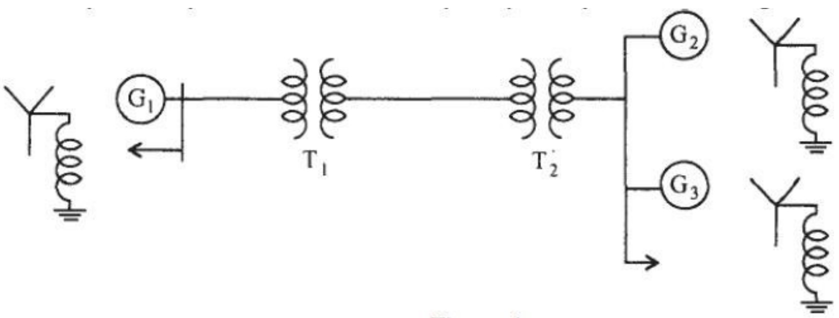
QUESTION BANK

BRANCH:EEE
SUB: Power System Analysis
YEAR/SEM/COURSE: III/II B.TECH

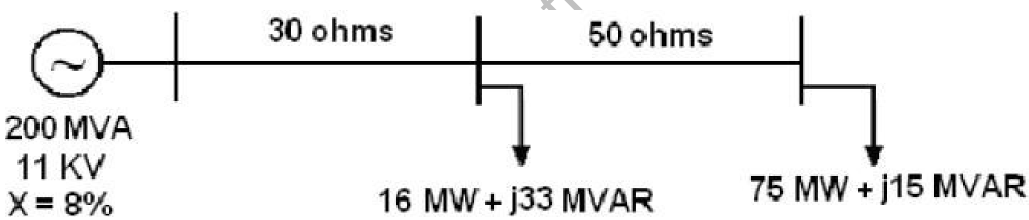
UNIT – 1

1. a) Obtain the per unit representation for the three-phase power system shown in figure 1 Figure



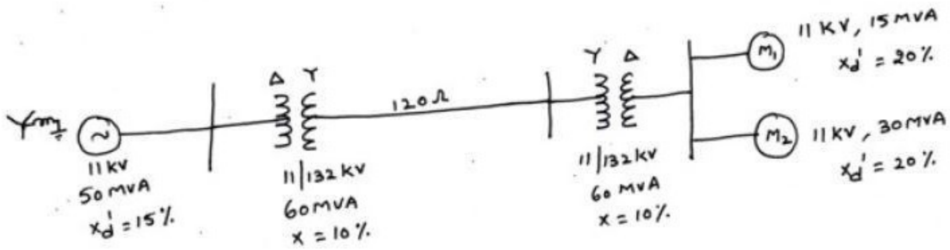
Generator 1 : 50 MVA; 10.5 KV; X = 1.8 ohm
Generator 2 : 25 MVA; 6.6 KV; X = 1.2 ohm
Generator 3 : 35 MVA; 6.6 KV; X = 0.6 ohm Transformer
T1 : 30 MVA; 11/66 KV; X = 15 ohm/phase
Transformer T2 : 25 MVA; 66/6.2 KV, as h.v. side X = 12 ohms
Transmission line: XL = 20 ohm/phase

2. a) Draw p.u impedance diagram of the network shown in figure.



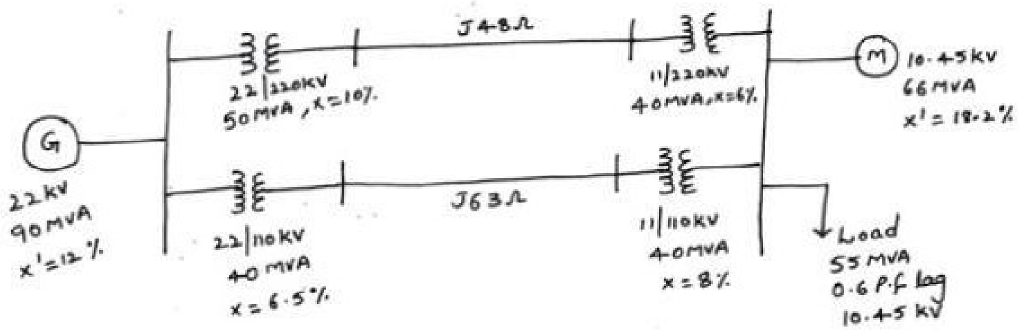
b) Why do you use a single line diagram for power system representation? What are the assumptions that are being made while drawing a single line diagram?

3. a) What is per unit system? How is the base quantities selected?
b) Draw the per unit impedance diagram for the power system shown in figure below.



4.

Draw the P.u impedance diagram for the power system shown in the figure below.



4.

5. a) Form Ybus for the network by direct inspection method:

Element	5-1	5-2	1-2	2-3	1-4	3-6	4-6
Positive sequence reactance	0.04	0.05	0.04	0.03	0.02	0.07	0.10

b)

Consider the system shown in Figure 1. Selecting 10,000 KVA and 110 KV as base values, find the p.u. impedance of the 200 ohm load referred to 110 KV side and 55 kV side.

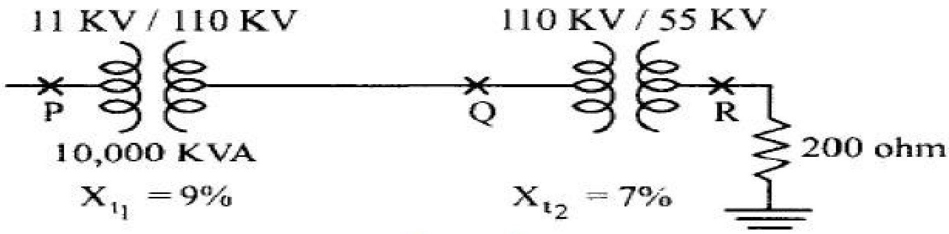


Figure 1

6.

a) Explain the importance of per-unit system.

b) Determine the incidence matrices A, B, *B'*, C, *C'* and K. From that verify the following relations for the figure 1, take 1 as ground bus
(i) $C_b = -B_L^T$ (ii) $A_b K^T = U$

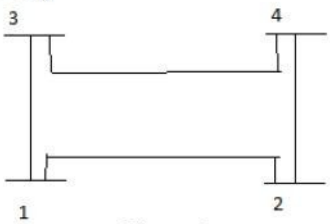
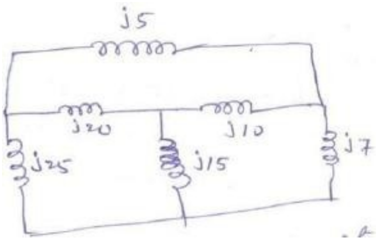


Figure 1

7. a) Write down the steps necessary to convert system parameters into per unit values.

b) Obtain Ybus by direct inspection method for the following network; assume the values are in p.u. admittances.



UNIT – 2

1.

a) Define voltage controlled bus (generator bus/PV bus).

b) Explain the step by step computational procedure for the Newton-Raphson method of load flow studies.

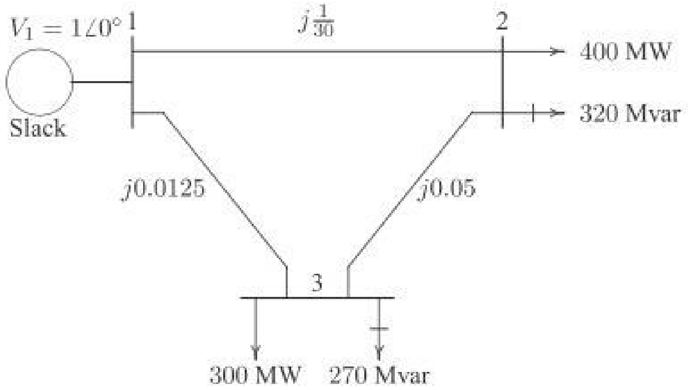
2.

a) What is swing bus (slack bus/reference bus)?

b) Explain the step by step computational procedure for the Gauss-Seidel method of load flow studies

3. A) Derive the basic equations for the load flow study using Gauss-Seidel method. With respect to this method, explain the following:
i) Acceleration factor. ii) Handling of PV buses.
B) What is Jacobian matrix? How the elements of Jacobian matrix are computed?

4. In fig shows the one-line diagram of a simple three-bus power system with generation at bus 1is$V$ 1.0 0o 1 = Đ per unit. The scheduled loads on buses 2 and 3 are marked on the diagram. Line impedances are marked in per unit on a 100 MVA base. For the purpose of hand calculations, line resistances and line charging susceptance re neglected.
Using gauss-Seidel method and initial estimates of V_2 =1.0 + j0$andV_3$ =1.0 + j0, determine V2 and V3. Perform two iterations.



5. a) List the quantities specified and quantities to be determined from the load flow study for the various types of buses
b) Write an algorithm for GS method when consider all types of buses
c) Develop the static load flow equations for load flow studies

UNIT – 3

1.

a) Form bus impedance matrix for the data given below.

Element number	Bus code From bus – To bus	Self impedance
1	2-3	0.6 p.u.
2	1-3	0.5 p.u.
3	1-2	0.4 p.u.

b) Explain the procedure for modification of Z_{bus} when a line is added or removed which has no mutual reactance.

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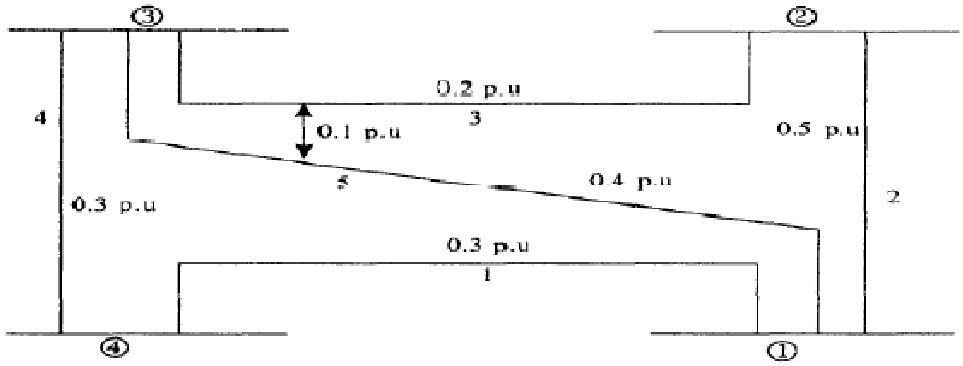
2.

Using the building algorithm construct Z_{BUS} for the system shown in figure 2. Choose 4 as reference bus.



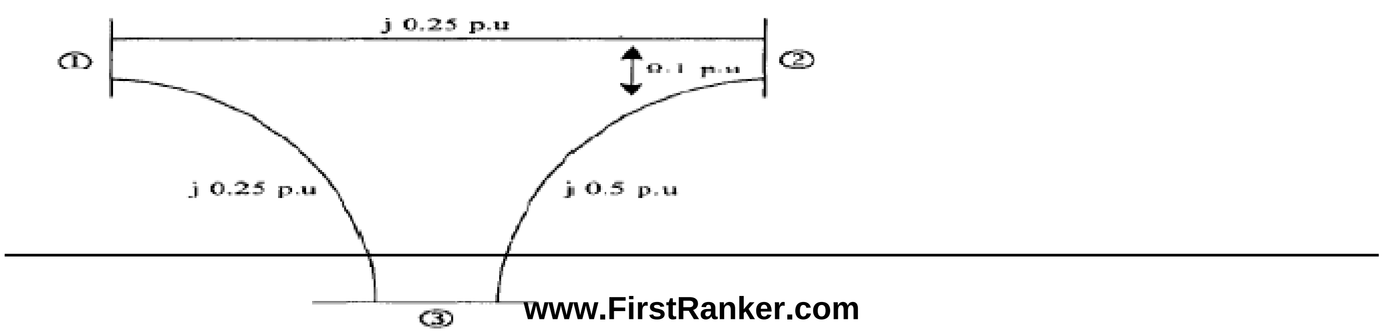
. Figure 2

3.
Impedances connected between various buses as follows:

X_{10}=1.2 , X_{30} = 1.3, X_{12}=0.23, X_{23} = 0.35, X_{24} = 0.12 and X_{43} = 0.3, where '0' is reference bus. All impedances are in P.u. find the bus impedance matrix for the networks connecting above impedances

4. Give the expressions for building Zbus for a power systems 1) Addition of a branch 2) Addition of a link

5. a) Compute the bus impedance matrix for the system shown in figure below by adding element by element. Take bus (2) as reference bus.



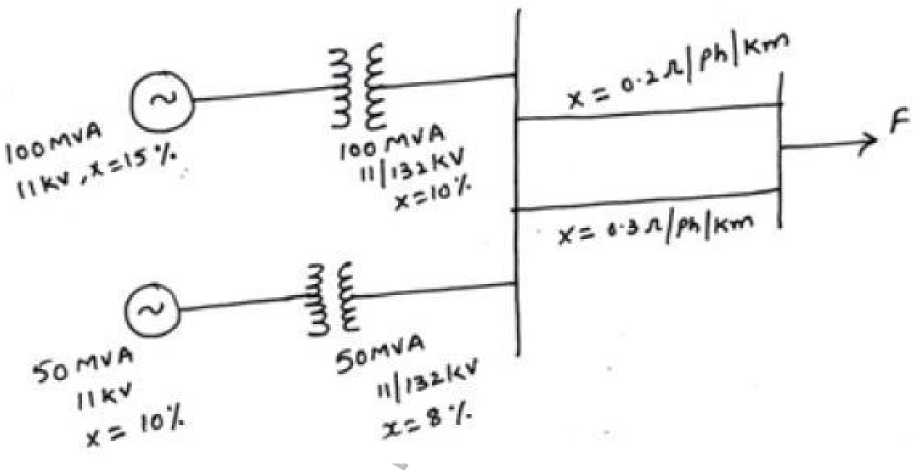
b) Give the applications of the ZBus building algorithm

UNIT – 4

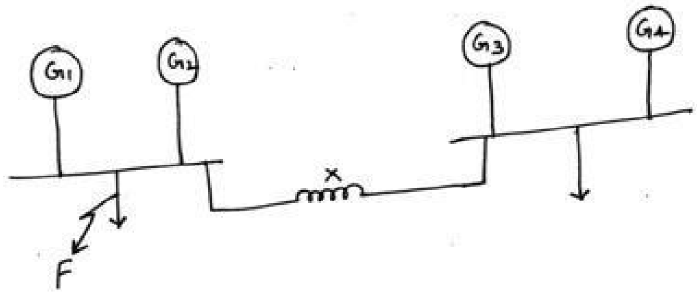
1. The short circuit MVA at the bus bars for a power plant A is 1200 MVA and for another plant B is 1000 MVA at 33 KV. If these two are to be interconnected by a tie-line with reactance 1.2 ohm. Determine the possible short circuit MVA at both the plants.
b) What are the harmful effects of short circuit faults on the power system?

2. a) There are two generating stations each which an estimated short circuit KVA of 500,000 KVA and 600,000 KVA. Power is generated at 11 KV. If these two stations are interconnected through a reactor with a reactance of 0.4 ohm, what will be the short circuit KVA at each station?
b) What do you understand by short-circuit KVA? Explain.

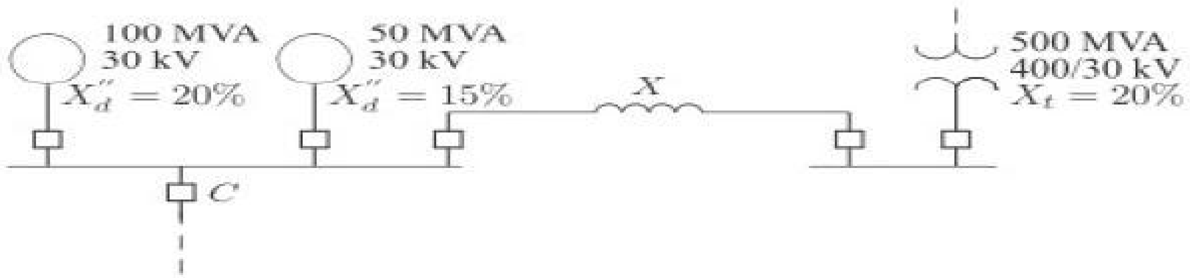
3. The following figure shows a generating station feeding a 132 kV system. Determine the total fault current fault level and fault current supplied by each alternator for a 3- phase fault at the receiving end bus. The line is 250 kM long.



4. Figure shows a system having 4 alternators each rated at 11 kV, 50 MVA and each having a subtransient reactance of 15%. Find a) fault level for a fault on one of the feeders(near the bus) with zero value of reactance X (b) the reactance of the current limiting reactor X to limit the fault level to 800 MVA for a fault on one of the
feeder(near the bus).



5. The system shown in Fig below shows an existing plant consisting of a generator of 100 MVA, 30 KV, with 20 percent sub transient reactance and a generator of 50 MVA, 30 KV with 15 percent reactance, connected in parallel to a 30-KV bus bar. The 30-KV bus bar feeds a transmission line via the circuit breaker C which is related at 1250 MVA. A grid supply is connected to the substation bus bar through a 500 MVA, 400/30KV transformer with 20 percent reactance. Determine the reactance of a current limiting reactor in ohm to be connected between the grid system and the existing bus bar such that the short –circuit MVA of the breaker C does not exceed.



UNIT – 5

1. a) What are the various types of faults? Discuss their frequency of occurrence and severity? Find the fault current when an L-L-G fault occurs at the terminals of an unloaded generator.

   b) Derive an expression for the positive sequence current Ia1 of an unloaded generator when it is subjected to a double line to ground fault.

2. a) What are symmetrical components? Explain the symmetrical component transformation.

   b) What is meant by sequence impedance? Explain the sequence network of an unloaded generator.

3. a) Prove that a line to ground fault at the terminals for an alternator with solidly grounded neutral is more severe than a three phase fault.

   b) Explain the zero sequence networks of transformers with diagrams.

4. Two 11kV, 20 MVA, 3f , star connected generators operates in parallel. The positive, negative and zero sequence reactance of each being respectively, j 0.18, j 0.15, j0.1P.u. The star point of one the generator is isolated and that of the other is earthed through a 2_ resistor. A

single line to ground fault occurs at the terminals of one of the generator. Determine i) fault current ii) current in ground resistor and iii) voltage across grounding resistor.

5. a) Distinguish between symmetrical and unsymmetrical faults.

b) A 20 MVA, 11kV generator solidly grounded neutral has a subtransient reactance of 0.25 P.u. The negative and zero sequence reactances are j0.14, j 0.07 respectively. A SLG fault occurs at the terminals of an unloaded generator. Determine the fault current and line to line voltages.

UNIT – 6

1. a) Derive the swing equation for a single machine connected to infinite bus system. State the assumptions if any and state the usefulness of this equation. Neglect the damping.

   b) Discuss the various factors affecting the transient stability of the system.

2. a) Explain the equal area criterion for the stability of an alternator supplying infinite bus via an inductor interconnector.

   b) Discuss the various methods for improving steady state stability.

3. a) Explain critical clearing time and critical clearing angle, deriving the expressions.

   b) Describe the methods of improving transient stability.

4. Draw a diagram to illustrate the application of equal area criterion to study Transient stability when there is a sudden increase in the input of generator.

5. (a) Derive an expression for the critical clearing angle for a power system consisting of a single machine supplying to an infinite bus, for a sudden load increment.

   (b) A 4 Pole, 50Hz, 11kV generator is rated 75 MW and 0.86 P.f lag the machine rotor has a moment of inertia of 9000kg.m2. Ffind the inertia constant in MJ/MVA and M constant or momentum in M-J sec/elec degree