**G 716**

# B.TECH. DEGREE EXAMINATION, MAY 2014

## Seventh Semester

Branch : Electrical and Electronics Engineering

EE 010 702—SYNCHRONOUS MACHINES (EE)

(Improvement/Supplementary)

[2010 admissions]

Time : Three Hours

Maximum : 100 Marks

## Part A

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

1. Define chording factor and what are its advantages.

2. Define voltage regulation.

3. What are the functions of damper windings in synchronous machines ?

4. What is Reluctance power ?

5. Discuss about exciter ceiling voltage.

(5 × 3 = 15 marks)

## Part B

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

6. Classify the types of armature windings in alternators.

7. Draw and explain the circuit model of alternator.

8. Explain synchronising current and synchronising power.

9. Discuss the effect of excitation on armature current and powerfactor of synchronous motor.

10. Explain the functions of excitation systems and the methods to increase their response.

(5 × 5 = 25 marks)

## Part C

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

11. (a) Derive the EMF equation of alternator. Discuss the effect of harmonics on pitch and distribution factors.

(8 marks)

Turn over

(b) A three-phase, 16 pole alternator has 144 slots and 10 conductors per slot. The coils are short chorded by 1 slot. Find pitch factor and distribution factor.

(4 marks)

*Or*

12. (a) Explain and compare the types of rotor construction in alternators.

(8 marks)

(b) An alternator has 18 slots/pole and the first coil lies in slots 1 and 16. Calculate the pitch factor for the fundamental and the third harmonic.

(4 marks)

13. (a) Explain slip test on salient pole alternator.

(6 marks)

(b) A 50 kVA, 440 V, 3-phase, star connected alternator has armature resistance of 0.25 $\Omega$/phase, synchronous reactance of 3.2 $\Omega$/phase and leakage reactance of 0.5 $\Omega$/phase. Determine (i) internal emf (E) ; (ii) no load emf (Eo) and the percentage regulation at rated load and upf.

(6 marks)

*Or*

14. (a) Explain the effects of armature reaction in alternators.

(6 marks)

(b) A 3-phase, star connected alternator is rated 20 kVA, 400 V and supplies load at 0.8 pf lag. The generator has resistance 0.5 $\Omega$/phase and direct axis and quadrature axis reactances of 4$\Omega$ and 2$\Omega$ respectively/phase. Calculate the load angle and voltage regulation.

15. (a) Explain with diagram, parallel operation of three-phase alternators.

(6 marks)

(b) A 11 kV, 3-phase, star connected synchronous motor draws a current of 60 A. The effective resistance and reactance per phase are 1 $\Omega$ and 30 $\Omega$ respectively. Find the induced emf for a power factor of 0.8 lag and lead.

(6 marks)

*Or*

16. (a) Explain the various methods of starting of synchronous motors.

(6 marks)

(b) The speed regulations of two 800 kW alternators A and B running in parallel are 100 % to 104 % and 100 % to 105 % from full-load to no load respectively. How will the two alternators share a load of 1000 kW ? What will be the maximum load that can be delivered by both the machines without overloading either of them ?

(6 marks)

17. (a) Explain the variation of current during symmetrical short circuit of unloaded alternator.

(6 marks)

(b) A 3-phase, 4 pole, 6000 kVA, 5000 V, 50 Hz star connected alternator having a short circuit reactance of 25 % is running on infinite busbars. Calculate the natural time period of oscillation if it has a moment of inertia of 16800 kg.-m.$^2$

(6 marks)

*Or*

18. (a) Explain the effect of varying excitation on armature current and powerfactor of synchronous motor.

(6 marks)

(b) A 5000 kVA, 10 kV, 50 Hz, 1500 r.p.m., 3-phase alternator runs in parallel with other machines at full-load, 0.8 pf lagging. Calculate (i) synchronizing power per unit mechanical angle of phase displacement ; (ii) synchronizing torque if the mechanical displacement is 0.5.

(6 marks)

19. (a) Explain the different types of excitation systems. (8 marks)

(b) Discuss the principle of operation of Brushless alternator. (4 marks)

Or

20. (a) With sketches, explain the constructional features of Brushless Alternator. (8 marks)

(b) Discuss excitation method in Brushless Alternator. (4 marks)

[5 × 12 = 60 marks]