

1630

M. Tech 1st Semester Examination

Power System Analysis & Design

EE1-512

Time : 3 Hours

Max. Marks : 100

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt any Five Questions. All questions carry equal marks.

1. Consider the linear graph in Fig. 1 which represents a 3-bus transmission system with all shunt admittance at a bus lumped together. Each transmission line has a series impedance of  $0.02 + j0.08$  and a half line charging admittance of  $j0.02$  (all in p.u.). 0 is the ground bus.

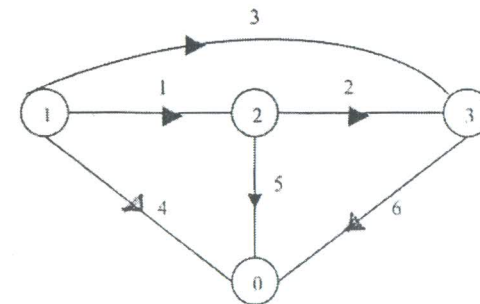


Fig. 1

Compute  $Y_{bus}$  by inspection as well as by the analytical formula or through singular transformation. (20)

[P.T.O.]

2. Consider the 3-bus system in Fig. 2. The line impedances are given in p.u. and line charging is neglected. Treat bus 1 as slack bus with voltage =  $1.05 \angle 0^\circ$ . At bus 2,  $P_{G2} = 25$  MW,  $Q_{G2} = 15$  MVAR,  $P_{L2} = 50$  MW and  $Q_{L2} = 25$  MVAR. At bus 3,  $P_{L3} = 60$  MW and  $Q_{L3} = 30$  MVAR. Assume 100 MVA as base MVA. Carry out 2 iterations of load flow using the Gauss-Siedel method with 1.4 as acceleration factor. (20)

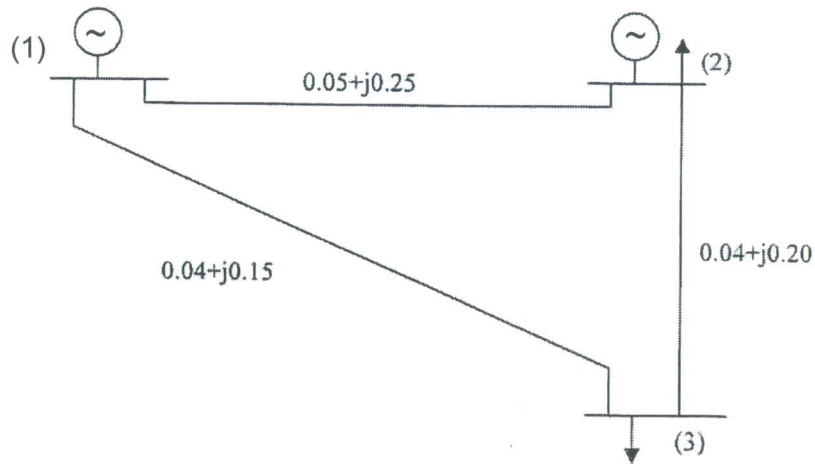


Fig. 2

3. In Z<sub>BUS</sub> building algorithm how partial Z<sub>BUS</sub> matrix get modified on the addition of
- a branch
  - a link
- Derive expression in each case. (20)
4. Derive expression for fault current, bus voltage during faulted conditions and current flowing through elements of three-phase network when line-to-line (L-L) fault occurs at one of the buses in symmetrical component domain. (20)

5. Give the formulation and draw flow chart to carry load flow studies using Newton-Raphson method in polar form. (20)
6. How addition of branch is realized in three-phase Z<sub>BUS</sub> building algorithm? (20)
7. (a) Explain the scheme for optimal ordering of buses to carry out Gauss elimination for sparse Jacobian matrix.  
(b) Through illustration explain any two schemes for storing sparse matrices. (12+8=20)
8. (a) Derive an expression for three-phase power in terms of symmetrical components.  
(b) Derive equivalent  $\pi$  model for tap changing transformer when admittance of the transformer is referred to unity side of tap changer. (10+10=20)