MUTHAYAMMAL ENGINEERING COLLEGE

(An Autonomous Institution)

(Approved by AICTE, New Delhi, Accredited by NAAC & Affiliated to Anna University)
Rasipuram - 637 408, Namakkal Dist., Tamil Nadu.

Department of Electrical and Electronics Engineering
Question Bank - Academic Year (2021-22)

Course Code & Course Name	**:**	**19EEC10 & POWER SYSTEM ANALYSIS**
Name of the Faculty	**:**	**Dr.N.Mohananthini**
Year/Sem/Sec	**:**	**III / VI / A & B**

UNIT I – INTRODUCTION

PART A (2 Marks)

1. What are the functions of power system analysis?
2. What is single line diagram?
3. Define per unit value.
4. What is Power system? What are the principle components of electrical power system?
5. What are the advantages of per unit system?
6. Define oriented graph and tree ?
7. Write the step by step procedures to be followed to find the per unit impedance diagram of a power system?
8. Define primitive network?
9. What is bus admittance matrix?
10. Which formula to be used to eliminate one node from the given Y bus matrix?
11. What are the main divisions of power system?
12. What is the need for system analysis in planning and operation of power system?
13. What is an infinite bus bar?
14. Define primitive network?
15. What is bus admittance matrix?

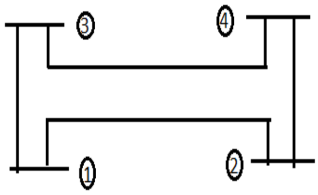
PART B (16 Marks)

1. Explain the modeling of generator, load, transmission line and transformer for power flow, short circuit and stability studies. **[CO1,K2]** (16)
2. The single line diagram of an unloaded power system is shown in fig. Reactances of the two sections of the transmission line are shown on the diagram. The generator and transformers are rated as follows: **[CO1,K4]** (16)

Generator G1: 20 MVA, 13.8 KV, X” = 20%
Generator G2: 30 MVA, 18.0 KV, X” = 20%
Generator G3: 30 MVA, 20.0 KV, X” = 20%
Transformer T1: 25 MVA, 220 Y / 13.8 Δ KV, X = 10%
Transformer T2:3 single phase units each rated at : 10 MVA, 127/18 KV,X = 10%
Transformer T3: 35 MVA, 220 Y / 22 Y KV, X = 10%
Draw the reactance diagram using a base of 50 MVA and 13.8 KV on generator G1 (16)

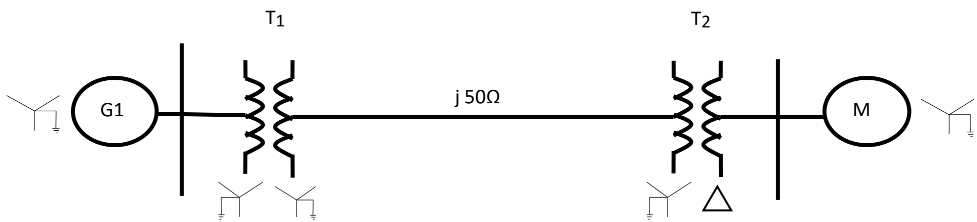
3. Form the admittance matrix for the data which is given in table. Select node 1 as reference node and use singular transformation method. **[CO1,K4]** (16)

S. No.	Self		Mutual	
	Bus Code	Impedance	Bus Code	Impedance
1	1-2	0.5	1-2	0.1
2	1-3	0.6		
3	3-4	0.4		
4	2-4	0.3		



4. i) Explain the Z bus building algorithm with an example of three bus system. (8)
   ii) Explain the modeling of power system components for load flow analysis. (8)

5. Draw the per unit reactance diagram for the power systems shown below. Neglect resistance and use a base of 100MVA, 220KV in 50 ohms line. The ratings of the generator, motor and transformers are



G: 40MVA, 25KV, X’’ = 20%
M: 50MVA, 11KV, X’’ = 30%
T_1: 40MVA, 33 Y/ 220Y KV, X = 15%
T_2: 30MVA, 11 Δ / 220Y KV, X = 15%
Load:11KV, 50MW+j68 MVAR

6.Form the admittance matrix for the data which is given in table. Select node 1 as reference node and use singular transformation method.

Element Number	Self	
	Bus Code	Impedance
1	1-2(1)	0.6
2	1-3	0.5
3	3-4	0.5
4	1-2(2)	0.4
5	2-4	0.2

UNIT II –POWER FLOW ANALYSIS

PART A (2 Marks)

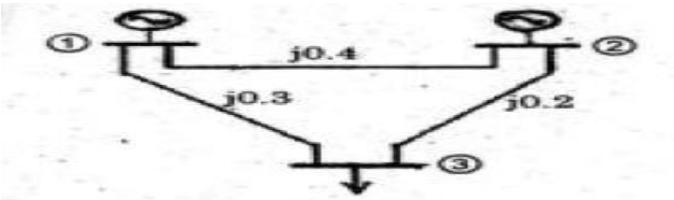
1. What is meant by acceleration factor in load flow studies?
2. What is the role of swing bus in power flow study?
3. At what condition generator bus is treated as load bus?
4. Formulate the power flow equation for a load flow study?
5. What are the advantages and disadvantages of N.R method?
6. What is the need for slack bus?
7. Write a polar form of power flow equation or static load flow equations.
8. What are the different types of buses in power flow studies?
9. Explain operational planning.
10. What are the quantities associated with each bus in a system?
11. Compare Gauss Siedel and Newton Raphson method of load flow studies.

12.When generator bus is treated as load bus?

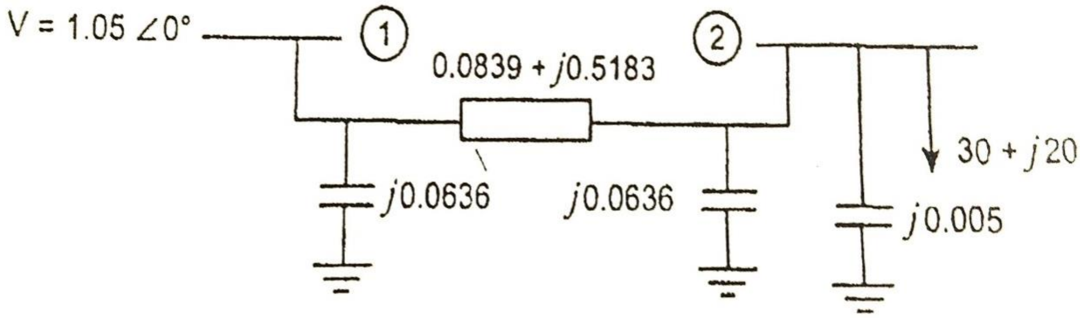
13. How approximation is performed in Newton-Raphson method?
14. Why do we go for iterative methods to solve load flow problems?
15. Mention any one advantage and one disadvantage of NR method over GS method.

PART B (16 Marks)

1. Develop an algorithm and draw the flowchart for the solution of load flow problem using Newton Raphson method.
2. (i) Derive the power flow equation in polar form**.** (8)
   (ii) Explain different types of buses in power flow studies. (8)
3. Figure shown below a three bus power system
   Bus1: Slack bus V=1.05***L***0° pu
   Bus 2: PV bus |V| = 1.02 pu, Pg=0.3pu,
   Bus3: PQ bus P_L =0..4 p.u. Q_L =0.2 p.u.
   Determine the voltage at the end of first iteration by Gauss Seidel method. Find the slack bus power, line flows, transmission loss. Neglect limits on reactive power generation.



4. Develop an algorithm and draw the flowchart for the solution of load flow problem using Gauss Seidel method.
5. Using Gauss Seidel method determine bus voltages and reactive power generation for the Figure 1. Shown. Take base MVA=100.



6. Perform one iteration of Newton Raphson Load flow method and determine the power flow solution for the given system shown. Take base MVA as 100 (Note: Use in rad mode)

Line Data:

Line	From Bus	To Bus	R (p.u)	X (p.u)	Half line charging admittance (p.u)
1	1	2	0.0839	0.5183	0.0636

Bus Data:

Bus	**P_L**	**Q_L**
1	90	20
2	30	10

UNIT III – FAULT ANALYSIS – BALANCED FAULTS

PART A (2 Marks)

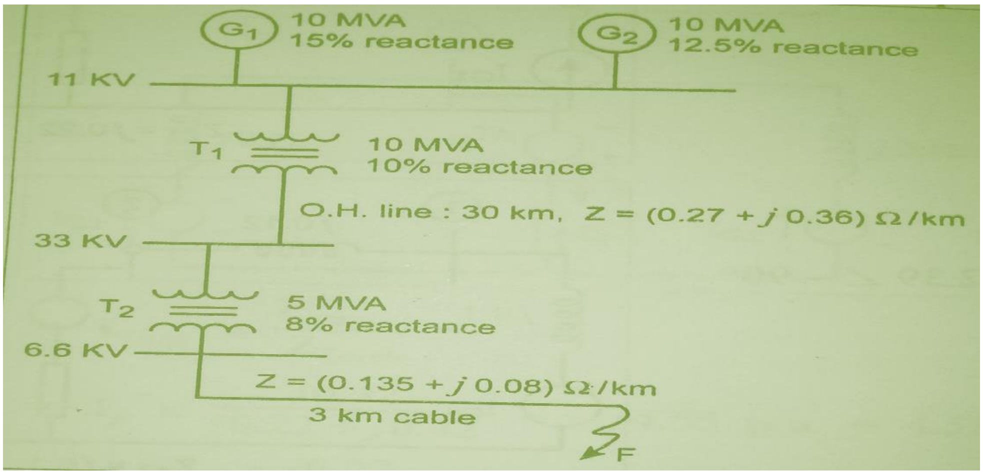
1. What is short circuit MVA?
2. What is meant by fault?
3. What is the need for short circuit studies?
4. Give the methods available for forming bus impedance matrix.
5. Define short circuit capacity of power system or fault level.
6. What is a bus?
7. Give the methods available for forming bus impedance matrix.
8. What is transient reactance?
9. What is synchronous reactance or steady state condition reactance?
10. Distinguish between symmetrical and unsymmetrical short circuit.
11. Define bolted fault.
12. What is the importance of short circuit analysis?
13. What is the order of severity and occurrence of different types of faults?
14. the assumptions made in fault analysis?
15. What is the significance of subtransient reactance in short circuit studies?

PART B (16 Marks)

1. (i)Explain the step by step procedure to determine balanced fault current using Thevenin's Equivalent circuit. **[CO3, K5]** (8)

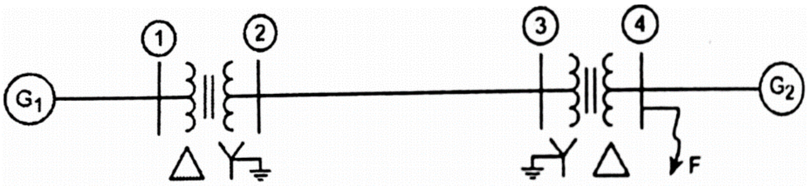
   (ii)Explain the step by step procedure of the formation of Z_{bus} by bus building algorithm. (8) **[CO3, K5]**

2. For the radial network shown in fig three phase fault occurs at F. Determine the fault current and the line voltage at 11 kV bus under fault conditions. **[CO3, K4]**

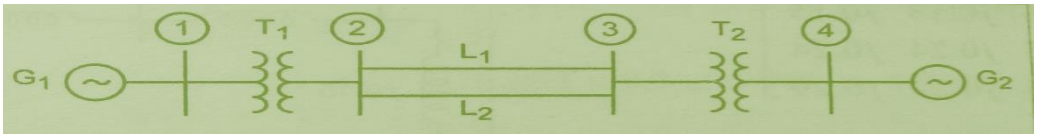


3. For the two bus system as shown in fig. Determine the fault current at the fault point and in other element and post fault voltage, for a bolted fault at bus 4. The sub transient reactance of the generators and positive sequence reactance of other elements are given

   Generator X=15%; Transmission line X=30%; Transformer X=20% **[CO3, K4]**



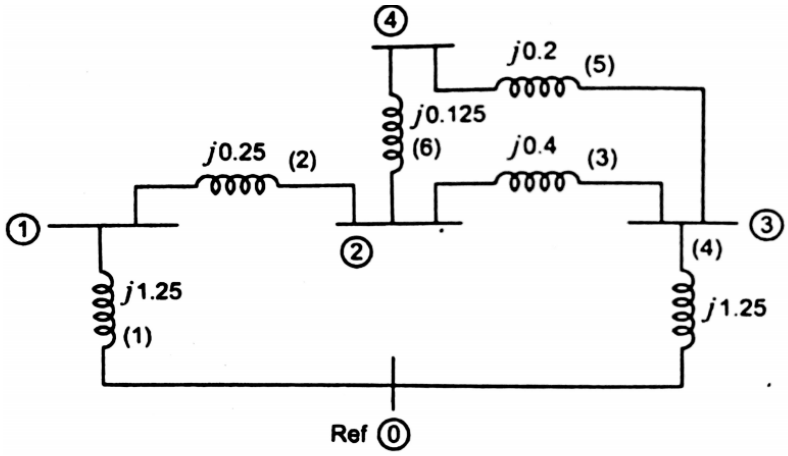
4. A Symmetrical fault occurs on bus 4 of system shown in Fig. Determine the fault current, post fault voltages and line currents using Z bus building algorithm.**[CO3, K4]**



G1, G2: 100MVA, 20kV, X^{+}=15% Transformer: X_{leak}= 9% L1, L2 :X^{+}=10%

5. Draw the flowchart and explain the step by step procedure for systematic fault analysis using Zbus.[**CO3, K2]**

6. Determine Z_{bus} for the network shown, where the impedance labeled (1) through (6) are shown in p.u preserve all buses . [**CO3, K4]**



UNIT IV : FAULT ANALYSIS – UNBALANCED FAULTS

PART A (2 Marks)

1. Define critical clearing time and critical clearing angle.
2. Define dynamic stability with an example.
3. What is steady state stability limit?
4. What is power system stability?
5. Write the power angle equation and draw the power angle curve.
6. Write the swing equation for a SMIB (Single machine connected to an infinite bus bar) system.
7. State the assumptions made in stability studies.
8. State the application of equal area criterion.
9. List the methods of improving the transient stability limit of a power system.
10. How power system stability is classified?
11. Write the swing equation for a SMIB system.
12. State the assumptions made in stability studies.
13. State the application of equal area criterion.
14. What is transient stability limit?
15. State the causes of voltage instability.

PART B (16 Marks)

1. Derive the swing equation of synchronous generator connected to infinite bus form the rotor dynamics, and extend the derivation for two parallel connected coherent and incoherent machines.
2. Explain the equal area criteria for the following applications:
   i)Sustained fault ii) Fault with subsequent clearing
3. The single line diagram of the figure shows a generator connected through parallel transmisison
   lines to a large metropolitan system considered as an infinite bus. The machine is delivering 0.9 p.u

power, 0.8 pf lagging, E_t=1.0p.u. The transient reactance of the generator is 0.3pu.

Determine

i. The power angle equation for the given system.

ii. Draw power angle curve

iii. Swing equation.

4. Explain the modified Euler method of analyzing multi machine power system for stability, with neat flow chart.
5. Derive the rotor dynamic equation for SMIB system.
6. Explain in detail the equal area criterion for to determination of critical clearing angle and time.

UNIT V :STABILITY ANALYSIS

PART A (2 Marks)

1. Define critical clearing time and critical clearing angle.
2. Define dynamic stability with an example.
3. What is steady state stability limit?
4. What is power system stability?
5. Write the power angle equation and draw the power angle curve.
6. Write the swing equation for a SMIB (Single machine connected to an infinite bus bar) system.
7. State the assumptions made in stability studies.
8. State the application of equal area criterion.
9. List the methods of improving the transient stability limit of a power system.
10. How power system stability is classified?
11. Write the swing equation for a SMIB system.
12. What is transient stability limit?
13. State the causes of voltage instability.
14. Define swing curve.
15. Define synchronizing or stiffness coefficient.

PART B (16 Marks)

1. Derive the swing equation of synchronous generator connected to infinite bus form the rotor dynamics, and extend the derivation for two parallel connected coherent and incoherent machines.
2. Explain the equal area criteria for the following applications:

   i)Sustained fault ii) Fault with subsequent clearing
3. The single line diagram of the figure shows a generator connected through parallel transmisison

   lines to a large metropolitan system considered as an infinite bus. The machine is delivering 0.9 p.u

   power, 0.8 pf lagging, E_t=1.0p.u. The transient reactance of the generator is 0.3pu.

   Determine

iv. The power angle equation for the given system.
v. Draw power angle curve
vi. Swing equation.

4. Explain the modified Euler method of analyzing multi machine power system for stability, with neat flow chart.
5. Derive the rotor dynamic equation for SMIB system.
6. Explain in detail the equal area criterion for to determination of critical clearing angle and time.

Course Faculty **HoD**