

(3 Hours)

80 Marks

NOTE

1. Question number 1 is compulsory
2. Attempt any three from the remaining
3. Figures to right indicates full marks
4. Assume suitable data if necessary and mention the same

1. Attempt any four of the following :- 20

a) Explain why frequency control loop and voltage control loop are not interacting 05

b) For following Y_{BUS} fill in the blanks, all $y_{i0} = 0$ 05

$$j \begin{bmatrix} -13 & 10 & 5 & - \\ - & -18 & 10 & - \\ - & - & -13 & - \\ - & - & - & - \end{bmatrix}$$

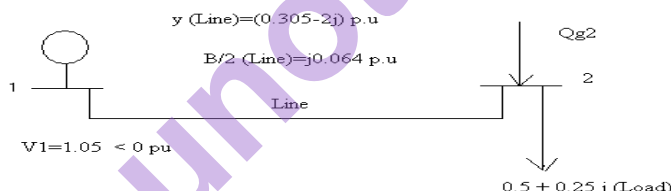
c) Define power system stability and classify it on the basis of nature of disturbance 05

d) State assumptions made in transient stability studies 05

e) In turbine speed governor system ΔP_c is unit step, $\Delta f = 0$, $R = 2.5$, $K_{sg} = 1$, $T_{sg} = 0.4$, Determine ΔY_E at $t = 0.2$ s 05

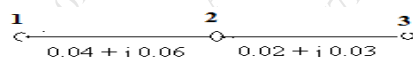
2. 20

a) A simple two-bus power system is shown in fig 10



$|V_2| = 1.0$ p.u (Bus 2 is PV bus). Obtain δ_2 and Q_{g2} at the end of first iteration of N-R method.

b) For the network shown in figure obtain the complex bus bar voltage at bus 2 at the end of the first iteration. Use the Gauss seidal method. Line impedances are given in pu Given Bus 1 is slack bus with $V_1 = 1 \angle 0$
 $P_2 + j Q_2 = -5.6 + j 1.46$ Assume $V_3^0 = 1.02 \angle 0$ $V_2^0 = 1 \angle 0$ 10



3. 20

a) Determine the economic operation point for three thermal units delivering a total load of 600 MW with considering generator limit 10

Unit1 $P_{max} = 600$ MW; $P_{min} = 150$ MW

$$F_1(P_1) = 550 + 7.7P_1 + 0.00165P_1^2$$

Unit2 $P_{max} = 500$ MW; $P_{min} = 125$ MW

$$F_2(P_2) = 300 + 7.88P_2 + 0.002P_2^2$$

Unit3 $P_{max} = 600$ MW; $P_{min} = 75$ MW

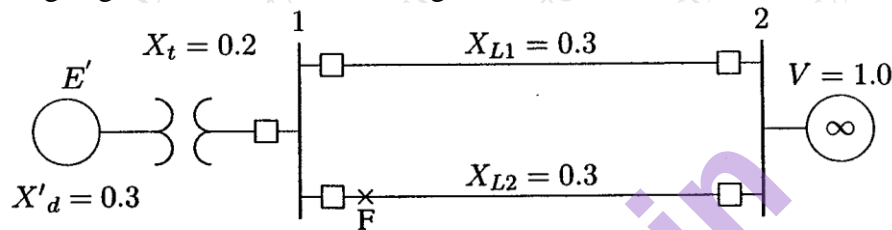
$$F_3(P_3) = 80 + 7.99P_3 + 0.005P_3^2$$

b) Derive formula for Bmn coefficients in transmission loss formula 10

4. 20
a) 10

Find the steady state power limit of a system consisting of a generator equivalent reactance 0.5 p.u connected to an infinite bus through a series reactance of 1.0 p.u. The terminal voltage of the generator is held at 1.2 p.u and the voltage of the infinite bus is 1 p.u

- b) 10
- A 50 Hz synchronous generator having inertia constant $H=5$ MJ/MVA and a direct axis transient reactance $x_d' = 0.3$ p.u is connected to an infinite bus through a purely reactive circuit as shown in the figure below. Reactances are marked on the diagram on a common system base. The generator is delivering real power $P_e=0.8$ pu and $Q=0.074$ pu to the infinite bus at voltage $v=1$ pu. A temporary three phase fault occurs at the sending end of the line at point F. When the fault is cleared, both the lines are intact. Determine the critical clearing angle and the critical clearing time



5. 20
a) 10

Draw turbine speed governor system and explain briefly 4 major parts in it

- b) 10
- Explain dynamic response of change in frequency for step change in load of an isolated power system. How dynamic response changes with integral control action

6. 20

- a) 10
- power pool and its advantages and disadvantages
- b) 10
- System state classification of power system security