

## Seventh Semester B.E. Degree Examination, Jan./Feb.2021 Power System Analysis - II

Time: 3 hrs.

Max. Marks: 100

**Note: Answer any FIVE full questions, choosing ONE full question from each module.**

### Module-1

- 1 a. Develop the relation between  $I_{BUS}$ ,  $V_{BUS}$  and  $Y_{BUS}$  by assuming no mutual coupling between transmission lines of a 3-bus system. (07 Marks)
- b. Derive the power flow equations and what are the specified practical limits of variables. (06 Marks)
- c. Find the  $Y_{BUS}$  by direct inspection method for a system with the following data:

Element No.	1	2	3
Bus code (i - k)	1 - 2	2 - 3	3 - 1
Line impedance (pu)	j0.04	j0.02	j0.05
Half-line charging admittance (pu)	j0.02	j0.01	j0.04

(07 Marks)

**OR**

- 2 a. Define the following terms with an example:  
(i) Oriented graph      (ii) Tree and      (iii) Co-tree (05 Marks)
- b. Write the algorithm of Gauss-Siedel load flow solution for a power system with a slack bus and (n-1) number of PQ buses. (08 Marks)
- c. The positive sequence reactances in pu are given for the network shown in Fig. Q2 (c). Take node-G as the reference bus. Form  $Y_{BUS}$  by singular transformation.

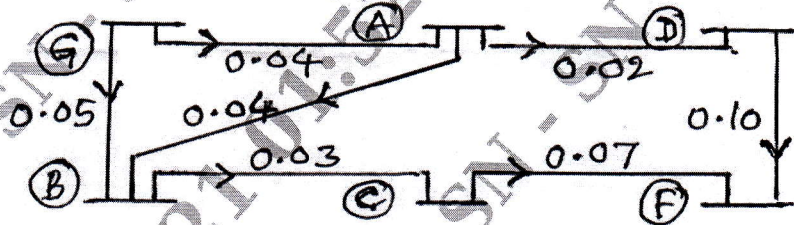


Fig. Q2 (c)

(07 Marks)

### Module-2

- 3 a. Write the iterative algorithm for NR method of load flow analysis of power system having both PQ and PV buses. (08 Marks)
- b. Explain the decoupled Newton method for load flow solution. (06 Marks)
- c. Compare the Newton Raphson and Fast decoupled load flow methods with different parameters. (06 Marks)

**OR**

- 4 a. What are the simplifications and assumptions made in Fast Decoupled Load Flow method? (06 Marks)
- b. Explain how the voltage profile is controlled by synchronous generators and VAR generators. (07 Marks)
- c. Derive the Jacobian matrix elements equations from the load flow equations. (07 Marks)

**Module-3**

- 5 a. Explain the following terms in the optimal operation of generators :  
 (i) Input Output curve (ii) Heat rate curve (iii) Incremental fuel cost curve. (06 Marks)
- b. Explain the optimal generation scheduling considering transmission losses. (09 Marks)
- c. What are the needs and importance of unit commitment? (05 Marks)

OR

- 6 a. With the assumptions made, derive the formula of transmission loss and hence B- coefficients for a two-plants system. (08 Marks)
- b. With random unit performance record obtain the probability of a unit being in up or down states for system reliability. (05 Marks)
- c. A constant load of 300 MW is supplied by two 200 MW generators for which the incremental fuel costs are:  $\frac{dC_1}{dP_{G_1}} = 0.1P_{G_1} + 20$  and  $\frac{dC_2}{dP_{G_2}} = 0.12P_{G_2} + 15$

Determine:

- (i) The most economical division of load between the generators
- (ii) The saving in Rs./day there by obtained compared to equal load sharing between machines. (07 Marks)

**Module-4**

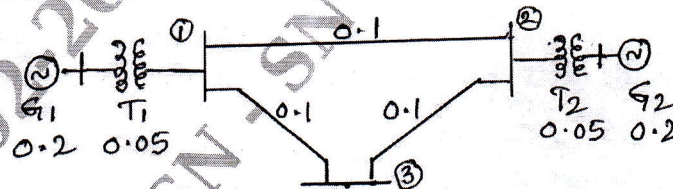
- 7 a. Explain the optimal power flow solution without inequality constraints. (08 Marks)
- b. Explain the solution technique for hydrothermal scheduling problem. (07 Marks)
- c. Briefly, explain the functions of system security analysis. (05 Marks)

OR

- 8 a. State the mathematical formulation of hydrothermal system with assumptions and constraints. (10 Marks)
- b. Explain the loss of load probability. (04 Marks)
- c. What are the inequality constraints on control variables in optimal power flow? (06 Marks)

**Module-5**

- 9 a. Explain the algorithm for short circuit studies of an n-bus system. (10 Marks)
- b. For the power system shown in Fig. Q9 (b) the reactances are given in pu. A solid three phase fault occurs on bus-3. Calculate (i) Fault current (ii) all bus voltages (iii) Fault current in the lines. (10 Marks)



OR

- 10 a. Explain with relevant diagrams, the point by point method of solving the swing equation. (10 Marks)
- b. Derive the generalize algorithm for finding the elements of  $Z_{BUS}$  when a branch is,  
 (i) Added between an old bus and reference bus  
 (ii) Added between two old buses. (10 Marks)

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