



COLLEGE OF ENGINEERING & TECHNOLOGY

Department: Electrical & Control Engineering

Lecturer : Dr. Ahmed Lotfy

Course : Power System Protection (1) Starting Time: 14:00

Course Code: EE442

Marks: 40

Date : 22 / 01 / 2015

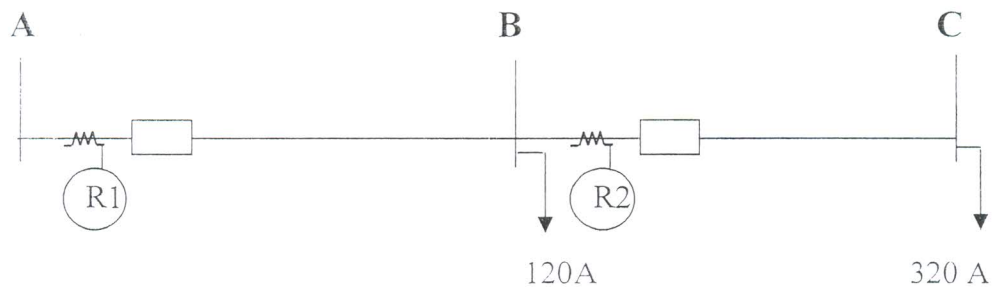
Time: 2 hours

Final Examination Paper

Answer the following questions:

1. - Check if 600:5 current transformers are suitable for the shown system.
 - Select suitable settings for time delay over-current relay R_2 then find out the response time for the given fault currents.
 - Set relay R_1 as backup to R_2 and check its response for local faults at B.

Bus	B	C
Minimum short circuit (A)	3700	2160
Maximum short circuit (A)	5000	3500



[A4, B17] (10 Marks)

- 2.a. Use illustrative drawings to show the construction of a plunger (solenoid) type over-current relay. Propose a suitable application for this type and give reason to your answer.

[A8] (5 Marks)

- 2.b. Discuss with the aid of drawing the transfer tripping distance protection scheme; show why non simultaneous trips are undesirable, and what kind of communication channel are not applicable with such scheme

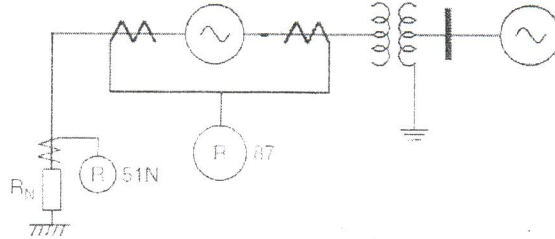
[A8] (5 Marks)

Members of course Examination Committee:	Signature of Members of course Examination Committee:	Date:
Lecturer: Prof. Ahmed Lotfy	<i>[Signature]</i>	5/1/2015
Course Coordinator: Prof. Amany ElZonkoly	<i>[Signature]</i>	5/1/2015
Head of Department: Prof. Hamdy Ashour	<i>[Signature]</i>	/1/2015

3.a. List the causes of unbalanced operation in power systems and the relevant means of detection, then discuss the effect of unbalanced operation on synchronous alternators.

[A8] (6 Marks)

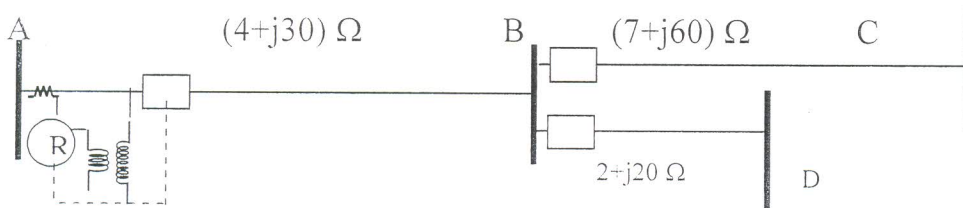
3.b. For the shown power system, State the expected differential protection response (Trip – No trip – Unknown) for the following cases, and give reason for your choice:



- A fault in the generator's windings with the generator's neutral solidly grounded
- A fault in the generator's winding with unknown neutral to ground resistance R_N
- A fault in the transformer's winding with the generator's neutral solidly grounded
- A fault in the transformer's winding with unknown neutral to ground resistance R_N

[A8] (4 Marks)

4. If **500:5** current transformer and **20 kV / 69.3 V** potential transformer are applied to a 3 steps **single phase** directional impedance relay with angle of maximum torque of 80 degrees and zone (1) and zone (2) possible settings from 0.5 to 15 and zone (3) setting from 1 to 30, both in increments of 0.1 Ω .



- Determine suitable three zone settings for distance relay (R) protecting line AB
- Check zone (2) of relay (R) with respect to zone (1) of downstream relays.
- Check relay's response to a 400 A, 0.8 lagging power factor single phase load.
- Draw the R-X diagram showing the Impedance relay characteristics and the different operating conditions.

[A4] (10 Marks)

Members of course Examination Committee:		Signature of Members of course Examination Committee:	Date:
Lecturer:	Prof. Ahmed Lotfy		5/1/2014
Course Coordinator:	Prof. Amany ElZonkoly		5/1/2014
Head of Department:	Prof. Hamdy Ashour		1/1/2014

GOOD LUCK

