INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

ELECTRICAL AND ELECTRONICS ENGINEERING

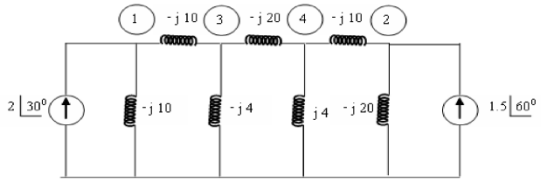
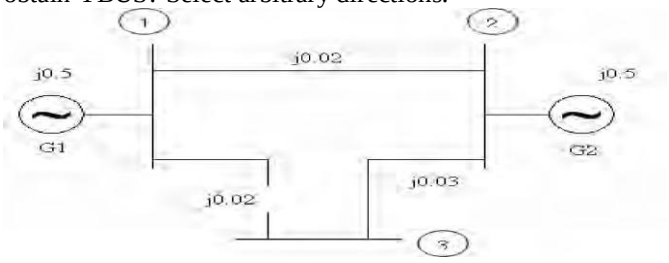
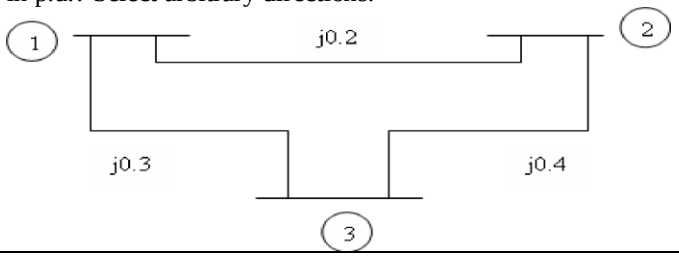
QUESTION BANK

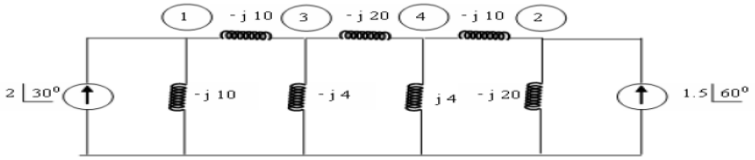
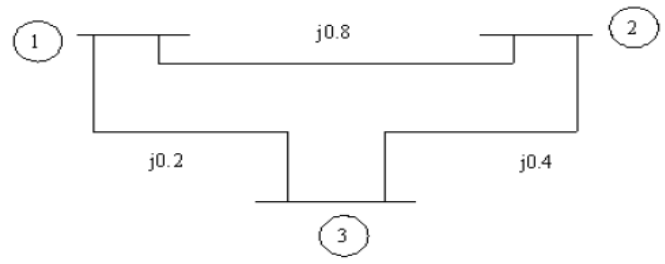
Course Name	**:**	**Computer Methods in Power Systems**
Course Code	**:**	**A60222**
Class	**:**	**III B. Tech - II Semester**
Branch	**:**	**EEE**
Year	**:**	**2017 – 2018**
Course Coordinator	**:**	**Dr. P Sridhar, Professor**
Course Faculty	**:**	**Mr. S Srikanth, Assistant Professor**

OBJECTIVE:

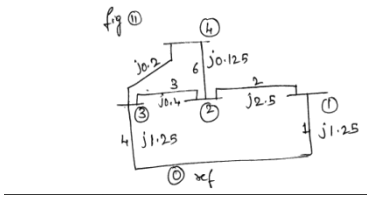
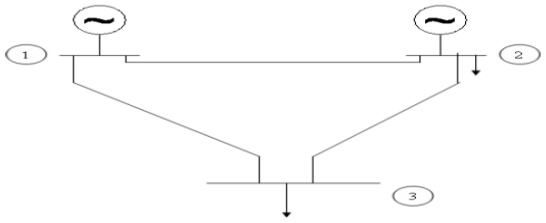
Computer methods in power systems introduce formation of Z bus of a transmission line, power flow studies by various methods. It also deals with short circuit analysis and analysis of power system for steady state and transient stability.

UNIT - I			
POWER SYSTEM NETWORK MATRICES			
PART – A (SHORT ANSWER QUESTIONS)			
S. No	**QUESTION**	**Blooms Taxonomy Level**	**Course Outcome**
1	List the advantages of Ybus matrix over ZBus Matrix	Remember	2
2	Write the formula to find Ybus matrix using singular transformation method	Remember	2
3	List the advantages of graph theory	Remember	1
4	In a graph if there are 8 elements and 5 nodes, then calculate the number of branches.	Remember	1
5	In a graph if there are 4 nodes and 7 elements, then calculate the number of links.	Remember	1
6	Calculate dimension of the bus incidence matrix in terms of number of elements and number of nodes.	Remember	1
7	Summarize different methods of forming Ybus matrix.	Remember	2
8	Give the dimension bus incidence matrix?	Remember	2

9	Define Z bus	Remember	3
10	State the Bus Incidence Matrix.	Remember	3
PART – B (LONG ANSWER QUESTIONS)			
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.	Remember	1
2	Define Terms a) Graphs b) Incident c) Tree d) co-tree e) loop f) cut set	Remember	1
3	Explain Incident Matrices?	Understand	2
4	Discuss about cut set incidence matrix?	Understand	2
5	Discuss about augmented loop incidence matrix	Understand	2
6	Discuss about formation of network matrices by singular transformation.	Understand	3
7	Describe formation of Z bus	Remember	3
8	Discuss Formation of Y bus by using direct inspection method	Understand	3
9	Derive branch matrices from bus matrices?	Understand	2
10	Discuss about bus admittance and bus impedance matrix.	Understand	3
PART – C (ANALYTICAL QUESTIONS)			
1	Calculate the YBUS by direct inspection method for the network shown below: 	Understand	3
2	For the power system network shown in figure use ground as a reference Bus. Define a tree and co-tree. Write the Bus - Branch incidence matrix and use it to obtain YBUS? Select arbitrary directions. 	Understand	2
3	Form YBUS for the given power system shown in figure with reactance value in p.u.? Select arbitrary directions. 	Understand	2

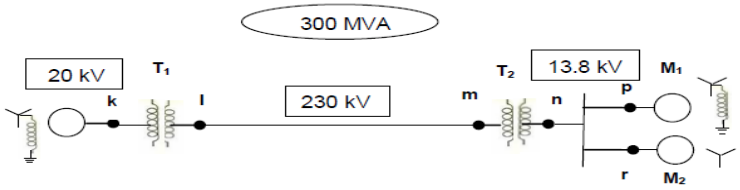
<table>
<tr><td>4</td><td>For the system shown below obtain i) primitive admittance matrix ii) bus incidence matrix Select ground as reference.
Line num Bus code Admittance in pu
1 1-4 1.4
2 1-2 1.6
3 2-3 2.4
4 3-4 2.0
5 2-4 1.8</td><td>Understand</td><td>3</td></tr>
<tr><td>5</td><td>(a) List the advantages of ZBUS building algorithm?
(b)Z bus matrix elements are given by Z11= 0.2, Z22= 0.6, Z12=0 find the modified ZBUS if a branch having an impedance 0.4 p.u. is added from the reference bus (Bus - 1) to new bus? Also find the modified ZBUS if a branch having an impedance 0.4 p.u. is added from existing bus (other than reference bus) to new bus?</td><td>Understand</td><td>3</td></tr>
<tr><td>6</td><td>Form ZBUS by building algorithm for the power system network, data given in the table below.
<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>0.15</td><td>3-4</td><td>0.15</td></tr>
<tr><td>2-3</td><td>0.65</td><td></td><td></td></tr>
<tr><td>3-4</td><td>0.35</td><td></td><td></td></tr>
<tr><td>4-1</td><td>0.75</td><td></td><td></td></tr>
<tr><td>2-4</td><td>0.25</td><td></td><td></td></tr>
</table></td><td>Understand</td><td>2</td></tr>
<tr><td>7</td><td>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.
 
</td><td>Understand</td><td>2</td></tr>
<tr><td>8</td><td>List the properties of node to branch incidence matrix?</td><td>Understand</td><td>2</td></tr>
<tr><td>9</td><td>Form Z_{BUS} by building algorithm for the power system network, data given in the table below.
<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></td><td>Understand</td><td>3</td></tr>
<tr><td>10</td><td>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.
 
</td><td>Understand</td><td>3</td></tr>
</table>

<table>
<tr><th colspan="4">UNIT - II</th></tr>
<tr><td colspan="4">POWER FLOW STUDIES</td></tr>
<tr><td colspan="4">PART – A (SHORT ANSWER QUESTIONS)</td></tr>
<tr><td>1</td><td>Define load bus</td><td>Remember</td><td>4</td></tr>
<tr><td>2</td><td>Define slack bus</td><td>Remember</td><td>4</td></tr>
<tr><td>3</td><td>Define bus impedance matrix</td><td>Remember</td><td>4</td></tr>
<tr><td>4</td><td>Write short notes on PQ bus</td><td>Remember</td><td>4</td></tr>
<tr><td>5</td><td>Write short notes on PV bus.</td><td>Remember</td><td>4</td></tr>
<tr><td>6</td><td>Write impedance matrix if adding branch to the reference bus</td><td>Remember</td><td>4</td></tr>
<tr><td>7</td><td>Write impedance matrix if adding link to the reference bus</td><td>Remember</td><td>4</td></tr>
<tr><td>8</td><td>If mutual coupled elements are removed then write the impedance matrix</td><td>Remember</td><td>4</td></tr>
<tr><td>9</td><td>Define reactive power</td><td>Remember</td><td>5</td></tr>
<tr><td>10</td><td>Define complex power and active power</td><td>Remember</td><td>4</td></tr>
<tr><td colspan="4">PART – B (LONG ANSWER QUESTIONS)</td></tr>
<tr><td>1</td><td>Explain the load flow solution using gauss seidel method</td><td>Understand</td><td>4</td></tr>
<tr><td>2</td><td>Write algorithm for formation of bus impedance matrix</td><td>Remember</td><td>5</td></tr>
<tr><td>3</td><td>Derive the static load flow equations</td><td>Remember</td><td>4</td></tr>
<tr><td>4</td><td>Write the algorithm for load flow solution for simple power system</td><td>Understand</td><td>5</td></tr>
<tr><td>5</td><td>How do you represent transformer in load flow studies</td><td>Understand</td><td>5</td></tr>
<tr><td>6</td><td>Explain the load flow solution using Newton Raphson method</td><td>Understand</td><td>6</td></tr>
<tr><td>7</td><td>Explain the Newton Raphson method in rectangular and polar co-ordinates form</td><td>Understand</td><td>6</td></tr>
<tr><td>8</td><td>Explain the decoupled and fast decoupled methods in load flow studies</td><td>Understand</td><td>6</td></tr>
<tr><td>9</td><td>Compare the decoupled and fast decoupled methods in load flow studies</td><td>Understand</td><td>5</td></tr>
<tr><td>10</td><td>List the Merits and Demerits of using polar and rectangular coordinates in load flow studies</td><td>Remember</td><td>4</td></tr>
<tr><td colspan="4">PART – C (ANALYTICAL QUESTIONS)</td></tr>
<tr><td>1</td><td>Define acceleration factor. What is its role in GS method for power flow studies?</td><td>Remember</td><td>4</td></tr>
<tr><td>2</td><td>Give the initial conditions assumed for the power flow studies by GS method</td><td>Understand</td><td>5</td></tr>
<tr><td>3</td><td>Line data:
<table>
<tr><td>Bus code</td><td>Admittance(p.u.)</td></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>
</table></td><td>Understand</td><td>5</td></tr>
</table>

	2-4 | 1.2-j2.3 3-4 | 2.1-j4.2 Load Data: 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 4 | 0.4 | 0.12 | 1.0 | PQ Calculate the voltages at all the buses at the end of first iteration using GS method.		
4	The data for 2-bus system is given below. S_{G1}=Unknown; S_{D1}=Unknown V_1=1.0p.u. ; S_1= To be determined. S_{G2}=0.25+jQ_{G2} p.u.; S_{D2}=1+j0.5 p.u. The two buses are connected by a transmission line p.u. reactance of 0.5 p.u. Find Q_2 and angle of V_2. Neglect shunts susceptance of the tie line. Assume $\|V_2\|$=1.0, perform two iterations using GS method.	Understand	6
5	For the network shown in figure , find the Zbus using Zbus building algorithm  	Understand	6
6	List the advantages of load flow studies?	Remember	5
7	Derive static load flow equations.	Understand	5
8	What is the data for load flow studies?	Understand	5
9	A 3-Bus power system is shown in figure. The system line and load data is given in Table. The voltage at Bus-2 is maintained at 1.03 p.u. the maximum and minimum reactive power limits of the generation at Bus-2 are 0.35 and 0 p.u. respectively. Taking Bus-1 as slack bus, obtain the load flow solution using GS-method.  Line Data: Bus Code | Impedance(p.u.) 1-2 | 0.08+j0.24 1-3 | 0.02+j0.06 2-3 | 0.06+j0.018 Load Data: Bus No. | Bus Voltage(p.u.) | P_{Gi} (p.u.) | Q_{Gi} (p.u.) | P_{Di} (p.u.) | Q_{Di} (p.u.) 1 | 1.05 | - | - | 0 | 0 2 | 1.03 | 0.2 | - | 0.5 | 0.2 3 | - | 0 | 0 | 0.6 | 0.25	Understand	5
10	Generalize the idea behind performing power flow analysis of any given power system	Understand	5

UNIT - III			
SHORT CIRCUIT ANALYSIS			
PART – A (SHORT ANSWER QUESTION)			
1	A 12 bus Power System has three voltage-controlled buses. Determine the dimensions of the Jacobean matrix.	Understand	7
2	In a load flow study, when PV bus is treated as PQ bus	Understand	7
3	Outline the best method for accurate load Flow Calculations on a large power system	Understand	7
4	List out some advantages of FDLF method with DLF method	Remember	8
5	Define Jacobean matrix	Remember	8
6	Compare Newton Rap son method With DLF method.	Remember	7
7	Write the assumption made in the Newton Raphson Method	Remember	7
8	Write the assumptions made in the DLF method	Remember	8
9	Write the assumptions made in the FDLF method	Remember	8
10	Write the advantages of Newton Raphson Method	Remember	8
11	A 24 bus Power System has three voltage-controlled buses. Determine the dimensions of the Jacobean matrix.	Understand	8
12	List the disadvantages of DLF method	Remember	9
13	Write the applications of Newton Raphson Method	Remember	9
14	Define per unit quantities	Remember	9
15	List the advantages of per unit quantities	Remember	8
16	Write the formulae for calculation of MVA	Remember	8
17	List the faults in power systems	Remember	8
18	Write the severities of faults	Understand	9
19	Define symmetrical components	Remember	8
20	Define unsymmetrical components	Remember	9
PART – B (LONG ANSWER QUESTIONS)			
1	Derive the algorithm for symmetrical short circuit analysis of a multi machine power system using Z bus matrix.	Understand	8
2	Define per unit quantities and list the advantages	Understand	8
3	Write application of series reactors	Understand	7
4	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

5	Determine the interrupting current in a circuit breaker connected to a generator rated at 20MVA, 33KV. Take Xd=25% and Eg=1p.u.	Understand	8
6	Write the three phase representation of power system for short circuit studies and briefly explain	Remember	7
7	Explain about Per-Unit equivalent reactance network of a three phase Power System	Understand	8
8	Briefly explain fault level of bus justify infinite bus as a constant voltage source	Understand	8
9	Write the three phase representation of power system for short circuit studies and briefly explain	Remember	8
10	Explain the use of automatic reclosing circuit breakers in improving system stability.	Understand	9
11	Give a step by step procedure of analyzing a L-G fault on a power system by bus impedance matrix method and explain	Remember	8
12	With the usual notation derive the equation of computation of sequence currents for a line to ground fault on an n bus power system using Z bus algorithm.	Remember	8
13	With the usual notation derive the equation of computation of sequence currents for a line to ground fault on an n bus power system using Z bus algorithm.	Remember	8
14	Develop the expressions for analyzing single line to ground fault in a large power system using Z_{Bus} matrix.	Understand	8
15	Explain about Line to ground fault.	Understand	9
	PART – C (ANALYTICAL QUESTIONS)		
1	The equivalent impedance of a 10 kVA, 2200 V/220 V, 60 Hz Transformer is 10.4 + j31.3 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 1.302 Ω 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 *Zeq*2 = 0.0525p78.13o 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

6	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. (c) 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	9
7	A 120 MVA, 19.5 kV generator has Xs = 0.15 per unit and is connected to a transmission line by a transformer rated 150 MVA, 230 Y/18Δ kV with X = 0.1 per unit. If the base to be used in the calculation is 100 MVA, 230 kV for the transmission line, find the per unit values to be used for the transformer and the generator reactance's	Understand	8
8	A 300 MVA, 20 kV three-phase generators has a sub transient reactance of 20%. The generator supplies a number of synchronous motors over 64-km transmission line having transformers at both ends, as shown in Fig. 1.11. The motors, all rated 13.2 kV, are represented by just two equivalent motors. Rated inputs to the motors are 200 MVA and 100 MVA for M1 and M2, respectively. For both motors X" = 20%. The three phase transformer T1 is rated 350 MVA, 230/20 kV with leakage reactance of 10%. Transformer T2 is composed of three single-phase transformers each rated 127/13.2 kV, 100 MVA with leakage reactance of 10%. Series reactance of the transmission line is 0.5 Ω/km. Draw the impedance diagram, with all impedances marked in per-unit. Select the generator rating as base in the generator circuit 	Understand	8
9	A transformer rated 200 MVA, 345Y / 20.5Δ kV connected at the receiving end of a transmission line feeds a balanced load rated 180 MVA, 22.5 kV, 0.8 power factor. Determine (a) The rating of each of three single-phase transformers which when properly connected will be equivalent to the above three-phase transformer and (b) The complex impedance of the load in per-unit, if the base in the transmission line is 100 MVA, 345 kV.	Understand	8
10	Explain the use of automatic reclosing circuit breakers in improving system stability.	Understand	9
11	a) Explain the analysis of a short circuit on a loaded three phase synchronous machine. b) A synchronous generator and a synchronous motor each rated 25 MVA, 11 KV having 15% sub transient reactance are connected through transformers and a transmission line. The transformers are rated 25 MVA, 11/66 kV and and 66/11 kV with leakage reactance of 10% on a base of 25 MVA, 66kV. The motor is drawing 15 MW at 0.8 power factor leading and a terminal voltage of 10.6kV when a symmetrical three fault occurs at the motor terminals. Find the sub transient current in the generator, motor and the fault.	Understand	8
12	A Three phase fault(not involving ground) occurs at bus p. explain the method of finding fault current & fault voltages(voltage at faculty bus and at healthy buses) in terms of symmetrical component quantities.	Understand	9
UNIT - IV			
POWER SYSTEM STEADY STATE STABILITY ANALYSIS			
PART – A SHORT ANSWER QUESTIONS			
1	Define stability.	Remember	10

2	Define steady state stability.	Remember	10
3	Define transient state stability.	Remember	10
4	Define dynamic state stability.	Remember	11
5	Define inertia constant.	Remember	10
6	Why transient stability limit is lower than steady state stability limit.	Understand	10
7	Give two methods to improve transient stability.	Remember	11
8	Write short notes on power angle curve.	Remember	10
9	Define Transfer reactance.	Remember	10
10	Define inertia constant.	Remember	10
PART – B LONG ANSWER QUESTIONS			
1	Discuss the various factors that affects the steady state stability of a power system	Understand	11
2	Distinguish between steady state, transient state and dynamic stability	Understand	12
3	Define power system stability and stability limit of the system	Remember	12
4	Derive the expression for steady state stability limit using ABCD parameters.	Understand	12
5	Derive the power angle equation of single machine connected to infinite bus	Understand	11
6	Give the list of methods improving transient stability of the system	Understand	12
7	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
8	Clearly explain what you understand stability. Distinguish between steady state and transient stability	Understand	11
9	Describe about steady state stability power limit	Understand	12
10	Explain the transfer reactance	Understand	10
PART – C ANALYTICAL QUESTIONS			
1	A 50 Hz, four pole generators rated 100 MVA, 11 kV has an inertia constant of 8 MJ/MVA. i) Find the stored energy in the rotor at synchronous speed. ii) If the mechanical input is suddenly raised to 80 MW for an electrical load of 50 MW, find rotor acceleration. iii) If the acceleration calculated in (ii) is maintained for 10 cycles, find the change in torque angle and rotor speed in rpm at the end of this period. iv) Another generator 200 MVA, 3000 rpm, having H=6 MJ/MVA is put in parallel with above generator. Find the inertia constant for the equivalent generator on a base of 100mva	Understand	11
2	Differentiate between steady state stability and transient state stability of power systems. Discuss the factors that effect.	Understand	12
3	Explain the Dynamic and transient stabilities.	Understand	12

4	List the methods of improving steady state stability limits	Understand	12
5	Write short notes a) Transfer reactance b) Synchronizing power co-efficient	Understand	12
6	Explain the power angle curve and determination of steady state stability.	Understand	11
7	Derive the maximum steady state power	Understand	11
8	Write short notes on elementary concepts of steady state stability dynamic stability and Transient stability.	Understand	11
9	Derive an expression for steady state stability limit if the resistance and shunt capacitance of the transmission line are considered	Understand	11
10	Differentiate between steady state stability and transient state stability of power systems. Discuss the factors that effect.	Understand	11
UNIT - V			
POWER SYSTEM TRANSIENT STATE STABILITY ANALYSIS			
PART – A (SHORT ANSWERS QUESTIONS)			
1	Write the swing equation.	Remember	13
2	Define transient stability.	Remember	13
3	List the application of Equal Area Criterion	Remember	14
4	Derive the critical clearing angle.	Understand	15
5	Explain point by point solution of swing equation	Understand	15
6	Write short notes on Auto Reclosing.	Remember	15
7	Write short notes on fast operating circuit breakers.	Remember	14
8	Write swing equation during Fault and post fault.	Remember	14
9	Explain the procedure for selection of circuit breakers in power systems.	Understand	13
10	Applications of auto reclosing and fast operating circuit breakers	Understand	13
PART – B (LONG ANSWERS QUESTIONS)			
1	Write the steps followed for determining multi machine stability	Remember	14
2	Write notes on the state variable formulation of swing equation	Remember	13
3	Give the mathematical model for the transient analysis of multi machine power system	Understand	13
4	Explain the critical clearing time and critical clearing angle	Understand	14
5	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
6	Discuss transient stability is lower than steady state stability and the use of automatic reclosing circuit breakers improve system stability	Understand	14
7	Write notes on concept of multi machine stability	Understand	14

8	Explain point by point method used for solving swing equation.	Understand	15
9	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
10	Explain "swing Curve" and its practical significance in stability analysis.	Understand	13
PART – C ANALYTICAL QUESTIONS			
1	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
2	Derive the transient stability by Equal Area Criterion, What are the application of Equal Area Criterion	Understand	14
3	Derive the critical clearing angle	Understand	14
4	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
5	a) Write short notes on fast operating circuit breakers. b) A 20 MVA, 50Hz generator delivers 18 MW over a double circuit line to an infinite bus. The generator has kinetic energy of 2.52 MJ/MVA at rated speed. The generator transient reactance is X'_d=0.35pu. Each transmission circuit has R=0 and a reactance of 0.2pu on a 20MVA base. Modules E'=1.1pu and infinite bus voltage V= 1.0 at an angle 0^0. A three phase short circuit occurs at the midpoint of one the transmission lines. Plot swing curves with fault cleared by simultaneous opening of breakers oat both ends of the line at 2.5 cycles after the occurrence of fault.	Understand	15
6	Derive swing equation of two coherent machines.	Understand	14
7	A 50 Hz, 4 pole turbo alternator rated 150 MVA, 11 KV has an inertia constant of 9MJ/MVA. Find the a) stored energy at synchronous speed b) the rotor acceleration if the input mechanical power is raised to 100 MW when the electrical load is 75 MW. C) The speed at the end of 10 cycles if acceleration is assumed constant at the initial value	Understand	14
8	A 10 MVA, 50Hz generator delivers 9 MW over a double circuit line to an infinite bus. The generator has kinetic energy of 2.52 MJ/MVA at rated speed. The generator transient reactance is X'_d=0.35pu. Each transmission circuit has R=0 and a reactance of 0.2pu on a 20MVA base. Modules E'=1.1pu and infinite bus voltage V= 1.0 at an angle 0^0. A three phase short circuit occurs at the midpoint of one the transmission lines. Plot swing curves with fault cleared by simultaneous opening of breakers oat both ends of the line at 2.5 cycles after the occurrence of fault.	Understand	14
9	Give details of assumptions made in the study of steady state and transient stability solution techniques.	Understand	15

10	A 50 Hz, four pole generators rated 100 MVA, 11 kV has an inertia constant of 8 MJ/MVA. i. Find the stored energy in the rotor at synchronous speed. ii. If the mechanical input is suddenly raised to 80 MW for an electrical load of 50 MW, find rotor acceleration. iii. If the acceleration calculated in (ii) is maintained for 10 cycles, find the change in torque angle and rotor speed in rpm at the end of this period. iv. Another generator 200 MVA, 3000 rpm, having H=6 MJ/MVA is put in parallel with above generator. Find the inertia constant for the equivalent generator on a base of 100 MVA.	Understand	15

Prepared by:
Mr. S Srikanth, Assistant Professor

HOD, EEE