Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY M. E. - SEMESTER – I • EXAMINATION – WINTER • 2013

Subject code: 710701N

Date: 23-12-2013

Subject Name: Power System Modeling and Simulation Time: 10.30 am – 01.00 pm Tot

Total Marks: 70

Instructions:

- 1. Attempt all questions.
- 2. Make suitable assumptions wherever necessary.
- 3. Figures to the right indicate full marks.
- Q.1 (a) Consider the input side of the transformer as one bus and output side as the other bus. The transformer is modeled as series resistance R and series inductive reactance X in P. U. referred to the one (Primary or secondary) side of the transformer (omit shunt branch on both sides of the transformer). Form the Y bus for the transformer (assume nominal turns ratio). Also give the modifications in Ybus when shunt branch is considered.
 - (b) For the system shown in the Figure, write the equations for finding V_1 and V_2 07 using G S method and also explain each term in expression of V_1 and V_2 . Assume bus No. 3 as slack bus and other two are load buses. Suggest the modifications required in calculation if Bus No. 2 is a PV bus.



- Q.2 (a) What is Jacobin matrix used in N R method of load flow study? Consider a power system with total *n* number of buses. Out of which *m* number of buses are PV buses. Find size of Jacobian also find the size of each sub matrices of Jacobian [J1, J2, J3 and J4] where, notations have usual meanings.
 - (b) How optimal load flow differs from the load flow? Explain any one method 07 used for solution of optimal power flow.

OR

- (b) Derive the expression for modification in the elements of Zbus when a new line 07 is added between the two existing *ith* and *jth* Bus.
- Q.3 (a) What is meant by power system state estimation? Using weighted least 07 squares technique derive an expression for 'n' number state variables in terms of 'm' number of measurements each of them having assigned typical weighting factor with usual notations and symbols.
 - (b) For a sample power system having only tow state variables following data have 07 been given : Estimated errors for four measurements respectively: 0.06228, 0.15349, 0.05965, -0.49298 The standard deviation for first two measurements : 0.1

Weighting factor last two measurements : 50

Find out whether bad data is present or not with the help of Chi-square method with confidence level of 99% probability. Use following table for bad data detection.

k	α			
	0.05	0.025	0.01	0.005
1	3.84	5.02	6.64	7.88
2	5.99	7.38	9.21	10.60
3	7.82	9.35	11.35	12.84
4	9.49	11.14	13.28	14.86
5	11.07	12.83	15.09	16.75
6	12.59	14.45	16.81	18.55
7	14.07	16.01	18.48	20.28
8	15.51	17.54	20.09	21.96
9	16.92	19.02	21.67	23.59
10	18.31	20.48	23.21	25.19

If bad data is present, state briefly remedy to eliminate bad data.

OR

- Q.3 (a) What are the constraints to be considered for contingency analysis? Using bus impedance matrix, derive expression for compensating currents' vector when two lines are added in existing power system between i-j buses and p-q buses respectively. Has any implication of Thevenin's theorem been found in the expression derived?
 - (b) What is power system security analysis? Explain different states of power 07 system and state necessary controls to be provided at different level.
- Q.4 (a) What is L U factorization? Use L U factorization or triangular factorization 07 method to solve the following equations
 - $2x_1 + x_2 + 3x_3 = 6$
 - $2x_1 + 3x_2 + 4x_3 = 9$
 - $2x_1 + 4x_2 + 7x_3 = 14$
 - (b) Explain Sparsity techniques and its advantages. Give any one method to 07 store sparse matrix in computer.

OR

- Q.4 (a) Explain Range-Kutta method for numerical integration with suitable example 07
 - (b) Explain Bewleys Lattice diagram with neat sketch. What information are 07 obtained from Bewleys Lattice diagram?
- Q.5 (a) Explain Linear Sensitivity factors, Generation shift factor and line outage 07 distribution factor for Power System Security.
 - (b) Discuss effect of traveling waves on short circuited transmission line.

OR

- Q.5 (a) Compare backward Euler's method and trapezoidal method in context to 07 application of these methods to the large scale power systems.
 - (b) For the purpose of multi machine stability analysis, the set of coupled first order differential equations are derived and then solved using some numerical technique. Write the steps which must be followed for writing such equations.

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