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Question Paper Code: U5302

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

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. Base impedance per phase is given by.... CO1- U
(a) $K_{vb} / MVAb$ (b) $(K_{vb})^2 / MVAb$ (c) $MVAb / (K_{vb})^2$ (d) $(MVAb)^2 / (K_{vb})$
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) $I_b = I_a + I_c$

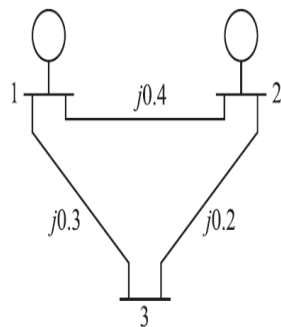
8. The value of a^2 is CO5- U
 (a) 1 (b) $1 \angle 120$ (c) $1 \angle 240$ (d) 0
9. Steady state stability of a power system is the ability of the power system CO6- U
 (a) To maintain voltage at the rated voltage level
 (b) To maintain frequency exactly at 50Hz
 (c) To maintain a spinning reserve margin at all times
 (d) To Maintain synchronism between machines and on external tie lines
10. By using which component can the transient stability limit of a power system be CO6- U
 (a) Series capacitor (b) Series resistance
 (c) Series inductor (d) Shunt resistance

PART – B (5 x 2= 10 Marks)

11. A 500 MVA, 11 kV synchronous generator has 0.2 pu synchronous reactance. CO2- App
 Solve the p.u reactance on the base value of 100 MVA and 22 kV.
12. What is the need for slack bus and how is it selected? CO3- U
13. Define Symmetrical faults. CO4- U
14. What is the significance of “a” operator? CO5- U
15. State Equal area criterion. CO6- U

PART – C (5 x 16= 80 Marks)

16. (a) Derive power flow equation from the fundamentals of power system and discuss various types of buses and their significance CO1- App (16)
 Or
 (b) For the system shown in Figure and data given in Table, determine the voltage at the end of the first iteration by Gauss–Seidal method CO2- App (16)
 .Assume MVA base as 100.



Bus	Voltage	Generator		Load		Q_{\min}	Q_{\max}
		P	Q	P	Q		
1	$1.05 \angle 0$	—	—	—	—	—	—
2	1.02	0.3	—	—	—	-10	100
3	—	—	—	0.4	0.2	—	—

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)

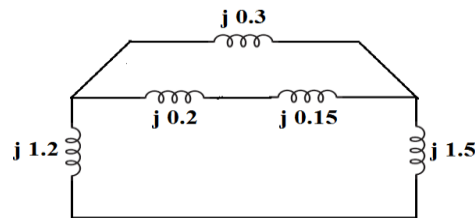
Or

- (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

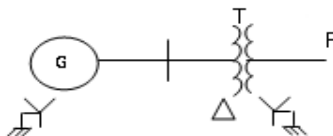
- (b) Using the method of building algorithm determine Z_{bus} for the network shown in figure where impedances are shown in p.u CO4- App (16)



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 Δ - 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 Δ / 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 the Swing equation describing the rotor dynamics of a synchronous machine connected to an infinite bus through a transmission line. CO6- App (16)

Or

(b) Derive the rotor dynamic equation for SMIB system and obtain its solution using RK method. CO6- App (16)