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**Question Paper Code: U5302**

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2023

Fifth Semester

Electrical and Electronics Engineering

21UEE502 - POWER SYSTEM ANALYSIS

(Regulations 2021)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. The off diagonal element of Y bus is called ..... and the diagonal element of Ybus is called..... CO1- U  
(a) Mutual & self-admittance (b) self & mutual- admittance  
(c) Mutual & self-impedance (d) self & mutual -impedance
2. For the formation of bus admittance matrix if a branch i is not connected to node j, then  $Y_{ij}$  is..... CO1- U  
(a) 0 (b) 1 (c) -1 (d) None of these
3. Which of the following matrix is used for load flow studies ? CO3- U  
(a) Jacobian Matrix (b) Admittance matrix (c) Impedance matrix (d) Sparse matrix
4. For accurate load flow calculations on large power systems, the best method is CO3- U  
(a) Gauss method (b) G-S method (c) N-R method (d) F- D method
5. Which among these is the most common occurring fault? CO4- U  
(a) Single line to ground fault. (b) Double line to ground fault  
(c) Ground Fault (d) Hysteris loss
6. Which among the following theorem are generally used for the calculation of symmetrical faults? CO4- U  
(a) Norton theorem (b) Thevenin theorem (c) Kirchhoff's laws (d) Maxwells theorem
7. The boundary condition in unbalanced fault is CO5- U  
(a)  $I_a + I_b + I_c \neq 0$  (b)  $I_a = I_b = I_c$  (c)  $I_a = I_b = I_c$  (d)  $I_b = I_a + I_c$

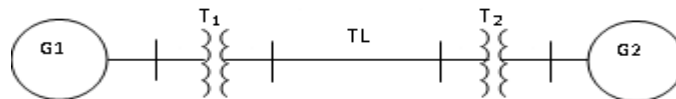
8. The value of  $a^2$  is CO5- U  
 (a) 1 (b)  $1 \angle 120$  (c)  $1 \angle 240$  (d) 0
9. Steady state stability of a power system is the ability of the power system CO6- U  
 (a) To maintain voltage at the rated voltage level  
 (b) To maintain frequency exactly at 50Hz  
 (c) To maintain a spinning reserve margin at all times  
 (d) To Maintain synchronism between machines and on external tie lines
10. The transient stability of power system can be effectively improved by CO6- U  
 (a) Excitation control (b) Phase shifting transformer  
 (c) Single pole switching of circuit breakers (d) Increasing the turbine valve opening

PART – B (5 x 2= 10Marks)

11. Classify the methods available to form bus admittance matrix. CO1- U
12. What do you mean by flat voltage start? CO3- U
13. Explain the significance of sub-transient and transient reactance in fault analysis. CO4- U
14. Write the symmetrical components of three-phase system. CO5- U
15. Define swing curve. What is its use? CO6- U

PART – C (5 x 16= 80Marks)

16. (a) Construct the structure and restructure of a power system and also model the Electricity market Entities. CO1- App (16)
- Or
- (b) Choosing a common base of 20 MVA on the transmission line, compute the per unit impedance (reactance) of the components of the power system shown in Fig. and draw the positive sequence impedance (reactance) diagram. CO2- App (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 high tension side

Tr 2: 10 MVA, 33/6.2 kV,  $X = 16.0$  ohm per phase on high tension side  
 Transmission line: 22.5 ohm per phase

17. (a) With neat flow chart explain the computational procedure for load flow solution using Newton Raphson method when the system contains all types of buses. CO3- App (16)

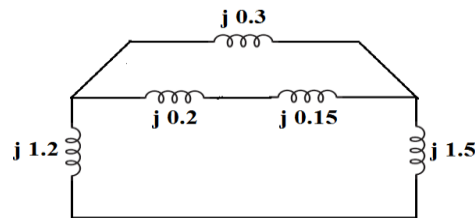
Or

- (b) Explain Fast decoupled method in detail and compare it with GS and NR methods. CO3- App (16)

18. (a) A synchronous generator and motor are rated 30,000 kVA, 13.2 kV and both have sub transient reactances of 20%. The line connecting them has a reactance of 10% on the base of the machine ratings. The motor is drawing 20 MW at 0.8 power factor leading and a terminal voltage of 12.8 kV when a symmetrical three-phase fault occurs at at the motor terminals.. Find the sub transient current in the generator, motor and fault by using the internal voltages of the machines. CO4- App (16)

Or

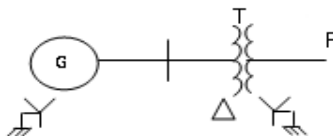
- (b) Using the method of building algorithm determine  $Z_{bus}$  for the network shown in figure where impedances are shown in p.u CO4- App (16)



19. (a) Develop the connection of sequence network when a line to line fault occurs in a power network. CO5- App (16)

Or

- (b) A 50 Hz, 50 MVA, 13.2 kV star grounded alternator is connected to a  $\Delta$  - Y transformer as shown in below figure. The positive, negative and zero sequence impedances of the alternator are 0.1, 0.1 and 0.05 pu respectively and that of transformer rated 13.2 kV  $\Delta$  / 120 kV Y 80 MVA with Y solidly grounded 0.1, 0.1 and 0.1 pu. Determine the fault current for a LG fault at point P. Draw the connection diagram for the sequence network for the fault. CO5- App (16)



20. (a) Derive Swing equation used for stability studies in power system. CO6- App (16)  
Or  
(b) State Equal area criterion .Derive the expression for critical CO6- App (16)  
clearing angle.