

Electrical Machines - II

P. Pages : 3

NIR/KW/18/3422

Time : Three Hours

1770

Max. Marks : 80

- Notes :
1. All questions carry marks as indicated.
 2. Solve Question 1 OR Questions No. 2.
 3. Solve Question 3 OR Questions No. 4.
 4. Solve Question 5 OR Questions No. 6.
 5. Solve Question 7 OR Questions No. 8.
 6. Solve Question 9 OR Questions No. 10.
 7. Solve Question 11 OR Questions No. 12.
 8. Assume suitable data whenever necessary.
 9. Illustrate your answers whenever necessary with the help of neat sketches.
 10. Use of non programmable calculator is permitted.

- 1.** a) Define the following terms : **6**
- i) Full pitched coil
 - ii) Short pitched coil
 - iii) Pole pitch
 - iv) Coil span
 - v) Distributed winding
 - vi) Concentrated winding
- b) Calculate the RMS value of induced emf per phase of a 10 – pole, 3 – phase, 50 Hz STAR connected alternator with 2 – slots per pole per phase and 4 – conductors per slot in 2 – layers. The coil span is 150° . The flux per pole has a fundamental component of 0.12 – wb and a 20% third component. **7**
- OR**
- 2.** a) Compare cylindrical rotor generator with salient pole synchronous generator. **6**
- b) A 3 – phase, 50 Hz, 2 – pole STAR connected turbo alternator has 54 – slots and 4 – conductors per slot. The pitch of the coil is 2 – slots less than the pole pitch. If the machine gives 3300 – V between lines on open circuit with sinusoidal flux distribution, determine the useful flux per pole. **7**
- 3.** a) Explain Armature Reaction and effect of armature reaction in 3 – phase alternator under various power factor conditions. **6**

- b) A 3 – phase STAR connected, 100 – kVA, 1000 – V alternator is tested for open circuit and short circuit tests. The alternator generator 950 – V across it terminals at an excitation of 5 – A during open circuit test. The same excitation circulates rated current during short circuit test. The effective armature resistance is 0.5 ohm per phase. Determine the voltage regulation of the alternator at :
- Unity power factor.
 - 0.8 power factor leading.

OR

4. a) Explain the ‘POTIER REACTANCE’ method to find the regulation of 3 – phase alternator. **7**
- b) A 1200 – kVA, 6600 – V, 3 – Phase STAR connected alternator with a resistance of 0.4 ohm and reactance of 6 – ohm per phase, delivers full load current of 0.8 power factor lagging and normal rated voltage. Estimate the terminal voltage for the same excitation and load current at 0.8 power factor leading. **7**
5. a) Why TWO REACTION THEORY is considered in salient pole synchronous generator? Explain it in brief and draw the phasor diagram of a salient pole machine as a generator operating at lagging power factor. **7**
- b) Define short – circuit Ratio and explain its significance. Prove that SCR is reciprocal of per unit direct axis reactance. **6**

OR

6. a) Write the conditions for parallel operation of synchronous generator. Also explain any one method for the synchronization. **6**
- b) Define negative sequence and zero sequence reactance of a synchronous machine. Explain laboratory method of the measurement of negative sequence and zero sequence reactance. **7**
7. a) For a salient pole synchronous generator, show that the power output per phase is given by- **7**
- $$P = \frac{VE_f}{X_d} \sin \delta + \frac{V^2}{2} \left[\frac{1}{X_q} - \frac{1}{X_d} \right] \sin 2\delta$$
- Also draw power – Angle characteristics of a salient pole synchronous generator.
- b) Draw and explain the phasor diagram for synchronous motor at CONSTANT LOAD and VARIABLE EXCITATION. Hence draw V and inverted V curves. **7**

OR

8. a) Explain the principle of working of 3 – phase synchronous motor. Why 3 – phase synchronous motor is not self – starting? **6**
- b) A 400 – V, 50 Hz, 3 – Phase, 37.3 – kW STAR connected synchronous motor has a full load efficiency of 88%. The synchronous impedance of synchronous motor is (0.2+ j1.6)–ohm / phase If the excitation of the motor is adjusted to give a leading power factor of 0.9. Calculate for full load. **8**
- armature current
 - back emf
 - power angle
 - mechanical power developed.

- 9.** a) Explain 3 – phase sudden short circuit in 3 – phase alternator with the help of oscillogram, clearly showing 3 – periods. **7**
- b) Define X_d'' and X_q'' . Explain the laboratory method to determine X_d'' and X_q'' . **6**

OR

- 10.** a) Compare 3 – phase synchronous motor with 3 – phase Induction motor. **6**
- b) Write a short note on HUNTING of synchronous generator. How HUNTING is reduced in synchronous machine? **7**

11. Write short notes on :

- a) Universal motor. **6**
- b) Hysteresis Motor. **7**

OR

12. Write short notes on :

- a) Repulsion motor. **6**
- b) BLDC motor. **7**
