EE62

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RAMAIAH
Institute of Technology

(Autonomous Institute, Affiliated to VTU)
(Approved by AICTE, New Delhi & Govt. of Karnataka)
Accredited by NBA & NAAC with 'A+' Grade

SEMESTER END EXAMINATIONS – JULY / AUGUST 2022

Program	: **B.E. : Electrical and Electronics Engineering**	**Semester**	: **VI**
Course Name	: **Power Systems Engineering-II**	**Max. Marks**	: **100**
Course Code	: **EE62**	**Duration**	: **3 Hrs**

Instructions to the Candidates:

- Answer one full question from each unit.
- Suitably assume any missing data.

UNIT- I

1. a) Define the terms and explain with example: — CO1 (06)
   i) Graph ii) Tree iii) Bus incidence Matrices.

   b) Form the bus impedance matrix for the network shown in Figure 1 by Z-building algorithm — CO1 (10)

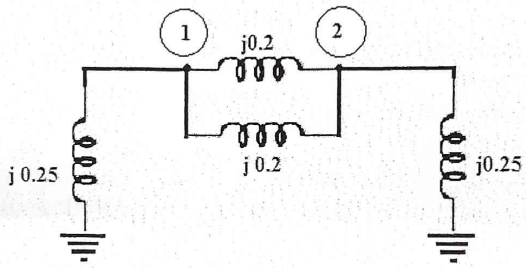

Figure 1

   c) Describe Primitive network with example? — CO1 (04)

2. a) Explain how to form Y Bus by using singular transformation method. — CO1 (06)

   b) Determine the Y Bus for 4 bus transmission line system, the bus diagram of which is shown below Figure 2 and the impedances and line charging admittances are tabulated. — CO1 (10)

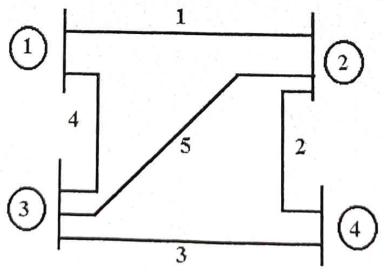

Figure 2

Line No	Bus-code	Impedance	Line charging Admittance for each line
1	1-2	J 0.20	J 0.04
2	2-4	J 0.25	J0.05
3	3-4	J 0.15	J0.03
4	3-1	J 0.10	J0.02
5	2-3	J 0.30	J 0.06

   c) Explain in detail the procedure of addition of a branch or link to a partial network. — CO1 (04)

UNIT – II

3. a) Explain the types of buses used for load flow analysis. CO2 (06)

b) For a given 14 bus power system with bus 1 as slack bus, buses 2 to 11 are PQ buses and buses 12 to 14 are PV buses, determine the dimension of the Jacobian matrix in the NR method of load flow solution. If in this system, if buses 12 to 14 are changed to PQ buses, determine the new order of the Jacobian matrix. CO2 (04)

c) The line data and bus data of a 3-bus system is given below: CO2 (10)

Line data

Line	Impedance (pu)
1-2	j0.1
1-3	j0.2
2-3	J0.2

Bus data

Bus	P_G(pu)	Q_G(pu)	P_L(pu)	Q_L(pu)	$V_{specified}$(pu)
1(slack)	-	-	-	-	1.0
2(PV)	5.3217	-	-	-	1.1
3(PQ)	-	-	3.6392	0.5339	-

Write the equations to be solved for the load flow solution using GS method. Obtain the voltages at the three buses at the end of one iteration using GS algorithm.

4. a) From the fundamentals derive the static load flow equations. CO2 (06)

b) Justify the validity of decoupling the load flow equations. Derive the equations to be solved using fast decoupled method. State the assumptions made. CO2 (08)

c) What are the data required for the load flow analysis. CO2 (06)

UNIT – III

5. a) What are the assumptions considered in deriving the transmission loss expression? CO3 (03)

b) Derive the generalized transmission loss formula in terms of B-coefficients. CO3 (07)

c) A plant consists of two units. The incremental fuel characteristics for the two units are given as: CO3 (10)

$$\frac{dC_1}{dP_{G1}} = 0.15P_{G1} + 30.0\ RS/MWh$$

$$\frac{dC_2}{dP_{G2}} = 0.25P_{G2} + 20.0\ RS/MWh$$

Find the optimal load sharing of two units when a total load of 300 MW is connected to the system. Also calculate the extra cost increased in Rs/hr if the total load is shared equally between them.

6. a) Derive the formula for economic dispatch problem with considering losses for an iteration method. CO3 (10)

b) What do you mean by ITL and penalty factor of the system? Write expressions for them. CO3 (02)

c) What are equality and inequality constraints in economic operation of a power system? CO3 (02)

d) On a system consisting of two generating plants, the incremental costs in Rs./MWh with P_{G1} and P_{G2} in MW are CO3 (06)

$$\frac{dC_1}{dP_{G1}} = 0.008P_{G1} + 8.0\ RS/MWh$$

$$\frac{dC_2}{dP_{G2}} = 0.0125P_{G2} + 9.0\ RS/MWh$$

The system is operating on economic dispatch with $P_{G1} = P_{G2} = 500$ MW, and $\frac{\partial P_L}{\partial P_{G2}} = 0.2$. Find the penalty factor of Plant-1

UNIT – IV

7. a) Discuss with relevant figures, the point by point method for solving swing equation under i) pre fault, ii) post fault and iii) during fault condition. CO4 (10)

b) At the beginning of a particular iteration in solution of swing equation, $\delta = 0.756\ rad$ and $\omega = 2.067$ rad/ sec. The mechanical power input =0.8 p.u. and the inertia constant M=0.0331 s^2/ rad. If the maximum electrical power is 1.333p.u., determine the values of δ and ω, for the next 3 iterations using Runge Kutta method, choosing step size of 0.02 sec. CO4 (10)

8. a) The generator of Figure 8(a) is delivering 1.0 p.u power to the infinite bus (| V | = 1.0 pu), with the generator terminal voltage of $|V_t|$ = 1.0 p.u. Calculate the generator emf behind transient reactance. Find the maximum power that can be transferred under the following conditions: CO4 (10)

   i. System healthy
   ii. One line shorted (3-phase) in the middle
   iii. One line open.

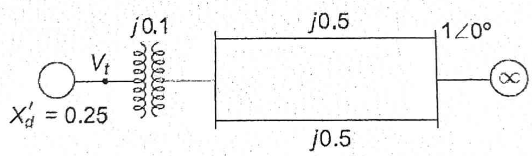

Figure 8(a)

b) Derive the power angle equation for non-salient pole synchronous machine. CO4 (10)

UNIT – V

9. a) Why should the system frequency be maintained constant? CO5 (02)

b) Explain with neat sketch the operation of P–F and Q–V Controllers. CO5 (08)

c) Find the static frequency drop, if the load is suddenly increased by 25 MW on a system having the following data: CO5 (10)
Rated capacity P = 500 MW
Operating Load P = 250 MW
Inertia constant H = 5 sec
Governor regulation R = 2 Hz p.u. MW
Frequency f = 50 Hz. Also find the additional generation.

10. a) Write the Comparison of shunt and series compensation. CO5 (04)

b) Derive the expression for the steady state frequency deviation. CO5 (08)

c) What are the factors effecting power system security? Explain each one in brief. CO5 (08)

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