



B.E DEGREE EXAMINATIONS: APRIL / MAY 2023

(Regulation 2018)

Sixth Semester

ELECTRICAL AND ELECTRONICS ENGINEERING

U18EE16203: Power System Analysis

COURSE OUTCOMES

- CO1:** Draw the reactance diagram for a given power system network and make load flow calculations.
- CO2:** Model the sequence networks in terms of symmetrical components.
- CO3:** Calculate the fault currents, voltages when symmetrical and unsymmetrical faults occur.
- CO4:** Analyze the stability of power system network using various methods.
- CO5:** Analyze load flow, fault and stability of power system network using simulation tool.

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 2 = 20 Marks)

(Answer not more than 40 words)

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|---|-----|-------------------|
| 1. Draw a single line diagram of a sample power system indicating all the essential components involved with its typical ratings. | CO1 | [K ₂] |
| 2. How are the base values chosen in per unit representation of power system? | CO1 | [K ₂] |
| 3. How will you formulate bus admittance matrix for a power system network? | CO1 | [K ₂] |
| 4. What do you mean by flat voltage start? | CO1 | [K ₁] |
| 5. What are the assumptions made in short circuit studies of large power system network? | CO3 | [K ₂] |
| 6. A network has a transient reactance of 25% with generator emf equal to 1 p.u. Compute the transient current in the network. | CO3 | [K ₂] |
| 7. Define positive sequence component with its phasors. | CO2 | [K ₁] |
| 8. Draw the sequence network for LLG fault in a power system network. | CO2 | [K ₁] |
| 9. List the methods of improving the steady state stability limit of power system. | CO4 | [K ₁] |
| 10. Define critical clearing time and on which factor critical clearing time depends? | CO4 | [K ₁] |

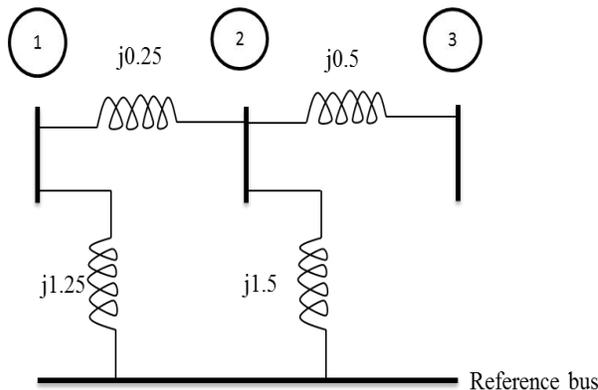
Answer any FIVE Questions:-
PART B (5 x 16 = 80 Marks)
(Answer not more than 400 words)

11. a) Two generators are rated as follows : 10 CO1 [K₂]
 G_1 : 50 MVA, 20 kV, Reactance 10%.
 G_2 : 100 MVA, 25 kV, Reactance 5%. Determine the reactance of the generator corresponding to base values of 200 MVA, 30 kV.
- b) A single phase transformer is rated at 110/440V, 1.5 kVA, leakage reactance measured from LT side of the transformer is 0.26 ohms. Determine the leakage reactance in p.u. 6 CO1 [K₂]

12. a) For a four bus system data given in table below, Formulate the bus admittance matrix. 6 CO1 [K₂]

Line (bus to bus)	Impedance in p.u	Half line charging admittance in p.u
1-2	$0.02+j0.08$	$j0.04$
1-3	$0.06+j0.24$	$j0.03$
2-3	$0.04+j0.16$	$j0.025$
2-4	$0.04+j0.16$	$j0.025$
3-4	$0.01+j0.04$	$j0.015$

- b) For a three bus power system network, obtain the complex bus bar voltage at bus 2 at the end of Gauss-Seidel first iteration. The line impedance connected between bus 1 and 2 is $(0.02+j0.04)$ p.u and impedance between bus 2 and 3 is $(0.04+j0.05)$ p.u. Voltage $V_1= 1.05$ p.u. $P_3+jQ_3= (-0.3+j0.6)$ p.u. , $V_2= 1.04$ p.u, $P_2= 0.5$ p.u. 10 CO1 [K₂]
13. a) Obtain the bus impedance matrix for the network shown in the following figure. 8 CO3 [K₂]



- b) An alternator and a synchronous motor each rated 25 MVA, 11 kV having 15% sub-transient reactance are connected through step up and step down transformers and a line. 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 0.8 p.f leading and a terminal voltage of 10.6 kV when a symmetrical three phase fault occurs at the motor terminals. Find the fault current at the motor terminals. 8 CO3 [K₂]
14. a) A set of three phase unbalanced currents are 6 CO2 [K₂]
 $I_a^0 = (100 + j50)A$, $I_a^1 = (546.3 + j156.46)A$, $I_a^2 = (48.9 - j21.85)A$.
Determine I_b.
- b) Derive the fault current for a line to line fault for an unloaded generator using symmetrical components. 10 CO3 [K₂]
15. a) Derive the swing equation and discuss its applications in the study of power system. 8 CO4 [K₂]
- b) Discuss the equal area criterion method applied to a machine swinging with respect to an infinite bus. 8 CO4 [K₂]
16. a) With a neat flow chart, explain the computational procedures for load flow solution using NR method, when the system contains all types of buses. 10 CO1 [K₂]
- b) Explain how the Electromagnetic Transient Analyzer Programme is used for power flow analysis. 6 CO5 [K₂]
