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

Question Paper Code : 19EE1A

# B.E / B.Tech DEGREE EXAMINATION, NOV / DEC 2021

*Fifth Semester*

**EE19501 - POWER SYSTEM ANALYSIS**

Electrical and Electronics Engineering

*(Regulations 2019)*

Time : Three Hours Maximum : 100 Marks

**Answer ALL Questions**

**PART A (10 x 2 = 20 Marks)**

1. Mention any two advantages of per unit system.
2. Why base values are needed in the analysis of power system?
3. Distinguish between Gauss Seidel method and Fast Decoupled method of load flow study.
4. How generator bus is defined in power system?
5. Give the reasons for occurrence of fault in power system.
6. When a fault is said to be bolted fault?
7. Write the importance of operator “a”.
8. Compare positive sequence impedance with negative sequence impedance.
9. Name some methods of improving transient stability limit of a power system.
10. State the term critical clearing time.

**PART B (5 x 13 = 65 Marks)**

11. a. Explain the modelling of various components for power flow analysis in detail.

**(OR)**

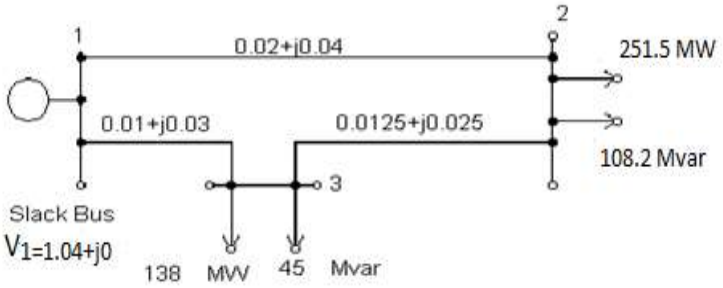
b. Form bus admittance matrix for a 4-bus system if the line series impedances are as given below.

| Line p-q | Impedance in p.u. |
|---|---|
| 1-2 | 0.145+j0.6 |
| 1-3 | 0.101+j0.41 |
| 1-4 | 0.145+j0.6 |
| 2-3 | 0.06+j0.21 |
| 3-4 | 0.06+j0.2 |

12. a. Explain the step by step procedure of Newton Raphson method of load flow solution.

**(OR)**

b. Figure below shows the one-line diagram of a simple 3 bus power system with generation at bus 1. The magnitude of voltage at bus 1 is adjusted to 1.04 p.u. The scheduled loads at buses 2 and 3 are as marked on the diagram. Line impedances are marked in p.u on a 100 MVA base. Determine the voltage at the end of first iteration using Gauss – Seidel method.




13. a. Explain how a symmetrical fault can be analysed using $Z_{BUS}$ with a neat flowchart.

**(OR)**

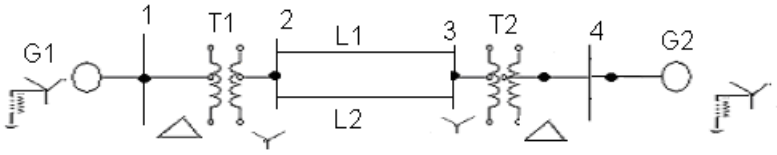
b. A synchronous generator and motor are rated for 30000 kVA, 13 kV and both have subtransient reactance of 20%. The line connecting them has a reactance of 10% on the base of machine ratings. The motor is drawing 20 MW at 0.86 p.f lagging and the terminal voltage of the motor is 12.6 kV when a symmetrical three phase fault occurs at the midpoint of the transmission line. Find the subtransient current in the generator, motor and fault point by using the internal voltage of the machines.

14. a. Derive the necessary equation to find the fault current for a line to line fault and draw its sequence networks.

**(OR)**

b. Determine the fault current in p.u. and MVA at faulted bus for double line to ground at bus 4 as shown in Figure. The ratings of the generators, transformers and transmission lines are:

G1 and G2: 100 MVA, 11 kV, $X_d'' = X_1 = X_2 = 14\%$; $X_0 = 5\%$; $X_n = 5\%$
T1 and T2: 100 MVA, 11 kV/220 kV, X = 9%;
L1 and L2: $X_1 = X_2 = 10\%$; $X_0 = 10\%$ on a base of 100 MVA.



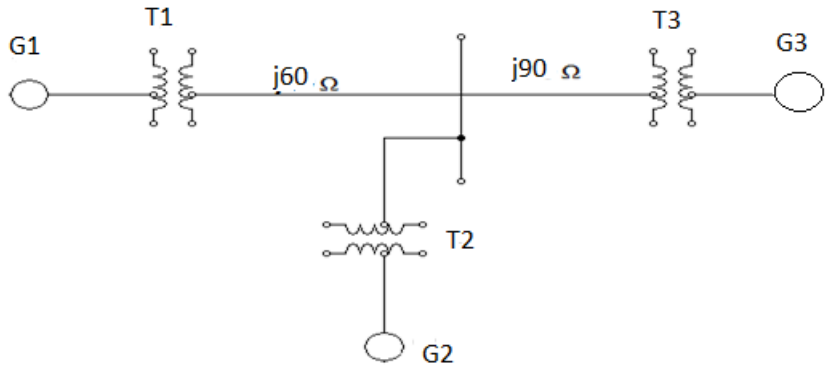

15. a. Obtain the Swing equation that is used for stability studies in power system.

**(OR)**

b. With detailed flowchart explain the modified Euler and Runge – Kutta methods of multi machine power system for stability.

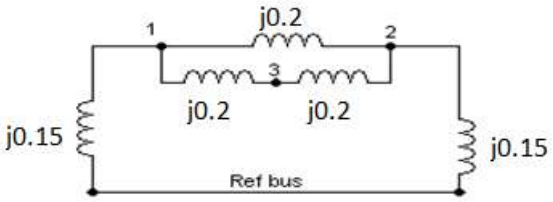
## PART C (1x15=15 Marks)

16. a. The single line diagram of an unloaded power system is shown in below Figure. The Generator and transformer ratings are:
G1: 20 MVA, 13 kV, X'' = 10%,
G2: 30 MVA, 18 kV, X''=10%,
G3 : 30 MVA, 20 kV, X'' = 10%,
T1 : 25 MVA, 13/220 kV (Δ/Y), X = 5%,
T2: 3 single phase units each rated 10 MVA, 127/18 kV(Y/Δ), X = 5%,
T3: 35 MVA, 220/22 kV (Y/Δ), X = 5%,
Draw the reactance diagram using a base of 100 MVA and 13 kV on the generator1.




**(OR)**

b. Form $Z_{BUS}$ matrix by using bus building algorithm method for the network shown in below figure where the impedances are given in p.u.




*****