

Kuwait University
Faculty of Engineering
Electrical Engineering Programme.
Department: Power and Electrical
Machines
Course Title: Protection & Switchgear in
Electrical Power Systems



Date: 20-6-2021
Time Allowed: 3 hrs
Full Mark: 90 Marks
Final Second Term Exam of 4th Year.
Year: 2020-2021.
Code Course : EPM 4226

- Please for your safety follow safety procedures.
- I hope that God will protect you and your families from COVID-19.
- Trust in God —Be confident —Be calm.
- Exam is not a punishment or a curse.
- It is the time to get the prize of your effort.

This course must be able to satisfy the GENERAL competencies for all engineering programs (Level A): A1, A3, A4, A6, A7&A9, the competencies for the BASIC Electrical engineering discipline (Level B): B3, B4 & B5 and the Electrical Power & Machines Engineering competencies (Level C): C1, C2&C4.

Important instructions for all students: please read carefully.

- The examination consists of 4 questions in 2 papers (4 pages)
- Read the questions carefully before answering.
- Remember to mark your answers with ordered numbers corresponding to questions.

Question 1:

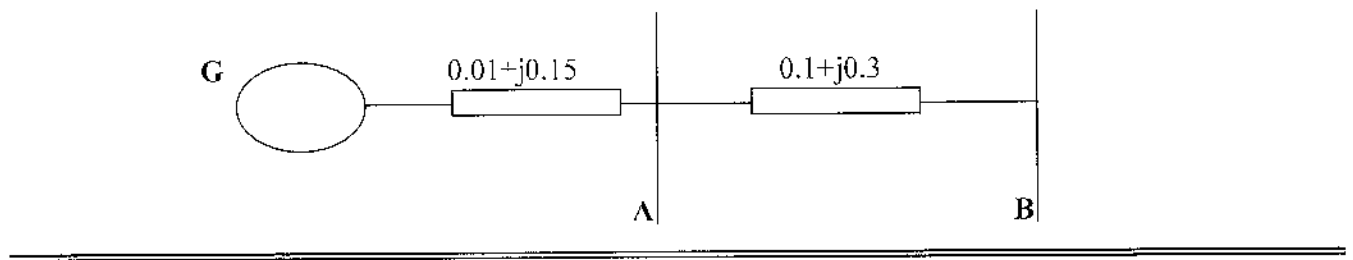
(45 Marks)

Answer the following 45 parts of the first question get one mark for each part:

- 1) In a single bus bar system there will be complete shutdown when
 - a) Fault occurs on the bus itself
 - b) Fault occurs on neutral line
 - c) Two or more faults occur simultaneously
 - d) Fault occurs with respect to earthing
- 2) For which of the following ratings of the transformer differential protection is recommended?
 - a) Above 30 KVA
 - b) Equal to and above 5 MVA
 - c) Equal to and above 25 MVA
 - d) None of the above
- 3) Differential relays are used for protection of _____
 - a) Feeders.
 - b) Alternators.
 - c) Transformers.
 - d) All of these
- 4) Which type of connection is employed for current transformers for the protection of star- delta connected 3 phase transformer?
 - a) delta-delta.
 - b) star-star.
 - c) delta-star.
 - d) star-delta
- 5) Distance relays decide on basis of which factor?
 - a) Current
 - b) Voltage
 - c) Both of these
 - d) None of these
- 6) Microprocessor relay belongs to which class of relays?
 - a) Electromechanical relay
 - b) Analog Static relay
 - c) Digital Static relay
 - d) None of these
- 7) Under voltage relays are used for _____
 - a) Motors
 - b) Alternators
 - c) Bus bars
 - d) All of these
- 8) Both voltage and current signals are required for _____

- a) A plain over current relay b) A differential relay c) A directional relay d) A biased directional relay
- 9) The method in which earthing is done through a transformer is referred as: _____
- a) Effective earthing b) Non-effective earthing c) Peterson coil earthing d) Flick method
- 10) Relays can be designed to respond to changes in _____
- a) Resistance, reactance, or impedance b) Voltage and current c) Temperature d) All of the above
- 11) For which of the following protection from negative sequence currents is provided?
- a) Generators b) Motors c) Transmission line d) Transformers
- 12) The pick-up current of a 100/5 transformer having a current setting of 300% will be
- a) 2.5 A b) 5 A c) 10 A d) 15 A
- 13) The under-voltage relay is recommended for _____
- a) Transformers b) Motors c) Feeder d) Busbars
- 14) The material used for busbar should have _____
- a) Low resistivity b) Low-cost c) High Softening temperature d) All of the above
- 15) Problems associated with differential protection is/are _____
- a) Magnetizing inrush current. b) Mismatching characteristics of CTs
c) Change of ratio as a result of tapping d) All of the above.
- 16) Which of the following bus-bar schemes has the lowest cost?
- a) Ring bus-bar scheme b) Single bus-bar scheme
c) Breaker and a half scheme d) Main and transfer scheme
- 17) Which relay comes into operation in the event of the failure of prime mover connected to the generator?
- a) Reverse power relay b) Differential relay c) Buchholz relay d) None of the above
- 18) The protection relay which has inherent directional characteristics _____
- a) Mho relay b) Reactance relay c) Distance relay d) All of these
- 19) The correct statement about the unbalanced condition in alternator:
- a) The same current flows through different phases in the unbalanced alternator
b) Unbalanced loading is not dangerous for the alternator
c) Unbalanced loading introduces eddy current in the alternator d) None of these is correct
- 20) For voltage is greater than 33 K V,Busbar arrangement is employed
- a) Single b) Double c) Duplicate d) None of the above
- 21) Which of the following medium is employed for the extinction of arc in air circuit breaker?
- a) Water b) Oil c) Air d) SF₆
- 22) In large generators protection provided against external faults is _____
- a) Biased differential protection b) Sensitive earth fault protection
c) Inter-turn fault protection d) All of the above.
- 23) Which type of protection is provided on a generator to protect against stator insulation failure?
- a) Differential protection b) Thermocouple actuated alarm

c) Consider the transmission line connected to a generator as shown in the following figure, the impedance data for the generator and the line are given in figure. A relay to be located at terminal A is to detect all fault on the transmission line. Assume a pre-fault voltage of 1.0 pu and allow for possible steady state overvoltage of 1.2 pu during normal operation. **Determine** the pickup settings for an overcurrent relay and under voltage relay to be used as fault detector for this circuit. Allow a sufficient margin between the normal condition and pickup setting to accommodate any inaccuracies in relay performance. Assume the maximum load current to 1.0 pu.



Best wishes

Associated prof., Dr.Eman Saad &Committee