UGANDA INSTITUTE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY

END OF SEMESTER II EXAMINATIONS

DEPARTMENT	:	**ICT**
YEAR	:	**TWO**
SEMESTER	:	**TWO**
PROGRAM	:	**DIPLOMA IN ELECTRICAL & ELECTRONICS ENGINEERING**
COURSE	:	**POWER SYSTEM PROTECTION & COORDINATION**
COURSE CODE	:	**ELT 2202**
DATE	:	**SATURDAY, JUNE 29, 2024**
TIME	:	**02:00 PM – 05:00 PM**
DURATION	:	**3 Hours**

INSTRUCTIONS

- The paper consists of two Sections A and B
- Answer **ALL** questions in Section A and **ANY THREE** questions in Section B
- Credit will be given to relevant examples and illustrations
- Don Not Write anything on this question paper

Section A[40 MARKS]:

1. The protection against direct lightning strokes and high voltage steep waves is provided by
    A. Ground wires
    B. Lightning arresters
    C. Lightning arresters and ground wires
    D. Earthing of neutral
2. Which of the following factors should be considered the design of a transmission line against lightning with ground wire?
    A. Mechanical strength of ground wire
    B. Clearance between line conductor and ground wire
    C. Clearance between line conductor and earth
    D. All of above
3. Lighting arresters are used in power system to protect electrical equipments against
    A. Power frequency over-voltages
    B. Over-voltages due to indirect lightning stroke
    C. Direct stokes of lightning
    D. Over-currents due to lightning
4. Overhead ground wires are used to protect a transmission line against
    A. Voltage surges due to direct lightning stroke
    B. Arcing earths
    C. Line-to-ground faults
    D. High voltage oscillations due to switching
5. An overhead transmission line is provided with earth wire for protection against
    A. Switching surge
    B. Lightning surge
    C. Power frequency over voltage
    D. All of above
6. When a transmission line is energized, ___________ propagate on it
    A. Voltage wave only
    B. Current wave only
    C. Both (A) and (B)
    D. None of above
7. A relay is used to
    A. Break the fault current
    B. Sense the fault
    C. Sense the fault and direct to trip the circuit breaker
    D. All of these
8. Back up protection is needed for
    A. Over voltage
    B. Short circuits
    C. Over current
    D. All of these

9. Which of the following is used for protecting transmission lines against direct strokes of lightning?
    A. Ground wires
    B. Circuit breakers
    C. Surge arrestors
    D. All of these
10. Which of the followingis a reason to resort to series compensation in an extra high voltage line?
    A. Improve stability
    B. Improve voltage profile
    C. Restrict fault currents
    D. None of these
11. Which of the following is the purpose of conducting fault studies?
    A. To determine fault voltages
    B. Short circuit MVA
    C. To determine fault currents
    D. All of these
12. Which of the following is a component of a power system?
    A. Automatic load frequency control mechanism
    B. Power transmission lines
    C. Protective relays
    D. All of these
13. In which of the following, voltage instability will lead to voltage collapse?
    A. Weak transmission system
    B. Uncoordinated control system
    C. Unmatched characteristics of reactive compensating device
    D. All of these
14. A switch is a device which_____.
    A. is used to open or close an electrical circuit
    B. is used under full load or no load conditions
    C. cannot interrupt the fault currents
    D. all of the above
15. An isolator is designed to open a circuit at ____.
    A. no load condition
    B. on load condition
    C. over load condition
    D. any of the above
16. A fuse is inserted _____
    A. in series with the circuit to be protected
    B. in parallel with the circuit to be protected
    C. in series with neutral
    D. as per consumers wants

17. A circuit breaker is a protecting device which operates____
    A. under normal conditions
    B. under abnormal condition.
    C. Both A and B
    D. in transient time only
18. Recovery voltage is also called as___
    A. normal frequency voltage
    B. transient frequency voltage
    C. sub transient frequency voltage
    D. peak voltage
19. What is the harmful effect of short circuits___
    A. Flow of heavy current will overheat the equipment
    B. short circuit current carrying parts produces forces of electro-dynamic interaction
    C. it may damage or destroy the equipment
    D. all of the above
20. The lesser the effective impedance in faulty circuit then the ____
    A. greater is the short circuit current
    B. lesser is the short circuit current
    C. greater is the system voltage
    D. any of the above depend on fault magnitude

SECTION B [60 MARKS]:

Question One:

A manufacturing plant is experiencing frequent electrical faults that cause power outages and equipment damage. You have been tasked with designing a protection system for the plant.

a) Explain why power system protection is necessary for the manufacturing plant. (4 marks)
b) Describe the basic requirements of a protection system that would be suitable for this application. (6 marks)
c) Identify and explain the function of the basic components of the protection system you would use. (10 marks)

Question Two:

During a routine inspection, a fault occurs in a transmission line causing significant disruption to the power supply. As an engineer, you need to analyse and mitigate such faults.

a) Identify and explain the types and causes of faults that can occur in generation, transmission, and distribution systems. Include both active and passive faults in your explanation. (6 marks)
b) Differentiate between transient and permanent faults, and symmetrical and

asymmetrical faults, providing examples of each. (6 marks)

c) Calculate the short-circuit kVA for a symmetrical fault in a system with a line voltage of 11 kV and an impedance of 0.4 ohms. (8 marks)

Question Three:

A new substation is being built, and you are responsible for designing the earthing system to ensure safety and reliability.

a) Explain the reasons for earthing electrical equipment and differentiate between system earthing and equipment earthing. (6 marks)
b) Describe the various earthing systems available and the concept of touch voltage and step voltage. (6 marks)
c) Propose methods for reducing earth resistance and explain how to measure earth resistance in the substation. (8 marks)

Question Four:

A new high-rise building requires a reliable circuit breaker system to ensure electrical safety and efficiency. You are tasked with selecting and explaining the appropriate circuit breakers for different parts of the building.

a) Explain the purpose of circuit breakers and differentiate between an isolator and a circuit breaker. (6 marks)
b) Describe the basic principle of operation of circuit breakers and the combination of protective relay and circuit breaker. (6 marks)
c) Discuss the different types of circuit breakers (MOCB, ABCB, SF6, Vacuum) and recommend the most suitable type for use in the high-rise building, explaining your choice. (8 marks)

Question Five:

a) Explain protection in relation to power systems protection. (2 Marks)
b) Mention any two objectives of power systems protection. (2 Marks)
c) Draw a diagram showing a well labelled structure of a power system. (4 Marks)
d) Name the primary protective equipment components in a power system. (4 Marks)
e) Explain the four most important requirements of power system Protection. (8 Marks)

End..