U.S.N | | | | | | | | | | |

P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Seventh Semester, B.E. - Electrical and Electronics Engineering

Semester End Examination; Jan. / Feb. - 2021

Computer Techniques in Power Systems

Time: 3 hrs *Max. Marks: 100*

***Note**: Answer **FIVE** full questions, selecting **ONE** full question from each unit.*

UNIT - I

1 a. Define the following with example:

i) Oriented graph ii) Tree and co-tree iii) Basic loop 10

iv) Basic cutset v) Primitive network

b. For the power system shown in Fig. 1(b), obtain the incidence matrices *a*, *b*, c and *k* with ground as reference. Select a tree for which link elements are 1 – 2, 1 – 4, and 2 – 3. Verify the relation $C_b = -B_l^t$. 10

2 a. The bus incidence matrix is given below. Draw the oriented graph. Obtain augmented loop incidence matrix. 8

$$A = \begin{bmatrix} 1 & 0 & 0 & 0 & -1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 0 & -1 & -1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & -1 & 1 & 0 \end{bmatrix}$$

b. What is Primitive network? Obtain the performance equation in both admittance form impedance form. 6

c. Consider three passive elements whose data is given below. Form the primitive impedance matrix and primitive admittance matrix. 6

Element	Self impedance	Mutual impedance
1	j0.6	-
2	j0.5	j0.2 (with element1)
3	j0.7	-

UNIT - II

3 a. Determine Y_{bus} by singular transformation for the system with as below: 6

Element No.	1	2	3	4	5
Bus code $p - q$	0 – 1	1 – 2	2 – 3	3 – 0	2 – 0
Self admittance	1.4	1.6	2.4	2.0	1.8

b. Derive an expression for the bus admittance matrix Y_{bus} using singular transformation method. 8

c. The single line diagram of a four bus system is shown in Fig. 3(c). The data is given in the table. Formulate Y_{bus} without line 1 – 2. If line 1 – 2 is added, show how Y_{bus} is modified? 6

Line	R	X
1 – 2	0.05	0.15
1 – 3	0.1	0.3
2 – 3	0.15	0.45
2 – 4	0.1	0.3
3 – 4	0.05	0.15

4 a. Derive the expression for addition of a link to the partial network using building algorithm with no mutual coupling. 10

b. Obtain Z_{bus} by building algorithm for the system shown in Fig. 4(b). All the impedances are in p.u. Add the elements in the order specified. 10

UNIT - III

5 a. Explain how buses are classified in a power system to perform load flow analysis? 6

b. Obtain the voltage at bus 2 for the system shown in Fig. 5(b) using G-S method, if $V_1 = 1\angle 0^\circ\ p.u$. 8

c. Compare the load flow methods with respect to storage requirements, computation time or iteration and number of iterations. 6

6 a. Derive the expression for the diagonal elements of sub matrices of the Jacobian in Newton Raphson method of load flow analysis. 8

b. Obtain the voltages at all buses for three bus system shown in Fig. 6(b) at the end of first iteration by N-R method. The data is given in the table below, 12

Line data	*SB*	*EB*	*R(Pu)*	*X(Pu)*	*Bc/2*	
	1	2	0.0	0.1	0.0	
	1	3	0.0	0.2	0.0	
	2	3	0.0	0.2	0.0	
Bus data	*Bus no.*	P_G	Q_G	P_D	Q_D	V_{sp}
	1(slack)	-	-	-	-	1.0
	2(PV)	5.3217	-	-	-	1.1
	3(PQ)	-	-	3.6392	0.5339	-

UNIT - IV

7 a. Derive the necessary condition for economic operation of generators neglecting transmission losses. 6

b. The fuel costs in Rs/hr for two plants are $F_1 = 0.004\,p_1^2 + 8p_1 + 10$; $F_2 = 0.006 + P_2^2 + 9P_2 + 15$.

The system is operating on economic load dispatch with $P_1 = P_2 = 500$ MW and $\frac{\partial P_L}{\partial P_2} = 0.2$. 6

Find penalty factor of plant1.

c. Obtain the expression for B coefficient considering two plant systems. 8

8 a. Compute the loss coefficients for the network shown in Fig. 8(a) using the given data; 8

$I_a = (1.0 - j0.15)p.u.$ $Z_a = (0.02+j0.15)p.u.$

$I_b = (0.5 - j0.1)p.u.$ $Z_b=(0.03 + j0.05)p.u.$

$I_c = (0.2 - j0.05)p.u.$ $Z_c = (0.02+j0.25)p.u.$

b. Explain the performance curves of thermal plant. 4

c. The fuel cost of two generating plants are given below; 8

$F_1 = 1.5 + 20P_{G1} + 0.1P_{G1}^2 \ Rs/h$ $F_2 = 1.9 + 30P_{G2} + 0.1P_{G2}^2 \ Rs/h.$

Find the optimal schedule for the demand P_D = 200 MW. Also find the savings per day when they share the load equally.

UNIT - V

9 a. Explain with necessary condition the solution of swing equation by point- by-point method. 10

b. With necessary equation, describe the solution of swing equation using modified Euler's method. 10

10 a. Explain with Phasor diagrams and necessary expression. The synchronous machine Models employed in transient stability studies. 10

b. Describe the solution of swing equation using RK method. 10

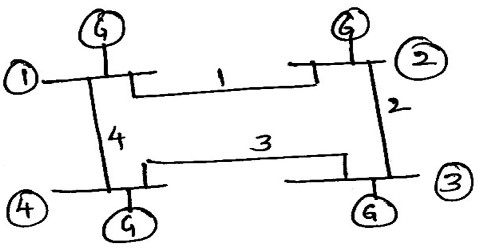

Fig. 1(b)

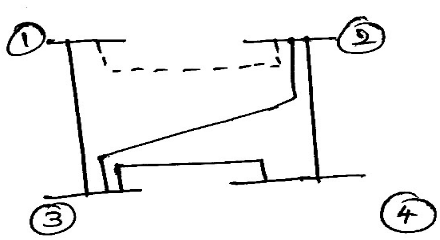

Fig. 3(c)

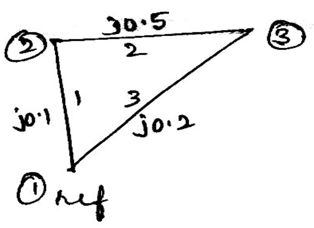

Fig. 4(b)

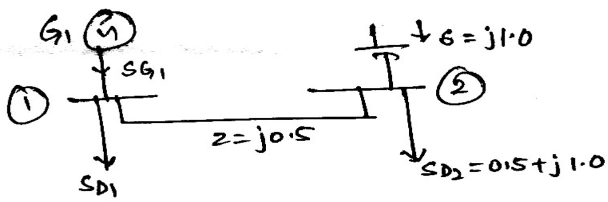

Fig 5(b)

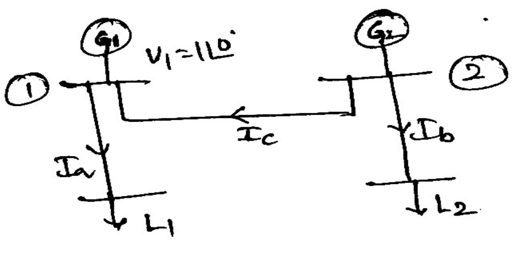

Fig. 8(a)

* * *