers. The coil span is 150°. The flux per pole has fundamental component of 0.12 Wb and 20 % third harmonic component. Find line emf generated. (8 marks)

(b) Compare salient pole and non salient pole types of rotor construction. (4 marks)

13. (a) Draw and explain phasor diagram of salient pole alternator on the basis of two reaction theory. (8 marks)

(b) A 3-phase, 50 Hz, 100 kVA, 3000 V star connected alternator has armature resistance of 0.3 Ω/phase. A field current of 40 A produces short circuit current of 200 A and a line emf of 1050 V on open circuit. Calculate the full-load voltage regulation at 0.8 pf leading. (4 marks)

Or

14. (a) Explain the method of predetermining voltage regulation by ZPF method. (8 marks)

(b) A 3-phase, star connected alternator supplies a current of 10 A at a phase angle of 20° at 400 V. The direct axis and quadrature axis reactances per phase are 10 Ω and 0.5 Ω. Find the components of armature current and voltage regulation neglecting armature resistance. (4 marks)

15. (a) Explain the synchronizing of alternators using synchronizing lamps. (6 marks)

(b) A 440 V, 50 Hz, 3 phase circuit 30 A at 0.8 pf lag. A star connected synchronous motor is used to improve the power factor to unity. Calculate the kVA input and the pf of the synchronous motor when it is also supplying a load of 10 kW and has an efficiency of 85 %. (6 marks)

Or

16. (a) Explain Hunting in synchronous motor and how is it prevented. (6 marks)

(b) Two similar 20 MW alternators operate in parallel. The speed load characteristics of the driving turbines are such that frequency of first alternator drops from 50 Hz on no load to 48 Hz on full load and that of second alternator drops from 50 Hz to 48.5 Hz. How will the two alternators share a load of 30 MW ? (6 marks)

17. Write short notes on the following :—

(i) Steady-state stability limit. (4 marks)

(ii) O curves. (4 marks)

(iii) Power angle characteristics. (4 marks)

Or

18. (a) Draw the circuit model of alternator during steady-state, transient and subtransient states. Discuss how the reactances during these states affect the machine performance. (6 marks)

(b) A 3-phase, star connected synchronous motor takes 48 kW at 693 V, the pf bung 0.8 lag. The induced emf is increased by 30 %, the power taken remaining the same. Find the new current and p.f. The machine has synchronous reactance of 2Ω/phase and negligible resistance.

(6 marks)

19. Explain and compare the various types of excitation systems.

Or

20. Explain the constructional details and principle of operation of Brushless alternator.

[5 × 12 = 60 marks]