



- 6 a. What is voltage regulation? Using ZPF method, determine regulation of alternator. Mention the advantages of this method over other methods. (10 Marks)
- b. The OCC of a 3 phase, 50 Hz synchronous machine is given by the following data:

$I_f(A)$	15	30	50	75	90	120	160
$V_{OC}(\text{Line})$	600	1200	1200	2900	3300	3700	4000

Under short circuit conditions a field current of 40 A gives the full load stator current. The armature resistance and leakage reactance per phase are known to be 0.01 and 0.12 pu when the machine is operating as a motor during full load current at the rated terminal voltage of 3.3 KV and 0.8 p.f. loading. Calculate the field current required. (10 Marks)

- 7 a. What is direct axis reactance and quadrature axis reactance? Derive expressions for  $X_d$  and  $X_q$ . (06 Marks)
- b. Derive the power flow equation including armature resistance. (08 Marks)
- c. Two similar 400 V, 3 phase alternators shares equal K.W. power delivered to a balanced 3 phase 50 KW, 0.8 pf lag load. If the p.f. of one machine is 0.9 lag. Find the power factor and current supplied by the other machine. (06 Marks)
- 8 a. Derive an expression for the power developed by a non salient pole synchronous motor. (08 Marks)
- b. The full load current of a 3.3 kVA, Y-connected synchronous motor is 160A at 0.8 p.f. lag. The resistance and synchronous reactance of the motor are  $0.8\Omega$  and  $5.5\Omega$  per phase respectively. Calculate the excitation e.m.f., torque angle, efficiency and shaft output of the motor. Assume mechanical stray load loss to be 30 KW. (12 Marks)

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