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

Question Paper Code: 55302

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2018

Fifth Semester

Electrical and Electronics Engineering

15UEE502 - POWER SYSTEM ANALYSIS

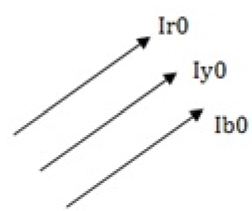
(Regulation 2015)

Duration: Three hours | Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. Which sequence component is represented by the following phasor?



(a) Positive sequence (b) Zero sequence
(c) Negative sequence (d) None of these

2. Determine half charging admittance if its series impedance is (0.2+j0.7)π/km and shunt admittance is j0.45*100.35 $* 10^{-5}$ /km. lines are rated at220kv.

(a) $1.756 * 10^{-6} l$ (b) $1.756 * 10^{-64} l$ (c) $1.756 * 10^{-5} l$ (d) $1.756 * 10^{-2} l$

3. Which among the following methods are highly accurate?

(a) Gauss Seidel method (b) Newton Raphson method
(c) Fast decoupled low flow method (d) All the above

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

(a) Linear convergence (b) Geometric convergence
(c) Quadratic convergence (d) All the above

5. What is the expression for fault current in line to line fault?

(a) $I_f = \sqrt{3} * (E_a / Z_1 + Z_2)$
(b) $I_f = 3 * (E_a / Z_1 + Z_2)$
(c) $I_f = \sqrt{3} * (E_a / Z_1 + Z_2 + Z_0)$
(d) $I_f = 3 * (E_a / Z_1 + Z_2 + Z_0)$

6. What is the value of zero sequence impedance in line to line faults?

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

7. What is the value of negative sequence impedance?

(a) 1
(b) Z
(c) Same as positive sequence
(d) ∞

8. Which one is most severe fault

(a) 3 phase fault
(b) LG fault
(c) LL fault
(d) DLG fault

9. What is the result of frequency instability?

(a) Voltage collaps
(b) Frequency swings
(c) Tripping of generating units
(d) Both (b) and (c)

10. What are the main applications of the swing curves?

(a) Designing the rotor field windings
(b) Designing the protective devices
(c) Used to limit the size of the machine
(d) All the above

PART - B (5 x 2 = 10 Marks)

11. Define single line diagram.

12. Mention any three advantages of N-R method over G-S method.

13. What for short circuit capacity should be known at any bus? Write down the expression for SCC?

14. Write the boundary conditions for single line to ground fault.

15. Define steady state and dynamic stability with an example.

PART - C (5 x 16 = 80 Marks)

16. (a) Write the step by step procedure for building the Z_{bus}. (16)

Or

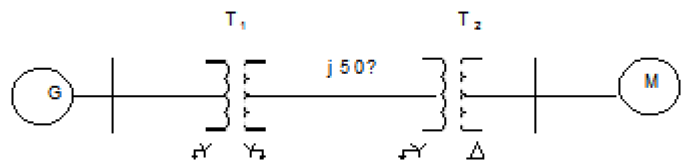
(b) Draw the reactance diagram for the power system shown in figure. Neglect resistance and use a base of 100MVA, 220KV in 50Ω line. The ratings of generator, motor and transformer are given below. (16)

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

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

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

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



17. (a) Clearly expalin the algorithmic steps for solving load flow equations using Gauss Seidel method when the system contains all types of buses. Assume that the generators at the P-V buses have adequate Q-limits. (16)

Or

(b) Consider the power system with the following data:

$$Y\text{ bus} = \begin{bmatrix} -j12 & j8 & j4 \\ j8 & -j12 & j4 \\ j4 & j4 & -j8 \end{bmatrix}$$

Bus No.	Type	Generation		Load		Voltage	
		P	Q	P	Q	Magnitude	Angle
1	Slack	-	-	-	-	1.0	0
2	PV	5.0	-	0	-	1.05	-
3	PQ	0	0	3.0	0.5	-	-

Assume that the bus 2 can supply any amount of reactive power. With a flat voltage start, perform the first iteration of power flow analysis using NR method. (16)

18. (a) Explain the step by step procedure for symmetrical 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

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

In this system, generators are connected to buses 1 and 4 and their sub transient reactances were included when finding Z bus . If pre fault 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)

19. (a) A synchronous generator and motor are rated 30 MVA, 13.2kV and both have sub transient reactance of 20%. The line connecting them has reactance of 10% on the base of machine ratings. The motor is drawing 20,000kW at 0.8 pf leading and terminal voltage of 12.8kV when a symmetrical 3 phase fault occurs at the motor terminals. Find the sub transient current in the generator, motor and fault point by using interval voltages of the machines. (16)

Or

(b) A 30MVA, 11KV, 3 synchronous generator has a direct sub transient reactance of 0.25p.u. The negative and zero sequence reactance are 0.35 and 0.1 p.u respectively. The neutral of the generator is solidly grounded. Find the sub transient current and the line-line voltage at the fault under sub-transient conditions when a line-line fault occurs at the terminals of the generator. Assume that the generator is unloaded and the operating at the rated voltage when the fault occur (16)

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

Or

(b) Derive the swing equation of synchronous generator connected to infinite bus from the rotor dynamics. (16)
