

DEPARTMENT OF ELECTRICAL ENGINEERING

MAJOR TEST, SECOND SEMESTER 2007-08

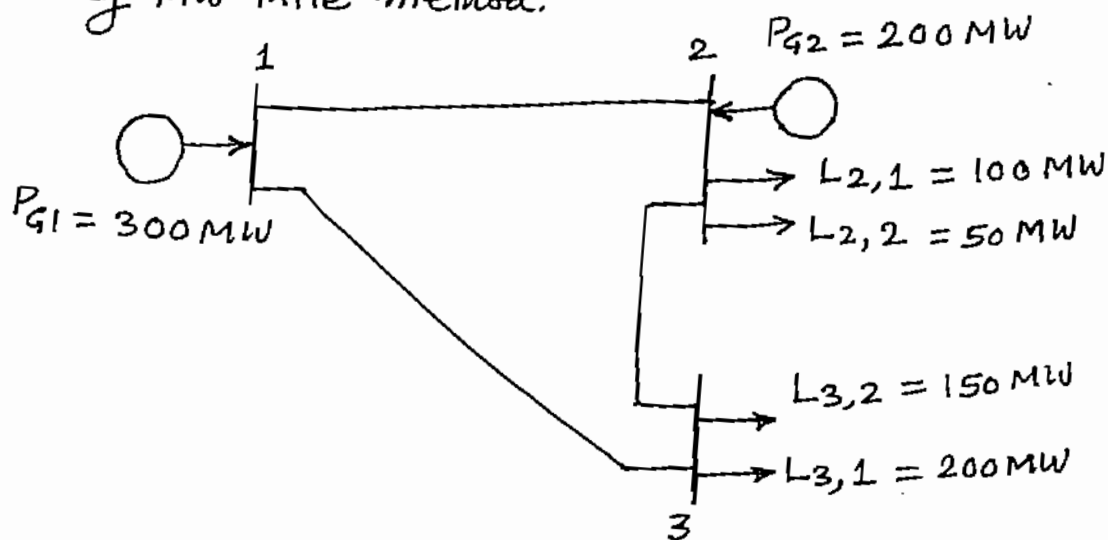
Course: Power System Control and Instrumentation  
EEL 796

Time: 2 Hours

Max Marks: 40

1 (a) What are different types of Transmission transactions?  
Explain the major components of the cost of transmission transactions.  
(2+2)

(b) A 3-bus power system with FOUR transactions between generating units and loads is shown below. Compute transmission charges for each of the 4 transactions using MW-Mile method.

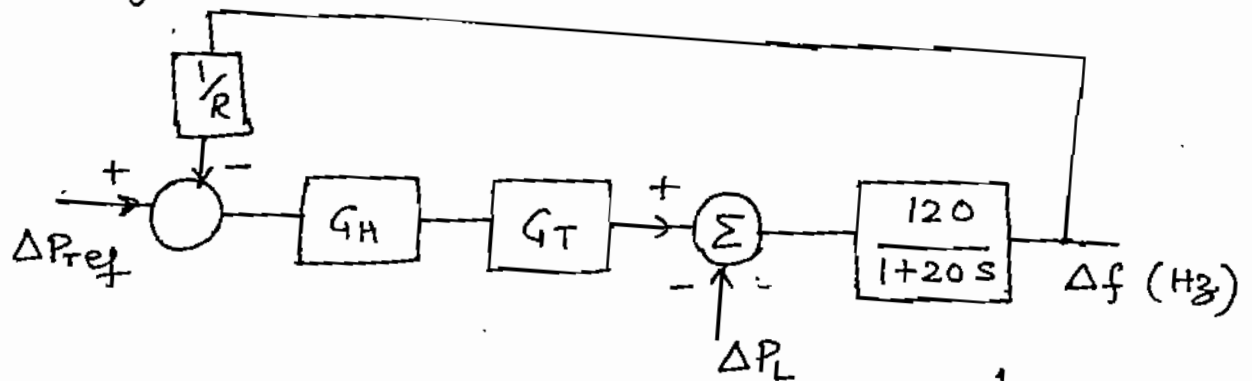


The system data are given below:

Line	R ( $\Omega$ )	X ( $\Omega$ )	Length	R ( $R_s$ /mile)
1-2	0.0	0.3	20 miles	200
1-3	0.0	0.1	10 miles	800
2-3	0.0	0.4	40 miles	400

Note: R = revenue required in  $R_s$  per mile.

- 2 (a) Transfer function model of a single-area system is given below.



$$R = 2 \text{ Hz/p.u. MW}, G_H = \frac{1}{1+sT_g}, G_T = \frac{1}{1+sT_t}$$

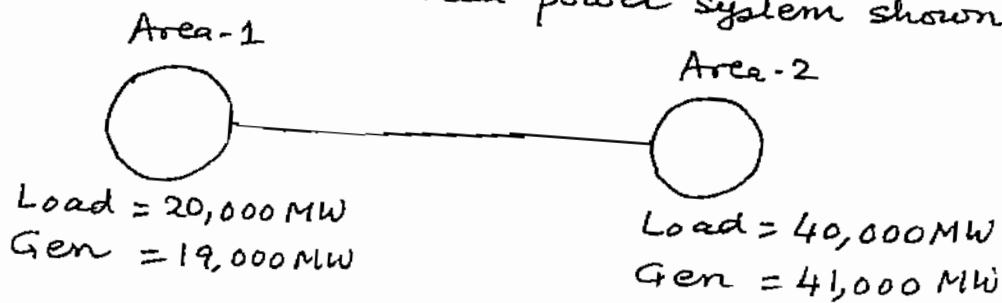
$\Delta P_{ref}$  and  $\Delta P_L$  are expressed in p.u.  $G_H$  and  $G_T$  are transfer functions of the governor and turbine respectively.

Determine

- Dynamic model of the system in state-space form.
- Expression for  $\Delta f(t)$  following step change in load i.e.  $\Delta P_L = 0.1$  p.u. Neglect time constants of the turbine & the governor.

(5)

- (b) Consider a two-area power system shown below:



$D_1 = D_2$  (The load in each area varies 1% for every 1% change in frequency)

$R_1 = R_2 = 5\%$ , system frequency = 50 Hz,

Area 1 is operating with a spinning reserve of 1000 MW spread over a generation of 4000 MW capacity, and area 2 is operating with a spinning reserve of 1000 MW spread uniformly over a generation of 10,000 MW. Determine  $ACE_1$  and  $ACE_2$  in steady state following loss of 1000 MW load in area 1.

3. (a) Explain following terms in reference to excitation system.

- (i) Excitation system ceiling voltage
- (ii) High response excitation system
- (iii) Excitation system nominal response
- (iv) Phase and gain margin

(1+1+1+2)

(b) Name the Ancillary services procured by ISO in a restructured power system. How is reactive power-voltage control <sup>service</sup> is evaluated?

(5)

4 (a) Explain the function of SCADA/EMS system. What are the parameters monitored/controlled in a power system?

(3)

(b) State the functions assigned to various IEDs in a substation control.

(2)

(c) What are merits of time synchronization of data acquisition/sampling in IEDs?

(2)

(d) Explain how "optimum sizing and location" of capacitors in a distribution system is obtained.

(2)