

M. Tech.

## ADVANCED ELECTRICAL MACHINES

SUBJECT CODE : PEE - 505/ELE - 505Paper ID : [E0485]

[Note : Please fill subject code and paper ID on OMR]

Time : 03 Hours

Maximum Marks : 100

## Instruction to Candidates:

- 1) Attempt any **Five** questions.
- 2) All questions carry equal marks.

- Q1)** (a) Discuss the physical concept and salient features of Park's transformation.
- (b) Sketch and explain the phasor diagrams and magnetic field relationships for a synchronous generator operating at leading power factor.
- Q2)** (a) Mention all the mutual inductances that are present in case of a 3-phase salient pole synchronous machine. Deduce the expression of each from fundamental principle.
- (b) A 3-phase, 50 Hz cylindrical rotor synchronous machine has the following parameters:
- Self inductance of a phase = 3.15 mH
- Armature leakage inductance = 0.35 mH
- Calculate the mutual inductance between armature phases and its synchronous reactance.
- Q3)** (a) How the synchronous impedance and armature resistance can be determined in a synchronous generator? Discuss the power angle characteristics under steady state conditions.
- (b) What is meant by short circuit ratio? Show that  $SCR = I/X_d$  in p.u.
- Q4)** Derive the field and armature phase current expressions during transient period of a 3-phase cylindrical type synchronous machine, when symmetrical 3-phase short circuit is established at its armature terminals.

Q5) Derive swing equation of synchronous machine. Explain linearized analysis technique and non linear analysis method to deal with machine oscillations.

Q6) (a) Discuss the experimental method to determine the equivalent circuit of a 3-winding transformer. Why leakage flux is modeled in a transformer equivalent circuit as an inductor?

(b) Discuss advantages of having the third winding in a transformer from application point of view for both 1-phase and 3-phase systems.

Q7) Discuss why inrush current appears during switching in process of transformers. How these currents in transformers can be estimated? Briefly describe the methods employed to limit this inrush current.

Q8) Write short notes on:

(a) Suppression of transformer harmonics.

(b) Constant flux linkage theorem.

(c) Sudden reactive loading in synchronous machines.

