MURANG'A UNIVERSITY OF TECHNOLOGY

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

UNIVERSITY POSTGRADUATE EXAMINATION

2020/2021ACADEMIC YEAR

YEAR SEMESTER EXAMINATION FOR MASTER OF

EET 607– POWER SYSTEM SIMULATION LAB

DURATION: 3 HOURS

INSTRUCTIONS TO CANDIDATES:

1. Answer Any **FOUR** questions.
2. Mobile phones are not allowed in the examination room.
3. You are not allowed to write on this examination question paper.

QUESTION ONE (30 MARKS)

a) Give three disadvantages of the Newton-Raphson method in power flow studies.

(3 mks)

b) Consider the three bus system in figure 1. Each of the lines has an impedance of 0.03+j0.09 per unit and a shunt admittance of 0.02 per unit. The lines are modelled in the equivalent π.

The specified per unit values for all the buses are tabulated in Table 1.

i. Draw the equivalent system model

ii. Compute the Y- bus matrix

iii. Carry out the first iteration for the Gauss Seidel method with a flat start and compute $V_2^{(1)}$ and $V_3^{(1)}$

(17 mks)

QUESTION TWO (20 MARKS)

a) Why are the conventional methods of network analysis not suitable for power flow studies?

(3 mks)

b) Explain and illustrate the Gauss-Scidel method in solving an one-dimensional equation.

(7 mks)

c) Find the solution to the following system of equation using the modified Gauss- Seidel method.

$f(x)= 15x^3+10X+5e^X$

$accuracy = 0.0001$

$x^{(0)} = - 0.31$

Perform 4 iterations using an acceleration factor of 1.25. (10 mks)

QUESTION THREE (20MARKS)

a) Derive the transmission loss equation. (8 mks)

b) Neglecting system losses and generator limits, find the optimal dispatch and total cost in $ per hour for 3 generators and the given load demand:

$C_1=500+ 5.3P_1+-0.004P_1^2$ (§ MWhr)

$C_2=400+5.5P_2+0.06P_2^2$

$C_3=200+5.8P_3+0.009P_3^2$

$P_{demand} = 800MW$

Use the iterative method with an initial guess, $\lambda(0) = 6$ (12 mks)

QUESTION FOUR (20 MARKS)

a) What are the advantages does Newton-Raphson method have over Gauss-Seidel method in solving the power flow problem? (3mks)

b) In the two bus system in figure 2, bus I is a slack Bus with $V_1 = 1.2 < 0^o$ per unit. A load of 100 MW and 50 MVar is taken from bus 2. The line impedance is $Z_{12}=0.12+j0.16$ per unit on a base of 100 MVA. Using the Newton-Raphson method, obtain the voltage magnitude and phase angle of bus 2. Start with an initial estimate of $V_2(0)= 1.05$ pu and $\delta_2^{(0)}=0^o$. Perform one iteration. (17 mks)

QUESTION FIVE (20 MARKS)

a) Solve using the newton- Raphson technique for.$x = \begin{pmatrix} x1 \\ x2 \end{pmatrix}$ such that $f(x_1,x_2)=0$ where

$f_1(x_1,x_2)=2x_1^2+x_2^2-8=0$

$f_2(x_1,x_2)=x_1^2-x_2^2-x_1x_2-4=0$

And $x^{(0)} = \begin{pmatrix} x1(0) \\ x2(0) \end{pmatrix} = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$

Perform two iterations. (10mks)

b) Using the fast decoupled method perform two iterations to solve the following three bus system of figure 3.

(10 mks)