Roll No. ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐   **Total No. of Pages : 02**

Total No. of Questions : 08

M.Tech.(EE)/(Power Engg.)   (Sem.–1)
ADVANCED ELECTRICAL MACHINES
Subject Code : ELE-505/PEE-505
Paper ID : [E0485]

Time : 3 Hrs.   **Max. Marks : 100**

INSTRUCTION TO CANDIDATES :
1. **Attempt any FIVE questions out of EIGHT questions.**
2. **Each question carries TWENTY marks.**

1. (a) What are the various basic parameters of a synchronous machine? Derive expressions for armature to field mutual inductances for a salient pole synchronous machine.

   (b) Explain how Park's transformations transform equations in a, b, c variables to d, q, o variables.

2. (a) A salient pole synchronous generator has

      X_q = 0.8 pu and γa = 0.02 pu. If this generator delivers rated kVA at 0.8 p.f. lagging and at rated voltage, calculate the load angle.

   (b) From the phasor diagram of a cylindrical rotor synchronous motor, derive the expression for per phase power output in terms of excitation emf and load angle.

3. (a) A balanced three–phase short circuit on a 3–phase salient pole alternator is performed at rated speed so that rated armature current flows under steady state short circuit conditions. If the armature short circuit is now suddenly removed, derive expressions for the field current and armature terminal voltage as a function of time. Neglect the effect of a damper bars.

   (b) Explain the various reactances and time constants from the q–axis equivalent circuits of a 3 phase synchronous machine.

4. (a) What are the causes of disturbances in synchronous machines? Discuss the effect of rotor oscillations on the performance of a synchronous machine.

   (b) Derive the electromechanical equation of shaft power in terms of inertia power and electrical damping constant for the synchronous machine dynamics.

5. An 11 / 3.3 / 0.4 kV star / star /delta, three winding transformer has a magnetizing current of 3.0 amperes. At rated voltage the secondary supplies a balanced load of 200 kVA at 0.8 p.f. lag and tertiary supplies a balanced load of 120 kW. The primary operates at a p.f of 0.81 lagging. Find the primary and tertiary phase currents and also the power factor at which the tertiary operates. Neglect losses.

6. What is Inrush Phenomena in transformers? Discuss qualitatively this phenomena if single phase transformer is switched on at the instant applied voltage is (*i*) maximum positive and (*ii*) zero with positive slope.

7. A delta–star, 6.6 / 0.4 kV bank of three indentical single phase transformer supplies a three phase balanced load of 600 kVA at 0.8 p.f. lagging and a single phase load of 80 kW at unity p.f. between a line and neutral. Determine the magnitude of currents in each primary phase winding and in each input line. Neglect internet voltage drops and no load currents.

8. (a) Explain how the exciting current of a single–phase transformers contain Harmonics even when the supply voltage is a sine wave.

   (b) Give the disadvantages of current and voltage harmonics in transformers. Explain how these harmonics can be eliminated?