Hall Ticket Number :										

R-15

Code: 5G261

III B.Tech. II Semester Regular & Supplementary Examinations May 2019

Power System Analysis

(Electrical and Electronics Engineering)

Max. Marks: 70 Time: 3 Hours

Answer *all five* units by choosing one question from each unit (5 x 14 = 70 Marks)

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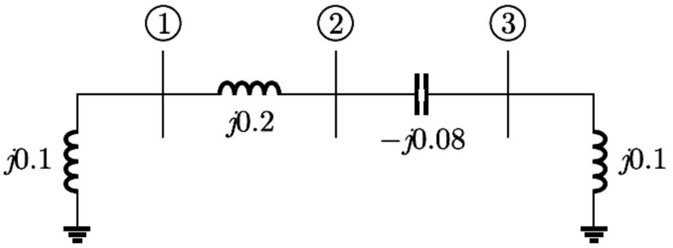
UNIT–I

1. a) Form z-bus and y-bus matrix for the following system



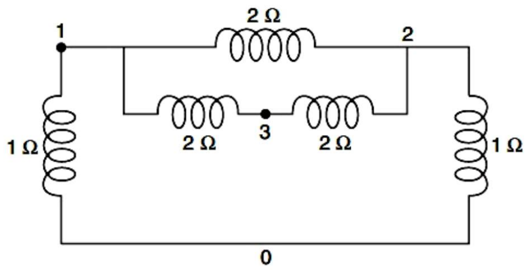
7M

b) Define the primitive network in impendence form and admittance form with network element representation and expression 7M

OR

2. a) Consider a power system network with at least 3 bus and find y-bus matrix using singular transformation 7M

b) Develop z-bus matrix for the network shown below



7M

UNIT–II

3. a) The following is the system data for a load flow solution:

Determine the voltages at the end of first iteration using newton Raphson method.

Load data				
BUS CODE	P	Q	V	REMARKS
1	-	-	1.06	SLACK
2	0.5	0.2	1+j0	PQ
3	0.4	0.3	1+j0	PQ
4	0.3	0.1	1+j0	PQ

LINE DATA	
Bus code	Admittance
1-2	2-j8
1-3	1-j4
2-3	0.66-j2.66
2-4	1-j4
3-4	2-j8

10M

b) Compare the Gauss-Seidel method, Newton Raphson method for load flow solution 4M

OR

4. a) Write an algorithm for the load flow solution using NR method polar co-ordinates 7M

b) Explain why load flow studies are performed and its significance in power system analysis & discuss about the classification of buses 7M

UNIT–III

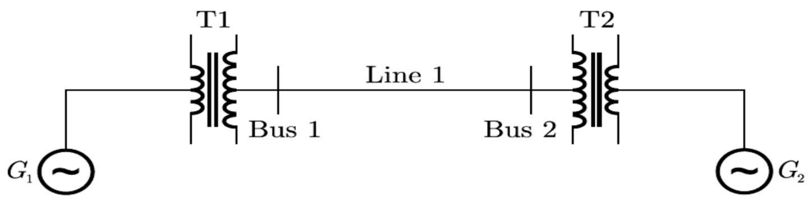
5. a) Draw the impedance diagram for the power system shown in the figure below, the specifications of the components are the following :

$G1$: 25 kV, 100 MVA, $X = 9\%$

$G2$: 25 kV, 100 MVA, $X = 9\%$

$T1$: 25 kV/220 kV, 90 MVA, $X = 12\%$

$T2$: 220 kV/25 kV, 90 MVA, $X = 12\%$



Line 1: 200 kV, $X = 150$ ohms

Choose 25 kV as the base voltage at the generator $G1$, and 200 MVA as the MVA base. 6M

b) Derive the expression for the fault current, when an unloaded alternator subjected to single line to ground fault. 8M

OR

6. a) The voltages across a 3-phase load are $V_a = 300$ V, $V_b = 300\angle -90°$ V and $V_c = 800\angle 143.1°$ V respectively. Determine the sequence components of voltages. Phase sequence is abc. 7M

b) A 500 MVA, 50 Hz, 3-phase turbo-generator produces power at 22 kV. Generator is Y-connected and its neutral is solidly grounded. It Sequence reactance's are $X1 = X2 = 0.15$ pu and $X0 = 0.05$ pu.It is operating at rated voltage and disconnected from the rest of the system (no load). Find the magnitude of the sub-transient line current for single line to ground fault at the generator terminal 7M

UNIT–IV

7. a) Derive the expression for maximum steady state power 8M

b) Explain methods to improve steady state stability limit 6M

OR

8. a) Write short notes on following
   i. Power angle diagram
   ii. Steady state stability limit
   iii. Synchronizing power coefficient 10M

b) List the assumptions used in deriving the power angle equation 4M

UNIT–V

9. a) Explain the effect of fault clearing time on stability 6M

b) Derive the expression for critical clearing angle and time when a 3 phase fault occurs on the transmission line 8M

OR

10. a) Explain equal area criterion in case of "**sudden loss of one parallel lines**" for analyzing transient stability? What happens if mechanical input is larger than maximum power transfer capability after above fault condition occurs? 8M

b) Explain the methods to improve transient stability analysis 6M

***

UNIT–III

5. a) Draw the reactance diagram for the power system shown in below fig. The ratings of generator, motor and transformers are given below. Neglect resistance and use a base of 50MVA, 138KV in the 40 line.

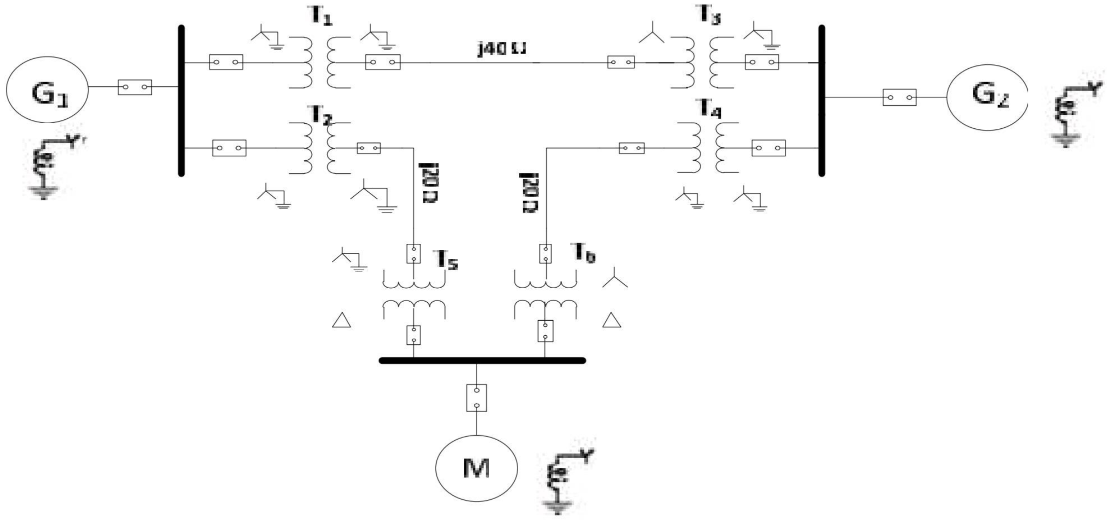
Generator G_1 : 20 MVA,18KV,X''=20% ;

Generator G_2 : 20 MVA,18KV,X''=20%;

Synchronous Motor: 30MVA, 13.8KV, X''=20%;

3-phase - Transformer: 20MVA, 138KV/20KV, X=10%;

3-phase - Transformer: 20MVA, 138KV/20KV, X=10%;



8M

b) Three phase voltages across a certain unbalanced 3Φ load are given as E_R = 176-j132; E_Y = -128-j96 and E_B= -160+j100. Find Positive, Negative and Zero sequence components of voltages. 6M

OR

6. a) Explain interconnection of sequence networks for a LL-G fault in power system network with necessary equations. 7M

b) A 25MVA, 11kV Synchronous Generator has positive, negative and zero sequence reactances of 12%, 12% and 8% respectively. The generator neutral is grounded through a reactance of 5%. A Single line to Ground fault occurs at the generator terminals. Determine fault current and line to line voltages. Assume that the generator is unloaded before fault. 7M

UNIT–IV

7. a) Prove that maximum power transfer can be achieved when X= 3 R. 7M

b) Explain various methods to improve Steady State Stability. 7M

OR

8. a) Derive the expression for the steady state stability limit. 7M

b) Explain the synchronizing power coefficient and analyze the system stability using power angle curve. 7M

UNIT–V

9. a) Explain various methods of improving transient stability. 7M

b) Derive the Swing equation of a Synchronous machine. 7M

OR

10. a) With the help of Equal area criterion for one machine connected to Infinite bus, derive the expressions for critical clearing angle and critical clearing time. 8M

b) A 50HZ generator is delivering 50% of the power that is capable of delivering through a transmission line to an infinite bus. A fault occurs that increases the reactance between generator and infinite bus 500% of the value before fault. When the fault is isolated the maximum power that can be delivered is 75% of the original maximum value. Determine the critical clearing angle for the condition delivered. 6M

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Hall Ticket Number :

Code: 5G261 **R-15**

III B.Tech. II Semester Supplementary Examinations Nov/Dec 2018

Power System Analysis

(Electrical & Electronics Engineering)

Max. Marks: 70 Time: 3 Hours

Answer *all five* units by choosing one question from each unit (5 x 14 = 70 Marks)

****

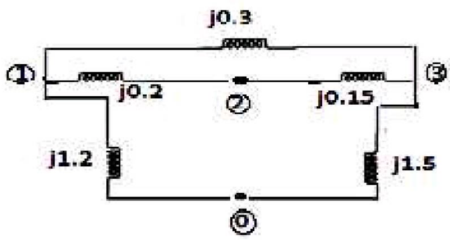
UNIT–I

1. a) Write the mathematical modeling of different power system elements. 7M

   b) Starting from the first principles show that a diagonal element of Y_{BUS} equal to the sum of admittances connected to that bus and an off diagonal element equal to the negative of the admittance directly connected between the buses. 7M

OR

2. For the network shown in fig below, form Z_{BUS} using step by step algorithm.



14M

UNIT–II

3. a) Write an algorithm for Gauss-Seidal load flow method including PV buses. 8M

   b) What are the different types of buses as categorized for load flow studies, explain each one of them in detail. 6M

OR

4. For the power system network, the generators are connected at all four buses, while loads are at buses 2, 3 and 4. The values of real and reactive powers are listed in table 1. All buses other than slack bus are of P-Q type. Line data are given in table 2. Assuming a flat voltage start, determine the voltage magnitudes and the phase angles at the three buses using G- S(Gauss-Seidel) method for first iteration.

Table 1. Bus data

Bus	Pi	Qi	Vt	Type of bus
1	---	---	1.05 0	Slack
2	-0.45	-0.15	---	PQ
3	-0.51	-0.25	---	PQ
4	-0.6	-0.3	---	PQ

Table 2. Line data

Line No.	Bus Code(p-q)	Line Impedance
1	1-2	0.08+j0.2
2	1-4	0.05+j0.1
3	2-3	0.04+j0.12
4	3-4	0.04+j0.14

14M

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(Electrical and Electronics Engineering)

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UNIT–I

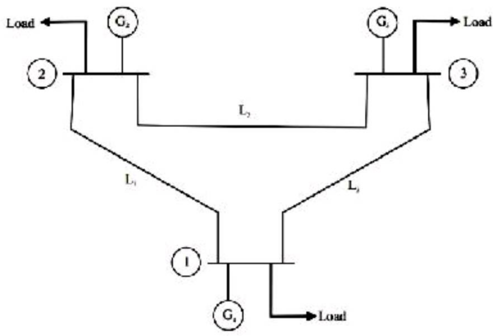
1. a) Write Z bus building algorithm 6M

   b) Derive the expression for bus admittance matrix Ybus in terms of primitive admittance matrix and bus incidence matrix 8M

OR

2. a) Write the procedure for the modifications of Z bus matrix for Network Changes 4M

   b) Consider the power system shown. Each generator and the line impedance of j0.2 pu and j0.5 pu respectively. Neglecting line charging admittances, form y bus matrix using direct inspection and singular transformation



10M

UNIT–II

3 The following is the system data for a load flow solution:

LINE DATA

Bus code	Admittance
1-2	2-j8
1-3	1-j4
2-3	0.66-j2.66
2-4	1-j4
3-4	2-j8

Load data

BUS CODE	P	Q	V	REMARKS
1	-	-	1.06	SLACK
2	0.5	0.2	1+j0	PQ
3	0.4	0.3	1+j0	PQ
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Determine the voltages at the end of first iteration using Gauss-Seidel method. 14M

OR

4. a) With a neat flow chart explain the load flow solution by Guass-seidal method 7M

   b) Explain

      I. Decoupled load flow and

      II. Fast decoupled load flow methods 7M

UNIT–III

5. a) Derive the fault current equation for double line to ground fault for an unloaded alternator 8M

b) The line currents in a 3-phase supply to an unbalanced load are respectively $I_a = 10 + j20$, $I_b = 12 - j10$ and $I_c = -3 - j5$ amperes. The phase sequence is abc. Determine the sequence components of currents 6M

OR

6 a) What is meant by per unit quantity? Why per unit method is considered superior to percent method for short-circuit calculations? 4M

b) A double line to ground fault occurs on phases *b* and *c*, at point *P* in the circuit whose single line diagram is shown Determine the sub transient currents in all phases of machine-1, the fault current and the voltages of machine I and voltages at the fault point. Neglect pre-fault current. Assume that machine-2 is a synchronous motor operating at rated voltage. Both the machines are rated 1.25 MVA, 600 volts with reactance's of $X = X2$= 8% and $X0$ = 4%. Each 3-phase transformer is rated 1.25 MVA, 600 volts delta/4160 volts star with leakage reactance of 5%. The reactance's of transmission line are $X1 = X2$ = 12% and $X0$ = 40% on a base of 1.25 MVA, 4160 volts

10M

UNIT–IV

7. a) Derive the condition for maximum power transfer can be achieved 7M

b) What is meant by stiffness of synchronous machine and explain how stability of the system can be understood using synchronizing power coefficient? 7M

OR

8. a) Derive the power angle equation? 7M

b) Explain methods to improve steady state stability limit also explain the deference between steady state stability limit and transient state stability limit 7M

UNIT–V

9. a) Explain equal area criterion in case of "**sudden change in mechanical input"**? Discuss its application and limitation in the study of power system Stability. 8M

b) Derive the swing equation explaining symbol of each term used 6M

OR

10. a) Explain the point by point method of solving the swing equation. Compare his method with the equal area criterion method 8M

b) Explain the methods to improve transient stability analysis 6M

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Hall Ticket Number :										

R-14

Code: 4G261

III B.Tech. II Semester Supplementary Examinations May 2019

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(Electrical and Electronics Engineering)

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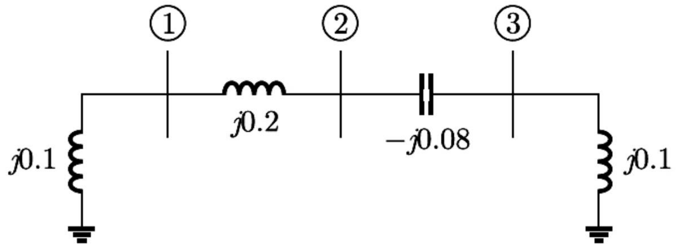

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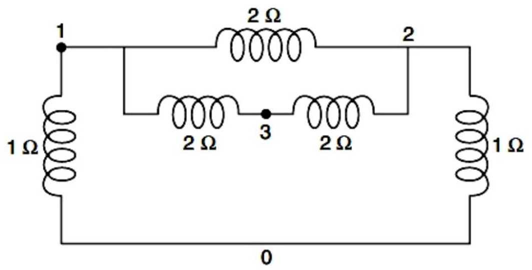

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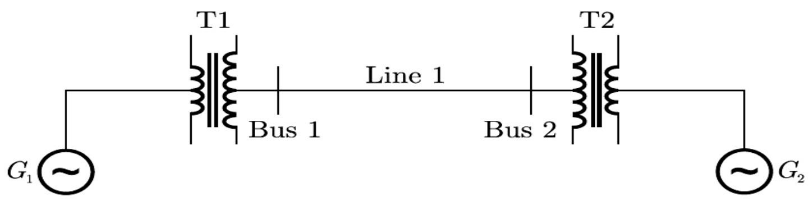

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Hall Ticket Number :										

R-14

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(Electrical and Electronics Engineering)

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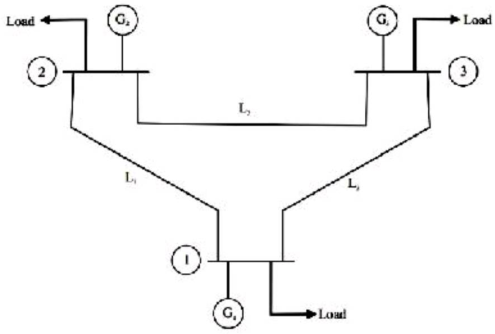

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