

(Following Paper ID and Roll No. to be filled in your Answer Book)

**PAPER ID : 121602** Roll No. 

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**B.Tech.**

(SEM. VI) THEORY EXAMINATION 2013-14

**POWER SYSTEM ANALYSIS**

*Time : 3 Hours*

*Total Marks : 100*

**Note :-** (i) Attempt **all** questions.

(ii) All questions carry equal marks.

1. Attempt any **four** parts of the following : **(4×5=20)**
- (a) What do you understand by “PER UNIT SYSTEM” ?  
What are the significances in power system analysis ? Also mention its limitations.
- (b) What do you mean by “SINGLE LINE DIAGRAM” in power system analysis ? Also mention its importances in Power System Analysis.
- (c) The line-to-ground voltages on the high voltage side of a set-up transformer are 160 KV, 33 KV and 38 KV on phases a, b and c respectively. The voltages of phase ‘a’ leads that of phase ‘b’ by  $100^\circ$  and lags that of phase ‘c’ by  $176.5^\circ$ . Determine analytically the Symmetrical components of voltage.

- (d) Explain the positive, negative and zero sequence components. Also mention its significance in Power System Analysis. Discuss the limitations of sequence components.
- (e) Consider a balanced 3- $\phi$  system shown in Fig. 1

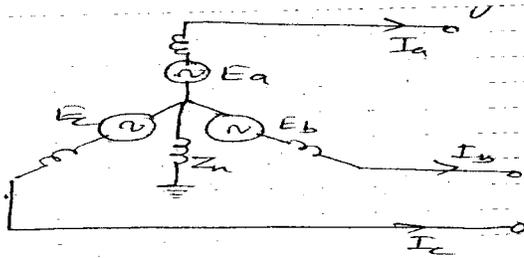
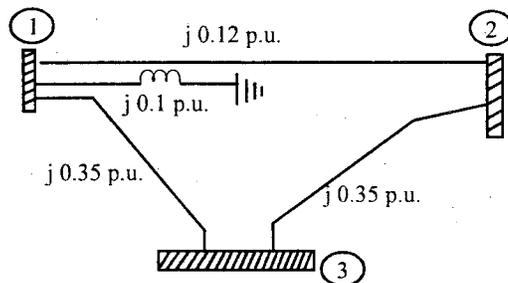


Fig. 1 : 3  $\phi$  Balanced System

Draw and explain the following :

- (i) Positive sequence network of Fig. 1.
  - (ii) Negative sequence network of Fig. 1.
  - (iii) Zero sequence network of Fig. 1.
- (f) A 25 MVA, 13.2 KV alternator with solidly grounded neutral has a subtransient reactance of 0.25 p.u. The negative and zero sequence reactances are 0.35 and 0.1 p.u. respectively. A single line to ground fault occurs at the terminals of an unloaded alternator; determine the fault current and the line-to-line voltages. Neglect resistances.
2. Attempt any **two** parts of the following : **(10 $\times$ 2=20)**
- (a) Write short notes on the following :
    - (i) Analysis of single-line to ground fault on an unloaded generator and power system network with and without fault impedance.

- (ii) Analysis of line-to-line fault on an unloaded generator and power system network with and without fault impedance.
- (b) Explain the procedure of formation of  $Z_{BUS}$  by using singular transformation and algorithms. What are the importances of  $Z_{BUS}$  Matrix in Power System Analysis ?
- (c) Discuss the computer method for short circuit calculations in power system networks. Also mention its importances in Power System Analysis.
3. Attempt any **two** parts of the following : **(10×2=20)**
- (a) What do you mean by “LOAD FLOW ANALYSIS” in power system networks ? Discuss the classification of buses in load flow analysis. Also mention the importances of buses in load flow analysis.
- (b) Draw and explain the algorithms and flow chart of Newton Raphson method used for load flow analysis in power system networks.
- (c) Consider the power system networks shown in Fig. 2.



**Fig. 2**

Determine the  $Y_{bus}$  matrix of Fig. 2. (all the values of lines are given in p.u. impedances). Also find  $Z_{bus}$  matrix from  $Y_{bus}$  matrix.

4. Attempt any **two** parts of the following : **(10×2=20)**

(a) Define the following terms regarding power system stability :

- (i) Voltage stability
- (ii) Rotor angle stability
- (iii) Frequency stability.

Also mention the significances of above terms related to power system.

(b) What are the factors affecting the steady-state and transient stability of the power system networks ? How is it minimized (Improvement) ? Derive swing equation. Also mention its applications in Power System Analysis.

(c) What do you mean by "EQUAL-AREA CRITERION" ? What are the basic roles of equal area criterion in power system analysis ? Also mention its limitations.

5. Attempt any **two** parts of the following : **(10×2=20)**

(a) A surge of 100 KV travelling in a line of natural impedance  $600 \Omega$  arrives at a junction with two lines of impedances  $800 \Omega$  and  $200 \Omega$  respectively. Find the surge voltages and currents transmitted into each branch line.

(b) What do you understand by "Surge impedance" and "velocity of propagation" in travelling waves ? Also derive an expression for surge impedance and velocity of propagation in transmission lines. Write the values of surge impedances of overhead lines and underground cables.

(c) A surge of 15 KV magnitude travels along a cable towards its junction with an overhead line. The inductance and capacitance of cable and overhead line are :

0.3 mH, 0.4  $\mu$ F and 1.5 mH, 0.012  $\mu$ F respectively. Find the voltage rise at the junction due to the surge.