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

Question Paper Code: 96302

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

Sixth Semester

Electrical and Electronics Engineering

19UEE602 – Power System Analysis

(Regulations 2019)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. The per unit of transformer is …. CO1- U

   (a) Larger if computed from primary side than from secondary side

   (b) The same whether they computed form primary or secondary

   (c) Always Zero

   (d) Always infinity

2. In an n-bus power system, considering n nodes network, the size of the Y_{bus} is…. CO1- U

   (a) (n-1) x (n-1) (b) (n+1) x (n+1) (c) n x n (d) 2n x 2n

3. For accurate load flow calculations on large power systems, the best method is….. CO2- U

   (a) Gauss Seidal (b) Newton Raphson (c) Fast Decoupled (d) Gauss Elimination

4. Which of the following matrix is used for load flow studies? CO2- U

   (a) Impedance matrix (b) Jacobian Matrix

   (c) Admittance matrix (d) Sparse matrix

5. Which among these is the most severe fault? CO3- U

   (a) L-G fault (b) L-L-G fault (c) L-L fault (d) Symmetrical fault

6. Which among the following methods are generally used for the calculation of symmetrical faults? CO3- U

   (a) Norton theorem (b) Thevenin’s theorem (c) Kirchhoff’s laws (d) All of these

7. What is the value of zero sequence impedance in line to line faults? CO4- U

(a) $Z_0 = 1$ (b) $Z_0 = \infty$ (c) $Z_0 = 3\, Z_n$ (d) $Z_0 = 0$

8. The value of the zero sequence impedance is… CO4- U

(a) 0 (b) Z+3n (c) Z+2n (d) Z

9. The Power Systems are operated with power angle around CO5- U

(a) 10^o (b) 30^o (c) 70^o (d) 80^o

10. The critical clearing time of a fault is power system is related to CO5- U

(a) Reactive power limit (b) Short circuit limit

(c) Steady-state stability limit (d) Transient stability limit

PART – B (5 x 2= 10 Marks)

11. Define per unit value. CO1- U

12. What do you mean by flat voltage start? CO2- U

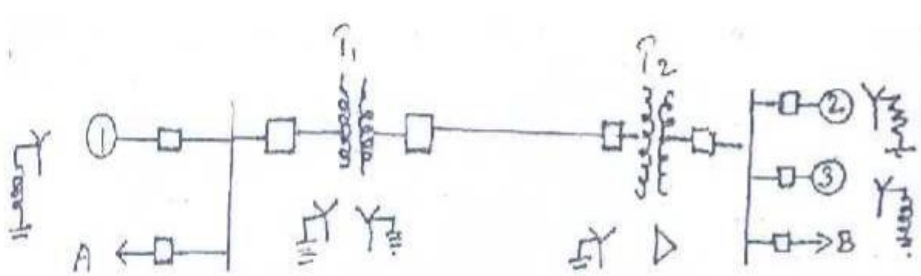
13. What are the major causes of fault in power system? CO3 -U

14. Write the symmetrical components of three phase system. CO4 -U

15. Define critical clearing time. CO5 -U

PART – C (5 x 16= 80Marks)

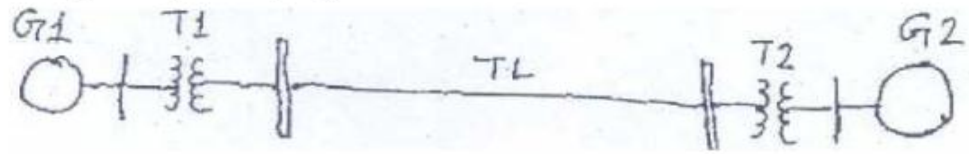
16. (a) Obtain the per unit impedance diagram of the power system shown in Fig CO1- U (16)



Generator No. 1: 30 MVA, 10.5 kV, X” = 1.6 Ohm
Generator No. 2: 15 MVA, 6.6 kV, X” = 1.2 Ohm
Generator No. 3: 25 MVA, 6.6 kV, X” = 0.56 Ohm
T1 (3phase): 15 MVA, 33/11 kV, X = 15.2 Ohm per phase on HT side
T2 (3phase): 15 MVA, 33/6.2 kV, X = 16 Ohm per phase on HT side
Transmission line: 20.5 Ohm/phase
Load A: 15 MW, 11kV, 0.9 P.F. lagging
Load B: 6.2KV, 34 MW+j20.07 MVAR.

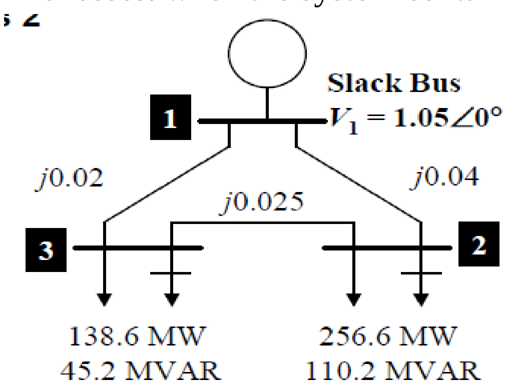
Or

(b) choosing a common base of 20 MVA, compute the per unit impedance (reactance) of the components of the power system shown in Fig. and draw the positive sequence impedance (reactance) diagram. CO1- U (16)



Gen 1 : 20 MVA, 10.5 kV, X” = 1.4 Ohm
Gen 2 : 10 MVA, 6.6 kV, X” = 1.2 Ohm
Tr 1 : 10 MVA, 33/11 kV, X = 15.2 Ohm per phase on HT side
Tr 2 : 10 MVA, 33/6.2 kV, X = 16.0 Ohm per phase on HT side
Transmission line : 22.5 Ohms per phase

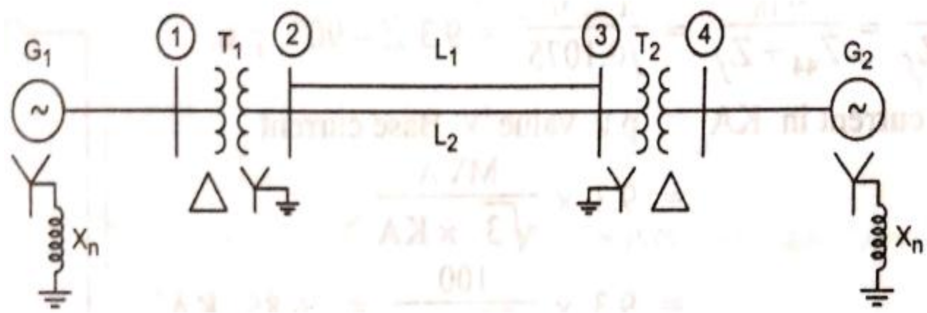
17. (a) Using Newton Raphson method, find the phasor voltages at buses 2 and 3. Find slack bus real and reactive power. Calculate line flows and line losses. when the system contains all types of buses CO2- U (16)



Or

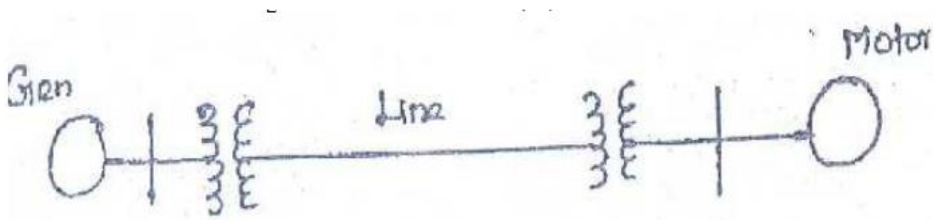
(b) With neat flow chart explain the computational procedure for load flowsolution using Fast Decoupled method when the system contains all types of buses CO2- U (16)

18. (a) Asymmetrical fault occurs on bus 4 of system shown in fig. compute the fault current, post fault voltage, line flow. CO3- App (16)
Generator G_1,G_2 = 100 MVA, 20 KV, X^+ =15 %
Transformer T_1,T_2 = X_{leak} = 9 %
Transmission line L_1,L_2 = X^+=10 %



Or

(b) A synchronous generator and a synchronous motor each rated 25 MVA, 11 kV having 15% sub-transient reactance are connected through transformers and a line as shown in fig. The transformers are rated 25 MVA,11/66 KV and 66/11 kV with leakage reactance of 10% each. The line has a reactance of 10% on a base of 25 MVA, 66 kV. The motor is drawing 15 MW at 0.5 power factor leading and a terminal voltage of 10.6 KV. When a symmetrical 3 phase fault occurs at the motor terminals. Find the sub-transient current in the generator, motor and fault. CO3- App (16)



19. (a) Derive the expression for fault current in Line-to-Line fault on an unloaded generator in terms of symmetrical components CO4- U (16)

Or

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

20. (a) Derive the swing equation of synchronous generator connected to infinite bus from the rotor dynamics and determining the swing curve of the above system using Runga-Kutta method. CO5- U (16)

Or

(b) Derive the power angle equation for a SMIB system. Also draw the power-angle curve CO5- U (16)