MENOUFIYA UNIVERSITY	B.SC. SECOND TERM	SUBJECT:POWER SYSTEM
FACULTY OF ENGINEERING	FINAL EXAMINATION	PROTECTION
ELECTRICAL ENGINEERING	TOTAL MARKS: 90	TIME: 3 HOURS
DEPARTMENT		DATE: 7/6/2014

ANSWER THE FOLLOWING QUESTIONS

1) A star connected generator whose neutral point is solidly grounded. The genarator is provided with a restricred earth fault unit protection. Will the relay operate for internal L-L, L-L-L-G faults and external L-G faults? Show the direction of current flow in the protection and in the power circuits for each fault case.　　　**(10 marks)**

2a) Simple time graded overcurrent relays are applied to 2- bus ring main (single feed pint), circuit breakers are connected at each side of each bus. Choose time delays for each overcurrent relay (including the source relay) and indicate which relays need to be directional. Repeat the process for 3-bus ring.　　　**(10marks)**

(2b) Describe briefly how can the current limiting fuse increases the short circuit current rating of the power distribution panel.　　　**(6marks)**

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3) An 11-kV busbar has duplicate incoming feeders each fitted with 1000/5 A I.D.M.T. relay having plug and time settings of 150% and 0.4. The corresponding data for an outgoing feeder is 400/5 A, 175%, 0.3. The substation is a firm supply for 25 MVA. For a 3-phase 250-MVA fault, calculate the time margin between the relayes for (a) two incoming feeders in (b) one in. Show that the protection on a single incoming feeder (other switched out) will not operate to a load of 25 MVA. Suggest a plug, a time setting, and a CT ratio of the source relay.　　　**(12marks)**

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4) In phase fault distance protection derive an equation for locating a-b fault in a transmission line. Also in ground fault distance protection derive an expression for locating b-g faults. Why does the ground fault relay requires a different configuration from those used for phase faults?　　　**(10marks)**

5-a) What is meant by infeed and outfeed effects? How will it affect the performance of a distance relay?　　　**(6marks)**

5-b) What is the effect of overlap in zone 2 of distance relay? How can this overlap be avoided?　　　**(6marks)**

5-c) Determine the three zone settings for the relay Rab in the system shown in Figure 1. The system nominal voltage is 138 kV, and the positive sequence impedances for the various elements are given in the figure. The transformer impedance is given in ohms as viewed from the 138 kV side. Assume that the maximum load at the relay site is 120 MVA, and select a CT ratio accordingly. The available distance relay has zone 1 and zone 2 settings from 0.2 to 10 Ω, and zone 3 settings from 0.5 to 40 Ω, in increments of 0. 1Ω. The relay angle can be adjusted to 75° or 80°　　　**(10marks)**

(6a) What is the electrical center? How does it affect the power system?.　　　**(5marks)**

6-b) For the system shown in Fig. 2, find out whether power swing locus passes through any of the transmission lines? **(10marks)**

6c) What is load encroachment? How can tripping of a relay on load encroachment be prevented? **(5marks)**
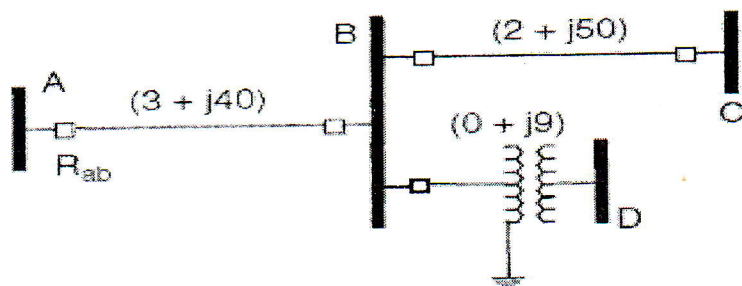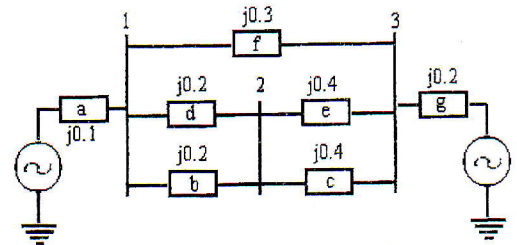

FIG. 1

FIG. 2

The following table is of no concern to the examination.

ILOs covered by the examination	The question or part of the question which covers a particular ILO.
a4-1	Q1
a4-2	Q1
a8-1	Q2a&Q2b
a8-2	Q3
a19-1	Q4&Q6a
b2-1	Q6c &Q6b
d9-1	Q5a
d9-2	Q5b&Q5c