Ref. No. EX/PG/PE/T/112B/31/2017

MASTER OF POWER ENGG. EXAMINATION, 2017
(1ST SEMESTER)

ADVANCED POWER SYSTEM PRINCIPLES

TIME: THREE HOURS FULL MARKS: 100

Answer any four questions

1. 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) Two thermal generating units are operating in parallel at 60 Hz to supply a total load of 700 MW. Unit 1, with a rated output of 600 MW and 4% speed droop characteristic, supplies 400 MW and unit 2, which has a rated output of 500 MW and 5% speed droop, supplies the remaining 300 MW of load. If the total load increases to 800 MW, determine the new loading of each unit and the common frequency change before any supplementary control action occurs. Neglect losses. 15

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

b) In a two-bus system when 100 MW is transmitted from plant 1 to the load, a transmission loss of 10 MW is incurred. Find the required generation for each plant and the power received by the load when the system λ is Rs 25/MWh. The incremental fuel costs of the two plants are given below:

$$\frac{dC_1}{dP_{G1}} = 0.02P_{G1} + 16.0 Rs/MWh$$

$$\frac{dC_2}{dP_{G2}} = 0.04P_{G2} + 20.0 Rs/MWh$$

Considering a load of 237.04 MW at bus 2, find the optimum load distribution between the two plants when losses are included but not coordinated. Also find the savings in Rs/hr when losses are coordinated. 20

3) 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. 25

4 a) Compare the merits and demerits of "Fast Decoupled" method with those of "Newton-Raphson" method. 5

b) Consider the three-bus power system shown in Fig. 4(b). Each of the three lines has a series impedance of 0.02 + j0.08 p.u. and a total shunt admittance of j0.02 p.u.. The specified quantities at the buses are shown in Table 1.

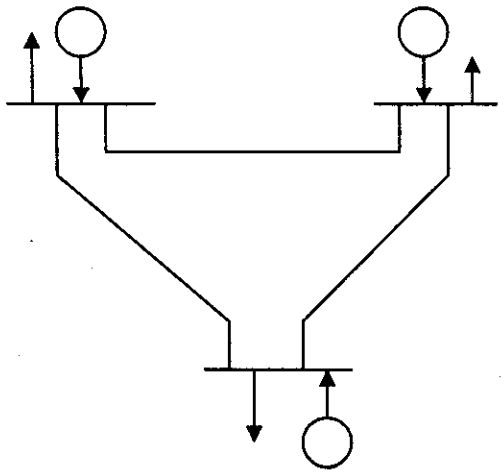

Fig. 4(b)

Controllable reactive power source is available at bus 3 with the constraint $0 \leq Q_{G3} \leq 1.5 p.u.$..Use Fast Decoupled method to obtain one iteration of the load flow solution. 20

Table 1

Bus. No.	P_G	Q_G	P_D	Q_D	Voltage specification
1	Unspecified	Unspecified	2.0	1.0	$V_1 = 1.1 + j0$
2	0.5	1. 0	0.2	0.3	Unspecified
3	0	Unspecified	1.5	0.6	$\|V_3\| = 1.04$

5. Find the critical clearing angle for the system shown in Fig. 5 for a three-phase fault at the point P. The generator is delivering 1.0 p.u. power under prefault condition. 25

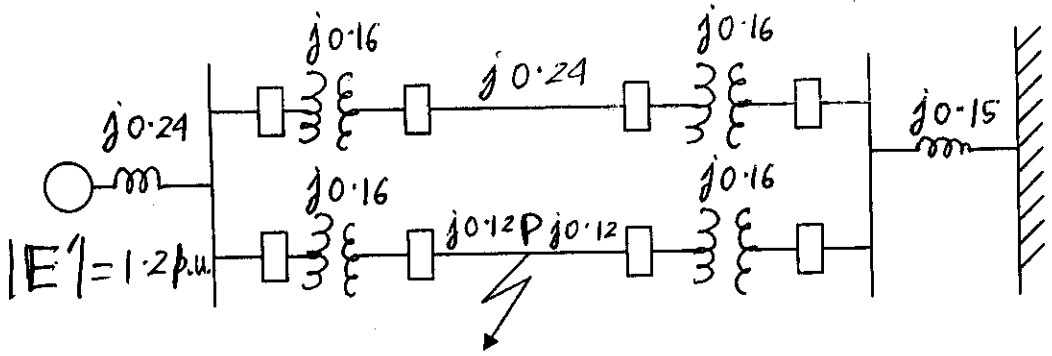

Fig. 5

6. Derive swing equation for a multi-machine system and explain its solution procedure. 25

7) Give a note on phase comparator. 25