2002 SCHEME

USN

**EE61**

# Sixth Semester B.E. Degree Examination, December 2010
## Power System Analysis and Stability

Time: 3 hrs. Max. Marks:100

**Note: 1.** ***Answer any FIVE full questions.***
**2.** ***Assume missing data suitably.***

1 a. With the help of a typical electric power system explain, i) One line diagram ii) Impedance and reactance diagram. **(06 Marks)**

b. Mention any four advantages of per unit system. **(02 Marks)**

c. The terminal voltage of the generator of the system shown in figure Q1 (c) is 13.2 kV. Determine the generator current, transmission line current, load current and the load power. Select a base of 10 MVA and 138 kV in the transmission line. **(12 Marks)**

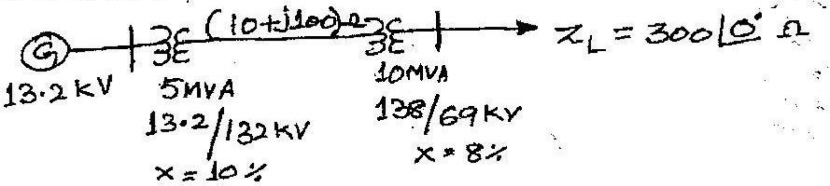



Fig. Q1 (c)

2 a. With the help of an oscillogram of the fault current define, i) Momentary current ii) Transient current. **(08 Marks)**

b. Determine the fault MVA, if a 3 phase fault takes place at 'F' in the diagram Q2 (b). The p.u. values of reactances are given with 100 MVA as base. **(12 Marks)**

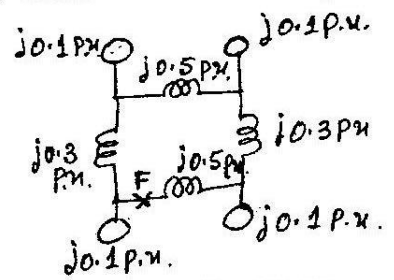



Fig. Q2 (b)

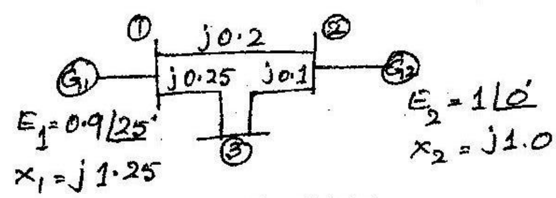


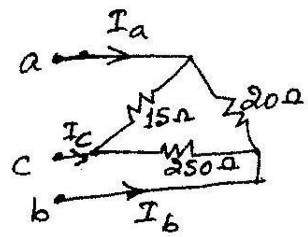

Fig. Q3 (a)

3 a. Develop the $Y_{bus}$ and node equations for the system shown in figure Q3 (a). **(08 Marks)**

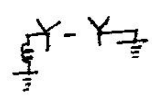
b. What are symmetrical components? Derive an expression for the three phase power in terms of symmetrical components. **(12 Marks)**

4 a. A delta connected resistive load is connected across a balanced three phase supply of 400 V as shown in figure Q4 (a). Find the symmetrical components of line currents and delta currents. **(10 Marks)**

Fig. Q4 (a)



4 b. Draw the zero sequence impedance network of a transformer for the following connections:

i) Y – Δ    ii) Δ – Δ    iii)     iv) Y – Y    v) Δ – 

**(10 Marks)**

5 a. A 250 MVA, 11 kV, 3 phase generator is connected to a large system through a transformer and a line as shown in figure Q5 (a). The parameters on 250 MVA base are as follows:

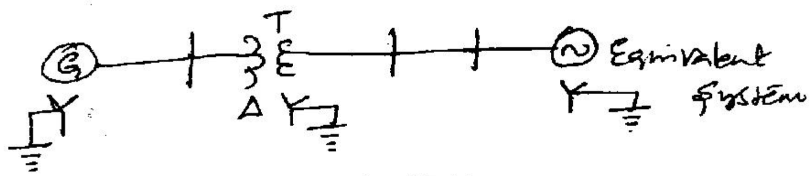



Fig. Q5 (a)

Generator : $X_1 = X_2 = 0.15pu,\ X_0 = 0.1pu.$

Transformer: $X_1 = X_2 = X_0 = 0.12$ pu

Transmission line : $X_1 = X_2 = 0.25pu,\ X_0 = 0.75pu.$

Equivalent system : $X_1 = X_2 = X_0 = 0.15pu$

Draw the sequence network diagrams for the system and indicate all per unit values. **(10 Marks)**

b. Derive an expression for fault current in a SLG at the terminals of an unloaded alternator by considering both the conditions: i) Without fault impedance and ii) With fault impedance. **(10 Marks)**

6 a. What are the different types of unsymmetrical faults? Explain in brief, their frequency of occurrence. **(08 Marks)**

b. The following data may be assumed for the network shown in figure Q6 (b):

Generator : 50 MVA, 11 kV, $X_1 = 80\%$, $X_2 = 50\%$, $X_0 = 20\%$

Transformer: 40 MVA, 11-110 kV, $X_1 = X_2 = X_0 = 6\%$.

The given values of percentage reactances are based on the capacity and voltage of each device. If a double line to ground fault occurs, find the current flowing in the conductor at 'F'. Choose a base power of 50 MVA for the entire system. **(12 Marks)**

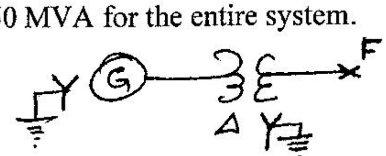



Fig. Q6 (b)

7 a. Explain the following: i) Transformer stability ii) Steady state stability. **(06 Marks)**

b. Explain hunting, related to AC machines. **(02 Marks)**

c. Derive the power angle equation of a non-salient pole synchronous machine connected to an infinite bus. Draw the power angle curve. **(12 Marks)**

8 a. Obtain the swing equation. **(05 Marks)**

b. Derive an expression for critical clearing angle. **(03 Marks)**

c. A generator operating at 50 Hz, delivers 1 p.u. power to an infinite bus, through a transmission circuit, in which, resistance is ignored. A fault takes place reducing the maximum power transferable to 0.5 pu, whereas before the fault this power was 2.0 pu. After clearance of the fault it is 1.5 pu. By the use of equal area criterion method find critical clearing angle. **(12 Marks)**

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