7. Explain how interchange between interconnected utilities through several transmission line saves the energy in the following case.

Consider two utility operating areas with following data :

Area : 1

| S.No. | Fuel Cost $F_1$ (R/MBtu) | Cost Coefficients | | | Unit Limits (MW) | |
|---|---|---|---|---|---|---|
| | | $a_i$ | $b_i$ | $c_i$ | $P_i^{min}$ | $P_i^{max}$ |
| 1 | 2.0 | 561 | 7.92 | 0.001562 | 150 | 600 |
| 2 | 2.0 | 310 | 7.85 | 0.00194 | 100 | 400 |
| 3 | 2.0 | 78 | 7.97 | 0.00482 | 50 | 200 |

Area : 2

| S.No. | Fuel Cost $F_1$ (R/MBtu) | Cost Coefficients | | | Unit Limits (MW) | |
|---|---|---|---|---|---|---|
| | | $a_i$ | $b_i$ | $c_i$ | $P_i^{min}$ | $P_i^{max}$ |
| 1 | 1.9 | 500 | 7.06 | 0.00139 | 140 | 590 |
| 2 | 1.9 | 295 | 7.46 | 0.00184 | 110 | 440 |
| 3 | 1.9 | 295 | 7.46 | 0.00184 | 100 | 440 |

Load : 700 MW on area 1 and 1100 MW on area 2. Prove how saving is achieved by interconnecting both the areas. (15) CO5



Roll No. ..... Total Pages : 4

**007601**

**May, 2023**

**B.Tech. (EL) 6th Semester**

**POWER SYSTEMS-II (Operation and Control), ELPC-601**

Time : 3 Hours] [Max. Marks : 75

*Instructions :*

1. *It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.*
2. *Answer any four questions from Part-B in detail.*

**PART–A**

1. (a) Explain Wheeling. (1.5) CO5

(b) What is the significance of doing Economic dispatch? (1.5) CO5

(c) Compare the various load flow techniques. (1.5) CO1

(d) Differentiate between SCADA and PMU. (1.5) CO4

(e) Define Power System Stability. Name various types of stability. (1.5) CO2

(f) Differentiate between SVC and STATCOM. (1.5) CO3

(g) What is free governing action in LFC? (1.5) CO3

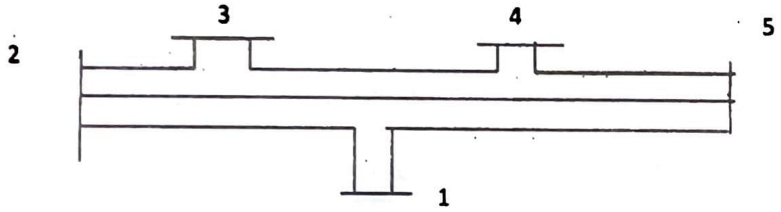
(h) What is Sparsity in power system and way of handling it? (1.5) CO1

(i) Explain energy broker system. (1.5) CO5

(j) Explain how assessment is done for power system security ? (1.5) CO4

## PART–B

2. The following is the system data for a load flow solution for a 5-bus power system. Each line has an impedance of $0.05 + j0.05$ pu. The line shunt admittances may be neglected. (15) CO1




| Bus Code | $P_D$ (p.u.) | $Q_D$ (p.u.) | $P_G$ (p.u.) | $Q_G$ (p.u.) | V | Bus Specification |
|---|---|---|---|---|---|---|
| 1 | 1 | 0.5 | 2.0 | 1.0 | $1.02+j0$ | PV |
| 2 | 0 | 0 | 2 | – | 1.02 | PQ |
| 3 | 0.5 | 0.2 | 0 | 0 | – | PQ |
| 4 | 0.5 | 0.2 | 0 | 0 | – | PQ |
| 5 | 0.5 | 0.2 | 0 | 0 | – | PQ |

1. Develop $Y_{BUS}$ matrix.
2. Determine $Q_2$, $\delta_2$,$V_3$, $V_4$ and $V_5$ after first iteration using GS method.
3. Assume $Q_{2min} = 0.2$ pu and $Q_{2max} = 0.6$ pu.



3. (a) Draw the state space model of single area load frequency control and explain it briefly. (5) CO3

(b) Single area consists of two units with the following parameters :

Unit-1– 1200 MVA, $R_1 = 6\%$ (on machine base)

Unit-2– 1000 MVA, $R_2 = 4\%$ (on machine base)

The units are sharing 1800 MW at nominal frequency of 50 Hz. Unit 1 supplies 1000 MW and unit 2 supplies 800 MW. The load is now increased by 200 MW. Find steady state frequency and generation of each unit if B = 0. (10) CO3

4. Derive the swing equation and explain with diagram how power system stability is analyzed using equal area criterion.

The inertia constant for a 50 Hz, 100 MVA alternator is 5 MJ/MVA.

Determine the energy content of the rotor. If the input of the alternator is suddenly increased by 20 MVA, what would be the acceleration? (15) CO2

5. (a) Explain WLSE scheme for state estimation of state variables in power system. (8) CO4

(b) What are the functions of Ancillary services in deregulated electricity market? (7) CO5

6. Write note on :

(a) AVR.

(b) Types of energy interchange. (15) CO3&5