Code No: **R32022** **R10** **Set No. 1**

III B.Tech II Semester Regular/Supplementary Examinations, May/June - 2015
POWER SYSTEM ANALYSIS
(Electrical and Electronics Engineering)

Time: 3 hours **Max. Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks
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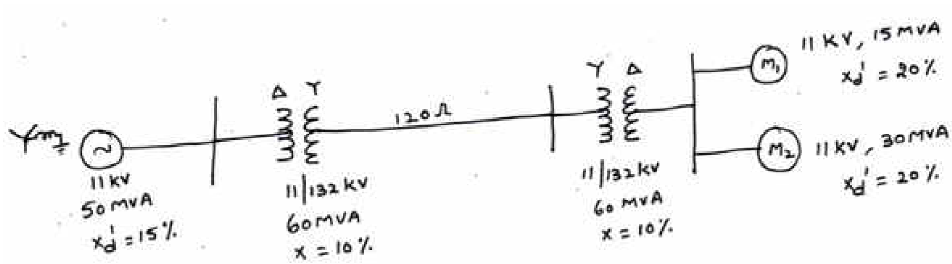
1 a) What is per unit system? How is the base quantities selected? [5]

b) Draw the per unit impedance diagram for the power system shown in figure below. [10]



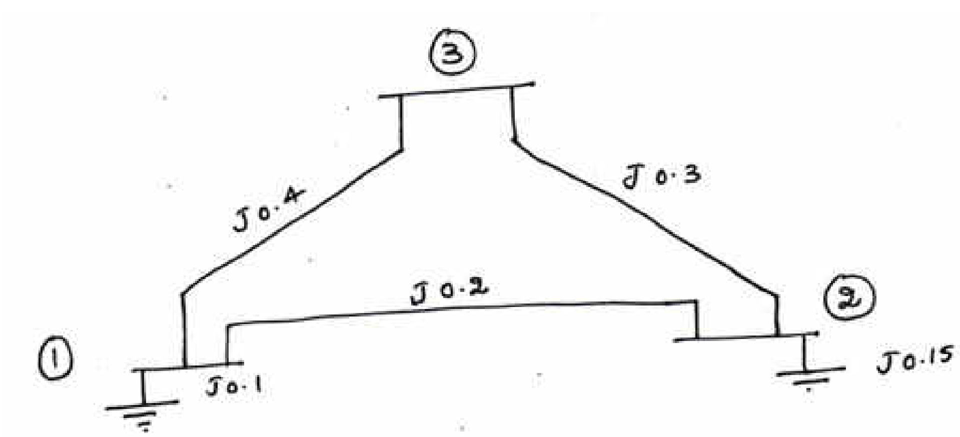
2 a) Starting from first principle show that a diagonal element of Y_{bus} equals the sum of admittances connected to that bus and an off diagonal element equals the negative of the sum of the admittances directly connected between the buses. [6]

b) Give an algorithm for a load flow study of a power system using G-S method. [9]

3 a) Write comparisons and differences between G-S and N-R Power flow methods. [6]

b) Derive the power flow equation for decoupled load flow method. [9]

4 Construct the bus impedance matrix for the network shown in below figure. All impedances are in P.u [15]



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5 a) Explain the symmetrical fault analysis using Z_{bus}. [6]

b) A 50 MVA, 13.2 kV generator, with reactance $x_d^{''} = 20\%,\ x_d^{1} = 35\%\ \ and\ x_d = 100\%$ is connected to a 50 MVA, 13.2/132 kV transformer, with x=10%. It is operating on no load at rated voltage. Find the sustained S.C current, the initial symmetrical rms current and the maximum possible DC component, if the S.C occurs on the LV side of the transformer. [9]

6 Three identical Y-Connected resistors form a load bank with a three phase rating of 400V, 100 kVA. Unbalanced voltages are applied to the load bank as follows. $|V_{ab}| = 320V,\ |V_{bc}| = 480V, |V_{ca}| = 400V$ The neutral of the load is not connected to neutral of the system. Determine the line voltages and currents into the load in P.u. [16]

7 Two 11kV, 20 MVA, 3ϕ, star connected generators operates in parallel. The positive, negative and zero sequence reactance of each being respectively, j 0.18, j 0.15, j0.1P.u. The star point of one the generator is isolated and that of the other is earthed through a 2Ω resistor. A single line to ground fault occurs at the terminals of one of the generator. Determine i) fault current ii) current in ground resistor and iii) voltage a cross grounding resistor. [16]

8 a) Distinguish between steady state, transient and dynamic stability. Derive power angle equation. [8]

b) Explain the different methods to improve the transient stability. [7]

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Code No: **R32022** **R10** **Set No. 2**

III B.Tech II Semester Regular/Supplementary Examinations, May/June - 2015
POWER SYSTEM ANALYSIS
(Electrical and Electronics Engineering)

Time: 3 hours **Max. Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks
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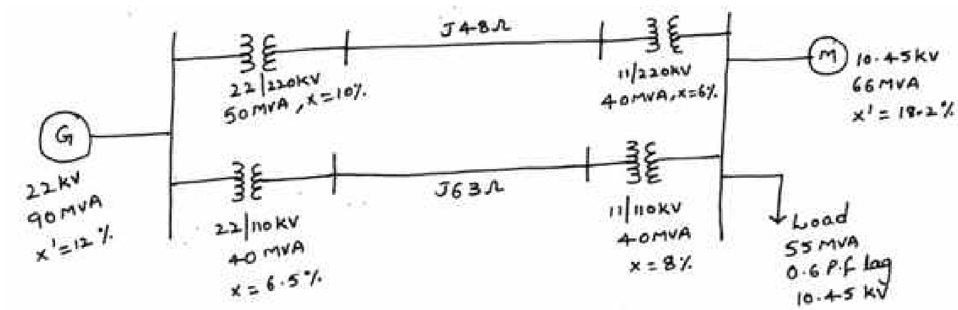
1 Draw the P.u impedance diagram for the power system shown in the figure below. [16]



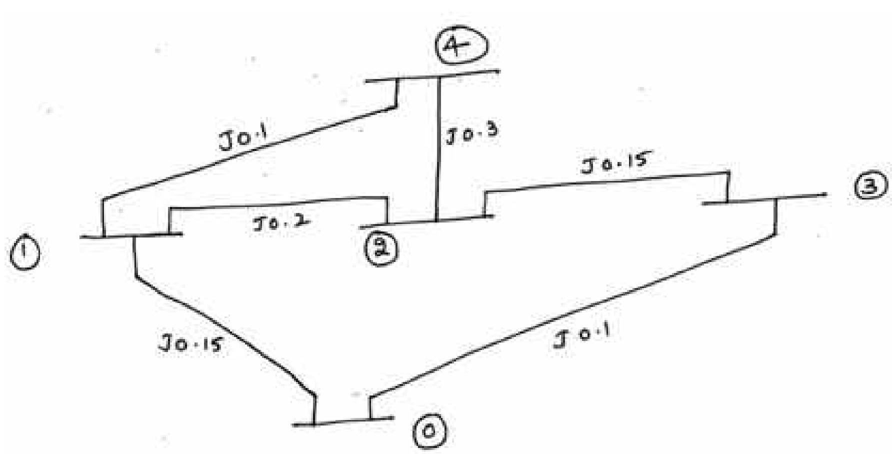
2 a) Discuss the step by step method of formation of Y_{bus}. [6]

b) Explain the G-S method for solution of non-linear equations of a power system. [9]

3 a) Derive the power flow equations of N-R method using rectangular coordinates. [8]

b) Write an algorithm for decoupled load flow method by considering all types of buses. [7]

4 Form the bus impedance matrix for the network shown in below figure. [15]



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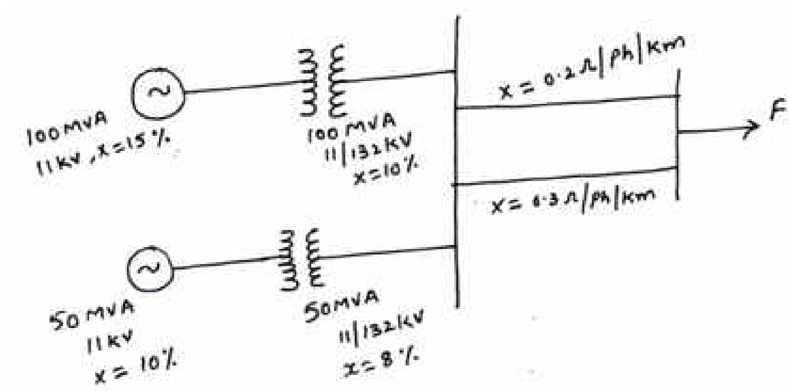
5 The following figure shows a generating station feeding a 132 kV system. Determine the total fault current fault level and fault current supplied by each alternator for a 3-phase fault at the receiving end bus. The line is 250 kM long. [15]



6 a) Explain the physical significance of symmetrical components. [7]

b) Three identical Y-connected resistors from a load bank with a three phase rating of 3.2kV, 750 kVA. The applied voltages are $|V_{ab}| = 3.84\,kV, |V_{bc}| = 2.56\,kV, |V_{ca}| = 3.2\,kV$. Find the line voltages and currents in P.u using symmetrical components. [8]

7 a) Distinguish between symmetrical and unsymmetrical faults. [6]

b) A 20 MVA, 11kV generator solidly grounded neutral has a subtransient reactance of 0.25 P.u. The negative and zero sequence reactances are j0.14, j 0.07 respectively. A SLG fault occurs at the terminals of an unloaded generator. Determine the fault current and line to line voltages. [9]

8 a) Describe the steady state stability power limit with necessary expressions. [7]

b) Using equal area criterion, derive an expression for critical clearing angle for a system having a generator feeding a large system though a double circuit line. [8]

Code No: **R32022** **R10** **Set No. 3**

III B.Tech II Semester Regular/Supplementary Examinations, May/June - 2015
POWER SYSTEM ANALYSIS
(Electrical and Electronics Engineering)

Time: 3 hours **Max. Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks
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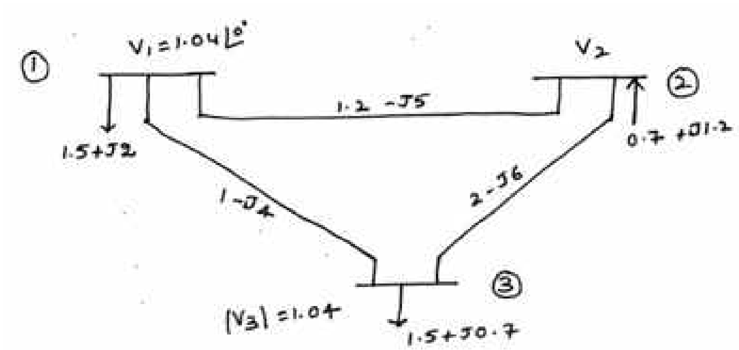
1 a) What are the steps needed for developing P.u impedance diagram of a given power system. [6]

b) Two generators rated at 10 MVA, 13.2 kV and 15 MVA, 13.2 kV respectively are connected in parallel to a bus. The bus feeds two motors rated 8 MVA and 12 MVA respectively with rated voltage 12.5 kV. The reactance of each generator is 15% and that of each motor is 20% on its own rating. Draw reactance diagram. [9]

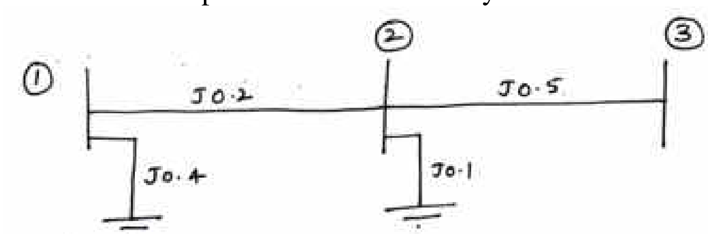
2 A three bus system is shown in below figure. Calculate the bus 2 voltage at the end of first iteration by G.S method. All values are in P.u [15]



3 a) Derive the necessary equations for elements of Jacobian using polar coordinates. [9]

b) Compare the G-S and N-R methods of load flow studies. [6]

4 Form the bus impedance matrix of the system shown in below figure. [15]



5 a) What are the steps needed for symmetrical fault calculations? [7]

b) What do you mean by synchronous machine reactance and explain its significance. [8]

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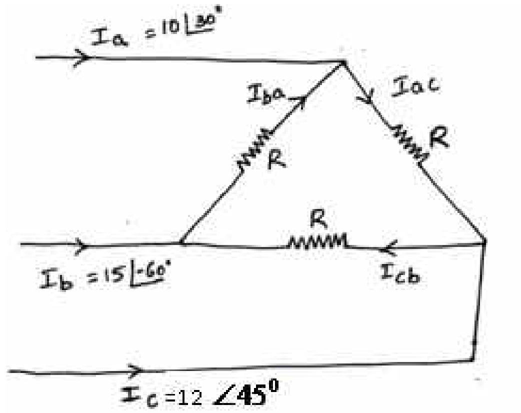
6	a)	Derive the expression for 3-Phase power in terms of symmetrical components.	[7]
	b)	A balance delta connected load is fed from unbalanced 3-Phase supply as shown in below figure. Find i) Symmetrical components of line currents ii) Symmetrical components of delta currents.	[8]



7	a)	Derive the necessary equation to determine the fault current for SLG fault, draw a diagram showing the interconnection of sequence networks.	[8]
	b)	A double line to ground fault occurs on a feeder. The sequence impedances upto fault points are (0.3 + j0.6), (0.3+j 0.55) and (1+ j 0.78) p.u. The fault resistance is 0.66 p.u. If voltage is $1\angle 0^0$, find fault current and voltage of faulty phases at fault point.	[7]
8	a)	How can the transient stability of a system be improved? Discuss the traditional as well as new approaches to the problem.	[8]
	b)	Find the rotor acceleration of a 50 Hz, 2 pole turbo generator rated 33 kV having 800 MJ of stored energy, if the mechanical input is suddenly raised to 120 MW for an electrical load of 70 MW.	[7]

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Code No: **R32022** **R10** **Set No. 4**

III B.Tech II Semester Regular/Supplementary Examinations, May/June - 2015
POWER SYSTEM ANALYSIS
(Electrical and Electronics Engineering)

Time: 3 hours **Max. Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks
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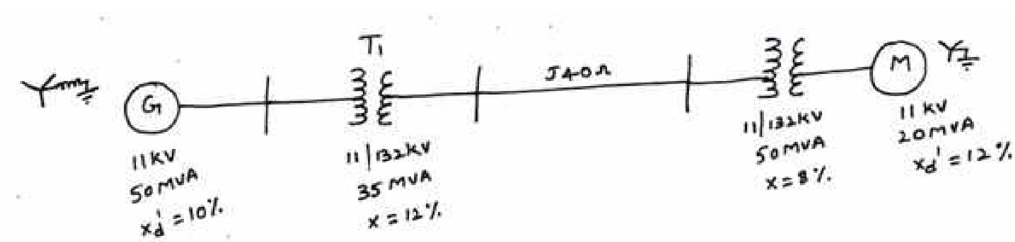
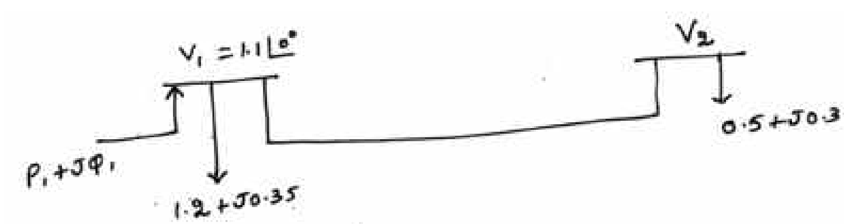
1 a) What are the advantages of per-unit quantities. [6]

b) Draw the p.u impedance diagram for the power system shown in below figure. [9]



2 a) Define i) Graph, ii) Tree and iii) incidence matrix. [5]

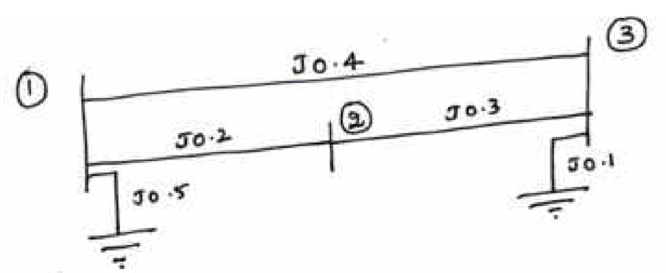
b) A two bus system is shown in below figure. Calculate the voltage at the end of second iteration by G-S method. The elements of bus admittance matrix are $Y_{11} = Y_{22} = 1.5\ \angle -86^0\ p.u\ and\ Y_{21} = Y_{12} = 1.8\angle 110^0\ Pu$ [10]



3 a) Derive equations for elements of Jacobin for fast decoupled method. State the assumptions that are considered. [9]

b) Write an algorithm for N-R load blow method using rectangular coordinates. [6]

4 Form the bus impedance matrix of the system shown in below figure. [15]



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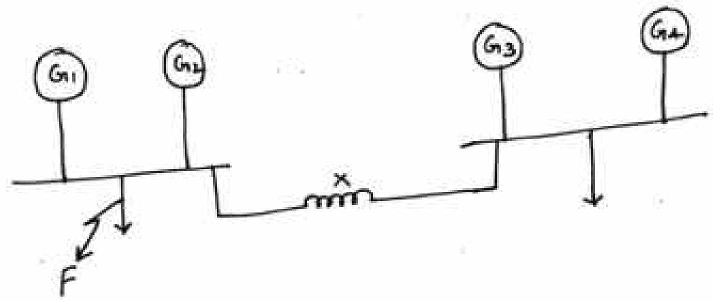
5 Figure shows a system having 4 alternators each rated at 11 kV, 50 MVA and each having a subtransient reactance of 15%. Find a) fault level for a fault on one of the feeders(near the bus) with zero value of reactance X (b) the reactance of the current limiting reactor X to limit the fault level to 800 MVA for a fault on one of the feeder(near the bus). [15]



6 a) Explain the principle of symmetrical components. Derive the necessary equations to convert phase quantities into symmetrical components. [9]

b) One conductor of a three phase line is open. The current flowing through the line 'a' is 5A. Assuming line 'c' is open, find symmetrical components of the line currents. [6]

7 a) In what respects are the fault calculations, for a fault on the alternator terminals, different from the fault calculations for a fault in a power system network. [7]

b) An alternator has the following sequence impedances $Z_1 = 0 + J1.0,\ Z_2 = 0.1 + J0.2, Z_0 = 0 + J1.0\,ohm$. The line to neutral voltage at the generator terminals is 1000 V. A fault between yellow and blue phases occurs. Determine the fault current and phase voltage of the healthy phase. [8]

8 a) Starting from first principle derive the swing equation of a synchronous machine. [7]

b) Explain the concept of equal area criterion. How can it be used to study transient stability? [8]

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