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; February - 2022

Computer Techniques in Power Systems

Time: 3 hrs *Max. Marks: 100*

Course Outcomes

The Students will be able to:

CO1: Form the bus admittance matrix for the given power system network by singular transformation method.
CO2: Develop general power flow equations (PFE) for an n-bus power system
CO3: Determining the solution of PFE using algorithms such as Gauss-Seidel and Newton-Raphson methods.
CO4: Design a power system by optimizing the overall operating cost subject to pre-specified constraints.
CO5: Determine the transient stability of a power system

***Note**: I) **PART - A** is compulsory. **Two** marks for each question.*
*II) **PART - B**: Answer any **Two** sub questions (from a, b, c) for Maximum of **18 marks** from each unit.*

Q. No.	Questions	Marks	BLs	COs	POs
	I : PART - A	**10**			
I a.	List any two properties of a tree.	2	L1	CO1	PO1
b.	Write the generalized algorithmic equations to form Y_{bus} by inspection method.	2	L1	CO2	PO1
c.	List the advantages of NR method over GS method.	2	L1	CO3	PO2
d.	Write the coordination equation for economic scheduling of generation with transmission loss considered.	2	L2	CO4	PO2
e.	List any two methods of solving the swing equation.	2	L1	CO5	PO1
	II : PART - B	**90**			
	UNIT - I	**18**			
1 a.	Construct branch path incidence matrix, element node and cut set incidence matrices for the oriented graph shown in Fig. 1(a). Choose 1, 2, 3, 4 as tree branches.	9	L2	CO1	PO2
b.	Define the following terms with an illustrative example: i) Oriented graph ii) Tree iii) Basic cut set incidence matrix iv) Basic loop incidence matrix	9	L1,2	CO1	PO1

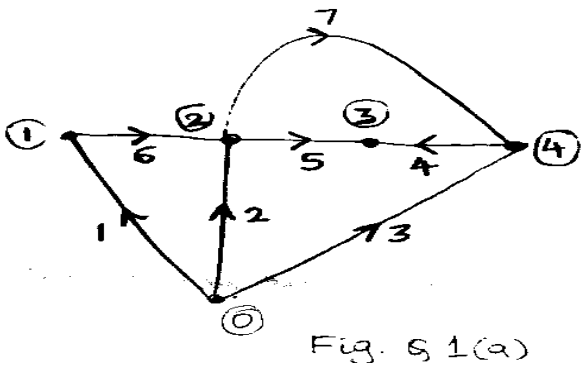

Fig. Q 1(a)

Contd... 2

c. For the oriented graph shown in Fig. Q1(c), obtain the matrices $\hat{A}$, A, K, B and $\hat{B}$. Choose 1, 2, 3 as tree branches.

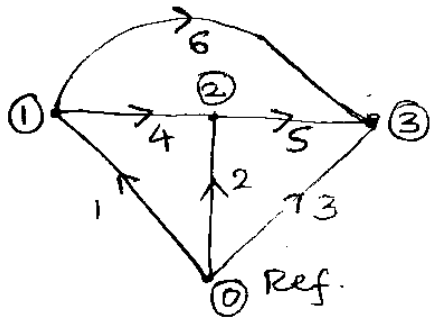

Fig. Q 1(c)

9 L2 CO1 PO2

UNIT - II **18**

2 a. Derive an expression for obtaining the bus admittance and bus impedance matrices (Y_{bus} and Z_{bus}) by the singular transformation analysis. 9 L1,2 CO2 PO2

b. Form Z_{bus} for the power system shown in Fig. 2(b) by adding the elements in the sequence 4 - 1, 1 - 2, 1 - 3, 4 - 3 by selecting node 4 as the reference. The p.u. reactance of all lines are indicated on the diagram. 9 L2,3 CO2 PO2

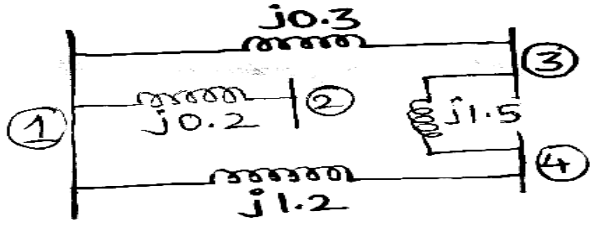

Fig. Q 2(b)

c. For the oriented graph with data as in Fig. Q2(c). Obtain Y_{bus} by singular transformation. Verify the answer by rule of inspection. The line impedance values are as marked in p.u.

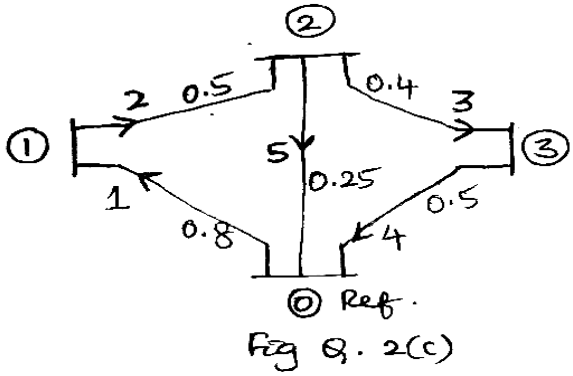

Fig Q. 2(c)

9 L3, 4 CO2 PO2

UNIT - III **18**

3 a. Explain the procedural steps to be followed to find the voltages at PQ and PV buses of given system by using GS load flow analysis by giving corresponding generalized equations. 9 L2,3 CO3 PO2,5

Contd... 3

b. Using Y_{bus} based GS method of LFA for the system shown in Fig. Q3(b). Compute voltage at bus 2 at the end of first iteration. Assume $\alpha = 1$.

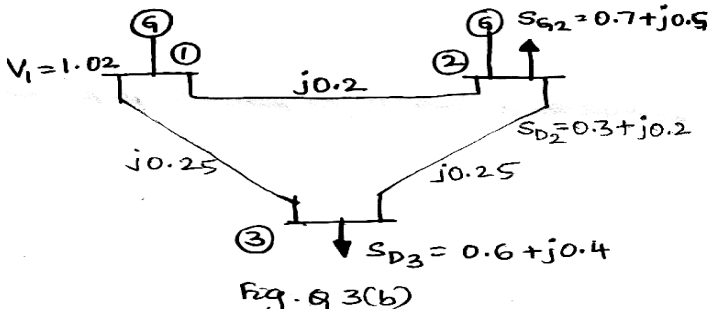

Fig. Q 3(b)

9 L3,4 CO3 PO2,5

c. Explain Newton-Raphson method of LFA in polar form for a system consisting of P-Q buses only. 9 L2,3 CO3 PO1,2

UNIT - IV **18**

4 a. Derive the condition for optimal scheduling of thermal plants considering losses. Explain the importance of penalty factor. 9 L2,3 CO4 PO1,2

b. What are B-coefficients? Obtain the general expression for B-coefficients. 9 L2,3 CO4 PO1,2

c. A two bus system is shown in Fig. Q4(c), if a load of 125 MW is transmitted from plant 1 to the load, a loss of 15.625 MW is incurred. Determine the generation schedule and the load demand; if the cost of received power is Rs. 24 /MWhr. Solve the problem using coordination equations and penalty factor method. The incremental production cost of plants are,

$$\frac{dF_1}{dP_1} = 0.025P_1 + 15 \quad ; \quad \frac{dF_2}{dP_2} = 0.05P_2 + 20$$

9 L3,4 CO4 PO2,5

Fig Q. 4 (c)

UNIT - V **18**

5 a. With necessary equations, describe the solution of swing equation using modified Euler's method. 9 L2,3 CO5 PO1,2

b. Giving the algorithmic equations required by the method-1 and method-2 of point-by-point solution technique discuss on the solution procedure for the swing equation obtain during transient stability studies. 9 L2,3 CO5 PO1,2,12

c. Explain the Runge-Kutta method for solving a swing equation of Synchronous machines. 9 L2,3 CO5 PO1,2,12

* * * *