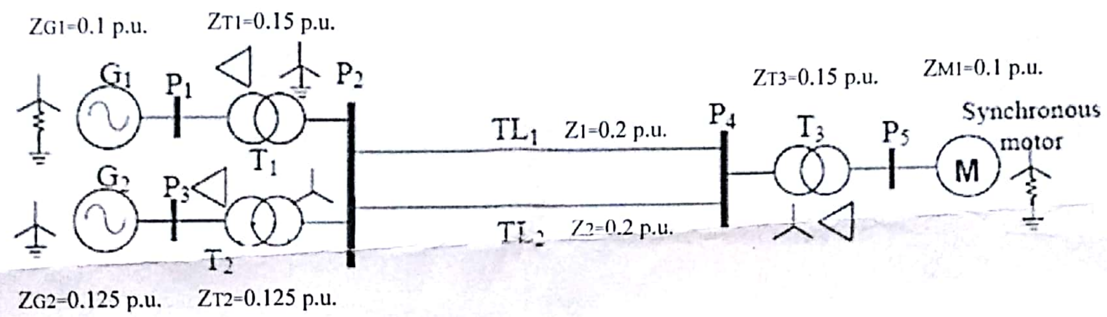
MAJOR EXAMINATION

POWER ENGINEERING - I (ELL 303)

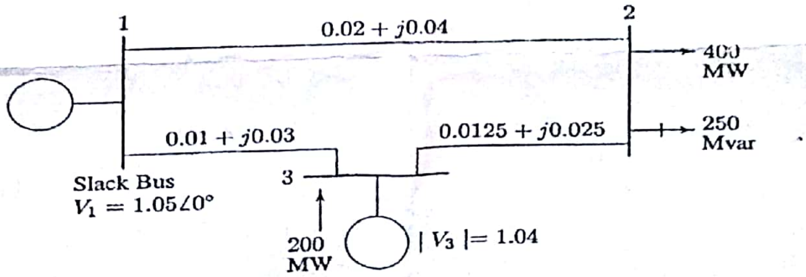
F.M.: 50 **Time: 2 Hours**

1. (a) Derive the expression for three phase complex power in terms of sequence components [3]
   (b) Draw the zero sequence network for the figure given below: [5]
   (All the values of the p.u. impedances are the zero sequence impedances)
   The grounding impedance, wherever present is 0.05 p.u.



2. A three-phase, 50 Hz, 500kV transmission line is 300 km long. The series impedance is z=0.045+j0.4 Ω per phase per km and the shunt admittance is y=j0.0004 Ω per phase per km. Calculate:
   (a) The ABCD parameters of the line. [4]
   (b) The transmission line efficiency if receiving end rated load is 800 MW, 0.8 p.f. lag at 500kV. [6]

3. For the system given below perform one iteration of Newton-Raphson load flow and calculate the line flows. [10]



P_2
P_3

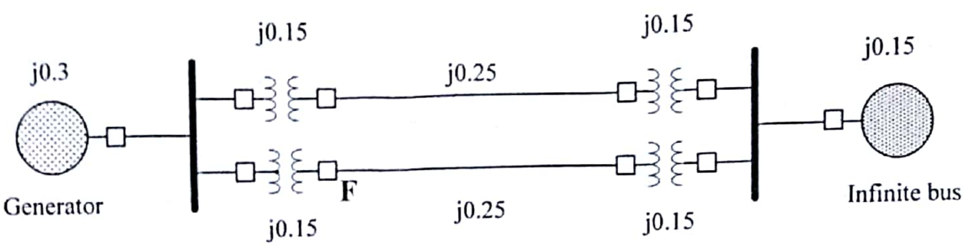
0.0325 + j 0.065
$V_2 I_2^* =$

83.58
86.82
170.4

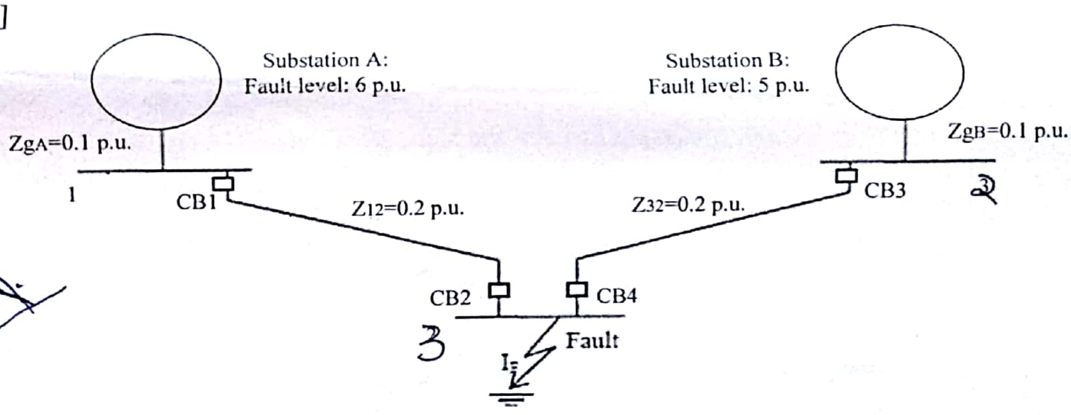
PTO

4. Determine the critical clearing angle for a generator for a three-phase fault at the point F (in the figure given below) when the generator is delivering 1 p.u power. Assume that the voltage behind transient reactance is 1.2 p.u. for the generator and that the voltage at the infinite bus is 1 p.u. [8]

Show the areas in the P - δ diagram. Find the critical clearing angle from the theoretical foundation equating both accelerating and de-accelerating area



5. In the figure given below containing two substations represented by Thevenin equivalent circuit as Substation A and Substation B. The Fault level is the short circuit current level at the substation with a voltage of 1p.u.. Find the fault current following a three-phase dead short circuit at bus number 3. [6]



6. (a) The reactances of an alternator rated 10 MVA, 5 kV are $X_1 = X_2 = 15$ % and $X_0 = 5$ %. The neutral of the alternator is grounded through a reactance of 0.4Ω. Single line to ground fault occurs at the terminals of the alternator. Determine the line currents, fault current and the terminal voltages. [4]

(b) Give a single line diagram of a 132 kV substation with one incoming and two outgoing feeders of 66 kV and 33 kV. Mark all the components used in the substation. [4]

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