Printed Pages : 4 **TEE – 601**

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

PAPER ID : 2059 Roll No. | | | | | | | | | | |

B. Tech.

(SEM. VI) EXAMINATION, 2008-09

POWER SYSTEM ANALYSIS

Time : 3 Hours] *[Total Marks : 100*

Note : (1) Attempt all questions
(2) All questions carry **equal** marks.

1 Attempt any **four** parts of the following: 4×5=20

(a) What do you understand by one line diagram? What is the difference between one line diagram and impedance diagram? Explain with the help of examples.

(b) Discuss per unit system. Explain the per unit representation of a transformer.

(c) A generator supplying an unbalanced load measures the following phase-to-ground voltages :

$$V_a = 18.0 \angle 0° \; kV$$

$$V_b = 13.3 \angle -132° \; kV$$

$$V_c = 12.0 \angle +110° \; kV$$

Find the symmetrical components of the set of phasor voltages.

(d) Discuss zero sequence networks of Transformers

(e) Discuss the transient on a transmission line.

(f) A synchronous generator rated 500 kVA, 400 V, 0.1 pu subtransient reactance is supplying a passive load of 400 kW at 0.8 lagging power factor. Calculate the initial symmetrical rms current for a three-phase fault at generator terminals.

2 Attempt any **two** parts of the following: **10×2=20**

(a) A synchronous generator is rated 25 MVA, 11 kV. It is star connected with the neutral point solidly grounded. The generator is operating at no load rated voltage. Its reactances are $X'' = X_2 = 0.20$ pu and $X_0 = 0.08$ pu. Calculate the symmetrical subtransient line currents for

(i) single line-to-ground fault

(ii) double line-to-ground fault

(iii) double line fault

(iv) symmetrical three phase fault.

Compare these currents and comment.

(b) Discuss the different kind of faults occuring under unloaded conditions of synchronous generator.

(c) Explain the interpretation of the Z_{bus} matrix. Discuss step-by-step Z_{bus} formulations.

3 Attempt any **two** parts of the following: **10×2=20**

(a) Discuss the classification of the buses for power flow analysis. What is Y_{bus}? Explain the development of power flow equation.

(b) What is Neuton-Raphson method? How it is applied for the solution of power flow equations? Explain with the help of an example.

(c) Consider the three bus system given in the following fig. 1.

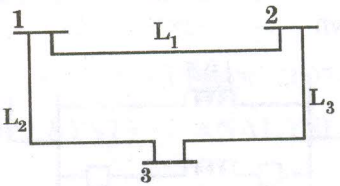

Fig. 1

All lines are assumed to have these parameter data:

$R = 0.075\,\Omega/km$ and phase.

$WL = 0.511\,\Omega/km$ and phase

$\frac{1}{WC} = 0.311\,M\Omega/km$ and phase.

$L_1 = 190\ kms;\ L_2 = 95\ km,\ L_3 = 125\ kms.$

All lines are assumed as electrically short.

Find Y_{bus} matrix for this system.

4 Attempt any **two** parts of the following:

(a) A 50 Hz transmission line 500 km long with constants given below ties up **two** large power areas.

$R = 0.11\,\Omega/km,\quad L = 1.45\,mH/km$

$C = 0.009\,\mu F/km,\ G = 0$

Find the steady state stability limit if $|V_S| = |V_R| = 200\ kV$ (constant). What will be the steady state stability limit if line capacitance is also neglected? What will be the steady state limit if the line resistance is also neglected? Comment on the results.

(b) Explain the equal area criterion for stability.In the system given in following figure. 2, where a three phase fault is applied at the point P as shown

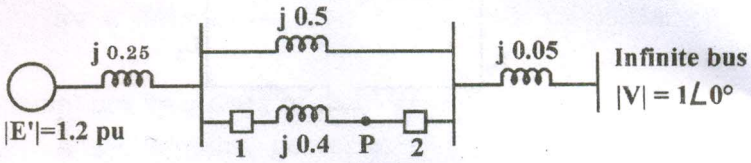

Fig. 2

Find the critical clearing angle for clearing the fault with simultaneous opening of the breaker 1 and 2. The reactance values of various components are indicated on the diagram. The generator is delivering 1.0 pu power at the instant preceding the fault.

(c) Explain the various factors affecting transient stability. What are different method for improvement?

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

(a) Derive the expressions for reflection and refraction coefficients of voltage and current waves for the following cases:

(i) terminated through resistance

(ii) through a cable

(b) Develop wave equation for an uniform transmission line and find the velocity of its propagation.

(c) Discuss protection of equipments and line against travelling waves.
