Reg. No. : | | | | | | | | | | |

Question Paper Code: 31533

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2016

Fifth Semester

Electrical and Electronics Engineering

01UEE503 - POWER SYSTEM ANALYSIS

(Regulation 2013)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 2 = 20 Marks)

1. What is per unit and give the advantages of per unit?
2. What is single line diagram?
3. What is an acceleration factor? and what is the need for slack bus in a power systems?
4. What are the drawbacks of Newton-Raphson methods?
5. What is the reason for transients during short circuits?
6. Define bolted fault.
7. What is sequence operator?
8. Define fault MVA?
9. What is meant by power angle curve?
10. Define critical clearing time.

PART - B (5 x 16 = 80 Marks)

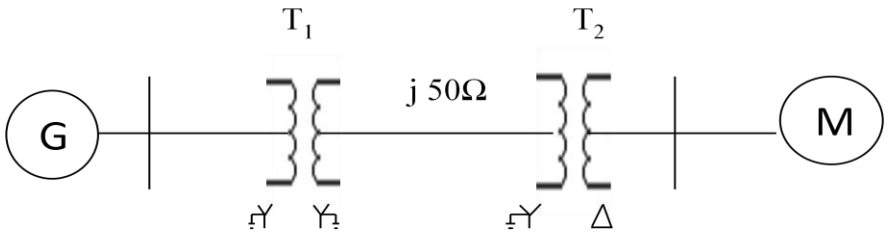
11. (a) Draw the reactance diagram for the power system shown in below figure. Neglect resistance and use a base of 100 *MVA*, 220 *KV* in 50 Ω line. The ratings of generator, motor and transformer are given below.

Generator : 40*MVA*, 25 *KV*, *X"* = 20%

Motor : 50*MVA*, 11 *KV*, *X"* = 30%

Y-Y Transformer : 40*MVA*, 33/220 *KV* , *X* = 15%

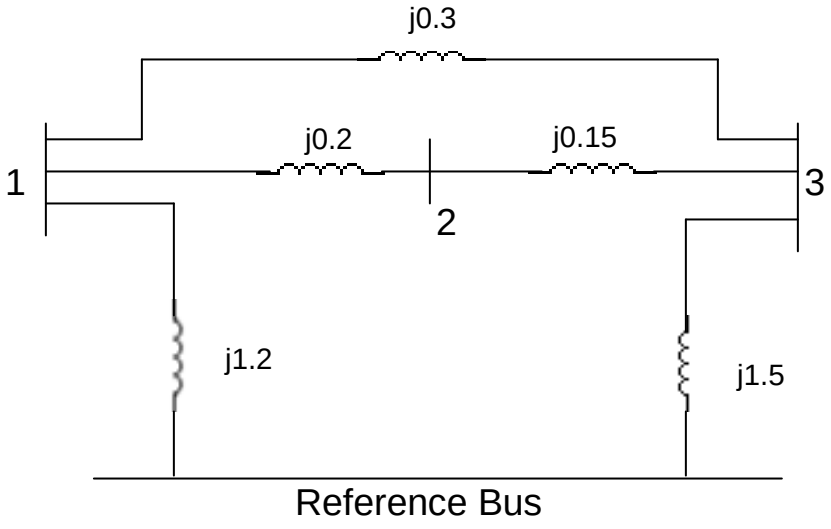
Y-Δ Transformer : 30*MVA*, 11/220 *KV (Δ/Y)*, *X* = 15%



(16)

Or

(b) Determine Z bus using Building algorithm for a power system whose reactance diagram is given in below figure.

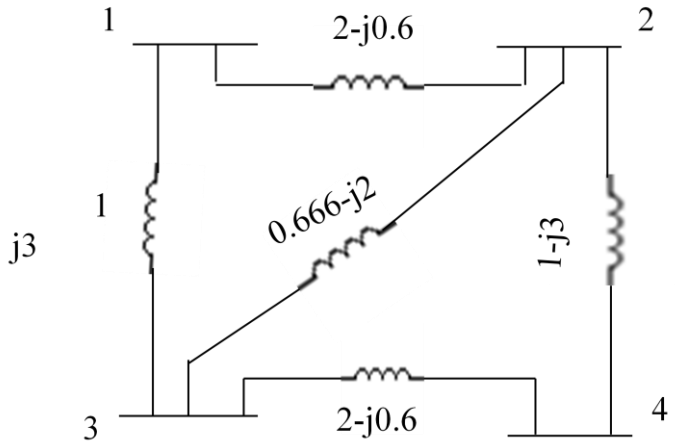


(16)

12. (a) Clearly the algorithmic steps for solving load flow equations using Newton-Raphson method (polar form) when the system contains all types of buses. Assume that the generators at the P-V buses have adequate Q- limits. (16)

Or

(b) For the sample system shown in below figure the generators are connected at all the four buses, while the loads are at buses 2 and 3. Values of real and reactive powers are listed in table, Bus 2 be a PV bus with $V2 = 1.04\ P.U$ and bus 3 and 4 are PQ bus. Assuming a flat voltage start, find bus voltages and bus angles the end of first Gauss seidel iterations. And consider the reactive power limit as $0.2 \leq Q_2 \leq 1$. (16)



Bus	Real power(P.U)	Reactive power(P.U)	Vp(P.U)	Remarks
1	--	--	$1.04\angle 0^o$	Slack bus
2	0.5	$0.2 \leq Q_2 \leq 1$	1.04P.U	PV bus
3	-1.0	0.5	--	PQ bus
4	0.3	-1.0	--	PQ bus

13. (a) Explain the step by step procedure for systematic fault analysis for three phase fault using bus impedance matrix. (16)

Or

(b) The bus impedances matrix of 4 bus system with values in P.U is given by,

$$Z\,\text{bus} = j\begin{pmatrix} 0.15 & 0.08 & 0.04 & 0.07 \\ 0.08 & 0.15 & 0.06 & 0.09 \\ 0.04 & 0.06 & 0.13 & 0.05 \\ 0.07 & 0.09 & 0.05 & 0.12 \end{pmatrix}$$

In this system generators are connected to buses 1 and 4 and their sub transient reactances were included when finding *Z* bus. If prefault current is neglected, find the sub transient current in P.U in the fault for a 3 *ph* fault on bus-4. Assume pre fault voltage as 1 P.U. If the sub transient reactances of generator in bus 2 is 0.2 P.U., find the sub transient fault current supplied by generator. (16)

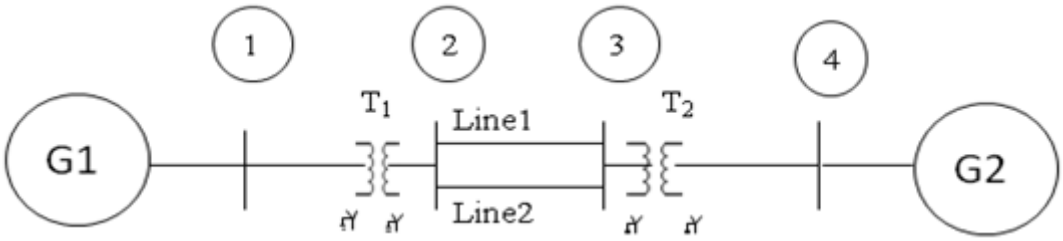
14. (a) Determine the fault current and *MVA* at faulted bus for a line to ground (solid) fault at bus 4 as shown in below figure

Generator : 100 *MVA*, 11 *KV*, $X^{+} = X^{-} =$ 15% $X^{o}_{=}$ 5% X^{n} =6%

Transformer T_1, T_2 : 100*MVA*, 11/220 *KV*, X_{leak} = 9%

L1, *L2* : $X^{+} = X^{-}$ = 10% $X^{o}_{=10}$ % on a base of 100 *MVA*

Consider a fault at phase '*a*'.



(16)

Or

(b) Draw the sequence network connection for LL fault at any point in a power system. From that obtain an expression for the fault current. (16)

15. (a) Derive swing equation for a single machine connected to infinite bus system. State the usefulness of this equation. State the reasons for non linearity of this equation. (16)

Or

(b) State and explain equal area criterion in connection with transient stability analysis. What are the advantages and limitations of this method? (16)