Roll No												

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

END TERM FINAL EXAMINATION

Semester: Odd Semester: 2019 - 20
Course Code: EEE 215
Course Name: POWER SYSTEM ANALYSIS
Program & Sem: B.Tech (EEE) & VII

Date: 27 December 2019
Time: 9:30 AM to 12:30 PM
Max Marks: 80
Weightage: 40%

Instructions:
(i) Read the all questions carefully and answer accordingly.
(ii) Missing data may be suitable assumed with justification

Part A [Memory Recall Questions]

Answer all the Questions. Each Question carries 1 marks. (20Qx1M=20M)

[All questions are at KNOWLODGE level]

Q I. All the sub questions of this Section are fill in the blank type or the True/False type.

[Bloom's Level: Knowledge]

a] The ratio of Actual Value to the Base value of any power system quantity is known as------ [C.O.No.1]

b] The Base value of power is 100MVA and the Base value of Voltage is 110KV for a system modeled for peak load flow study. The base value of the Current is----------AMPS [C.O.No.1]

c] Actual value of the Fault current computed for a 22O KV system is found to be 1800 AMPS with a base values of 100MVA &220 KV. The fault current computed for the same system with 10 MVA base&220 KV base is found to be 1800 AMPS only. State whether this statement is TRUE/FALSE

[C.O.No.1]

d] Synchronous Generators are represented as either" PAI" network model or "TEE" network model

State whether this statement is TRUE/FALSE [C.O.No.1]

e] Load Flow Model is "STATIC MODEL". State whether this statement is TRUE/FALSE. [C.O.No.2]

f] It is required to obtain all the Bus Voltages of a 220KV Karnataka State Power Grid for a peak load conditions. The Data Engineer has collected the following Data from the grid:

Line data, Load Data & the Generator Data.

Identify the appropriate data from the above which decides the reduction in the rows and columns of a Jacobian matrix at a given iteration. [C.O.No.2]

g] ----------Method of solution of a Load Flow studies has linear convergence characteristic and hence takes more iterations for a given problem. [C.O.No.2]

h] A power system generally under normal condition, undergoes to ALERT state due to some faults.

List any four types of faults which causes the system to go to ALERT state. [C.O.No.3]

i] The 11KV Yealahanka system having about 24 Distribution Transformers and about 15 KMs of 11KV line is found to be faulty due to the bird touching R phase & Y phase conductor somewhere at the midpoint of the line. Name the type of fault for this scenario. [C.O.No.3]

j] In a Transmission line at the tower number 37, it was found that the Y phase Jumper [A piece of conductor which joins the two sides of the tower conductor]. Is open. Name the type of fault. [C.O.No.3]

k] The transients generated for a 3 phase symmetrical fault is a Medium Fast Transient, state whether this statement is TRUE/FALSE [C.O.No.3]

l] Before occurrence of the fault, the Synchronous Generator is represented with synchronous Reactance with its steady state value. Name the other two values of Reactance which appears soon after the occurrence of the fault till it reaches to steady state. [C.O.No.3]

m] ----------Current is always greater than the Load Current in a power system. [C.O.No.3]

n] The value of the operator used in Sequence Transformation matrix is ---------- [C.O.No.3]

o] The nature of the Power System Stabilty Problem is Dynamic, however some time it is studied as static. State whether this statement is TRUE/FALSE [C.O.No.4]

p] Name the two important control loops of power system to be considered for stability analysis.

[C.O.No.4]

q] In a southern Indian grid system, there are 12 Generating stations and each station has different number of generating running in parallel. The system frequency is being constant at 50.5 C/S. The steady state power transfer capability of this system is around 2800 MW. The transient stability limit of this system considered for a single line ground fault is around 680 MW. State whether this statement is TRUE/FALSE. [C.O.No.4]

r] Mention the nature of swing equation. [C.O.No.4]

s] Is voltage stability is dynamic in nature or Static in nature? [C.O.No.4]

t] Angle stability is an effect but the Voltage stability is a cause in recent power system collapses. Is this statement TRUE/FALSE? [C.O.No.4]

Part B [Thought Provoking Questions]

Answer all the Questions. [Each question carries different marks as entered in front of the question] [All are at Comprehension level]

[5 Q, 31Marks]

2. Draw the Per Unit reactance diagram for a simple power system having one synchronous generator having a reactance of 10%, a Transformer having a reactance of 5%, A transmission line having a reactance of 4P.U. and a Transformer having a reactance of 5%. All are in series &all the reactance values are for the same base values. [6M] [C.O.No.1]

3 .It is required to carry out the system load enhancement study for the Karnataka state power grid for the summer peak load conditions.

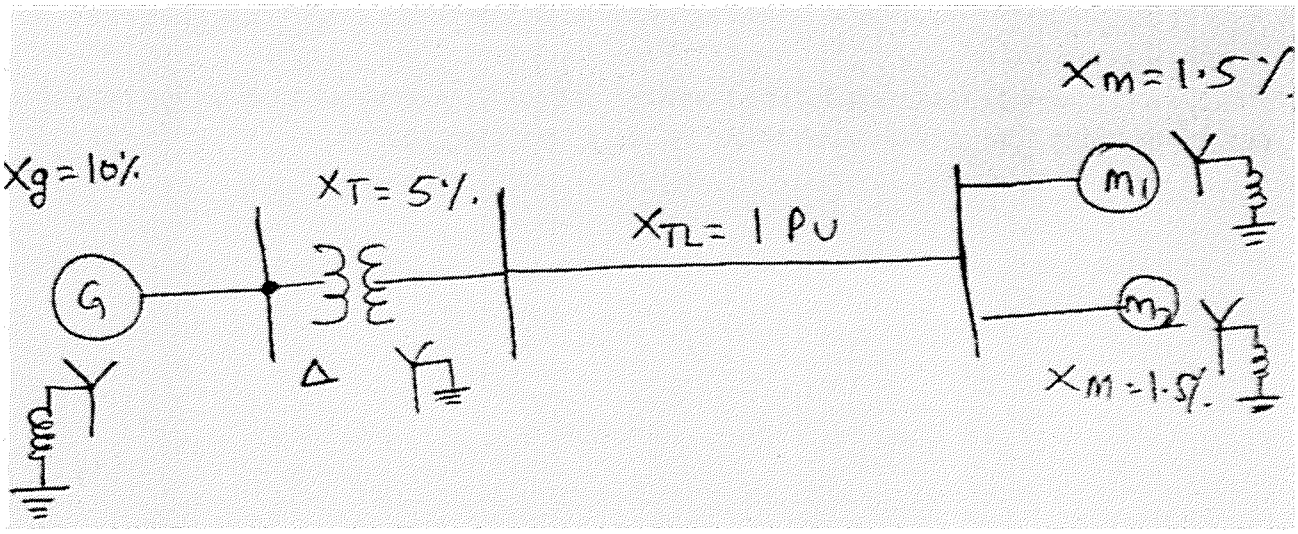
i) Name the study to be conducted on this system [1+2+2=5M][C.O.No.2]

ii) List all the data required to be collected for this study

iii) What are the output of this study?

4. Name the two methods that can be used for the study selected in the above question and write the respective voltage and power equations. [1+2+2=5M] [C.O.No.2]

5. Draw the Positive sequence, Negative sequence and Zero sequence diagrams for the sample power system shown below. [3+3+3 =9M] [C.O.No.3]



6. Differentiate between three different types of power system angle stability problem.

[6M] [C.O.No.4]

Part C [Problem Solving Questions]

Answer all the Questions. [Each question carries different marks as entered in front of the question] [All questions are at Application level]

[3 Q, 29Marks]

7 .A partial load flow results of a portion of a large power system is furnished below:

Sl no	Bus No.	Bus voltage in P.U.	Bus voltage angle in degrees	Bus Active Power in P.U.	Bus Reactive power in P.U.
01	400KV-001	0.989	-1.8	1.5	0.96
02	400KV-002	0.942	-2.3	2.47	1.48
03	220 KV-001	0.912	-2.5	2.11	1.38
04	220KV-002	0.899	-2.9	1.34	0.912

1] Name the appropriate method of Load Flow used for such systems [2M] [C.O.No.2]

2] Identify the remaining quantities to be found from the above partial results [3M] [C.O.No.2]

3] Compute the same for the transmission line to which the data is provided below:

[8M] [C.O.No.2]

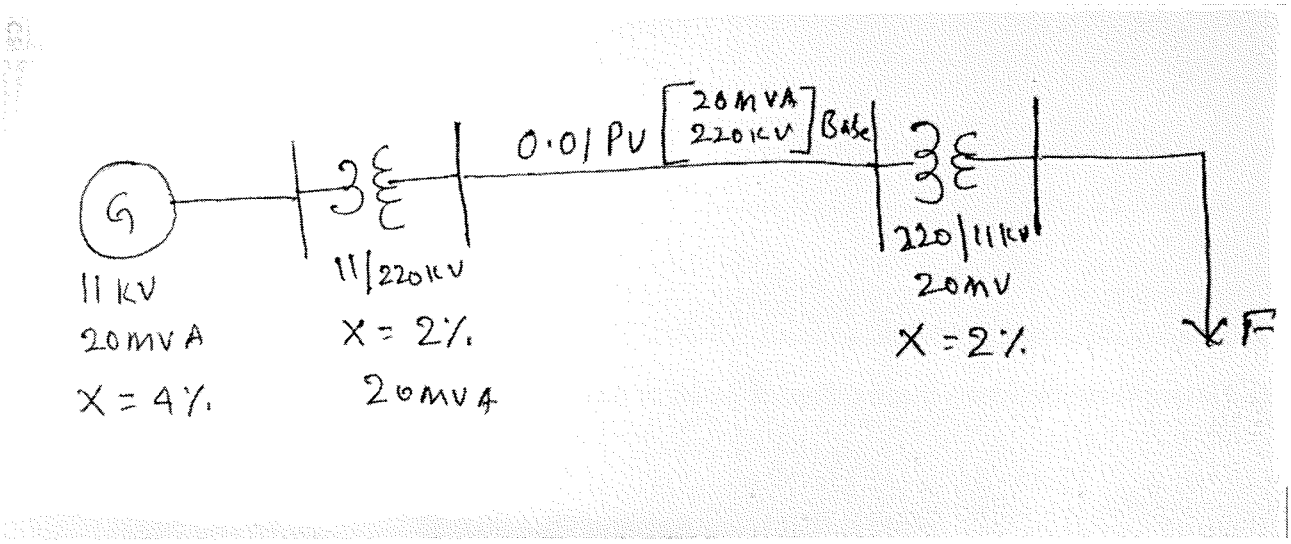
a) Impedance value in P.U. Line from Bus No [400KV-001 TO 400 KV -002] is

[0.17+j0.23]

b) Impedance value in P.U. Line from Bus No [220KV-001 TO 220 KV -002] is

[0.12+j0.25]

8. A sample power system considered for demonstration of power system simulation package has the following components as shown in the single line diagram:



It is considered that a 3phase to ground symmetrical solid fault occurs at the secondary side of the transformer –T2.[at point F]

1] Identify what are the quantities to be computed from the data provided? [3M] [C.O.No.3]

2] Compute all the quantities identified above. [8M] [C.O.No.3]

9.Following data refers to a synchronous generator used in a power system:

A] Frequency: 50 C/S B] Number of Poles: 4 C] Rated capacity 100MVA

D] Voltage rating: 11 KV E] Inertia Constant: 10MJ/MVA F] Electrical Load= 60MW

G] Mechanical Input raised to 85MW [All the losses are neglected]

1] Identify the relevant quantities that could be found which helps for stability analysis from the above data. [2M] [C.O.No.4]

2] Find the identified data. [3M] [C.O.No.4]

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SCHOOL OF ENGINEERING

END TERM FINAL EXAMINATION

Extract of question distribution [outcome wise & level wise]

Q.NO.	C.O.NO (% age of CO)	Unit/Module Number/Unit /Module Title	Memory recall type [Marks allotted] Bloom's Levels	Thought provoking type [Marks allotted] Bloom's Levels	Problem Solving type [Marks allotted]	Total Marks
			K	C	A	
1	CO 01 CO 02 CO 03 CO 04	All the 4 modules	20 [4+3+7+6]			20
2	CO 01	MODULE 01	-	06	-	09
3	CO 02	MODULE 02	-	05	-	06
4	CO 02	MODULE 02	-	05	-	06
5	CO 03	MODULE 03	-	09	-	06
6	CO 04	MODULE 04	-	06	-	06
7	CO 02	MODULE 02	-	-	13	10
8	CO 03	MODULE 03	-	-	11	10
9	CO 04	MODULE 04	-	-	05	06
	Total Marks		20	31	29	

K =Knowledge Level C = Comprehension Level, A = Application Level

C.O WISE MARKS DISTRIBUTION:

CO 01: 10 MARKS, CO 02: 26 MARKS, CO 03: 27 MARKS, CO 04:17 MARKS

Note: While setting all types of questions the general guideline is that about 60%

Of the questions must be such that even a below average students must be able to attempt, About 20% of the questions must be such that only above average students must

be able to attempt and finally 20% of the questions must be such that only the bright students must be able to attempt.

I hereby certify that all the questions are set as per the above guidelines.

Faculty Signature:

Reviewer Commend:

Format of Answer Scheme

GAIN MORE KNOWLEDGE
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SCHOOL OF ENGINEERING

SOLUTION

Semester: Odd Sem. 2019-20
Course Code: EEE215
Course Name: POWER SYSTEM ANALYSIS
Program & Sem: B.TECH. EEE VII

Date: xx.12.2019
Time: 3 HRS
Max Marks: 80
Weightage: 40%

Part A (0Q x 0M = 0Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
I	1] Per Unit Value 2] 100*1000000/1.732*110*1000 = 524.879A 3] TRUE 4] FALSE 5] TRUE 6]Generator Data 7] G-S Method	**1M**	**QUESTION NO I [30MTS] At the rate of 1.5mts for each**

	8] 3Phase fault, Line to line fault, single line to ground fault, Double line to ground fault, Single open conductor fault, Double conductor open fault. [Any four of these] 9]Line to Line Fault 10] TRUE 11] TRUE 12]Sub Transient &Transient 13] Fault Current 14] 1 at an angle 120 degrees 15] TRUE 16] A.L.F.C & A.V.R. 17] TRUE 18] Non-linear Second Order differential equation with constant co efficient. 19] Dynamic In nature 20] TRUE	**1M**	**QUESTION NO I [30MTS] At the rate of 1.5mts for each**

Part B (5Q, 31 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
II	Single line diagram with the reactance of generator, transformer, transmission line and transformer all in series with the values mentioned.	For Diagram = 4M For marking values =2M	15Mts
III	i) Load Flow Study ii) Line data, conductor size, and spacing, Load Data, Active &Reactive power Loads, Generator Data, Capacity, and Reactive power limit. iii) Voltage magnitude and the angles at all the buses , Line flows, line losses, total loses, slack bus power	1M 2M 2M	15 Mts.
VI.	Gauss-Siedel Method and the Newton- Rapson Method G-S Method: Voltage Equation: N-R Method: Active power & Reactive power equation	1M 2M 2M	13Mts.
V	Positive Sequence diagram: 3 voltage sources, all the machine reactance and the line reactance in series Negative Sequence diagram: Same as above without the voltage sources.	3M 3M	15 Mts.

	Zero Sequence diagram: Only reactance with closed loop for star connected machines	3M	
VI.	Steady State Stability: For small and gradual disturbances Transient Stability : For large and sudden disturbances Dynamic Stability: For small and continuous disturbances.	2M 2M 2M	10Mts.

Part C (0Q x 0M = 0Marks)

Q No	**Solution**	**Scheme of Marking**	**Max. Time required for each Question**
VII.	1] N-R Method 2] Line flows [active and reactive] Line losses[active and reactive] Total losses[Active and reactive], slack bus power [Active and reactive] 3] Pl 1-2 = V1* [V1-V2] /Z12 Pl 2-1 = V2*[V2-V1]/Z12 P loss [1-2] = Pl1-2+ Pl2-1 Similarly for the other line also.	2M 3M 4M 4M	25 Mts.
VIII.	1] 3phase symmetrical short circuit current Fault Level of the system at various voltage levels Circuit Breaker capacity 2] fault Current= 1/ total reactance Total reactance =0.09 pu Fault current = 1/0,09 = 11.11pu Fault current in amps = .11.11*base current Base current= 20mva/1.732*11okv =105 amps 105*11.11/1000 =1.166KA Fault Level at 220KV Bus = 1.732*220*1.166 =444mva	3 M 4M 4M	30 Mts.
IX.	1] Kinetic Energy Stored in the rotor of the generator Accelerating Power for the given case 2] KE = GH KE = 100*10 = 1000MJ PA = 85MW-60 MW = 25 MW	2M 3M	10Mts

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BENGALURU

SCHOOL OF ENGINEERING

TEST – 2

Sem & AY: Odd Sem 2019-20 | **Date**: 19.11.2019

Course Code: EEE 215 | **Time**: 9.30 AM to 10.30 AM

Course Name: POWER SYSTEM ANALYSIS | **Max Marks**: 40

Program & Sem: B.Tech (EEE) & VII | **Weightage**: 20%

Instructions:

i. *Answer all the questions.*

ii. *MCQ may have two or more correct answer and if so only if you mark all the correct, the full marks will be awarded.*
Missing data in the numerical s may suitably assumed with justification.

Part A [Memory Recall Questions]

Answer all the Questions. Each Question carries one mark. **(10Qx1M=10M)**

[QNo. 01 to 05 – C.O.02, Knowledge]

1. The reactive power limit of the Generator Bus -2 in a 14 Bus IEEE standard system is found to be 0.01 to 0.14pu. These limits are dependent on:
   A] The speed of the Prime mover.
   B] The frequency of the voltage.
   C] The field current limits of the Field Circuit.
   D] Real Power generated by the Generator.
2. Total Number of Active Power and Reactive Power equations obtained for solving 3 Bus power system out of which one Bus is slack Bus is:
   A] 4 B] 6 C] 3 D] 8
3. Load flow equations are generally solved by Iterative Methods as these equations are:
   A] Non Linear B] Linear C] Algebraic D] Approximate solutions are accepted.
4. Generally for a large power system studies the Load flow is computed for various load conditions and line outage conditions. The best method suited for such systems are:
   A] Both G-S &N-R Methods B] Only G-S Method C] N-R Method D] Analog Methods.
5. "The Load Flow Equations are solved in G-S method."
   Select the correct sentence from the options provided below with reference to the above statement.
   A] The equations are linearized using tailor Series expansion.
   B] The non-linearity nature of the equations are maintained throughout the solution.
   C] The Jacobin Matrix is reduced for faster solution.
   D] The Number of iterations are independent of slack bus selection.

[QNO.6 to 10 –C.O.03, Knowledge]

6. Lightning and switching transients are classified as Ultra-Fast Transients in power systems. The peak values of these transients helps in deciding ----------:
   A] Circuit Breaker Ratings. B] Basic Insulation Level of Electrical Equipment.
   C] Both options A& B. D] Fault level of the system.
7. The Log report of faults of a southern grid system for 12/11/19 shows that, there was a single line to ground fault on Bangalore- Mysore 220kv line at 18 Hours, 38 Minutes, 21 seconds near tower number 37. Assuming that there were no other abnormalities in the system at that time identify the nature of Transients generated in the system due to this fault:
   A] Medium Fast Transients. B] Ultra-Fast Transients C] Slow Transients. D] Zero Transients.
8. The magnitude of the Fault current in a 3 phase symmetrical fault does not depend on:
   A] Location the fault. B] Fault Impedance. C] Source Voltage. D] Pre fault Load Current.
9. A 400 kv transmission line from Madugiri to Yelahanka was found to be subjected to a fault at location between tower number 21 and 22. The nature of the fault is that, the R phase conductor is Touching the Y Phase conductor. Select the correct statement/statements for this scenario.
   A] The Nature of the Fault is Series fault.
   B] The nature of the Fault is Shunt fault.
   C] The nature of the fault is symmetrical Fault.
   D] The nature of the fault is asymmetrical Fault.
10. For carrying out a symmetrical fault analysis of a large power system, identify what are the data required from the given list:
   A] Pre fault voltage of the generator Bus.
   B] Number of circuit breakers and its capacity.
   C] Total reactance of the system from source to the fault point.
   D] Pre fault Load current.

Part B [Thought Provoking Questions]

Answer both the Questions. **(2Q=15M)**

11. For a 3 Bus system having one generator Bus [Slack] and two Load buses, write the Voltage equations for the Load Buses in G-S Method &Name all the variables and parameters.

7M (C.O.02)[Comprehension]

12. It is required to prepare the Tender documents with technical specifications for a new receiving station to be installed in Bangalore zone to enhance the Voltage profiles of the region. Identify the type of study to be conducted and mention the data required for the study and write 4steps to be followed for the study. [2+3+5=8M](C.O.03)[Comprehension]

Part C [Problem Solving Questions]

Answer both the Questions. **(2Q=15M)**

13. A partial Load Flow Results of a portion of the 220 KV system of a Southern Indian grid consisting of Hubli Bus, Ponda Bus and the Raichur Bus is furnished below:

7M [C.O.02, Comprehension Level] [2+2+4]

Load flow Results

Sl no	Bus No./Bus Name	Voltage Magnitude In PU.	Voltage Angle
01	01/ Raichu	0.98	-1.4 Degrees
02	02/Hubli	0.94	-2.1 Degrees
03	03/Ponda	0.87	-3.4 Degrees

Line Data

Line From-To	Line Series Admittance value in PU	Shunt Admittance Value in PU
Raichur- Hubli	2-j4	0
Raichur -Ponda	3-j5	0
Hubli-Ponda	1-j2	0

i) Based on the above result identify the Bus which is best suited for installation of a shunt capacitor based on the voltage profile criterion.

ii) List all the remaining results that could be obtained from the above data and the results.

iii) Compute the Line Flow between Hubli and Ponda.

14. It is required to compute the Circuit breaker rating for the system having one Generator [20 MVA, 11 KV, % X= 10], One Transformer [10 MVA, 11KV/220 KV, %X = 10, one Transmission Line having a Reactance of 3 Ohms & a Transformer [10MVA, 220KV/11KV,%X=10] at the 11 KV bus at the far end of the system.

i) Identify the type of study to be conducted.

ii) Obtain the necessary result from the data provided by considering the Base value of 10 MVA & 220 KV &11KV base voltages at respective Buses.

(C.O.02)[Comprehension] [2+2+4=8M]

Format of Answer Scheme

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SOLUTION

Semester: 7th

TSET -2 [SET –B]

Date: 019/11/2019

Time:

Course Code: EEE-215

Max Marks: 40

Course Name: POWER SYSTEM ANALYSIS

Weightage: 20%

Part A (10Q x 1M = 10Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
1	(C)	1M	3Mts
2	(A)	-11-	
3	(A)	-11-	
4	(C)	1-1	
5	(b)	-11-	
6	(B)	-11-	
7	(A)	1-11-	
8	(D)	-11-	
9	(B – D)	-11-	
10	(A . C)	-11-	

10M

30Mts

PART -B

(7+8 = 15 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
11	$V_2^{(1)} = \frac{1}{Y_{22}}\left[\frac{P_2 - jQ_2}{V_2^{(k)*}} - Y_{21}V_1^{(0)} - Y_{23}V_2^{(0)}\right]$ $V_3^{(1)} = \frac{1}{Y_{33}}\left[\frac{P_3 - jQ_3}{V_3^{(0)*}} - Y_{31}V_1^{(1)} - Y_{32}V_2^{(1)}\right]$ Naming of all ratios	4M. 3M.	20 Mt
12	i) 3Φ Sym. fault Study Data Line data - Cond, Spacing & Configuration. Tr. Data - MVA, Voltage X. Z / X.	2M. 3M.	2 M.
	Steps: 1) Select the base values of p.u. 2) Draw the p.u. React. Diag. 3) Identify the fault point 4) Compute I_f & FIL.	3M.	

13) i) Ponda bus as the voltage is lowest — 2M.

ii) Line flows.
Line losses.
Slack bus power.
Active power loss.
Reactive power loss. — 4M.

25M

iii) $S_{L_{32}} = V_3^{*}\left[V_3 - V_2\right] y_{32}$

$= 0.87\angle -3.4\left[0.87\angle -3.4 - 0.94\angle -2.1\right]\left[1 - j2\right]$

14) i) 3 ϕ Sym. fault Analysis - 2M.

ii) P.U. values.

MVA = 100, Voltage = 220 kV for T/L.

$Z_b = \frac{kV^2}{MVA} = 484\ \Omega$

$x_{TL} = 3/484 = 0.0061\ pu$

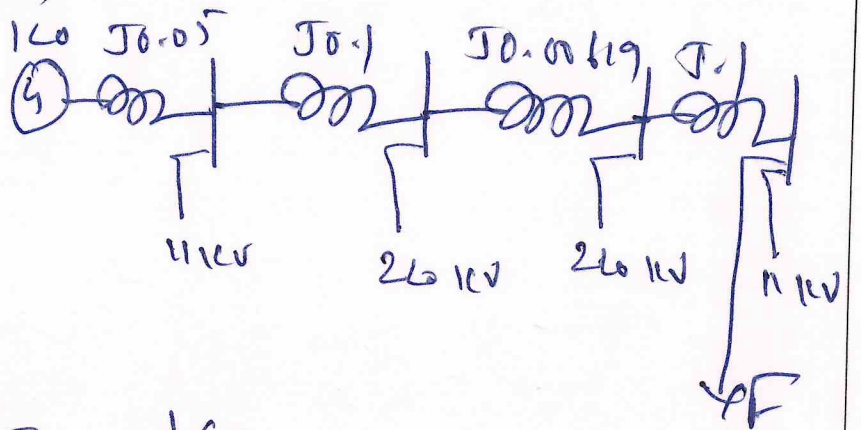
$x_{G1} = 0.1/20 \times 10 = 0.05\ pu$

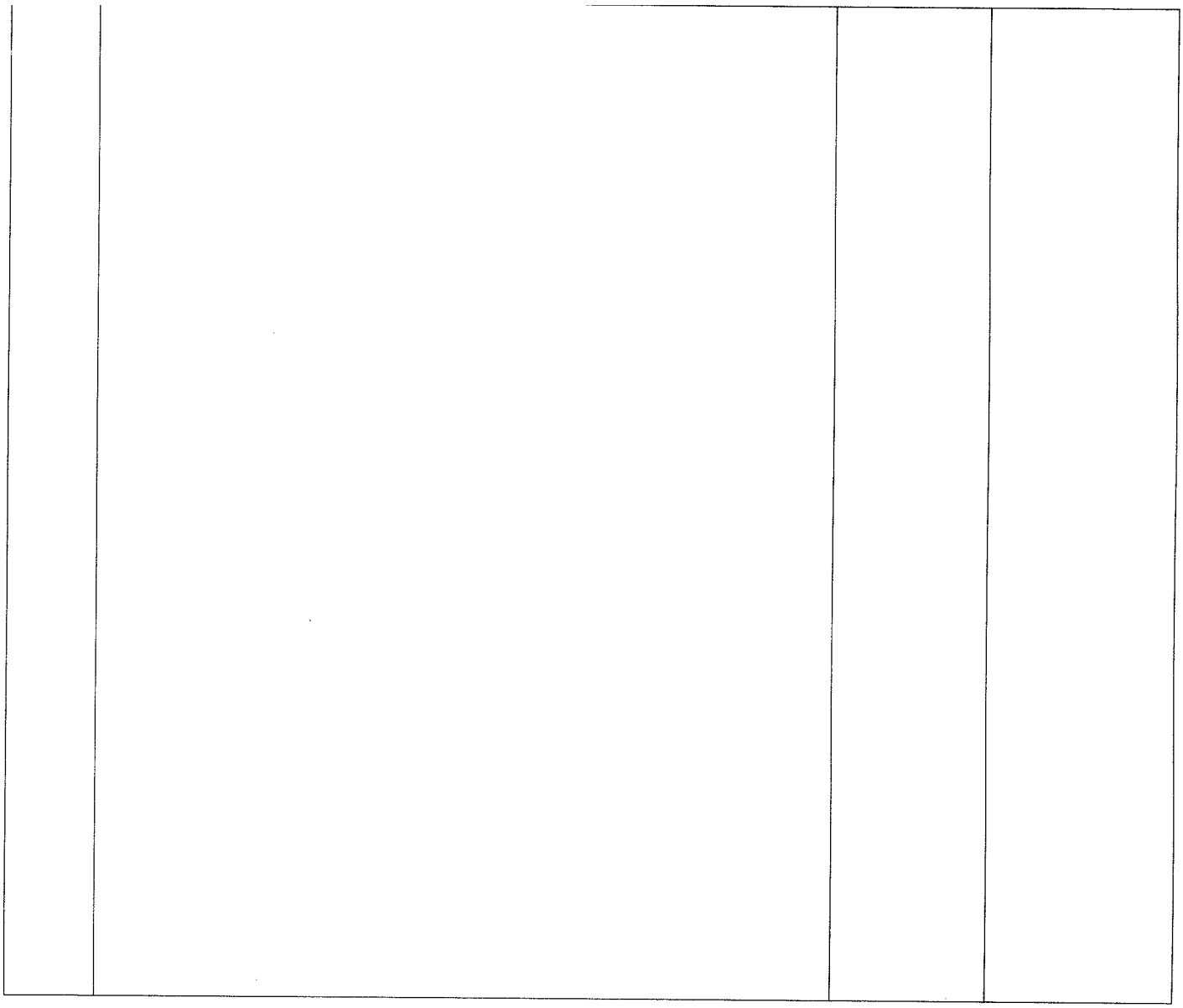
$x_{T1} = 0.1\ pu.$

$x_{T2} = 0.1\ pu.$

2M.

PART –C (8+7=15)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
14	(iii) Reactive P.U. Dia  $I_f = \frac{100}{X}$, $X = 0.05+0.1+0.0619+.1$ $I_f = 1/.2561 = 3.9047$ pu I_f in kA = $I_f \times I_1$. $\frac{3.9047}{1000} \times \frac{10\times10^6}{\sqrt{3}\times33\times10^3}$ I_f in kA = 0.6831 kA FC = $\sqrt{3}\times11\times.6831 = 13.015$ MVA	4M 2M	



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[Bloom's Level: Knowledge]

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b] The Base value of power is 100MVA and the Base value of Voltage is 110KV for a system modeled for peak load flow study. The base value of the Current is----------AMPS [C.O.No.1]

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[C.O.No.1]

d] Synchronous Generators are represented as either" PAI" network model or "TEE" network model

State whether this statement is TRUE/FALSE [C.O.No.1]

e] Load Flow Model is "STATIC MODEL". State whether this statement is TRUE/FALSE. [C.O.No.2]

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n] The value of the operator used in Sequence Transformation matrix is ---------- [C.O.No.3]

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[C.O.No.4]

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s] Is voltage stability is dynamic in nature or Static in nature? [C.O.No.4]

t] Angle stability is an effect but the Voltage stability is a cause in recent power system collapses. Is this statement TRUE/FALSE? [C.O.No.4]

Part B [Thought Provoking Questions]

Answer all the Questions. [Each question carries different marks as entered in front of the question] [All are at Comprehension level]

[5 Q, 31Marks]

2. Draw the Per Unit reactance diagram for a simple power system having one synchronous generator having a reactance of 10%, a Transformer having a reactance of 5%, A transmission line having a reactance of 4P.U. and a Transformer having a reactance of 5%. All are in series &all the reactance values are for the same base values. [6M] [C.O.No.1]

3 .It is required to carry out the system load enhancement study for the Karnataka state power grid for the summer peak load conditions.

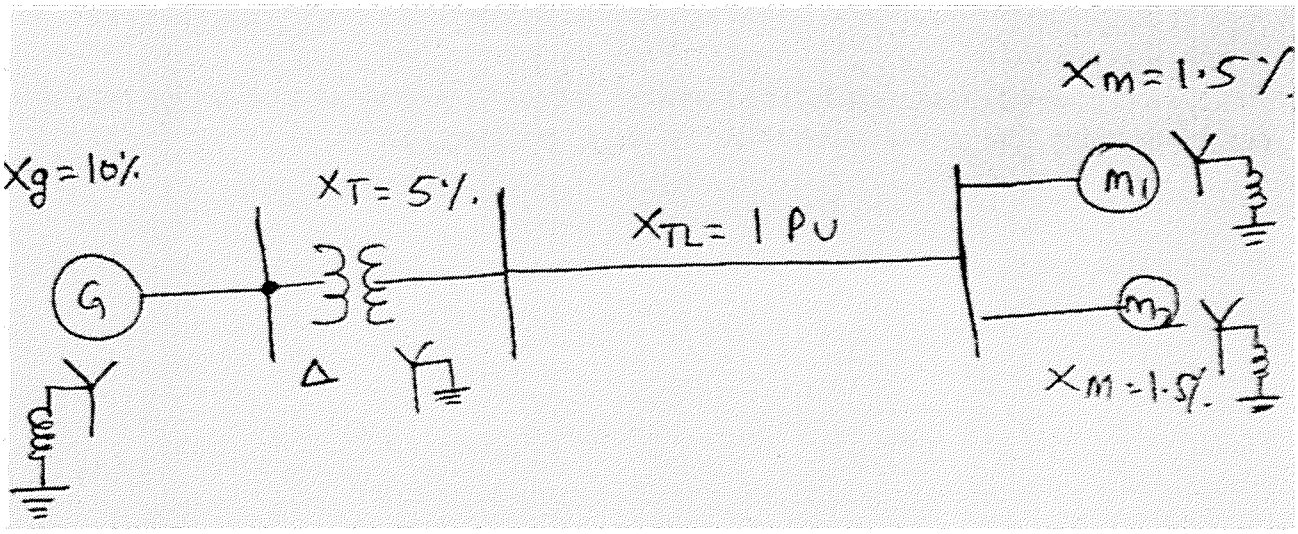
i) Name the study to be conducted on this system [1+2+2=5M][C.O.No.2]

ii) List all the data required to be collected for this study

iii) What are the output of this study?

4. Name the two methods that can be used for the study selected in the above question and write the respective voltage and power equations. [1+2+2=5M] [C.O.No.2]

5. Draw the Positive sequence, Negative sequence and Zero sequence diagrams for the sample power system shown below. [3+3+3 =9M] [C.O.No.3]



6. Differentiate between three different types of power system angle stability problem.

[6M] [C.O.No.4]

Part C [Problem Solving Questions]

Answer all the Questions. [Each question carries different marks as entered in front of the question] [All questions are at Application level]

[3 Q, 29Marks]

7 .A partial load flow results of a portion of a large power system is furnished below:

Sl no	Bus No.	Bus voltage in P.U.	Bus voltage angle in degrees	Bus Active Power in P.U.	Bus Reactive power in P.U.
01	400KV-001	0.989	-1.8	1.5	0.96
02	400KV-002	0.942	-2.3	2.47	1.48
03	220 KV-001	0.912	-2.5	2.11	1.38
04	220KV-002	0.899	-2.9	1.34	0.912

1] Name the appropriate method of Load Flow used for such systems [2M] [C.O.No.2]

2] Identify the remaining quantities to be found from the above partial results [3M] [C.O.No.2]

3] Compute the same for the transmission line to which the data is provided below:

[8M] [C.O.No.2]

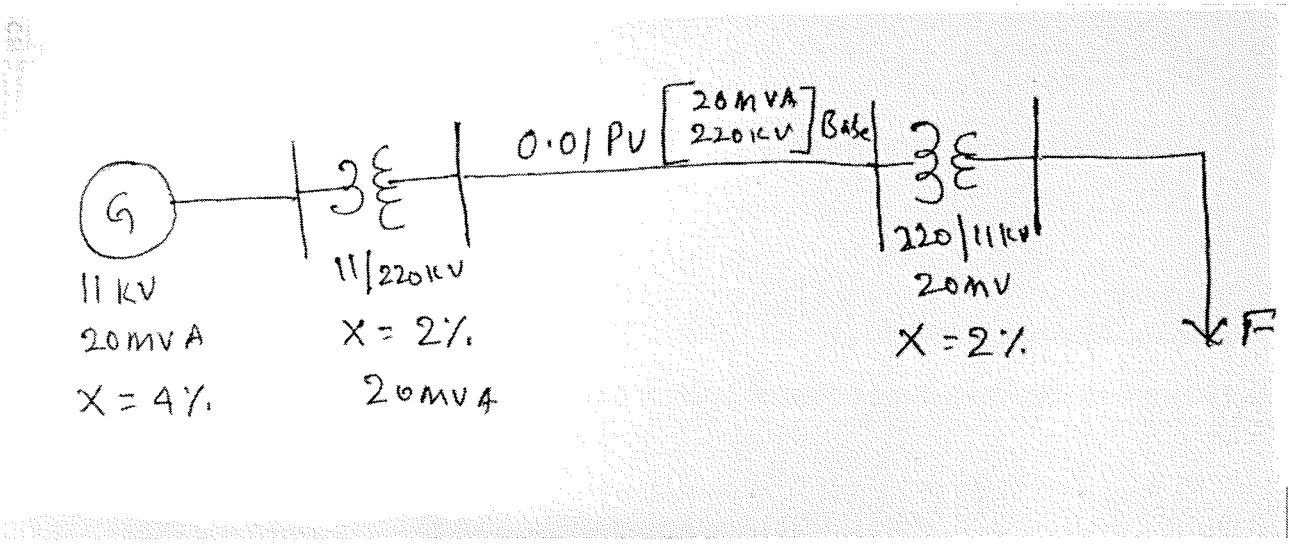
a) Impedance value in P.U. Line from Bus No [400KV-001 TO 400 KV -002] is

[0.17+j0.23]

b) Impedance value in P.U. Line from Bus No [220KV-001 TO 220 KV -002] is

[0.12+j0.25]

8. A sample power system considered for demonstration of power system simulation package has the following components as shown in the single line diagram:



It is considered that a 3phase to ground symmetrical solid fault occurs at the secondary side of the transformer –T2.[at point F]

1] Identify what are the quantities to be computed from the data provided? [3M] [C.O.No.3]

2] Compute all the quantities identified above. [8M] [C.O.No.3]

9.Following data refers to a synchronous generator used in a power system:

A] Frequency: 50 C/S B] Number of Poles: 4 C] Rated capacity 100MVA

D] Voltage rating: 11 KV E] Inertia Constant: 10MJ/MVA F] Electrical Load= 60MW

G] Mechanical Input raised to 85MW [All the losses are neglected]

1] Identify the relevant quantities that could be found which helps for stability analysis from the above data. [2M] [C.O.No.4]

2] Find the identified data. [3M] [C.O.No.4]

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REACH GREATER HEIGHTS

SCHOOL OF ENGINEERING

END TERM FINAL EXAMINATION

Extract of question distribution [outcome wise & level wise]

Q.NO.	C.O.NO (% age of CO)	Unit/Module Number/Unit /Module Title	Memory recall type [Marks allotted] Bloom's Levels	Thought provoking type [Marks allotted] Bloom's Levels	Problem Solving type [Marks allotted]	Total Marks
			K	C	A	
1	CO 01 CO 02 CO 03 CO 04	All the 4 modules	20 [4+3+7+6]			20
2	CO 01	MODULE 01	-	06	-	09
3	CO 02	MODULE 02	-	05	-	06
4	CO 02	MODULE 02	-	05	-	06
5	CO 03	MODULE 03	-	09	-	06
6	CO 04	MODULE 04	-	06	-	06
7	CO 02	MODULE 02	-	-	13	10
8	CO 03	MODULE 03	-	-	11	10
9	CO 04	MODULE 04	-	-	05	06
	Total Marks		20	31	29	

K =Knowledge Level C = Comprehension Level, A = Application Level

C.O WISE MARKS DISTRIBUTION:

CO 01: 10 MARKS, CO 02: 26 MARKS, CO 03: 27 MARKS, CO 04:17 MARKS

Note: While setting all types of questions the general guideline is that about 60%

Of the questions must be such that even a below average students must be able to attempt, About 20% of the questions must be such that only above average students must

be able to attempt and finally 20% of the questions must be such that only the bright students must be able to attempt.

I hereby certify that all the questions are set as per the above guidelines.

Faculty Signature:

Reviewer Commend:

Format of Answer Scheme

GAIN MORE KNOWLEDGE
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SCHOOL OF ENGINEERING

SOLUTION

Semester: Odd Sem. 2019-20
Course Code: EEE215
Course Name: POWER SYSTEM ANALYSIS
Program & Sem: B.TECH. EEE VII

Date: xx.12.2019
Time: 3 HRS
Max Marks: 80
Weightage: 40%

Part A (0Q x 0M = 0Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
I	1] Per Unit Value 2] 100*1000000/1.732*110*1000 = 524.879A 3] TRUE 4] FALSE 5] TRUE 6]Generator Data 7] G-S Method	**1M**	**QUESTION NO I [30MTS] At the rate of 1.5mts for each**

	8] 3Phase fault, Line to line fault, single line to ground fault, Double line to ground fault, Single open conductor fault, Double conductor open fault. [Any four of these] 9]Line to Line Fault 10] TRUE 11] TRUE 12]Sub Transient &Transient 13] Fault Current 14] 1 at an angle 120 degrees 15] TRUE 16] A.L.F.C & A.V.R. 17] TRUE 18] Non-linear Second Order differential equation with constant co efficient. 19] Dynamic In nature 20] TRUE	**1M**	**QUESTION NO I [30MTS] At the rate of 1.5mts for each**

Part B (5Q, 31 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
II	Single line diagram with the reactance of generator, transformer, transmission line and transformer all in series with the values mentioned.	For Diagram = 4M For marking values =2M	15Mts
III	i) Load Flow Study ii) Line data, conductor size, and spacing, Load Data, Active &Reactive power Loads, Generator Data, Capacity, and Reactive power limit. iii) Voltage magnitude and the angles at all the buses , Line flows, line losses, total loses, slack bus power	1M 2M 2M	15 Mts.
VI.	Gauss-Siedel Method and the Newton- Rapson Method G-S Method: Voltage Equation: N-R Method: Active power & Reactive power equation	1M 2M 2M	13Mts.
V	Positive Sequence diagram: 3 voltage sources, all the machine reactance and the line reactance in series Negative Sequence diagram: Same as above without the voltage sources.	3M 3M	15 Mts.

	Zero Sequence diagram: Only reactance with closed loop for star connected machines	3M	
VI.	Steady State Stability: For small and gradual disturbances Transient Stability : For large and sudden disturbances Dynamic Stability: For small and continuous disturbances.	2M 2M 2M	10Mts.

Part C (0Q x 0M = 0Marks)

Q No	**Solution**	**Scheme of Marking**	**Max. Time required for each Question**
VII.	1] N-R Method 2] Line flows [active and reactive] Line losses[active and reactive] Total losses[Active and reactive], slack bus power [Active and reactive] 3] Pl 1-2 = V1* [V1-V2] /Z12 Pl 2-1 = V2*[V2-V1]/Z12 P loss [1-2] = Pl1-2+ Pl2-1 Similarly for the other line also.	2M 3M 4M 4M	25 Mts.
VIII.	1] 3phase symmetrical short circuit current Fault Level of the system at various voltage levels Circuit Breaker capacity 2] fault Current= 1/ total reactance Total reactance =0.09 pu Fault current = 1/0,09 = 11.11pu Fault current in amps = .11.11*base current Base current= 20mva/1.732*11okv =105 amps 105*11.11/1000 =1.166KA Fault Level at 220KV Bus = 1.732*220*1.166 =444mva	3 M 4M 4M	30 Mts.
IX.	1] Kinetic Energy Stored in the rotor of the generator Accelerating Power for the given case 2] KE = GH KE = 100*10 = 1000MJ PA = 85MW-60 MW = 25 MW	2M 3M	10Mts