Ref. No. :EX/PE/PE/B/T/323B

B. E. POWER ENGG. 3RD YEAR 2ND SEMESTER EXAMINATION 2023

POWER SYSTEM ANALYSIS AND OPERATION

TIME: THREE HOURS **FULL MARKS:100**

1. Explain the following terms:
(i) must run unit (ii) minimum up time and minimum down time (iii) transitional cost (iv) ramp rate limit (v) valve-point effect 3+5+4+5+3 [CO1]

OR

For a two-generator system, fuel costs of the plants are given below:

$F_1 = 200 + 10.333P_{G1} + 0.00889P_{G1}^2$ Rs/h, $10MW \le P_{G1} \le 150MW$

$F_2 = 240 + 10.833P_{G2} + 0.00740P_{G2}^2$ Rs/h, $15MW \le P_{G2} \le 100MW$

The transmission loss is given by $P_L = 0.001P_{G1}^2 + 0.0025P_{G2}^2$
Determine the economic schedule to meet 200MW demand and the corresponding cost of generation. 20 [CO1]

2. a) Describe the advantages of interconnected operation of power systems. 8 [CO2]
b) Two thermal generating units are operating in parallel at 50 Hz to supply a total load of 700MW. Unit 1, with a rated output of 600MW and 4% speed droop characteristic, supplies 400MW and unit 2, which has a rated output of 500MW and 5% speed droop characteristic, supplies the remaining 300MW. If the total load increases to 800MW, determine the new loading of each unit and the common frequency change before any supplementary control action occurs. 12 [CO2]

OR

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. Derive necessary equations and explain the different parameters of control. 20 [CO2]

3. a) Describe different factors that affect power system transient stability. 6 [CO3]
b) Explain the equal-area criterion for stability of an alternator supplying infinite bus bar via an inductive interconnector. Mention the limitations of the method. 14 [CO3]

OR

Find the critical clearing angle for the system shown in Fig. 3 for a three-phase fault at the point P. The generator is delivering 1.0 p.u. power under prefault condition. 20 [CO3]

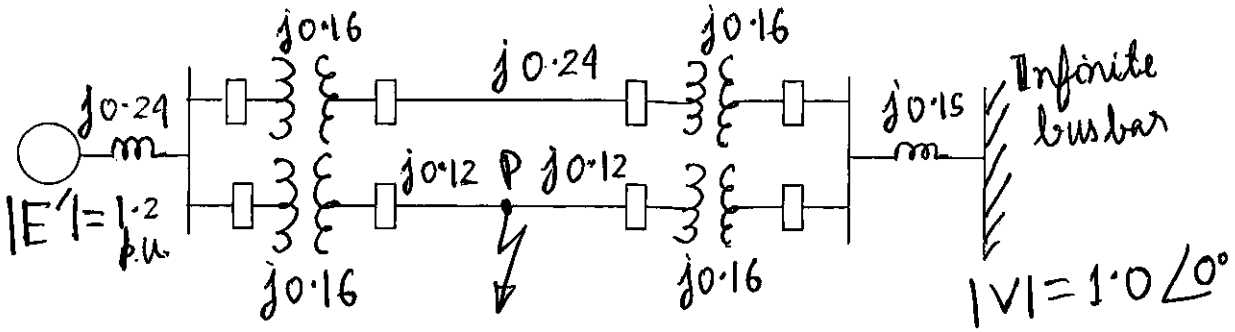

Figure. 3

4. a) Compare the merits and demerits of "Fast Decoupled " method with those of "Newton-Raphson" method. 5 [CO4]

b) Consider the three-bus power system shown in Fig. 4. Each of the three lines has a series impedance of 0.026 + j0.11 p.u. and a total shunt admittance of j0.04p.u. The specified quantities at the buses are shown in Table 1. 15 [CO4]

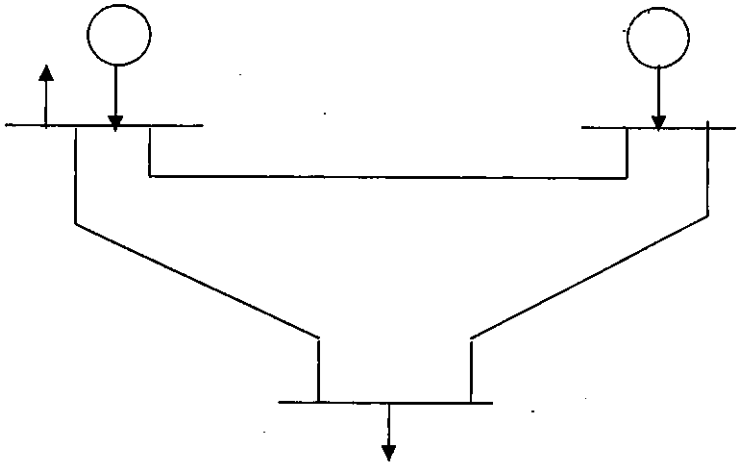

Figure 4

For bus 2 the minimum and maximum reactive power limits are 0 and 0.8 p.u. Find the load flow solution using Gauss-Seidel method.

Table 1

Bus No.	P_G	Q_G	P_D	Q_D	Voltage specification
1	Unspecified	Unspecified	1.0	0.5	$V_1 = 1.02 + j0$ (Slack bus)
2	1.5	Unspecified	0	0	$\|V_2\| = 1.04$ (PV bus)
3	0	0	1.2	0.5	Unspecified (PQ bus)

OR

Give a note on optimal power flow. 20 [CO4]

5. a) What is load forecasting ? 4 [CO5]

b) Describe short-term load forecasting and long-term load forecasting. 16 [CO5]