UNIVERSITY OF RUHUNA

Faculty of Engineering

Mid-Semester 7 Examination in Engineering: June 2014

Module Number: EE7240 **Module Name: Power System Analysis**

[Two Hours]

[Answer all questions]

Q1 a) i) What is meant by fault and fault level in a power system?
ii) Why do we need to study of fault analysis in power systems?

[2.0 Marks]

b) Consider the power system shown in Figure Q1 b). If a symmetrical fault occurs at 480 V bus bar,
i) find the fault current at the bus bar by using per unit method.
ii) calculate the fault current contribution from generator 2 and motor 2.
Select S_{base}= 20 MVA.

[4.0 Marks]

c) Using the MVA method, calculate the fault currents mentioned in Q1 b) parts i) and ii)

[4.0 Marks]

Q2 a) Explain, what is meant by "Symmetrical components" with reference to an unbalanced three-phase system.

[1.0 Mark]

b) In a three-phase power system, if a double line to ground fault occurs through fault impedance (Z_f), show that current through the fault impedance (Z_f) is three times the zero sequence current.

[1.0 Mark]

c) Two 11 kV, 20 MVA, three-phase, star connected generators operate in parallel. The positive, negative and zero sequence reactances of each being, j0 .18 pu, j0.15 pu and j0.10 pu, respectively. The star point of one of the generators is isolated and that of the other is solidly grounded. A double line-to-ground fault occurs on terminals of one of the generators. Assume fault is solid (Z_f =0).

i) Calculate fault current in each phase.
ii) Find the voltage of the healthy phase.

[3.0 Marks]

Q3 a) Briefly explain steady-state stability and transient stability of a power system.

[1.0 Mark]

b) Obtain the swing equation for a system where two generators swinging coherently.

[1.0 Mark]

c) A four-pole synchronous generator rated for 11 kV, 100 MVA, 50 Hz has an inertia constant of 8.0 MJ/MVA.

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

ii) Find rotor acceleration, if the mechanical input is suddenly raised to 80 MW for an electrical load of 50 MW. Assume that mechanical and electrical losses are negligible.

iii) If the acceleration calculated in Q3 c) ii) is maintained for 10 cycles, find the change in torque angle and rotor speed in rpm at the end of this period.

[3.0 Marks]

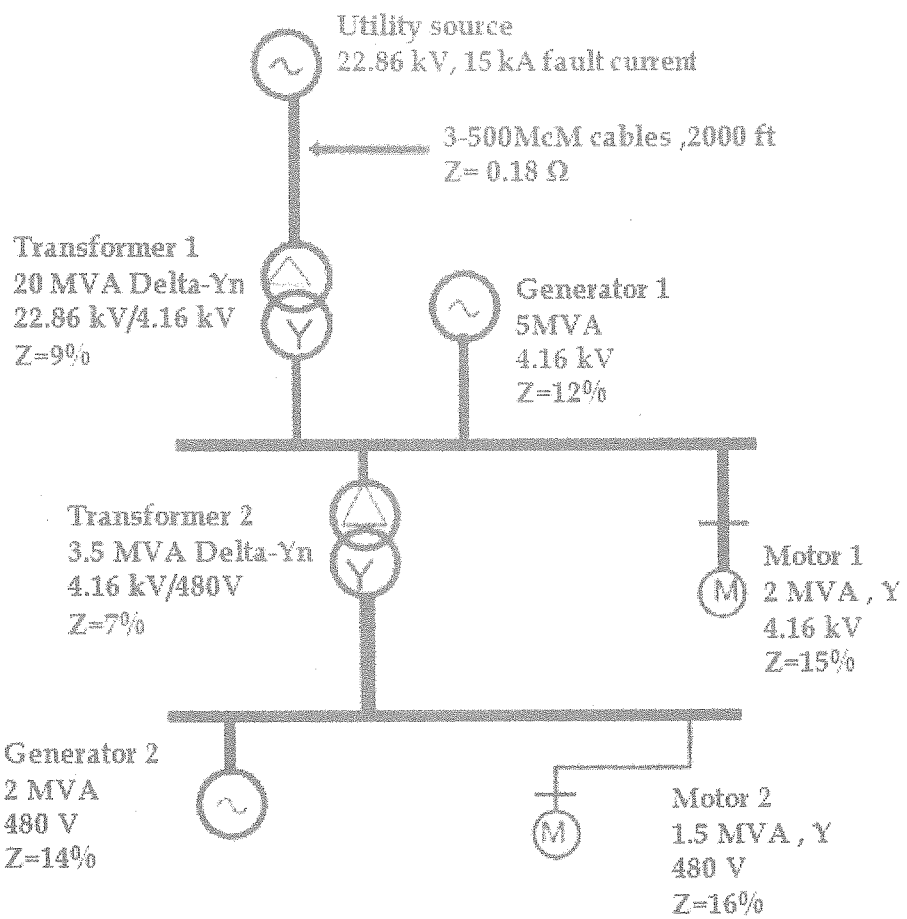

Figure Q1 b)