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M S RAMAIAH INSTITUTE OF TECHNOLOGY

(AUTONOMOUS INSTITUTE, AFFILIATED TO VTU)

BANGALORE – 560 054

SEMESTER END EXAMINATIONS – JANUARY 2015

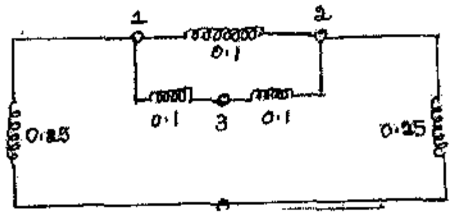
Course & Branch	: B.E: Electrical & Electronics Engg.	Semester	: VII
Subject	: Power Systems -II	Max. Marks	: 100
Subject Code	: EE702	Duration	: 3 Hrs

Instructions to the Candidates:

- Answer one full question from each unit.

UNIT – I

1. a) Find Zbus using Zbus building algorithm for the 3 bus system shown in fig Q1a (10)



FigQ1a

b) For the system shown in table below find YBUS using the method of singular transformation and verify the answer by singular transformation. Chose bus 1 as reference bus. (10)

Bus Code	1-2	2-3	1-3	2-4	3-4
Z in Pu	J 0.2	J 0.4	J 0. 1	J 0. 5	J 0. 4

2 a) for a power system having a line z=0.6 PU, connected between busses 1 & 2, the ZBus is given by (08)

$$ZBus = j\begin{bmatrix} 0.08313 & 0.02530 & 0.05421 \\ 0.02530 & 0.11205 & 0.06868 \\ 0.05421 & 0.06868 & 0.26145 \end{bmatrix}$$

If this line connected between 1 and 2 is replaced by a line of z= 0.4 PU. Find the fault current , if a 3 phase fault occurs at bus 1

b) For the system indicated below write [Z_{Prim}] and [A] required to obtain YBus by singular transformation, (06)

Line No.	Self Impedance		Mutual Impedance	
	Bus Code	Z in PU	Bus Code	Z in PU
1	1-2 (1)	0.6		
2	1-3	0.5	1-2(1)	0.1
3	3-4	0.5		
4	1-2(2)	0.4	1-2(1)	0.2
5	2-4	0.2		

c) Obtain the required equations and represent the off nominal transformer by its equivalent circuit (06)

UNIT – II

3 a) In the expression $3x - \cos x = 1$, find the value of x corrected upto 4 decimal places, Using Newton Raphson's method, (06)

b) Compare the performance of Gauss-Seidel and Newton-Raphson methods for load flow solution. (04)

c) For the network shown in fig Q3C, obtain the complex bus voltage at bus 2 at the end of first iteration. Use Gauss-Siedel method. Line impedances shown in fig are in PU. Given Bus 1 is slack bus with $V_1 = 1.0\angle 0^\circ$ PU . $P_2+jQ_2 = -5.96 + j1.46$ PU, $|V_3| = 1.02$ PU. (06)

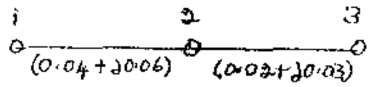


Fig Q3C

d) Mention the assumptions made in FDLF Load flow analysis. (04)

4. a) Obtain the expressions of jacobian of Newton Raphson's load flow model (10)

b) A three bus power system on a 100 MVA base has the bus quantities indicated in table below (10)

Bus	Generation		Load		Bus Voltage	
No.	P_G (MW)	Q_G(MVAR)	P_L(MW)	Q_L(MVAR)	V PU	Δ deg
1	-	-	0	0	1.02	0
2	25	15	50	25	-	-
3	0	0	60	30	-	-

The Ybus in PU for the 3 Bus system is $YBus = \begin{bmatrix} -j7 & j3 & j4 \\ j3 & -j8 & j5 \\ j4 & j5 & -j9 \end{bmatrix}$

Determine the voltages at bus 2 and bus 3 at the end of first iteration using Gauss-Siedel method. Take the acceleration factor $\alpha = 1.6$

UNIT – III

5. a) Obtain an expression for the transmission line loss in terms of generations for a system of two generators connected to several loads through a transmission network (10)

b) The incremental fuel cost in Rs/Hour for 3 units is given by (05)

$$\frac{dc_1}{dP_1} = 0.1P_1 + 40 \qquad \frac{dc_2}{dP_2} = 0.25P_2 + 30 \qquad \frac{dc_3}{dP_3} = 0.3P_1 + 20$$

Total load demand is 400 MW. Find the economic generation schedule.

c) For a system consisting of two generating unit, the incremental cost(IC) in Rs/MW-Hr are (05)

$IC_1 = 20 + 0.1\, Pg_1$

$IC_2 = 22.5 + 0.15\, Pg2$

The system is operating under economical condition with

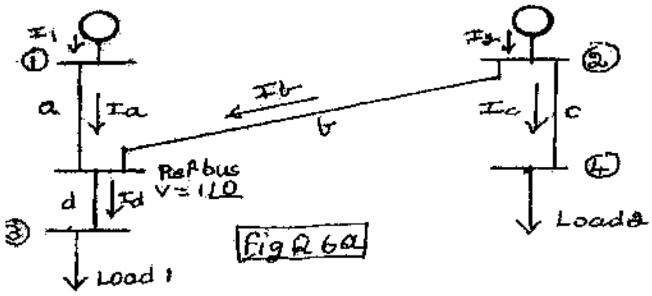
$P_{g1} = P_{g2} = 100$MW and $\frac{\partial P_L}{\partial P_{g2}} = 0.2$

Find the penalty factor of plant 1

6. a) For the system shown in fig Q6a the branch currents and impedances are : (12)

I_a = 2-j0.5 pu ; $Z_a = Z_b$ = 0.015+j0.06 pu ;
I_b = 1.6-j0.4 pu ; $Z_c = Z_d$ = 0.01+j0.04 pu ;
I_c = 1-j0.25 pu ;
I_d = 3.6-j0.9 pu ;

Calculate the loss formula coefficients of the system in pu;



b) The incremental fuel cost in Rs/Hour for 2 units system is given by (08)

$$\frac{dc_1}{dP_1} = 0.1P_1 + 20 \qquad \frac{dc_2}{dP_2} = 0.12P_2 + 15$$

Total load demand is 300 MW. Find the economic generation schedule using iterative method

UNIT – IV

7. a) A 20MVA, 50 Hz generator delivers 18 MW over a double circuit line to an infinite bus. The generator has an kinetic energy of H= 2.52 MJ/MVA at rated speed. The sending end voltage is 1.1 PU and that of the infinite bus is 1.0 PU .The transfer reactance before and during fault are 0.45 PU and 1.25 PU respectively. The critical clearing angle is around 120° . Find the critical clearing time. (10)

b) With flow chart and associated equations explain Runge-Kutta method of solving swing equation (10)

8. a) Enumerate modified Euler's method of solving swing equation (10)

b) A system having single generator operating at 50Hz is connected to infinite bus and has the following data (10)

Shaft power input = 0.8 PU
Voltage of infinite Bus = $1 \angle 0^0$ PU E_s= 1.2 Pu
Inertia Constant M(PU) = 5.77×10^{-4} S^2/ele deg
Transfer Reactance before fault X_1 = 0.7 PU
Transfer Reactance during fault X_2 = 1.9 PU
Transfer Reactance after clearing fault X_3= 0.9
Find $\delta(t)$ if fault is cleared in 6.25 cycles and determine the system stability. Use point-by-point method.

UNIT – V

9. a) What is the need for reactive power compensation in a power system and explain any two types of compensators (10)

   b) Write a brief note on FACTS Controller (05)

   c) A 500 MVA synchronous generator operates on full load at a frequency of 50 Hz. The load is reduced to 400 MW. The steam valve begins to operate with a time lag of 0.5 Sec. Determine the change in frequency if H= 5MW-Sec/MVA. (05)

10. a) Develop the complete block diagram representation of automatic load frequency control of an isolated power system and obtain the expression for change in frequency with change in load. (12)

    b) Two generators rated 200MW and 400MW are in parallel. The droop characteristics of their governors are 4% and 5%, respectively from no load to full load. The speed changers are so set that the generators operate at 50Hz sharing the full load of 600 MW in the ratio of their ratings. If the load reduces to 400 MW, how will it be shared among the generators and what will the system frequency be ? Assume free governor operation. (08)
    The speed changers of the governors are reset so that the load of 400MW is shared among the generators at 50Hz in the ratio of their ratings. What are the no load frequencies of the generators?

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