R18 Regulation *Subject code:* 2P6BC

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous, Accredited by NAAC with 'A' Grade)

B.Tech VI Semester Regular/Supplementary Examinations, June 2022

POWER SYSTEM ANALYSIS

(Electrical and Electronics Engineering)

Maximum Marks: 70 Date:20.06.2022 Duration: 3 hours

Note: 1.This question paper contains two parts A and B.
2. Part A is compulsory which carries 20 marks. Answer all questions in Part A.
3. Part B consists of 5 Units. Answer any one full question from each unit which carries 10M.
4. Each question carries 10 marks and may have a, b, c, d as sub questions.

Part-A

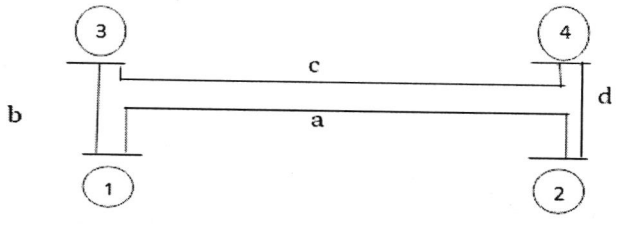
All the following questions carry equal marks (10x2M=20 Marks)

1 What is single line diagram.
2 A generator rated 25MVA, 11KV has a reactance of 15%. Calculate its p.u. reactance for a base of 50MVA and 10KV.
3 What is the need for slack bus in power flow analysis?
4 Discuss the types of the buses.
5 Define positive, negative and zero sequence components.
6 Define short circuit capacity.
7 What is power system stability?
8 List the methods of improving the transient stability limit of a power system.
9 A four pole,60HZ synchronous generator has a rating of 200MVA,0.8 power factor lagging. the moment of inertia of the rotor is 45100 kg-m^2 formulate M and H
10 List the types of disturbances that may occur in a single machine infinite system.

Part-B

Answer All the following questions. (5X10M=50Marks)

11 Form the bus admittance matrix Y bus of a given network shown in figure using direct inspection method. 10M



Element Number	Self-Impedance of the branch	
	Bus Code	Impedance Z
a	1-2	0.6
b	1-3	0.4
c	3-4	0.5
d	2-4	0.2

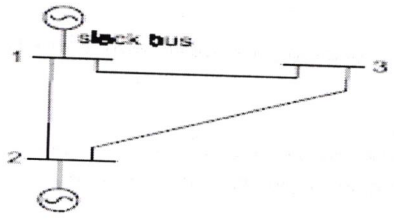
OR

12 A. Derive a equation Y_{bus} matrix by a singular transformation method . 5M
B. Write advantages and disadvantages of P.U systems. 5M

13 Derive necessary expressions for the off-diagonal and diagonal elements of the sub- matrices J1 , J2 , J3 and J4 for carrying out a load flow study on power system by using N-R method in Polar form. 10M

OR

14 Figure below shows the single line diagram of a sample 3-bus system data for the systems are given below. All the bus voltage magnitudes and angles are given in per unit. 10M
i) Using Gauss seidel method, determine the phasor values of voltages at bus 2 and 3. (perform only for 1 iterations)



Schedule generation and loads and assumed bus voltages for the sample power system

Bus code *i*	Assumed bus voltage	Generation		Load	
		MW	*MVAr*	*MW*	*MVAr*
1 (slack bus)	1.05 + *j*0.0	–	–	0	0
2	1 + *j*0.0	50	30	305.6	140.2
3	1 + *j*0.0	0.0	0.0	138.6	45.2

Base MVA = 100

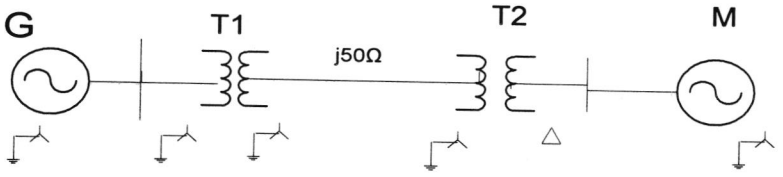
Line Impedances

Bus code *i* – *k*	Impedance Z_k
1-2	0.02 + *j*0.04
1-3	0.01 + *j*0.03
2-3	0.0125 + *j*0.025

15 A. Explain the step-by-step procedure to find the fault current of L-G fault. 5M
B. Explain the concept of symmetrical component is used short circuit studies in the power system. 5M

OR

16 Draw the reactance diagram for the power system shown in below figure. Neglect resistance and use a base of 100 MVA,220KV in 50-ohm line. The ratings of the generator, motor and transformer are given below. 10M



Generator: 40MVA,25 KV,X"=20%
Synchronous motor: 50MVA,11 KV,X"=30%
Transformer 1: 40MVA,33/220 KV,X=15%
Transformer 2: 30MVA,11/220 KV,X =15%

17 A. Derive synchronizing power coefficient. For what value of synchronizing power coefficient, the system remains stable. 4M

B. Determine of Steady State Stability of power system and list the methods of improving the Steady State stability of a power system. 6M

OR

18 Derive power angle equation and draw the power angle curve . 10M

19 Derive the swing equation of a synchronous machine swinging against an infinite bus. Clearly state the assumption in deducing the swing equation. 10M

OR

20 A. Derive Expression for critical clearing angle. 5M

B.A generator operating at 50 Hz delivers 1 p.u. power to an infinite bus through a transmission circuit in which resistance is ignored. A fault takes place reducing the maximum power transferable to 0.4 p.u. whereas before the fault, this power was 1.6 p.u. and after the clearance of the fault, it is 1.2 p.u. By the use of equal area criterion, determine the critical clearing angle. 5M