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BIEE-022

B.Tech. – VIEP – ELECTRICAL ENGINEERING (BTELVI)

00692

Term-End Examination

December, 2017

BIEE-022 : POWER SYSTEMS

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any **five** questions. All questions carry equal marks. Assume missing data suitably (if any). Use of scientific calculator is allowed.*

1. (a) What is the difference between One-line diagram and Impedance diagram ? Explain with the help of examples. 7

(b) Define per unit impedance and give the expression for base impedance and per unit impedance, referred to a new base. Also list the advantages of the per unit system. 7

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

$V_a = 18{\cdot}0 \angle 0°$ kV, $V_b = 13{\cdot}3 \angle -132°$ kV, $V_c = 12{\cdot}0 \angle +110°$ kV.

Find the symmetrical components of the set of phasor voltages. 7

(b) A transmission line of inductance 0·1 H and resistance 5 Ω is suddenly short-circuited at the far end, as shown in the figure. Write the expression for the short-circuit current i(t). Find approximately the value of the maximum momentary short-circuit current. 7

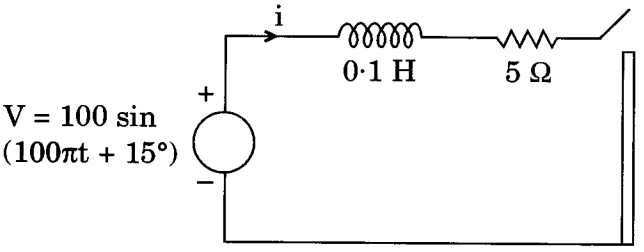

Figure 1

3. (a) Discuss the assumptions made for short-circuit analysis of a power system. Deduce the expression for system impedance matrix in bus frame of reference (Z_{Bus}) using singular transformation. 7

(b) A 3-phase, 15 MVA, 11 kV, 50 Hz generator with solidly earthed neutral has sub-transient reactance X''_d of 20%, direct axis transient reactance X'_d of 25% and synchronous reactance X_d of 60%. Negative sequence reactance $X_2 = 20\%$ and zero sequence reactance $X_0 = 8\%$. The generator is operated on the open circuit when a fault occurs. Take $E_0 = 1{\cdot}0$.

If the fault is a 3-phase short without an impedance, compute the initial symmetrical sub-transient, transient and sustained p.u. values of the line current under faulty conditions. 7

4. (a) Develop necessary equations and describe the load flow solution using the Gauss-Siedel method. 7

(b) Classify various types of buses in power systems for load flow studies. Discuss Nodal Admittance Matrix. 7

5. (a) Define and derive the swing equation for a finite machine connected to an infinite bus. Discuss the applications in the study of power system stability. 7

(b) For improving the transient stability of a power system, discuss the following discrete supplementary control terms : 7

(i) Dynamic braking

(ii) High speed circuit breaker reclosing

(iii) Independent control of excitation

(iv) Series capacitor insertion

6. (a) Derive the expressions for reflection and refraction coefficients of voltage and current waves for the following cases : 7

(i) Terminated through resistance

(ii) Terminated through a cable

(b) Explain surge impedance and velocity of propagation of travelling waves. A 500 kV, 2 μ-sec rectangular surge travels along the line terminated by a capacitor of 2500 pF. Determine the voltage across the capacitance and reflected voltage wave, if the surge impedance loading of the line is 400 Ω. 7

7. Write short notes on any ***two*** of the following : *2×7=14*

(a) Bewley's Lattice Diagram

(b) Load Flow Analysis using Fast Decoupled Method

(c) Surge Impedance
