Ref. No. Ex/PG/PE/T/112B/2018

M.E. Power Engineering - First Year - First Semester, 2018

ADVANCED POWER SYSTEM PRINCIPLE

TIME: THREE HOURS FULL MARKS: 100

Answer any five questions

1. a) What is load flow solution? Explain its significance in power system analysis. 5
b) Discuss various types of buses in a power system for load flow studies. Justify the classification. 9
c) Discuss the merits and demerits of Gauss-Seidel method for load flow solution. 6

2) Explain clearly with a flow chart the computational procedure for load flow solution using Newton Raphson method when the system contains all types of buses. 20

3. Consider the three-bus power system shown in Fig. 3. Each of the three lines has a series impedance of 0.026 + j0.11 p.u. and a total shunt admittance of j0.04 p.u.. The specified quantities at the buses are shown in Table 1.

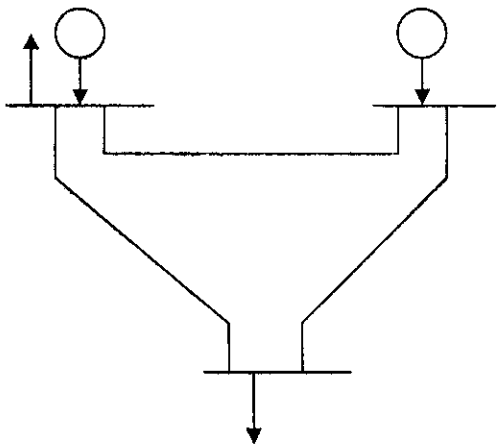

Fig. 3

For bus 2 the minimum and maximum reactive power limits are 0 and 0.8 pu. Find the load flow solution using Fast Decoupled method. 20

Table 1

Bus. No.	P_G	Q_G	P_D	Q_D	Voltage specification
1	Unspecified	Unspecified	1.0	0.5	$V_3 = 1.02 + j0$ (slack bus)
2	1.5	Unspecified	0	0	$\|V_2\| = 1.04$ (PV bus)
3	0	0	1.2	0.5	Unspecified (PQ bus)

4. a) Discuss various factors that affect power system transient stability. 5

b) A power system consists of two plants connected by a transmission line. The only load is located at plant 2.When 300 MW is transmitted from plant 1 to plant 2, power loss in the line is 20 MW. Find the required generation for each plant and the power received by the load when the system λ is 12.50$/MWh. The incremental fuel costs of the two plants are given below:

$$\frac{dC_1}{dP_{G1}} = 0.010P_{G1} + 8.5\$/MWh$$

$$\frac{dC_2}{dP_{G2}} = 0.015P_{G2} + 9.5\$/MWh$$

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5. a) Show the block diagram of Two-area Load Frequency control of power system with single tie-lines connecting them. Assume each area being provided with P-I controllers. Explain the different parameters of control. 10

b) b) Two power systems A and B each having a regulation (R) of 0.05 pu on their respective capacity bases and a stiffness (damping co-efficient) of 0.75 pu are connected through a tie-line, initially carrying no power. The capacity of system A is 2000 MW and that of system B is 3000 MW. If there is an increase in load of 200 MW in system A, what is the change in steady state and power transfer. 10

6. Find the critical clearing angle for the system shown in Fig. 6 for a three-phase fault at the point P. The generator is delivering 1.0 p.u. power under prefault condition. 20

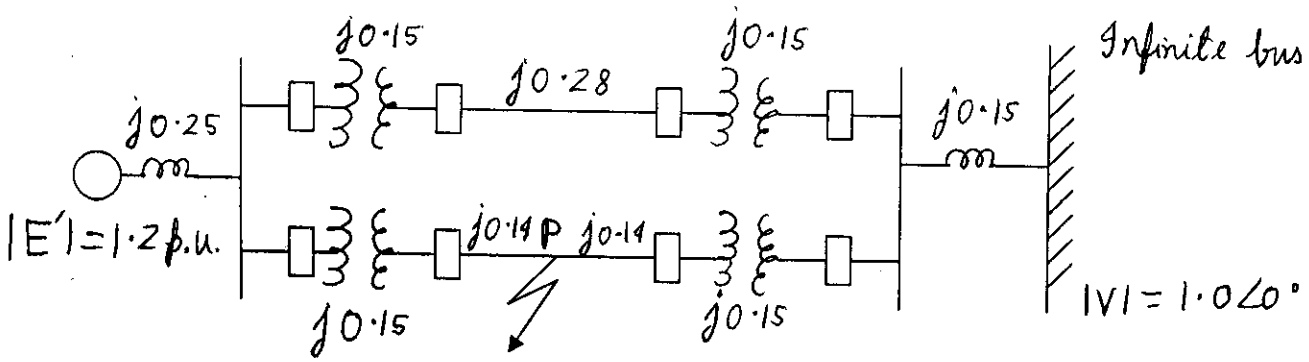

Fig. 6

7) Derive swing equation for a multi-machine system and explain its solution procedure. 20

8) Give a note on phase comparator. 20