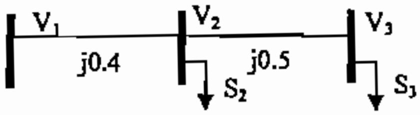
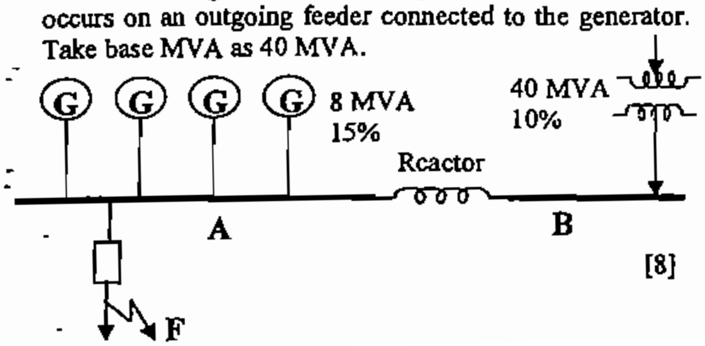
MAJOR EXAM
EEL 303

Time 02 Hrs   Full Marks : 80

1. Two voltage sources $V_1 = 120\angle 5^0$ V and $V_2 = 100\angle 0^0$ V are connected by a short line of impedance $Z = 1 + j7$. Determine the real and reactive power supplied or received by each source and the power loss in the line. [5]
2. The On line diagram of a three phase power system is shown, where the line impedances are marked in p.u. on a 100 MVA, 400 kV base. The load at bus 2 is S_2 = 15.93 MW – j 33.4 Mvar, and at bus 3 is S_3 = 77 MW + j 14 Mvar. It is required to hold the voltage at bus 3 at $400\angle 0^0$ kV .Determine the voltage at bus 2 and 1 . [5]

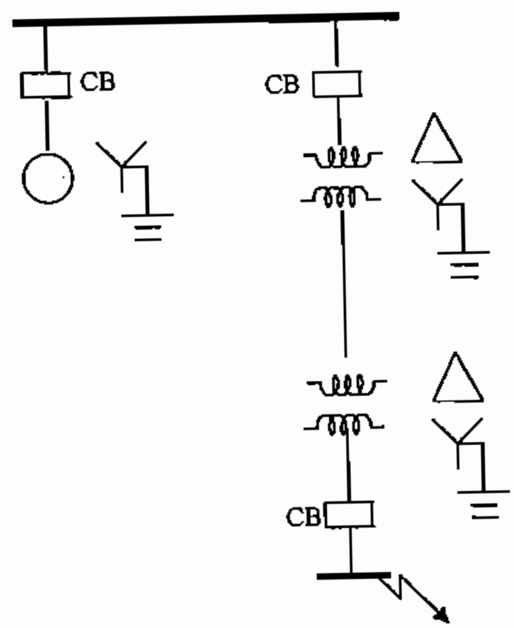


3. A three phase 60 Hz, 500 kV transmission line is 300 km long. The line inductance is 0.97 mH/km/ph and its capacitance is 0.0155 µF/km/ph. Assuming the line is lossless, Calculate the receiving end voltage when the line is terminated in an open circuit and is energized with 500 kV at the sending end. Calculate the value of the shunt reactor to be installed at the receiving end to keep the no load receiving end voltage at 500 kV. [5]
4. What is a stringing chart? What is its utility? [4]
5. Discuss the effect of load power factor on the regulation of a short line. [7]
6. The steady state limit of a power system is 150 MW. A generator with constant excitation is supplying 75 MW to the system. Estimate the maximum permissible sudden increase in generator output without causing instability. [8]
7. The 33 kV bus bars of a station are in two sections A and B separated by a reactor. Section A is fed from 8 MVA generators having a reactance of 15%. The section B is fed from a grid through a 40 MVA transformer of 10% reactance. The CBs have a rupturing capacity of 400 MVA. Find the reactance of the reactor to prevent the CBs from being overloaded if a symmetrical short circuit occurs on an outgoing feeder connected to the generator. Take base MVA as 40 MVA.

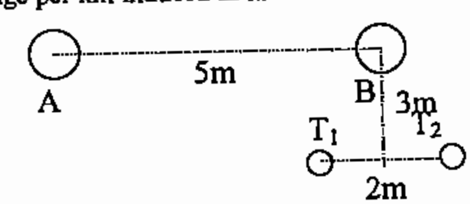


[8]

8. A three phase 11 kV, 12 MVA alternator has positive, negative and zero sequence reactances as 0.3 p.u, 0.3 p.u and 0.1 p.u. respectively. If the generator has no load, find the ratio of fault currents for line-to-ground fault to that when all the 3-phases are dead short-circuited. [5]
9. The data of the network are as follows [10]
   G : 2.5 MVA, solidly earthed
   reactance : Z_1 = 10%, Z_2 = 15%, Z_0 = 10%,
   T1 : 2.5 MVA, 6.66 / 11 kV, reactance 5%, solidly earthed on 11 kV side
   T1 : 2.5 MVA, 11 / 6.66 kV, reactance 5%, solidly earthed on 6.6 kV side
   Cable : 0.4 Ω at 11 kV. Z_0 of cable 1Ω
   If a fault occurs at F, find the fault current for (i) LG fault and (ii) LL fault.



10. A 50 Hz, single phase transmission line and a telephone line are running parallel as shown. The transmission line carries a current of 200A. Assuming zero current is flowing in the telephone line, find the magnitude of the voltage per km induced in it. [5]

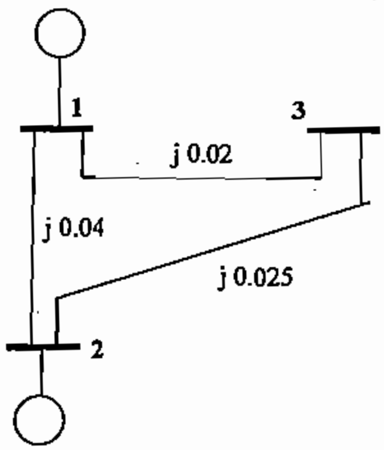


11. The nodal admittance equation of a multi machine system is given as [5]

$$Y = \begin{bmatrix} -j10 & j8 & j2.5 & j2.5 \\ j8 & -j20 & j2.5 & j5 \\ j2.5 & j2.5 & -j6 & 0 \\ j2.5 & j5 & 0 & -j8 \end{bmatrix}$$

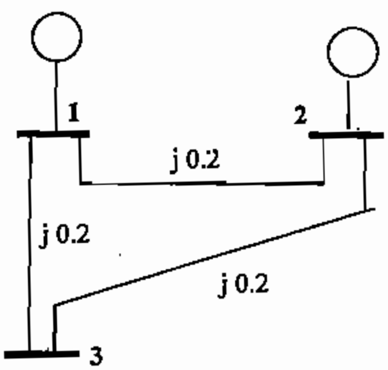
Eliminate node 1 and corresponding voltage V_1 such that $a_2V_2 + a_3V_3 + a_4V_4 = 0$. Find a_2, a_3 and a_4.

12. Perform Gauss Siedel Load flow for 1 iteration for the system shown [8]



Bus Code	Assumed Bus Voltage	Gen P	Gen Q	Load P	Load Q
1	1+j0	-	-	-	-
2	1+j0	50	30	305.6	140.2
3	1+j0	0	0	138.6	45.2

13. The Z_{bus} of the system shown is given as [5]



$$Z_{bus} = \begin{bmatrix} 0.2793 & 0.2206 & 0.25 \\ 0.2206 & 0.2798 & 0.25 \\ 0.25 & 0.25 & 0.35 \end{bmatrix}$$

Find the Z_{bus} if line 2-3 is removed