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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIRST SEMESTER M. TECH DEGREE EXAMINATION

Electrical Engineering

(Power Electronics & Power Systems)

04EE6403—Computer Applications In Power Systems

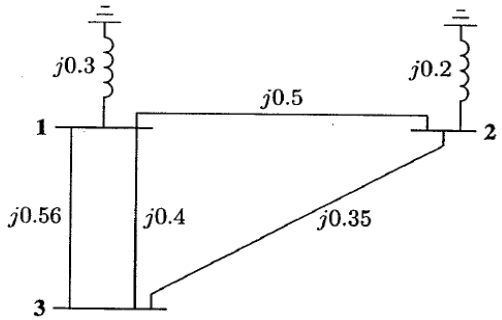
Time: 3 hrs Max. Marks: 60

PART A

Answer All Questions

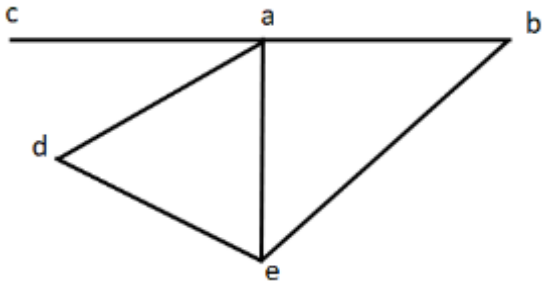
Each question carries 3 marks

1. What is bus frame, branch frame and loop frame of references?
2. The bus impedance matrix for the network in figure is given below. The line between buses 1 and 3 with impedance j0.56 is removed by the simultaneous opening of breakers at both ends of the line. Determine the new bus impedance matrix.



$$Z_{Bus} = \begin{bmatrix} j0.183 & j0.078 & j0.141 \\ j0.078 & j0.148 & j0.106 \\ j0.141 & j0.106 & j0.267 \end{bmatrix}$$

3. Compare Newton Raphson and Fast Decoupled Load flow algorithm.
4. Optimally order the nodes of given graph showing necessary steps.



5. Explain the operation of TCSC in power system.
6. Build Z bus for three phase short circuit fault in a power system.
7. What are the different types of fault occurring power system.
8. Draw the zero sequence impedance diagram for star –star grounded, star grounded-delta, delta-star configuration of transformer.

PART B

Each question carries 6 marks

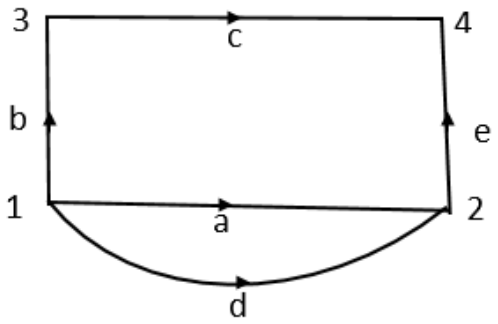
9. Write the algorithm for Zbus building.

OR

10. Comment on AC-DC Load Flow.

11. For the network shown in figure, form the primitive matrices [z] & [y] and obtain the bus admittance matrix by singular transformation.

Elements	Self-impedance	Mutual impedance
a	j0.6	
b	j0.5	j0.1 (with element a)
c	j0.5	
d	j0.4	
e	j0.2	



OR

12. In a three bus power system, bus 1 is slack bus and buses 2 and 3 are P-Q buses. Its bus admittance matrix is

$$\begin{array}{c} \\ 1 \\ 2 \\ 3 \end{array}\begin{array}{c} \begin{array}{ccc} 1 & 2 & 3 \end{array} \\ \begin{bmatrix} - & - & - \\ -2+j6 & 2.7-j8 & -0.7+j2 \\ -1+j3 & -0.7+j2 & 1.7-j5 \end{bmatrix} \end{array}$$

The slack bus voltage is $1.04 < 0^0$. At bus 2, real power generation is 0.7, real power load is 0.2, reactive power generation is 0.1 and reactive power load is 0.3. Taking flat start and using Gauss Seidel method, find the bus voltage V2 after first iteration.

13. Formulate an OPF problem with necessary constraints.

OR

14. Explain the representation of synchronous machine.
15. How to incorporate static tap changing transformers in load flow.

OR

16. Explain load flow involving shunt voltage controller FACTs Device.
17. Write algorithm for symmetrical fault analysis using Zbus.

OR

18. Perform a Single line to ground fault analysis on a large system using Zbus.
19. The reactance's of an alternator rated 10 MVA, 6.9 kV are X1 =15 %; X2 = 20 % and Xg0 = 5 %. The neutral of the alternator is grounded through a reactance of 0.38 Ω. Line to line fault, with fault impedance j0.15 p.u. occurs at the terminals of the alternator. Determine the line currents, fault current and the terminal voltages.

OR

20. The positive sequence, negative sequence and zero sequence bus impedance matrices of a power system are shown below. A double line to ground fault with Zf=0, occurs at bus 4. Find the fault current and voltages at faulted buses.

$$Z_{bus}^{(1)} = Z_{bus}^{(2)} = j\begin{array}{c} \\ 1 \\ 2 \\ 3 \\ 4 \end{array}\begin{array}{c} \begin{array}{cccc} 1 & 2 & 3 & 4 \end{array} \\ \begin{bmatrix} 0.1437 & 0.1211 & 0.0789 & 0.0563 \\ 0.1211 & 0.1696 & 0.1104 & 0.0789 \\ 0.0789 & 0.1104 & 0.1696 & 0.1211 \\ 0.0563 & 0.0789 & 0.1211 & 0.1437 \end{bmatrix} \end{array}$$

$$Z_{bus}^{(0)} = j\begin{array}{c} \\ 1 \\ 2 \\ 3 \\ 4 \end{array}\begin{array}{c} \begin{array}{cccc} 1 & 2 & 3 & 4 \end{array} \\ \begin{bmatrix} 0.19 & 0 & 0 & 0 \\ 0 & 0.08 & 0.08 & 0 \\ 0 & 0.08 & 0.58 & 0 \\ 0 & 0 & 0 & 0.19 \end{bmatrix} \end{array}$$