

JK Lakshmipat University Jaipur
INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination, May 2019
B. Tech. in Electrical Engineering, Semester VI

Roll No.....

Course Code : EE601 Power System Analysis

Time: 3.00 hours

Max. Marks: 40

Instructions to students:

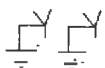
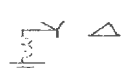
1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
- Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.

Answer all questions

Part A – (5 × 1.5 = 7.5 marks)

1. Draw the models used to represent generators in short circuit analysis?
2. Why the acceleration factor commonly used in load flow study? Where we use it?
3. Why the transient stability limit is lower than steady state stability limit?
4. Which sequence current flow through ground wire and why?
5. Two generator rated at 10 MVA, 13.2 kV and 15 MVA, 13.2 kV respectively are connected in parallel to a bus. The bus feeds two motors rated at 8 MVA and 10 MVA respectively. The rated voltage of motors is 12.5 kV. The reactance of each generator is 15% and each motor is 20% on its own rating. Assume 50 MVA, 13.3 kV base and draw reactance diagram.

Part B – (5 × 3 = 15 marks)

6. A wye connected synchronous generator has sequence reactances: $X_0 = .09$, $X_1 = .22$ and $X_2 = .36$ all in per unit. The neutral point of the machine is grounded through a reactance of .09 PU. The machine is running on no load with rated terminal voltage when it suffers an unbalanced fault. The fault currents out of the machine are $I_a = 0$, $I_b = 3.75 \angle 150^\circ$ and $I_c = 3.75 \angle 30^\circ$ in per unit with respect to the a phase line to neutral voltage.
 - (a) Determine terminal voltages in each phase of the machine with respect to ground
 - (b) voltage at neutral point with respect to ground.
 - (c) type of fault
7. Draw a general diagram which can be used to determine zero sequence network of a two winding transformer. Using this circuit, draw zero sequence network of
 - (i) Δ - Δ (ii) Y- Δ (iii)  (iv)  (v) 

8. An 11 kV, 25 MVA, three phase, star connected generator is connected through a reactor to feeder. The positive, negative and zero sequence reactance's of generator being, respectively, $j0.2$, $j0.1$, $j0.05$ pu. The star point of one of the generators is grounded through $j0.1$ pu. The positive, negative and zero sequence reactance's of reactor is $j0.1$ and feeder being, respectively, $j0.1$, $j0.1$, $j0.15$ pu. Estimate the fault current and voltage across grounding reactor when line to ground fault occurs at the end of feeder terminals.
9. Why load flow study is important? How busses and variables are classified? What are the restriction and assumption for load flow study?
10. A generator with transient reactance $=j0.2$ connected thru transformer with reactance of $j0.1$ to a bus that is then connected to metropolitan area, considered to be infinite bus, thru 2 parallel transmission lines that have a reactance. The impedance of each of the parallel transmission lines is $j0.5$ and the delivered power is 0.8 per unit when both the terminal voltage of the machine and the voltage of the infinite bus are 1.0 per unit. Determine the power angle equation for the system during the specified operating condition.

Part C – (2 × 5 = 10 marks)

11. Three 6.6 KV generators A, B, and C each of 10% leakage reactance and MVA ratings 40, 50 and 25 respectively electrically, as shown in figure by a tie bar through current limiting reactors. Each of 12% reactance based upon the rating of the machine to which it is connected. A three- phase feeder is supplied from the bus bar of generator A at a line voltage of 6.6 KV. The feeder has a resistance of 0.06ohm/phase and an inductive reactance of 0.12 ohm/phase. Estimate the maximum MVA that can be fed into a symmetrical short circuit at the far end of the feeder.

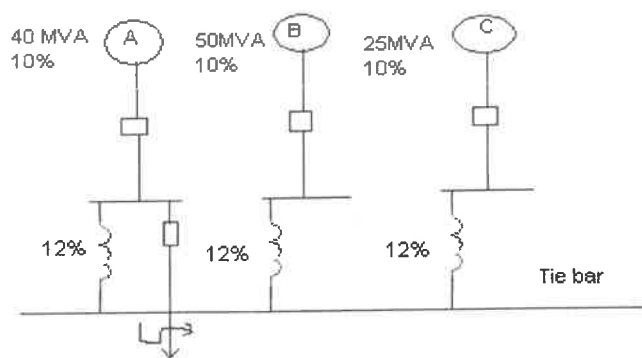


Figure 1

12. What is critical clearing angle? Illustrate the application of equal area criterion to study transient stability for a fault on one of the parallel circuit of a two circuit line feeding an infinite bus. The fault is very close to sending end bus and is subsequently cleared by the opening of faulted lines.

OR

12. (a) How can the transient stability of the system be improved? Discuss the traditional as well as new approaches to the problem.

(b) A three phase generator delivers 1.0 p.u, power to an infinite bus through a transmission network when a fault occurs. The maximum power which can be transferred during prefault, during fault and post fault conditions is 1.75 p.u, 0.4 p.u, 1.25 p.u. Find critical clearing angle.

Part D – (1 × 7.5 = 7.5 marks)

13. The given figure shows a four bus power system. Each line has an impedance $j 0.2$ p.u. The line shunt admittances may be neglected. The bus power and voltage specifications are given below.

(i) Form Y Bus.

(ii) Find Q_2 , δ_2 , V_3 , V_4 and V_5 after the first iteration using Gauss-Seidal method. Assume $Q_{2,\min} = 0.2$ p.u and $Q_{2,\max} = 0.6$ p.u.

Bus No.	P_L	Q_L	P_G	Q_G	V	Bus Specification
1	1.0	0.5	not specified	not specified	1.02 $\angle 0^\circ$	slack bus
2	0	0	2	not specified	1.02	PV bus
3	0.5	0.2	0	0	not specified	PQ bus
4	0.5	0.2	0	0	not specified	PQ bus

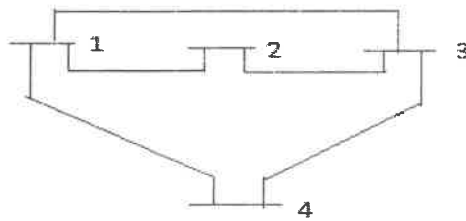


Figure 2

