

FEDERAL UNIVERSITY OF TECHNOLOGY OWERRI
DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING
RAIN SEMESTER 2013/2014 EXAMINATION

PSE 512: POWER SYSTEM PROTECTION Time: 3 Hours

INSTRUCTIONS: ANSWER all questions in section A and two each from sections B and C

SECTION A

1. A short circuit current is identified by a) Heavy current flow b) Voltage rise c) Voltage drop d) none of these
2. A most serious consequence of a major uncleared short-circuit fault could be a) blowing of fuse b) fire c) heavy voltage drop d) none of these
3. Fuse normally protect a system against a) over-current b) under current c) Resonance d) Lightning surge
4. The minimum oil circuit breaker has less volume of oil because solid insulation is provided for insulating the contacts from the earth. False True.
5. Backup protection functions when a) secondary protection fails b) primary protection fails c) both secondary and primary protection fail d) none of these
6. Purpose of backup protection is to a) increase the speed b) increase the reach c) leave no blind spot d) guard against failure of primary
7. Protective relays are the devices that detect abnormal conditions in electrical circuits by measuring voltage only. False/True
8. The actuating quantity for the relays may be a) magnitude b) frequency c) phase angle d) any of these
9. In the protection scheme, relay functions as a) a switching device b) sensing device c) breaking device d) none of these
10. Relay contacts are normally made up of a) silver contact b) copper contact c) platinum contact d) steel contact

SECTION B

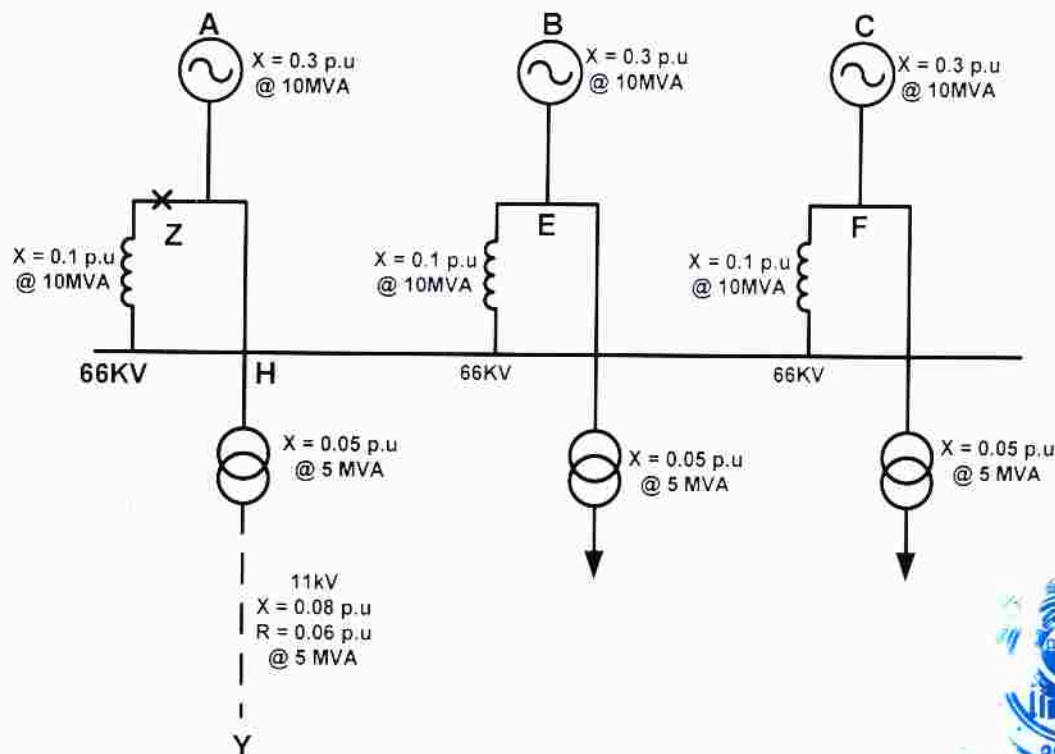
1a. Write short notes on the following: i. Principles of time current grading ii. Discrimination by time iii. Unit protection iv. Protection zones v. Time graded systems

b. State the main requirement of correct current relay application and list the seven different types of data normally required for setting such a relay. Hence state the main disadvantage of time discrimination method of achieving correct relay co-ordination.

2. The new IPP station at Egbema in Imo State has four bus bar sections to each of which is connected a generating unit of 30 MVA having 12 % leakage reactance while the busbar reactors having a reactance of 10 %. Determine the maximum MVA fed into a fault on the busbar section to new 132 KV substation, and the maximum MVA if the number of similar busbar sections like FUTO station were increased to infinity. From the first principle show the mathematical equation used.

3. A generation station is shown in Fig. B3 and the rating and per-unit reactance of the different elements are as indicated. Compute the Volt-amperes and the current fed into the following 3-phase short circuit:

- a) at the busbar section @ Z
- b) at the distant end @ a feeder Y



SECTION C

Question 1: (a) Discuss the functionality and justification for utilization of any five protection components of the distribution system show on the one-line diagram of the figure below.

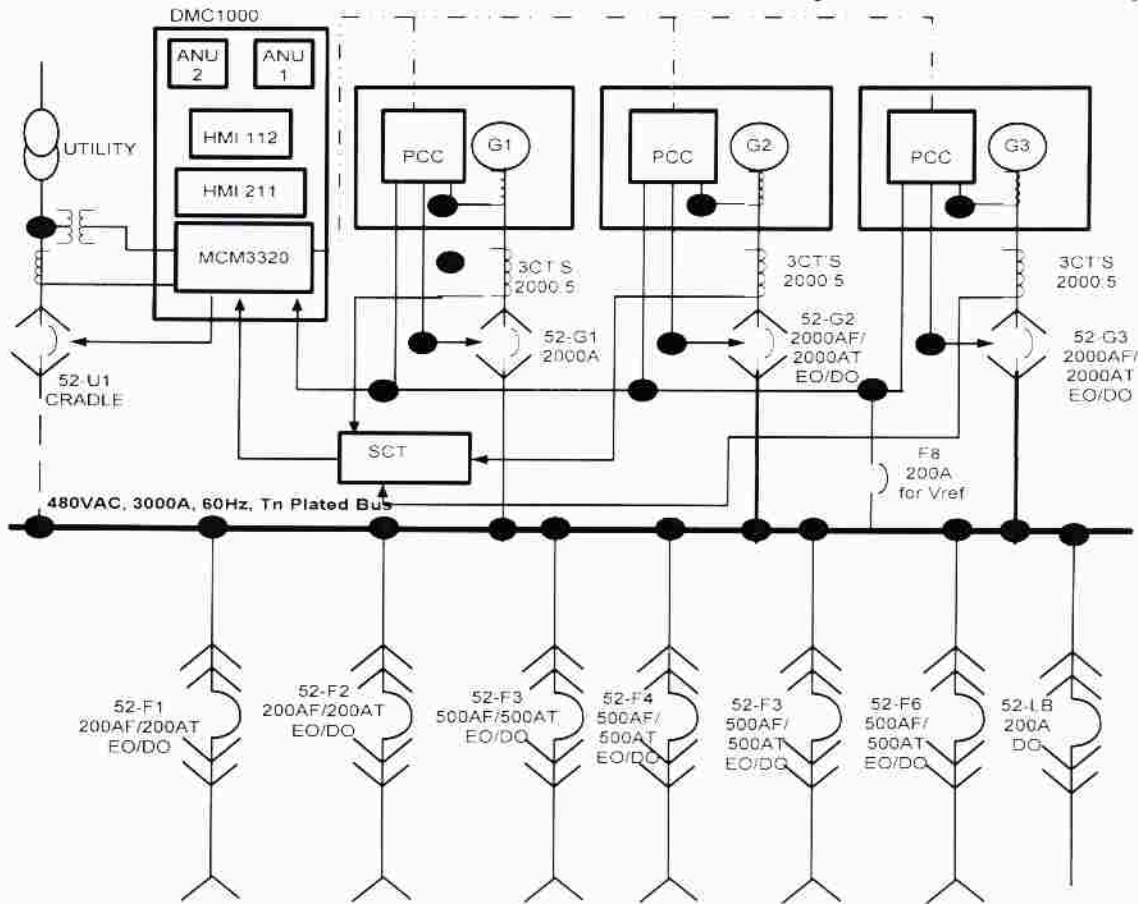


Fig. C1: Final One-Line Design of HCL P-Gear System

- (b) A contractor handling the new distribution system of Nigerian Breweries (NB) Plc plant at Owerri, Nigeria has presented Fig. 1 as the proposed distribution system layout. If NB technical team has agreed that system should contain grouped of loads served by five feeder breakers 500A respectively arranged at one end of the local general system in a dry environment. As a newly hired internal Protection Engineer for NB, present with reasons a sketch of the modified one-line diagram you will present to the NB Board in order to provide a cheaper, but still safe and reliable design for this project.
2. (a) Enumerate five hazards that are detectable in an electric motor.
 - (b) Recommend with reasons one appropriate protection scheme for each.
 - (c) Discuss four major sources of transients for each of high voltage systems and low voltage systems.
 - (d) Develop model for protecting each of the low voltage source transients.
3. (a) Present a characterization of system faults associated with generators.
 - (b) Present a design for a typical power system protection zones having two sources and four load centers.
 - (c) What is the significance of overlapping the protection zones in your design of 4(b)?



