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M.Tech. (EE) (Sem.–1)

POWER SYSTEM DYNAMICS-I

Subject Code : MTEE-102-18

M.Code : 75216

Date of Examination : 17-01-23

Time : 3 Hrs. Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. Attempt any FIVE questions out of EIGHT questions.
2. Each question carries TWELVE marks.

1. a) Explain advantages of per unit system of parameter measurement.

   b) Prove that power remains unaltered when three phase system quantities are transformed to two-phase equivalent quantities.

2. Explain the transformation of alternating currents from three phases (a, b, c) to (α, β, 0) axes. Also comment upon the transformation of voltage and impedance three phases (a, b, c) to (α, β, 0) axes.

3. A 555 MVA, 24kV, 0.95 p.f. 60Hz, 3-phase 2 pole synchronous generator has the following inductances and resistances associated with the stator and field windings:

l_{aa}	$l_{a,b}$	l_{afd} (mH)	L_{ffd}	R_a	R_{fd}
(mH)	(mH)		(mH)	(Ω)	(Ω)
3.2758+0.0458cos(2θ)	1,63790.0458cos(2θ + (π/3))	40.0cos(2θ)	576.92	0.0031	0.0715

   a) Determine L_q in henrys

   b) If the stator leakage inductance L_l is 0.05129 mH, determine L_{aq} in henrys.

   c) Using the machine rated values as base values for the stator quantities, determine the per unit values of the L_{aq} following in the L_{ad}-base reciprocal per unit system.

4. a) Define and explain sub-transient and transient time constants of synchronous machine.

   b) Write flux-linkage equations of synchronous machines.

5. a) Explain why armature dynamics are neglected in small signal analysis of power system.

   b) Explain the eigen properties of the state matrix.

6. a) Draw and explain block diagram for power system stabilizer model.

   b) Explain the procedure for linearization of non-linear equations.

7. Figure below shows the single line diagrams of thermal generating station consisting of four 555MVA, 24kV, 60Hz units.

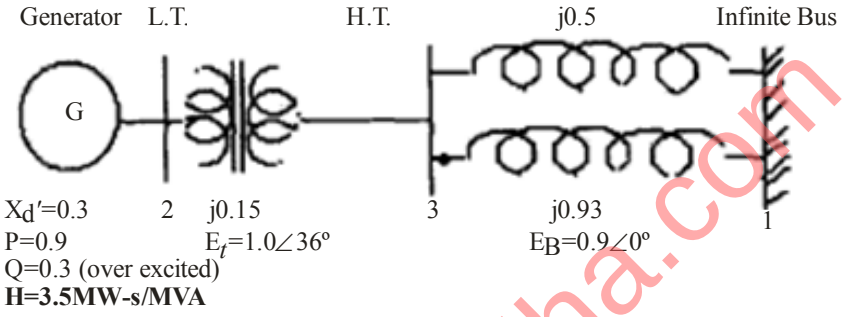

Fig. Single line diagram of SMIB

The post fault condition in per unit on the 2220MVA, 24kV base is as given below:

Parameter	Value	Parameter	Value	Parameter	Value
X_d	1.81	T'_{do}	8.0	P	0.9
X_q	1.76	H	3.5 MW_s/ MVA	Q	0.3 (overexcited)
X'_d	0.3	K_D	0, 10,-10	E_t	1.0 ∠36°
X_l	0.16	R_a	0.003	E_B	0.995∠0°

If the generators are to be modeled as a single equivalent generator represented by the classical model,(a) write the linearized state equation of the system, (b) determine the eigenvalues, damped frequency of oscillations in Hz, damping ratio, and undamped natural frequency for each of the following values of damping coefficient (in pu torque/pu speed) $K_D = 0$.

8. a) Explain ZIP load modeling for the analysis of power system.

   b) Explain block diagrams of prime movers employed in hydro power stations.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.