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10EE71

**Seventh Semester B.E. Degree Examination, Dec.2019/Jan.2020**  
**Computer Techniques in Power System Analysis**

Time: 3 hrs.

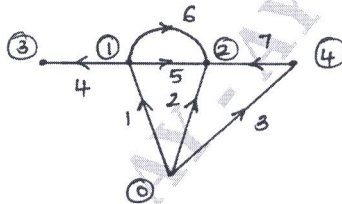
Max. Marks:100

**Note:** Answer any FIVE full questions, selecting atleast TWO questions from each part.

**PART - A**

- 1 a. Define i) Graph ii) Path iii) Tree iv) Loop. (04 Marks)  
 b. The oriented connected graph of a system is shown in fig. Q1(b), obtain  
 i) Basic cutset incidence matrix B ii) Basic loop incidence matrix C.  
 Select 5, 6 and 7 as links. Prove that  $C_b = -B_l^t$ . (10 Marks)

Fig.Q1(b)



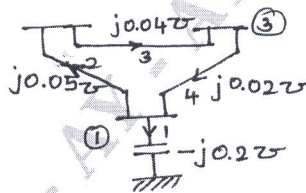
- c. What is a Primitive Network? The data relating to passive elements is given in Table Q1(c). Obtain i) Primitive impedance matrix ii) Primitive admittance matrix. (06 Marks)

Table Q1(c)

Element	Self Impedance (Pu) $Z_{pq, pq}$	Mutual Impedance (Pu) $Z_{pq, rs}$
1	0.6	-
2	0.8	0.1 (with element 1)
3	0.2	-

- 2 a. Obtain an expression for bus admittance matrix using Singular transformation method. (06 Marks)  
 b. Form  $Y_{BUS}$  using singular transformation for the power system shown in fig. Q2(b). (06 Marks)

Fig.Q2(b)



- c. Derive an expression for off diagonal elements  $Z_{qi}$  of bus impedance matrix using building algorithm when branch is added to the partial network. (08 Marks)
- 3 a. Explain how buses are classified to carryout load flow analysis in Power System. Discuss the significance of slack bus. (07 Marks)  
 b. Write a short note on Acceleration of Convergence. (03 Marks)  
 c. For a 3 bus power system elements of  $Y_{BUS}$  are given as  $Y_{11} = 4.5 - j18$  ;  $Y_{12} = -2.5 + j1.0$  ;  $Y_{13} = -2 + j8$  ;  $Y_{22} = 4.5 - j20$  ;  $Y_{23} = -2 + j10$  ;  $Y_{33} = 4 - j18$ . Real bus powers are given by 1.6 and -0.7 and reactive bus powers are 1.6 and -0.7 at buses 2 and 3 respectively. Bus 1 is slack bus with  $E_1 = (1.04 + j0)$ . Assuming initial voltages at buses 2 & 3 to be  $(1 + j0)$ , find the value of voltage at bus 3 at the end of first iteration using Gauss – Siedal method with an acceleration factor of 1.6. (10 Marks)

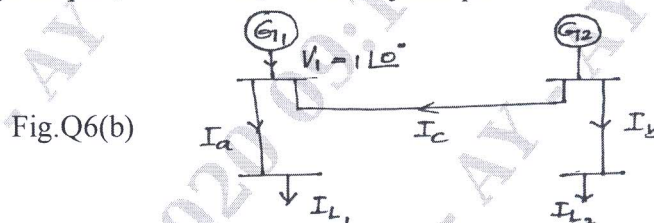
Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
 2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.

- 4 a. Write the step by step algorithmic procedure for load flow analysis using Newton - Raphson's method in Polar co-ordinates. (08 Marks)
- b. Compare NR and GS methods for load flow analysis procedure. (06 Marks)
- c. What are the assumptions made in fast decoupled load flow method? Write a flow chart of the method. (06 Marks)

**PART - B**

- 5 a. Derive an expression for optimal loading including transmission losses for an 'n' plant system. (06 Marks)
- b. The fuel costs of two units are given by  $F_1 = 1.5 + 20 P_{G_1} + 0.1 P_{G_1}^2$  Rs/hr.  
 $F_2 = 1.9 + 30 P_{G_2} + 0.1 P_{G_2}^2$  Rs/hr.  
 $P_{G_1}$  &  $P_{G_2}$  are in MW. Find the optimal schedule neglecting losses when the demand is 200MW also calculate  $\lambda$ . (06 Marks)
- c. The incremental cost of 2 plants are ,  $IC_1 = 0.1P_1 + 22$  Rs/M whr  
 $IC_2 = 0.12P_2 + 16$  Rs/M whr  
 If both units are operating at all time,  $P_{\min} = 20$ MW and  $P_{\max} = 100$ MW, determine economical operating schedule of the plants for loads 40MW, 80MW, 160MW and 180MW, neglecting transmission losses. (08 Marks)

- 6 a. Derive an expression for loss co-efficients and transmission loss in terms of generation in an interconnected system. (10 Marks)
- b. For the network shown in fig. Q6(b) , obtain the loss co-efficients. Take  
 $I_a = 1.0 + j0.15$  pu       $Z_a = 0.02 + j0.15$  pu  
 $I_b = 0.5 - j0.10$  pu       $Z_b = 0.03 + j0.15$  pu  
 $I_c = 0.2 - j0.05$  pu       $Z_c = 0.02 + j0.25$  pu (10 Marks)



- 7 a. Explain with necessary equations and graphs, the solution of swing equation by point by point method. (10 Marks)
- b. Explain clearly representation of loads in a power system during transient period. (10 Marks)
- 8 a. Illustrate the steps involved in estimating internal voltage angles and machine speed using Range - Kutta method during transient period. (10 Marks)
- b. Discuss on Modified Euler's method for transient stability studies. (10 Marks)

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