* S F - 7 1 0 5 / 2 0 0 *

SF-7105

B. E. - III (Sem. VI) (Elect.) Examination

May / June - 2011

Electrical Power System - II

(Old Syllabus)

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

Instructions :

(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) (ELECT.)**

Name of the Subject :

☛ **ELECTRICAL POWER SYSTEM - 2 (OLD)**

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

Seat No. :

Student's Signature

(2) Assume necessary suitable data and clearly indicate it.

(3) Scientific calculator use is allowed Model Fx 82, 100 and equivalent.

1 (a) Fill in the blanks : **5**

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

(ii) Only _____ network contains a voltage source.

(iii) Line to earth resistance is considered in _____ sequence network.

(iv) In zero sequence network, line to earth resistance is considered being multiplied by _____.

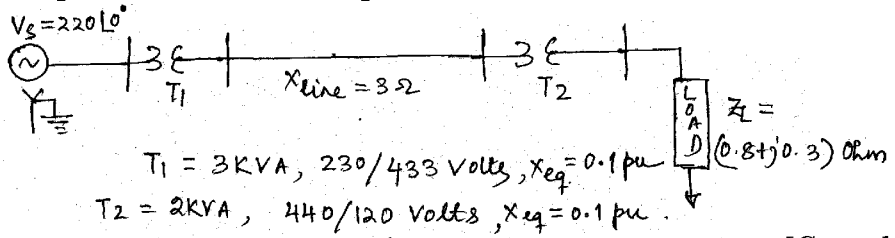
(v) The per unit impedances of a transformer referred from the primary and secondary side are_____.

(b) (i) Enumerate the position in which reactors may be connected. **6**

(ii) What do you mean by infinite bus ?

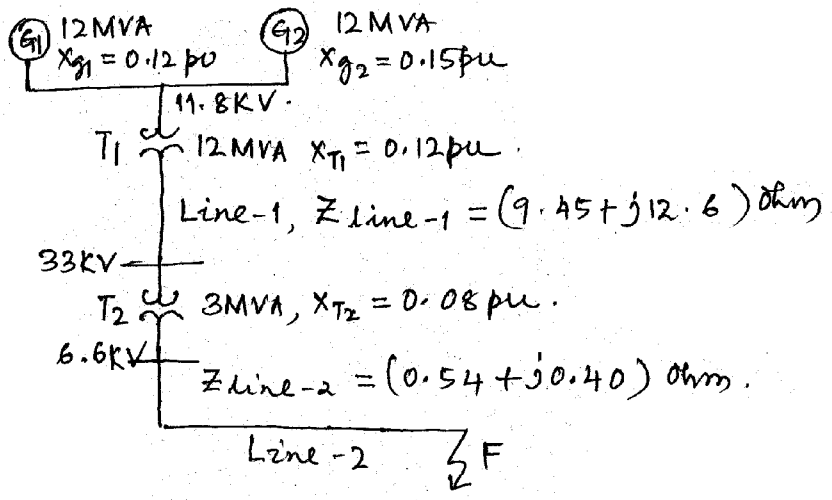
(iii) What do you mean by per unit quantity ? Why is suitable for short circuit calculation.

(c) Fig. shows single line diagram of a single phase circuit. Using the base values of 3KVA and 230 Volts, draw the per unit circuit diagram and calculate the load current in per unit and in amperes.



2 (a) Discuss the short circuit algorithm for large systems. **6**

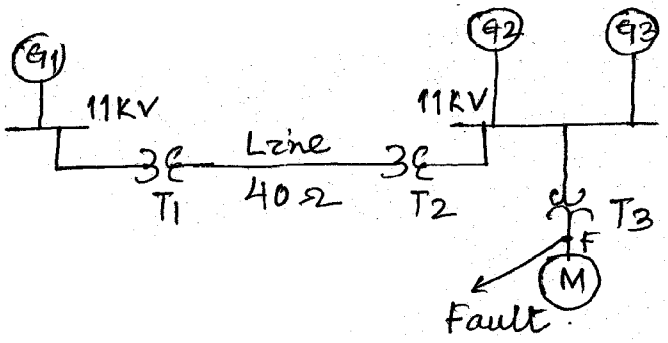
(b) A radial power system network is shown in the fig. A three phase balanced fault occurs at F. Determine the fault current and the line voltage at 11.8 kV bus under fault conditions. **9**



OR

2 (a) Discuss the principle of symmetrical components. Derive the necessary equations to convert phase quantities into symmetrical components and vice versa. **6**

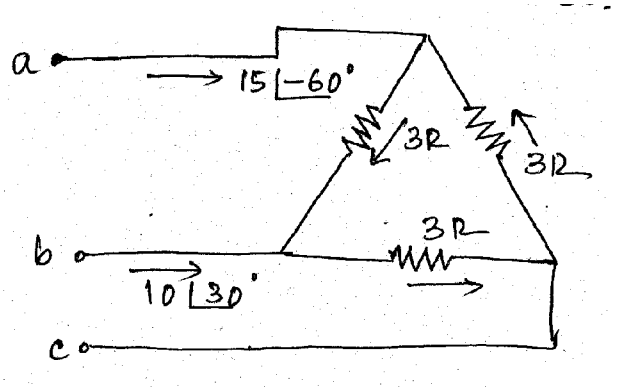
(b) Two generating stations are connected together through transformers and a transmission line as shown in fig. If a 3 phase fault occurs at F, calculate the fault current. **9**



G_1 : 11 KV, 40 MVA, 15%
G_2 : 11KV, 20 MVA, 10%
G_3 : 11 KV, 20 MVA, 10%
T_1 : 40 MVA, 11/66 KV, 15%
T_2 : 40 MVA, 66/11 KV, 15%
T_3 : 5MVA, 11/6.6KV, 8% Line reactance 40Ω.

3 (a) Draw the sequence networks of synchronous m/c and its physical interpretation. **5**

(b) A delta connected resistive load is connected across an unbalanced three-phase supply as shown in fig. Find the symmetrical components of deta currents. **10**



OR

3 (a) Discuss the calculation of L-L-G fault current with use of symmetrical components. **6**

(b) The estimated short circuit MVA at the busbars of a generating station-1 is 900 MVa and at another generating station-2 of 600 MVA. Generator voltage at each station is 11.2 KV. The two stations are interconnected by a reactor of reactance 1 ohm per phase. Compute fault MVA each station. **9**

4 (a) Fill in the blanks : **5**

(i) The surge impedance of a 100 km long underground cable is 50 Ω. The surge impedance of a 40 km long similar cable would be _____ ohms.

(ii) Value of characteristic impedance (Zc) for transmission line is _____ Ω.

(iii) The reflection coefficient of a short-circuited line for voltage is _____.

(iv) Equal area criterion gives the information regarding _____ stability.

(v) The critical clearing time of a fault in power systems is related to _____.

(b) Explain in brief : **10**

(i) Critical clearing angle

(ii) Current limiting reactor

(iii) Transfer reactance

(iv) Power system stability.

(c) What is the application of Bewley's diagram ? Draw the Bewley diagram for voltage when receiving end is open-circuited. **5**

5 (a) Develop swing equation for a generator delivering power to infinite bus. 7

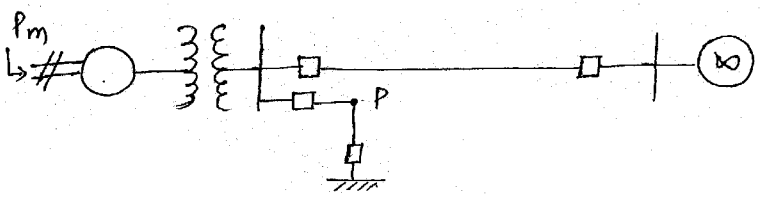
(b) A 50Hz synchronous generator capable of supplying 400 MW of power is connected to a large power system and is delivering 80 MW when a three phase fault occurs at its terminals. Determine : 8

(i) the time in which the fault must be cleared if the max. power angle is to be 85°. Assume H=7MJ/MVA on a 100 MVA base.

(ii) The critical clearning angle.

OR

5 (a) For the system shown in fig. operating with mechanical input P_m at a steady state angle δ_o. If a 3 phase fault occurs at the point P of the outgoing line, find out the expression for critical clearing angle δe_r and critical clearning time t_{cr} for the system with the help of equal area criterion. 10



(b) A 60 Hz, 4 pole turboalternator rated 100 MVA, 13.8 KV has an inertia constant of 10 MJ/MVA. 5

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

(ii) If the input to the generator is suddenly raised to 60 MW for an electrical load of 50 MW find the rotor acceleration.

(iii) If the rotor acceleration calculated in part(ii) is maintained for 12 cycles find the change in torque angle and rotor speed in rpm at the end of this period.

6 Answer any two : 15

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

(b) Solve swing equation by Point-by-Point method.

(c) Two stations are connected together by an underground cable having a surge impedance of 50 Ω joined to an overhead line with a surge impedance of 400 Ω. If a surge having a maximum value of 110 kV travels along the cable towards the junction with the overhead line, determine the value of the reflected and the transmitted wave of voltage and current at the junction.