

Exam.Code:0934
Sub. Code: 6661

2053
B.E. (Electrical and Electronics Engineering)
Fourth Semester
PC-EE-401: Electrical Machine - II

Time allowed: 3 Hours

Max. Marks: 50

NOTE: Attempt five questions in all, including Question No. I which is compulsory and selecting two questions from each Part. Assume suitably missing data, if any.

x-x-x

- Q1.a. Explain the concept of cross-magnetizing effect in a synchronous machine with the help of appropriate phasor diagram. (2)
- b. What is the stability limit of a 3-phase salient pole synchronous generator? (1)
- c. Write the condition for voltage phasors during one dark and two bright lamp method for parallel operation of two synchronous machines. (1)
- d. Derive the expression for short-circuit-ratio (SCR). (3)
- e. Draw the proper circuit arrangement for conducting the slip-test on a 3-phase salient pole synchronous machine. (3)

PART-A

- Q2.a. Write the procedural detail in step-by-step manner to find out voltage regulation using potier-triangle method.
- b. The following table gives the data for open-circuit and zero power factor load tests on a 6-pole, 440 V, 50 Hz, 3-phase, star connected alternator. The effective ohmic resistance between any two terminals of the alternator is 0.3 ohms and the per-phase synchronous reactance is 6.35 ohms. Find the voltage regulation at full load current at 0.8 p.f. lagging using synchronous impedance method.

Field current (A)	2	4	6	7	8	10	12	14	16	18
O. C. terminal voltage (V)	156	288	396	440	474	530	568	592	-	-
S. C. line current (A)	11	22	34	40	46	57	69	80	-	-
ZPFC terminal voltage (V)	-	-	-	0	80	206	314	398	460	504

(4, 6)

P.T.O.

(2)

Q3. Analyse the performance of a synchronous machine at constant load with variable excitation with the help of suitable phasor diagrams during:

- a) motoring mode of operation.
- b) generating mode of operation.

Also, give the expression for minimum excitation.

(5, 5)

Q4. At any instant a 3-phase (symmetrical) short circuit develops at the terminals of a 100 MVA, 22 KV 50 Hz synchronous generator. However, before this instant *i.e.* during normal operation it is open circuited and is expected to give rated terminal voltage. Neglecting dc and double frequency components of current.

- a) Determine the initial current(actual), and
- b) find the current at the end of the three cycles and at the end of 20 s.

When

Base 100 MVA

$X_d = 1$ pu, $X_d' = 0.3$ pu, $X_d'' = 0.2$ pu.

$T_{dw} = 0.03$ s, $T_f = 1$ s.

(2,4+4)

PART-B

Q5. Derive the expressions for power-flow equations *i.e.* output active power, $P_e(\text{out})$, output reactive power $Q_e(\text{out})$, and input mechanical power $P_m(\text{in})$ of a three-phase synchronous machine in terms of Z_s , E_f , V_t , α and δ . The machine is working in generating mode.

(3, 2, 3)

Also, develop the equations *i.e.* $P_e(\text{out})$ and $P_m(\text{in})$ when armature resistance is neglected.

(1, 1)

Q6.a. Develop the speed and torque expressions for a magnet brushless dc (BLDC) motor.

b. Explain the effect of change in excitation when the two alternators are operating in parallel.

(5, 5)

Q7. Write short note on the following

- a. Linear induction motor.
- b. Operation of Universal motor with AC supply.

(5,5)