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TEE – 601

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

PAPER ID : 2059 **Roll No.**

B.Tech.

(SEM VI) EVEN SEMESTER THEORY EXAMINATION, 2009-2010

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 : **(4x5=20)**

(a) Describe single line diagram representing synchronous machines transformers and feeders from generating end to distributing end. Discuss about impedance and reactance diagram with examples.

(b) Discuss per unit system. How are the base values chosen in representation of a power system ?

(c) What do you understand by instantaneous maximum momentary current for line ? Explain it with the help of suitable diagram.

(d) Derive an expression for fault current for single line - to - ground fault by symmetrical component method.

(e) In a three phase, four wire system, the currents in R, Y and B lines under abnormal conditions of loading are as under :

$\bar{I}_R = 200 \angle 30°\ A$

$\bar{I}_Y = 100 \angle 300°\ A$

$\bar{I}_B = 60 \angle 180°\ A$

Calculate the zero, positive and negative sequence currents in R line and return current in the neutral wire.

(f) A 600 kVA, 450 V alternator supplies a purely resistive load of 480 kW at 450 V. The subtransient reactance of the generator is 8%. Assuming the load is directly connected across the generator terminals, find the initial symmetrical r.m.s. current in p.u. at the generator terminal for a 3 - phase dead short at its terminals.

2. Attempt **any two** parts of the following : **(2x10=20)**

(a) What do you understand by sequence networks ? What is their importance in unsymmetrical fault calculations ?

The per unit values of positive, negative and zero sequence reactance of a network at fault are 0.16, 0.14 and 0.2. Determine the fault current if fault is double line to ground.

(b) A 25 MVA, 11 kV, 3 - phase alternator was subjected to the following faults : 3 - phase fault = 1000 A; line - to - line fault = 1400 A; line to ground fault = 2200 A. The generator neutral is solidly grounded. Ignoring resistances calculate the values of three reactances of alternator.

(c) Describe in detail with flow chart diagram, the computational method for short circuit calculations.

3. Attempt **any two** parts of the following : **(2x10=20)**

(a) Classify various types of buses in power system for load flow studies. Discuss clearly with a flow chart the computational procedure for load flow solutions using Gauss - Seidel method when the system contains all types of buses.

(b) Develop load flow algorithm with flow chart by Newton - Raphson method using nodal admittance approach.

(c) Form Y_{bus} for 4 - bus system as shown in fig. 1, if the line series impedances are as follows :

Line (bus to bus)	Impedance
1 - 2	0.15 + j0.6 p.u.
1 - 3	0.1 + j0.4 p.u.
1 - 4	0.15 + j0.6 p.u.
2 - 3	0.05 + j0.2 p.u.
3 - 4	0.05 + j0.2 p.u.

Neglect the shunt capacitance of line.

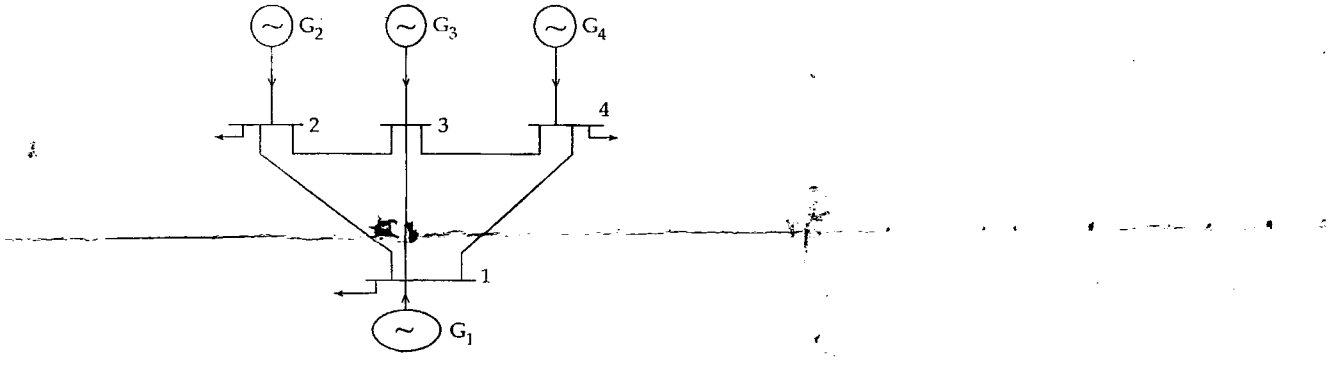

Fig. 1 : 4-bus system

4. Attempt **any two** parts of the following : **(2x10=20)**

(a) Differentiate between steady state stability and transient state stability of a power system. Derive an expression for maximum power transfer between two nodes.

Show that this power is maximum when $X = \sqrt{3}R$, where X is the reactance and R is the resistance of system.

(b) A 50 Hz, synchronous generator is connected to an infinite bus through a line. The p.u. reactance of generator and line are j0.3 p.u. and j0.2 p.u. respectively. The generator no load voltage is 1.1 p.u. and that of infinite bus is 1.0 p.u. The inertia constant of generator is 3 MW - sec/MVA. Determine the frequency of natural oscillations if generator is loaded to (i) 70% and (ii) 80% of its maximum power transfer capacity and small perturbation power is given.

(c) Derive swing equation and discuss its application in the study of power stability. Discuss the methods for improving the transient state stability of a power system.

5. Attempt **any two** parts of the following : **(2x10=20)**

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

(b) Make the analysis of a wave travelling along a line terminated with an inductance L. Derive an expression for the voltage across inductance connected at the end of transmission line of surge impedance Zc when a step wave of magnitude E is travelling along it.

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

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