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RM-7105

B. E. III (Sem. VI) (Electrical) Examination

May / June – 2010

Electrical Power System - II

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

Instruction :

(1)

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fillup strictly the details of ☛ signs on your answer book.

Name of the Examination :

☛ **B. E. 3 (Sem. 6) (Electrical)**

Name of the Subject :

☛ **Electrical Power System - 2**

☛Subject Code No. : **7 1 0 5** ☛Section No. (1, 2,.....) : **1&2**

Seat No. :

Student's Signature

(2) Answer all questions.
(3) Figures to the **right** indicate full marks.
(4) Make suitable assumption if **necessary**.
(5) Answer two sections in **separate** answer books.

SECTION - I

1 (a) Write in short : **6**

(i) What are unsymmetrical faults?

(ii) What is relation between percentage impedance and Pu impedance?

(iii) Draw the sequence network for single line to ground fault without fault impedance.

(b) Fill in the blanks : **4**

(i) A symmetrical fault on a power system is _____ severe than an unsymmetrical fault.

(ii) The most common type of 3 phase unsymmetrical fault is _____.

(iii) Only the _____ network contains a voltage source.

(iv) The neutral grounding impedance Zn appears as _____ in the zero sequence equivalent circuit.

(c) Write in short :

(i) Advantages of per unit presentation. **3**

(ii) Enumerate the position in which reactors may be connected. **3**

(iii) Describe the tie bar method of inter connecting the bus bar section in a generating station. What are the advantages of tie bar system over the ring system ? 4

2 (a) Discuss calculation of L-L fault using symmetrical components. 8

(b) Fig. a shows a generating station feeding a 220 kV system. Determine the total fault current, fault level and fault current supplied by each generator for a three phase fault at the receiving end of the line. 8

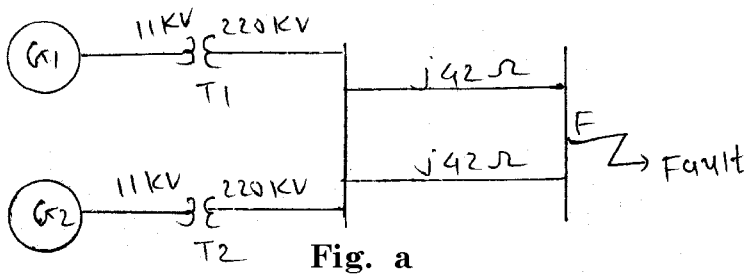

Fig. a

G_1 : 11 kV, 100 MVA x'_{g1} = j 0.15
G_2 : 11 kV, 75 MVA x'_{g2} = j 0.125
T_1 : 100 MVA X_{T1} = j 0.10, 11/220 kV
T_2 : 75 MVA X_{T2} = j. 0.08, 11/220 kV

OR

2 (a) Determine expression for positive, negative and zero sequence impedance of 3 phase transmission line, consider equal mutual impedance between phases. 8

(b) A 50 MVA generator with a reactance of 0.1 Pu is connected to a busbar. A 25 MVA transformer with a reactance of 0.05 Pu is also connected through a bus bar reactor of 0.1 Pu to the same bus bar. Both these reactances are based on 25 MVA rating. If a feeder taken out from the bus bar through a circuit breaker develops a fault, what should be the rating of circuit breaker ? 8

Consider three phase fault (symmetrical)

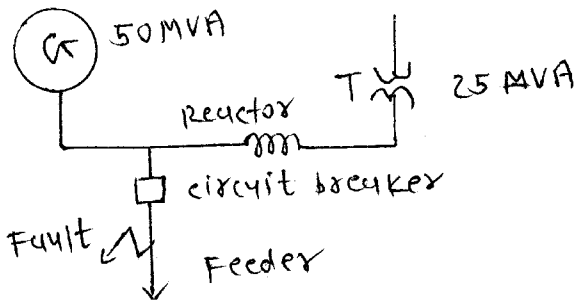

Fig. b

3 Attempt any **two** : **14**

(a) Derive an expression for fault current for line to ground fault by symmetrical components method.

(b) A generator of negligible resistance having 1.0 per unit voltage behind transient reactance is subjected to different types of faults.

Types of faults	Resulting fault current in Pu
3 Phase	3.33
L - L	2.23
L - G	3.01

Calculate the per unit values of three sequence reactances.

(c) A 25 MVA, 11 kV, three phase generator has a subtransient reactance of 20% the generator supplies two motor over a transmission line with transformers at both ends as shown in the one line diagram of fig c. The motors have rated input of 15 MVA and 7.5 MVA, both 10 kV with 25% subtransient reactance. The three phase transformers are both rated 30 MVA, 10.8/121 kV, connection with leakage reactance of 10% each. The series reactance of the line is 100 ohms. Draw the positive and negative sequence networks of the system with reactances marked in per unit.

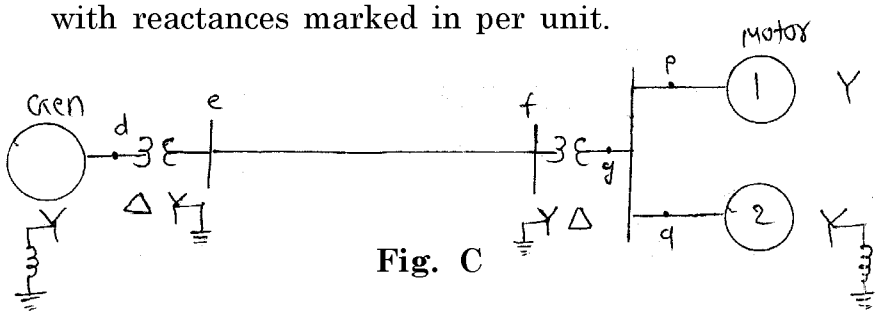

Fig. C

SECTION - II

4 (a) Answer in brief : (2 to 3 lines) **10**

(i) Define : Power system stability

(ii) Write : Power angle equation with usual notations.

(iii) Typical values of characteristic impedance (Z_c) for transmission line and cable are_____ and _____ respectively (80, 100, 400, 40).

(iv) List out various methods available for stability assessment.

(v) List out types of Power system transients.

(b) A 50 Hz, 4 Pole, turbo-generator rated 100 MVA, 11 kV has an inertia constant of 8 MJ/MVA. **5**

Find :

(i) The stored energy in the rotor at synchronous speed.

(ii) The rotor acceleration (neglecting mechanical and electrical losses) if the mechanical input is suddenly raised to 80 MW for an electrical load of 50 MW.

(c) A transmission line with characteristic impedance Z_c is terminated in an inductor L. When line is connected to step voltage V_1, derive the reflected and refracted voltage wave as function of time and explain their effect with diagram. **5**

5 (a) Develop "Rotor swing equation" of generator delivering power to infinite bus. **6**

(b) The kinetic energy stored in the rotor of a 50 Hz, 60 MVA synchronous machine is 200 MJ. The generator has an internal voltage of 1.2 pu and is connected to an infinite bus operating at a voltage of 1.0 pu through a 0.3 pu reactance. The generator is supplying rated power when three phase short circuit occurs on the line. Subsequently circuit breakers operate and the reactance between the generator and the bus becomes 0.4 pu. Using the step by step algorithm, plot the sing curve for the machine for the time before the fault is cleared. (Calculate up to two iterations). **6**

OR

5 (a) Stating algorithm, explain the steps involved in point by point method for solving swing equation of a single machine connected to an infinite bus and how will you determine the transient stability of the system using this method. **6**

(b) Find the maximum steady state power capability of a system consisting of a generator equivalent reactance of 0.4 pu connected to an infinite bus through a series reactance of 1.0 pu. The terminal voltage of the generator is held at 1.10 pu and the voltage of the infinite bus is 1.0 pu. **6**

6 Answer any **three** : **18**

(i) Derive the reflection and refraction coefficients of travelling waves with usual notations.

(ii) Discuss quantitatively and in brief the application of equal area criterion when applied to sudden loss of one of parallel line.

(iii) Write short note : Bewley Lattice Diagram.

(iv) Explain the factors affecting transient stability and latest trends to improve them.

(v) Write short note on transient stability.