International Islamic University Chittagong
Department of Electrical and Electronic Engineering

Final Examination Autumn-2018
Course Code: EEE 3519
Time: 2 hours 30 minutes

Program: B.Sc. Engg. (EEE)
Course Title: Power System Analysis
Full Marks: 50

Part A

[Answer any ***two*** questions from the followings; Figures in the right margin indicate full marks.]

1(a). Why transient and sub-transient current arises in power system? Describe with proper sketch. **03**

1(b). Why we need fault analysis? Shaw the connection diagram of feeder reactors. Also write two advantages of feeder reactors. **03**

1(c). A 3-phase transmission line operating at 10 kV and having a resistance of 1Ω and reactance of 4Ω is connected to the generating station bus bars through 5MVA step up transformer having a reactance of 5%. The bus bars are supplied by a 10MVA alternator having 10% reactance. Calculate the short circuit kVA fed to symmetrical fault between phases if it occurs **04**

a. At the load end of transmission line
b. At the high voltage terminals of the transformer

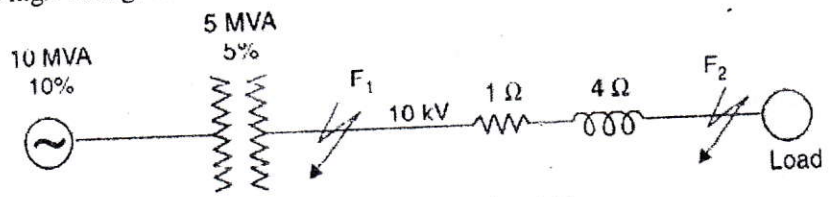

Fig. 1: For question 1(c).

2(a). "An unbalanced three phase system can be represented by three balanced systems in term of symmetrical components". Explain. **04**

Also, developed the relationship between the symmetrical components and unbalanced Phasors. **4.5**

2(b). Suppose, impedance matrix for a three bus power system in given as:

$$Z = \begin{vmatrix} j0.3 & j0.3 & j0.7 \\ j0.3 & j0.5 & j0.4 \\ j0.7 & j0.4 & j0.6 \end{vmatrix}$$

Find the fault current when 3-phase short circuit fault occurs at bus 2. Also find the post fault voltages of all the bus. Assume pre-fault voltage of all bus is 1pu.

2(c). In a 3-φ system, it has been found that negative sequence components and zero sequence components are absent. Is it a sound system, how? **1.5**

3(a). Draw the zero sequence network of the following circuit diagram in **Fig. 2.** **2.5**

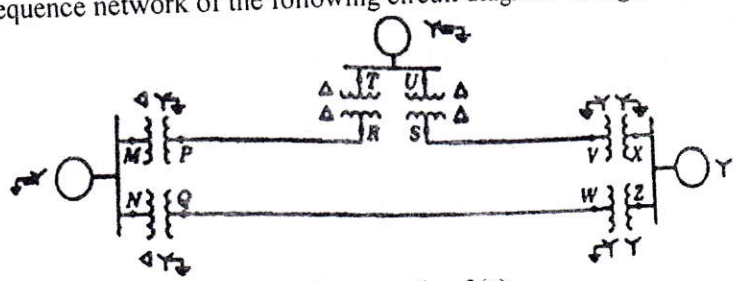

Fig. 2: For question 3(a).

3(b). "The line currents following to a Δ-connected load can contain no zero sequence components."- Justify the statement. **02**

3(c). The current in a 3-phase unbalanced system are: **4.5**

$$I_A=(12+j6)\ A;\quad I_B=(12-j12)A\ ;\quad I_C=(-15+j10)A$$

The phase sequence in ABC. Calculate the zero, positive and negative sequence components of the currents.

3(d). Why do we use reactors in the power system? **01**

Part 2

[Answer any ***three*** questions from the ngs; Figures in the

4(a). Deduce the expression of positive sequence current for a line to line solid fault at the terminals of an unloaded generator. The neutral of the Y-connected generator is grounded through an impedance Z_n. Explain why zero sequence, is absent in this connection diagram. **05**

4(b). A 50MVA, alternator was subjected to different types of faults. The fault currents are as under: **05**

- 3-phase fault = 2000A
- Line to line fault = 2600A
- L ground fault = 4200A

The generator neutral is solidly grounded. Find the values of the three sequence reactances of the alternator. Ignore resistances

5(a). Why transient stability limit is lower than the steady state limit? Briefly discuss about the power transmission capability. **2.5**

5(b). hat is meant by swing curve? What inf th wing equation of synchronous genera

5(c). are the factors that affecting the trans machine? ulti-machine system? Justify "We cannot apply equal area criterion for the statement.

6(a). Write down the name of the methods that ca ro transien synchronous machine. Also, briefly explain one of them. **2.5**

6(b). Find the critical clearing angle of the p system shown in Fig. 3 for a three-phase fault at point F. Generator is supplying 1 p w under pre-fault condition. **7.5**

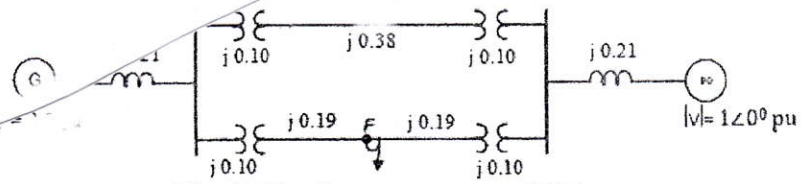

Fig. 3: Simple power system of 6(b).

7(a). What are the purposes of stability studies? What assumptions are commonly made in multi-machine stability analysis? **2.5**

7(b). Deduce a mathematical expression for critical clearing angle (δ_{cr}) and critical clearing time (t_{cr}) that can maintain stability of a synchronous generator. **04**

7(c). What is the order of severity and occurrence of different types of fault? Show the connection of the sequence networks of an unloaded generator for a double line to ground fault at the generator terminals. If the neutral of the generator is absent, double line to ground fault approaches like a line to line fault. Why? **3.5**