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M S RAMAIAH INSTITUTE OF TECHNOLOGY

(AUTONOMOUS INSTITUTE, AFFILIATED TO VTU)

BANGALORE – 560 054

SEMESTER END EXAMINATIONS – DEC 2013 / JAN 2014

Course & Branch	:	**B.E.- Electrical & Electronics Engg.**	**Semester**	:	**VII**
Subject	:	**Power Systems**	**Max. Marks**	:	**100**
Subject Code	:	**EE702**	**Duration**	:	**3 Hrs**

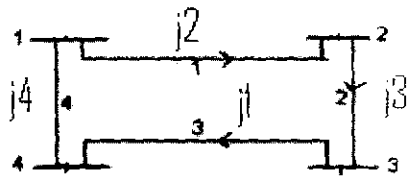
Instructions to the Candidates:

- Answer one full question from each unit.

UNIT – I

1. a) Derive the step-by-step algorithm for formation of bus impedance matrix, when added element to the partial network is link. (12)

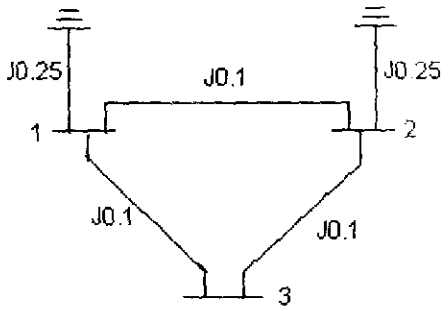
   b) For the power system shown in Fig (1b), select bus 1 as reference bus and form Ybus and Zbus. (08)



Fig(1b)

2 a) Derive the standard expression for Y_{bus} using singular transformation (10)

   b) The one-line diagram of sample system is shown in Fig(2b) , construct the bus impedance matrix by using Z_{bus} building algorithm. (10)



Fig(2b)

UNIT – II

3. a) Derive the expression for the static power flow equations. (10)

   b) For the simple system shown in Fig (3b), obtain the voltage at bus 2 using Gauss-Seidel method at the end of 1st iteration. If $V_1 = 1\angle 0^0$ compute the line flows and total losses in the line (10)

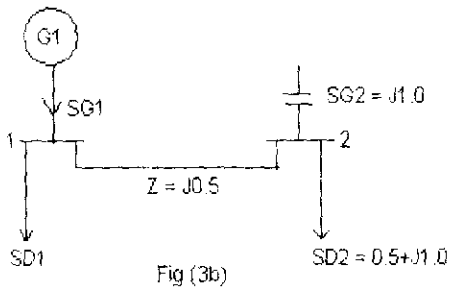


Fig (3b)

4. a) Explain the Newton-Raphson model for power flow solution. Give expression for Jacobian element and Algorithm. (12)

   b) Compare Gauss-Seidel (GS) and Newton-Raphson (NR) methods of load flow analysis (08)

UNIT – III

5. a) Derive the expression for optimal load dispatch including transmission loss (10)

   b) A constant load of 300 MW is supplied by two 200 MW generators, 1 and 2, for which respective incremental fuel costs are $\frac{dC_1}{dP_{G1}} = 0.10\,P_{G1} + 20$ and $\frac{dC_2}{dP_{G2}} = 0.12\,P_{G2} + 15$ with power P_G in MW and costs C in Rs/h. Determine, (a) the most economical division of load between the generators and (b) the saving in Rs/day thereby obtained compared to equal load sharing between machines. (10)

6. a) Explain with flow chart Iterative method of optimal scheduling of thermal power plant, neglecting loss. (08)

   b) The power system shown in Fig (6b) consists of two plants 1 and 2 connected to bus 1 and 2, respectively. There are two loads and a network of four branches. The reference bus with a voltage of $1\angle 0^0$ PU. The branch currents and impedances are (12)

   $I_a = 2\text{-}j0.5$ PU, $I_b = 1.6\text{-}j0.4$ PU, $I_c = 1\text{-}j0.25$ PU and $I_d = 3.6\text{-}j0.9$ PU

   $Z_a = Z_b = 0.015+j0.06$ and $Z_c = Z_d = 0.01+j0.04$

   Calculate the loss formula coefficients of the system in PU and in reciprocal megawatts, if the base is 100 MVA

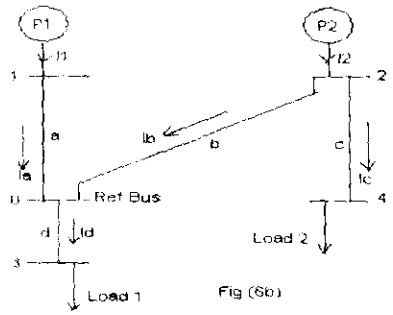


Fig (6b)

UNIT – IV

7. a) Explain the solution of swing equation by point-by-point method. (10)
   b) Discuss the representation of synchronous machine and load for transient stability studies (10)

8. a) With the help of flow chart, explain the method of finding the transient stability of a given power system using modified Euler's method. (10)
   b) Explain the Runge-kutta method for the solution of swing equation. (10)

UNIT – V

9. a) Obtain the expression for change in steady state frequency deviation caused by changes in load demand (10)
   b) An isolated 75 MVA synchronous generator feeds its own load and operates initially at no-load at 3000 rpm, 50Hz. A 20 MW load is suddenly applied and the steam valves to the turbine commence to open after 0.5 sec due to the time-lag in the governor system. Calculate the frequency to which the generated voltage drops before the steam flow meets the new load. The stored energy for the machine is 4kW-sec per kVA of generator capacity. (10)

10. a) Two generators rated 200MW and 400MW are operating in parallel. The drop characteristics of their governors are 4% and 5% respectively from no-load to full load. Assume free governor operation and the generators are operating at 50 Hz at no load, how would a load of 600 MW is shared between them? (05)
   b) Write a short note on series compensation (05)
   C) An interconnected 60Hz power system consists of single area with three generating units 500, 750 and 1000 MVA respectively. The regulation constant of each units is R=0.05 PU on its own rating. Each unit is initially operating at one half (1/2) of its rating, when the system load suddenly increases by 200 MW. Determine (i) the state steady frequency deviation of the area, (ii) the new system frequency and (iii) the increase in turbine power output. Choose a base of 1000 MVA. (10)

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