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

PAPER ID : 2498 Roll No.

B.Tech.

(SEM. VI) EVEN THEORY EXAMINATION 2012-13

POWER SYSTEM ANALYSIS

Time : 3 Hours *Total Marks : 100*

Note :– Attempt **all** questions. Each question carries equal marks.

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

   (a) What do you understand by "Per Unit System" in power system analysis ? What are the importance and limitations of per unit system ?

   (b) The line currents in a 3 ρ supply to an unbalanced load are respectively :

   $I_a = 10 + j\,20$ Amp

   $I_b = 12 - j\,10$ Amp and

   $I_c = -3 - j\,5$ Amp.

   The phase sequence is abc. Determine the sequence components of currents.

   (c) A 50 Hz, 50 mVA, 13.2 kV star-grounded alternator is connected to a line through a Δ/Y transformer as shown in figure-1.

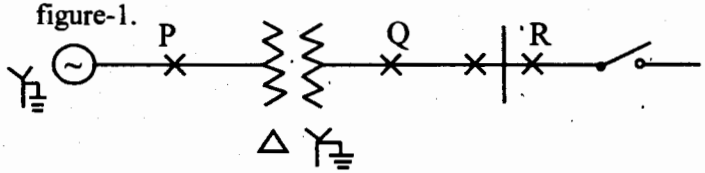

Figure-1

The positive, negative and zero sequence impedances of the alternator are j 0.1, j 0.1 and j 0.05 p.u. respectively.

The transformer rated at 13.2 kV Δ/120 kVY, 50 MVA with star solidly grounded has the sequence impedances of $X'' = X_2 = X_0$ = J 0.1 p.u. each. The line impedances between Q and R are X'' = J 0.03, X_2 = J 0.03 and X_0 = J 0.09 p.u. respectively. Assuming the fault to take place at P, determine the subtransient fault current for :

(i) 3-ρ fault

(ii) a line-to-ground fault

(iii) a line-to-line fault

(iv) a double line to grounded fault.

Also express fault currents as a % of 3-ρ fault current as calculated in (i).

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

(a) What do you mean by "Unsymmetrical Fault" in P.S.A ? What are the drawbacks of unsymmetrical fault in power system analysis ?

(b) Explain the line-to-line fault on an unloaded generator and power system network with and without fault impedances.

(c) Discuss the computer methods for short-circuit calculations in 3-ρ unsymmetrical faults. What are the advantages and disadvantages of this method ?

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

(a) Explain the following :

(i) Reference Bus or Slack Bus.

(ii) Voltage Controlled Bus or Generator Bus.

(iii) Load Bus.

Also mention their importance.

(b) Consider the power system network as shown in figure-2 :

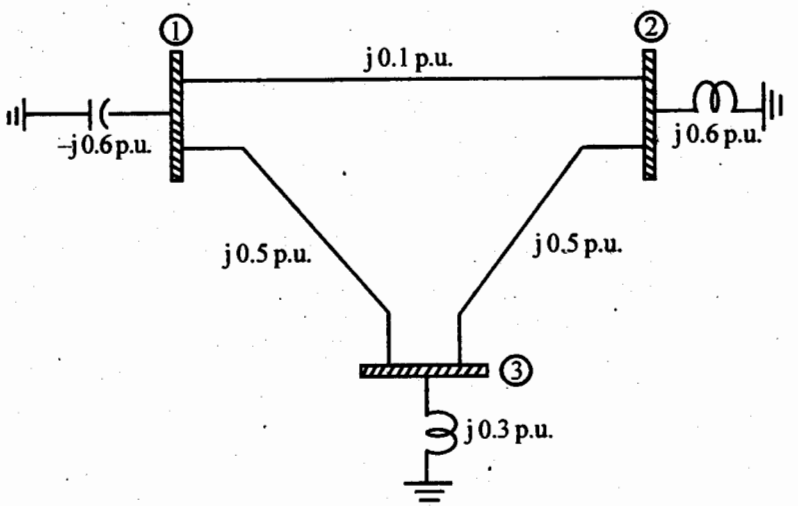

Figure-2

Determine Y_{BUS} matrix for above power system network shown in figure-2.

(c) Explain the algorithms of Newton-Raphson method. What are the advantages and disadvantages of Newton-Raphson method over Gauss Siedal method ?

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

(a) Explain the following :

(i) Voltage Stability

(ii) Rotor Angle Stability.

Also mention their importance in power system networks.

(b) What do you mean by "Swing Equation" in power system networks ? What is the importance swing equations in power system networks ? Also mention its drawbacks. What are the factors affecting steady state and transient stability and methods of improvement ?

(c) Discuss the transient stability studies by equal area criterion and step-by-step method.

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

(a) Explain the Bewlag's Lattice Diagram. What is the importance of Bewlag's Lattice Diagram in power system analysis ? Also mention its limitations.

(b) Show that a travelling wave moves with a velocity of light on the overhead line and its speed is proportional to $\frac{1}{\sqrt{\varepsilon r}}$ on a cable with dielectric material of permittivity εr.

(c) Explain with neat sketches the mechanism of lighting discharge. Differentiate between a hot lighting stroke and a cold lighting stroke.