Ref. No.: EX/PE/PE/B/T/323B /2025

B. E. POWER ENGG. 3RD YEAR 2ND SEMESTER EXAMINATION 2025

POWER SYSTEM ANALYSIS AND OPERATION

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

1. For a two-generator system, fuel cost function of these plants is 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, $15MW \le P_{G2} \le 100MW$

Transmission loss is given by $P_L = 0.001P_{G1}^2 + 0.0025P_{G2}^2$

Determine economic dispatch for meeting 150MW demand and corresponding cost of generation.

20 [CO1]

Or

1. a) Explain the following terms:
(i)) spinning reserve requirement (iii) ramp rate limit constraints (v) valve-point effect

3+4+3 [CO1]

b) Show that transmission loss is a function of real power generation of each plant.

10[CO1]

2. a) What is control area? Describe the merits of interconnected operation of power systems.

2+4[CO2]

b) 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. 14 [CO2]

Or

2. a) Give a note on controlling of generator power output. 5 [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.

15 [CO2]

[Turn over

3. a) Describe different factors that affect power system transient stability. 8 [CO3]
b) Derive swing equation while an alternator connected to infinite bus bar via an inductive interconnector. 12 [CO3]

Or

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

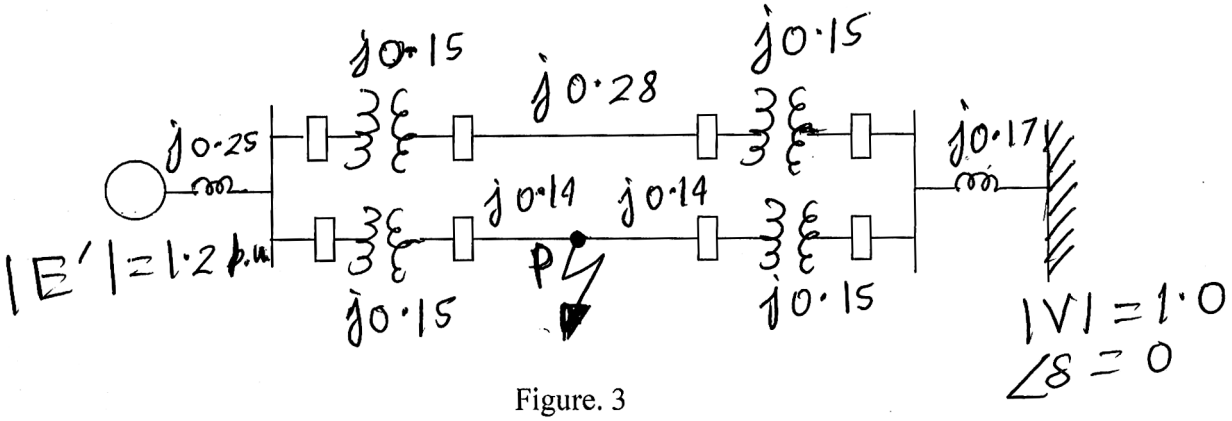

Figure. 3

4. a) Describe the merits of Fast Decoupled load flow method. 5 [CO4]
b) Consider three-bus power system depicted in Fig. 4. Each line has a series impedance of 0.025 + j0.12 p.u. and a total shunt admittance of j0.03p.u. Specified quantities of the buses are shown in Table 1. 15 [CO4]

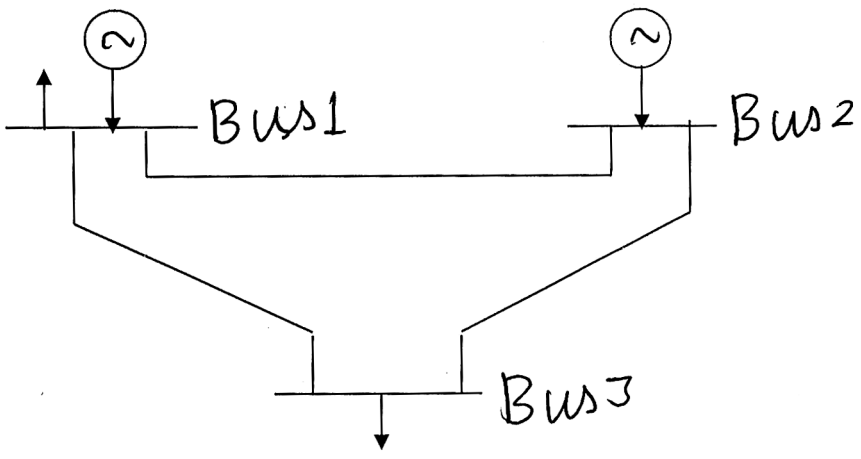

Figure 4

For bus 2 the minimum and maximum reactive power limits are 0 and 0.75 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	$\lvert V_2 \rvert = 1.04$ (PV bus)
3	0	0	1.2	0.5	Unspecified (PQ bus)

OR

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

5. a) What is load forecasting ? 3 [CO5]
b) Describe different types load forecasting. 12 [CO5]
c) Describe different factors which affect load patterns. 5 [CO5]