A **Reg. No. :** | | | | | | | | | | |

Question Paper Code: 55302

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2024

Fifth Semester

Electrical and Electronics Engineering

15UEE502 - POWER SYSTEM ANALYSIS

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. What is the per unit impedance Z(Pu) in a three phase system? CO1- R

   (a) $(Z * (MVA)_B) / (KV)^2$ (b) $(1000 * (KV)_B) / \sqrt{3}\ I_B$

   (c) $(Z * (KV)^2) / (MVA)_B$ (d) None of the above

2. What is the formula to calculate the (kV)B on the LT section? CO1- R

   (a) (kV)B onHT section * (HT voltage rating) / (LT voltage rating)

   (b) (kV)B on LT section * (HT voltage rating) / (LT voltage rating)

   (c) (kV)B on HT section * (LT voltage rating) / (HT voltage rating)

   (d) (kV)B on LT section * (LT voltage rating) / (HT voltage rating)

3. What is infinite bus in power system? CO2- R

   (a) A large system with infinite voltage

   (b) A large system in which the voltage and frequency varies

   (c) A large system whose voltage and frequency remains constant throughout

   (d) Both (a) and (b)

4. What type of convergence takes place in NR method? CO2- R

   (a) Linear convergence (b) Geometric convergence

   (c) Quadratic convergence (d) All of the above

5. What will be the value of current Ia, if the fault occurs between the lines B, C and ground? CO3- R

(a) Ia = 1 (b) Ia = 0 (c) Ia = ∞, (d) Ia = - (Ib + Ic)

6. Four identical alternators each are rated for 20 MVA, 11 KV having a subtransient reactance of 16% are working in parallel. The short circuit level at the busbar is CO3- R

(a) 500 MVA (b) 400 MVA (c) 125 MVA (d) 100 MVA

7. What is the fault current expression in case of LLG faults? CO4- R

(a) $I_f = 3\ Ia1$ (b) $I_f = 0$ (c) $I_f = 3\ Ia0$ (d) $I_f = Ia1$

8. What percentage of faults occurring is single line to ground fault? CO4- R

(a) 50 % (b) 60 % (c) 35 % (d) 70 %

9. Why are the series capacitors used? CO5- R

(a) Improve the voltage

(b) Reduce the fault level

(c) Improves the power factor

(d) Compensate for line inductive reactance and improve the stability of the power system

10. Which among these is related to the critical clearing time of a fault in a power system? CO5- R

(a) Transient stability limit (b) Steady state stability limit

(c) Frequency limit (d) All of these

PART – B (5 x 2= 10 Marks)

11. Define per unit value of an electrical quantity and write the equation for base impedance for a three phase power system. CO1-R

12. What is slack bus? Explain why one of the bus in the system is taken as slack bus in load flow studies? CO2-R

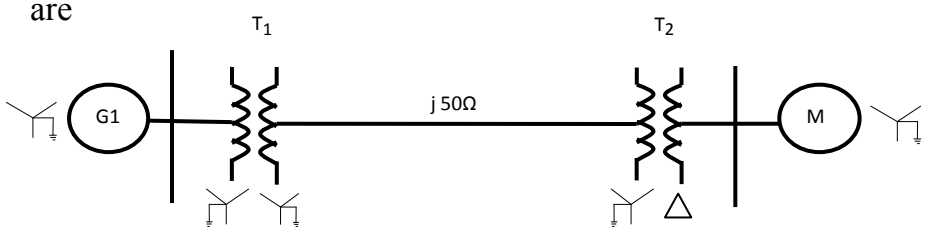
13. What is symmetrical fault? CO3-R

14. What are the symmetrical components of a three phase system? CO4-R

15. State equal area criterion. CO5-R

PART – C (5 x 16= 80Marks)

16. (a) Draw the per unit reactance diagram for the power systems shown below. Neglect resistance and use a base of 100MVA, 220KV in 50 ohms line. The ratings of the generator, motor and transformers are — CO1-App (16)



G: 40MVA, 25KV, X'' = 20%
M: 50MVA, 11KV, X'' = 30%
T_1: 40MVA, 33 Y/ 220Y KV, X = 15%
T_2: 30MVA, 11 Δ / 220Y KV, X = 15%

Or

(b) Draw the network and find bus admittance matrix for the parameters of 4-bus system are as given below. — CO1- App (16)

Line starting bus	Line ending bus	Line impedance	Line charging Admittance
1	2	0.2+j0.8	j0.02
2	3	0.3+j0.9	j0.03
2	4	0.25+j1.0	j0.04
3	4	0.2+j0.8	j0.02
1	3	0.1+j0.4	j0.01

17. (a) The system data for a load flow solution are given in table1 & table II. Determine the voltages at the end of first iteration by Gauss-Seidel method. Take $\alpha = 1.6$. — CO2- App (16)

Line Admittances

Buscode	Admittance
1-2	2-j8
1-3	1-j4
2-3	0.666-j2.664
2-4	1-j4
3-4	2-j8

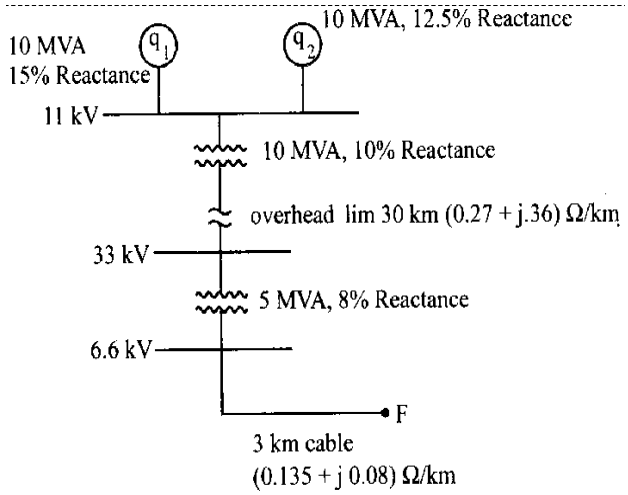
Bus Specifications

Bus code	P	Q	V	Remarks
1	-	-	$1.06\angle 0^0$	Slack
2	0.5	0.2	-	PQ
3	0.4	0.3	-	PQ
4	0.3	0.1	-	PQ

Or

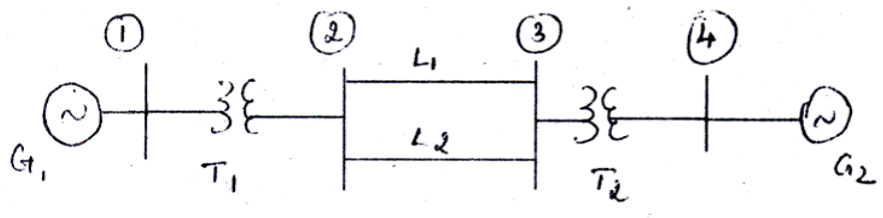
(b) Develop an algorithm and draw an flow chart for the solution of load flow problem by Newton Raphson(NR) method. CO2- App (16)

18. (a) For a radial network shown below a three phase fault occur at F. Determine the fault current and the line voltage at 11 KV bus under fault conditions. CO3- App (16)



Or

(b) A symmetrical fault occurs at bus 4 for the system shown below. Determine the fault current and post fault voltages using Z bus building algorithm. CO3- App (16)



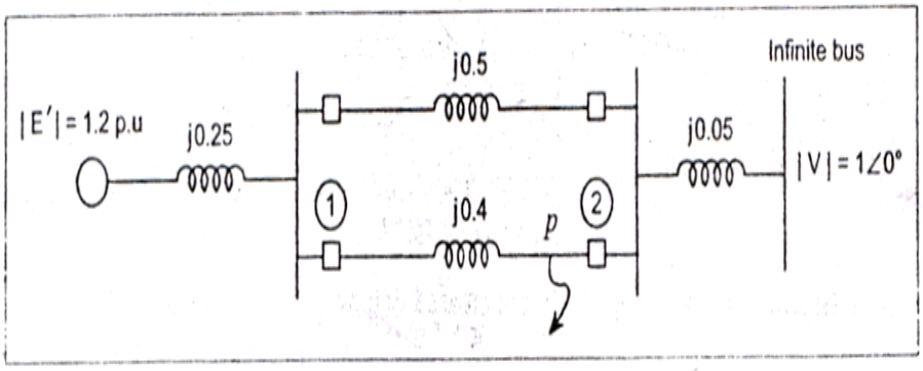
G1,G2: 100MVA,20kV,X=15%
Transformer leakage: $X_{leakage}$=9%
L1,L2: X=10%

19. (a) A salient – pole generator without dampers is rated 20 MVA, 13.8 kV and has a direct axis subtransient reactance of 0.25 per unit. The negative and zero sequence reactance's are 0.35 and 0.10 per unit respectively. The neutral of the generator is solidly grounded. Determine the sub- transient current in the generator and the line – to – line voltages for subtransient conditions when a single line – to – ground fault occurs at the generator terminals with generator operating unloaded at rated voltage. Neglect resistance. CO4- App (16)

Or

(b) Derive the necessary equation to determine the fault current for a single line to ground fault. Draw a diagram showing the inter-connection of sequence networks. CO4- App (16)

20. (a) A there phase fault is applied at the point P as shown in Fig. Find the critical clearing angle for clearing the fault with simultaneous opening of the breakers 1 and 2. The reactance values of various components are indicated in the diagram. The generator is delivering 1.0 p.u power at the instant preceding the fault. CO5- App (16)



Or

(b) Derive the swing equation of single machine connected to a infinite bus and draw the swing curve. CO5- App (16)

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