



INSTITUTE OF AERONAUTICAL ENGINEERING (Autonomous)

Dundigal, Hyderabad - 500 043

ELECTRICAL AND ELECTRONICS ENGINEERING

ASSIGNMENT QUESTIONS

Course Name	:	Computer Methods in Power Systems
Course Code	:	A60222
Class	:	III B. Tech - II Semester
Branch	:	EEE
Year	:	2017 - 2018
Course Coordinator	:	Dr. P Sridhar, Professor
Course Faculty	:	Mr. S Srikanth, Assistant Professor

OBJECTIVE:

Computer methods in power systems introduce formation of Z bus of a transmission line, power flow studies by various methods. It also deals with short circuit analysis and analysis of power system for steady state and transient stability.

ASSIGNMENT - I				
UNIT - I				
S. No	QUESTION			Course Outcomes
1	Define a tree and co-tree. For any example write the Bus - Branch incidence matrix and use it to obtain YBUS. Select arbitrary directions.			1
2	Define Terms a) Graphs b) Incident c) Tree d) co-tree e) loop f) cut set			1
3	Explain Incident Matrices?			2
4	Discuss about cut set incidence matrix?			2
5	Discuss about augmented loop incidence matrix			2
6	Form ZBUS by building algorithm for the power system network, data given in the table below.			2
	Bus Code	Self Impedance(p.u.)	Bus Code	Mutual Impedance (p.u.)
	1-2	0.15	3-4	0.15
	2-3	0.65		
	3-4	0.35		
	4-1	0.75		
	2-4	0.25		
7	a) Explain the branch path incidence matrix (K) with an example. b) Find the Y_{BUS} by direct inspection method for the network shown in figure.			2

8	List the properties of node to branch incidence matrix?	Understand	2																																
9	Form Z_{BUS} by building algorithm for the power system network, data given in the table below.	Understand	3																																
	<table><tr><th>Bus Code</th><th>Self Impedance(p.u.)</th><th>Bus Code</th><th>Mutual Impedance (p.u.)</th></tr><tr><td>1-2</td><td>0.1</td><td></td><td></td></tr><tr><td>2-3</td><td>0.6</td><td></td><td></td></tr><tr><td>3-4</td><td>0.3</td><td></td><td></td></tr><tr><td>4-1</td><td>0.7</td><td>3-4</td><td>0.1</td></tr><tr><td>2-4</td><td>0.2</td><td></td><td></td></tr></table>			Bus Code	Self Impedance(p.u.)	Bus Code	Mutual Impedance (p.u.)	1-2	0.1			2-3	0.6			3-4	0.3			4-1	0.7	3-4	0.1	2-4	0.2										
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10	a) If the mutual coupling between the two elements of a power system network is zero, then what are the off-diagonal elements of the Z_{BUS} matrix? How do you decide the order of Z_{BUS} ? b) For the network shown in figure, with reactance values in p.u., obtain Z_{BUS} by building algorithm. Take bus-3 as reference bus. 	Understand	3																																
UNIT - II																																			
11	Explain the load flow solution using gauss seidel method	Understand	4																																
12	Write algorithm for formation of bus impedance matrix	Remember	5																																
13	Derive the static load flow equations	Remember	4																																
14	Define acceleration factor. What is its role in GS method for power flow studies?	Remember	4																																
15	Give the initial conditions assumed for the power flow studies by GS method	Understand	5																																
16	Line data: <table><tr><th>Bus code</th><th>Admittance(p.u.)</th></tr><tr><td>1-2</td><td>1+j6</td></tr><tr><td>1-3</td><td>2-j3</td></tr><tr><td>2-3</td><td>0.8-j2.2</td></tr><tr><td>2-4</td><td>1.2-j2.3</td></tr><tr><td>3-4</td><td>2.1-j4.2</td></tr></table> Load Data: <table><tr><th>Bus No.</th><th>P (p.u.)</th><th>Q (p.u.)</th><th>V (p.u.)</th><th>Remarks</th></tr><tr><td>1</td><td>-</td><td>-</td><td>1.03</td><td>Slack</td></tr><tr><td>2</td><td>0.52</td><td>0.23</td><td>1.0</td><td>PQ</td></tr><tr><td>3</td><td>0.42</td><td>0.32</td><td>1.0</td><td>PQ</td></tr></table>	Bus code	Admittance(p.u.)	1-2	1+j6	1-3	2-j3	2-3	0.8-j2.2	2-4	1.2-j2.3	3-4	2.1-j4.2	Bus No.	P (p.u.)	Q (p.u.)	V (p.u.)	Remarks	1	-	-	1.03	Slack	2	0.52	0.23	1.0	PQ	3	0.42	0.32	1.0	PQ	Understand	5
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	4	0.4	0.12	1.0	PQ	Calculate the voltages at all the buses at the end of first iteration using GS method.		
UNIT - III								
17	A Three phase fault(not involving ground) occurs at bus p. explain the method of finding fault current & fault voltages(voltage at Evaluate faculty bus and at healthy buses) in terms of symmetrical component quantities.						Understand	8
18	Determine the interrupting current in a circuit breaker connected to a generator rated at 20MVA, 33KV. Take $X_d=25\%$ and $E_g=1\text{p.u.}$						Understand	8
19	Write the three phase representation of power system for short circuit studies and briefly explain						Remember	7
20	Explain about Per-Unit equivalent reactance network of a three phase Power System						Understand	8
ASSIGNMENT - II								
UNIT - III								
1	The equivalent impedance of a 10 kVA, 2200 V/220 V, 60 Hz Transformer is $10.4 + j31.3 \text{ S}$ when referred to the high-voltage side. The transformer core losses are 120 W. Determine (a.) the per-unit equivalent circuit (b.) the voltage regulation when the transformer delivers 75% of full load at a power factor of 0.6 lagging, and (c.) the transformer efficiency given the transformer load of part (b).						Understand	7
2	(a) A generator operating at 50Hz 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 0.5 p.u. whereas before the fault this power was 2.0 p.u. and after the clearance of the fault it is 1.5 p.u. By the use of equal area criterion determine the critical clearing angle. (b) Derive the formula used in the above problem.						Understand	8
3	A single phase 9.6 kVA, 500 V / 1.5 kV transformers has an impedance of 1.302Ω with respect to primary side. Find its per-unit impedance with respect to primary and secondary sides.						Understand	8
4	A single phase 20 kVA, 480/120, 60 Hz single-phase transformer has an impedance of $Z_{eq2} = 0.0525 + j78.13 \text{ S}$ referred to the LV winding. Determine the per-unit transformer impedance referred to the LV winding and the HV winding						Understand	8
5	A three phase 500 MVA, 22 KV generator has winding reactance of 1.065 ohms find its per unit reactance.						Understand	8
UNIT - IV								
6	Discuss the various factors that affects the steady state stability of a power system						Understand	11
7	Distinguish between steady state, transient state and dynamic stability						Understand	12
8	Define power system stability and stability limit of the system						Remember	12
9	Derive the expression for steady state stability limit using ABCD parameters.						Understand	12
10	Derive the power angle equation of single machine connected to infinite bus						Understand	11
11	Give the list of methods improving transient stability of the system						Understand	12

12	Derive the equal area criterion of stability and explain clearly how you can determine the stability limit of a synchronous motor when there is a sudden change in the mechanical load on the motor	Understand	12
13	Differentiate between steady state stability and transient state stability of power systems. Discuss the factors that effect.	Understand	11
UNIT - V			
14	Draw a diagram to illustrate the application of equal criterion to study transient stability when there is a sudden increase in the input of generator	Remember	15
15	Discuss transient stability is lower than steady state stability and the use of automatic reclosing circuit breakers improve system stability	Understand	14
16	Write notes on concept of multi machine stability	Understand	14
17	Explain point by point method used for solving swing equation.	Understand	15
18	Derive the expression for critical clearing angle for a synchronous machine connected to infinite bus system when a 3 phase fault occurs and it is cleared by opening of circuit breakers	Understand	14
19	A 200 MVA 11 KV 50 Hz 4 pole turbo generator has an inertia constant of 6 MJ/ MVA. (a) Find the stored energy in the rotor at synchronous speed. (b) The machine is operating at a load of 120 MW. When the load suddenly increases to 160 MW, find the rotor retardation. Neglect losses. The retardation calculated above is maintained for 5 cycles, find the change in power angle and rotor speed in rpm at the end of this period	Understand	14
20	What is the critical fault clearing angle and its effect upon the stability? Obtain an expression for the same. What are the factors that affect the transient stability? Explain in detail.	Understand	14

Prepared by:
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