CHUKA  **UNIVERSITY**

UNIVERSITY EXAMINATIONS

EXAMINATION FOR THE AWARD OF DEGREE OF BACHELORS OF SCIENCE IN ELECTRICAL AND ELECTRONIC ENGINEERING

EENG 215: WORKSHOP PRACTICE III

STREAMS: EB24 **TIME: 2 HOURS**

DAY/DATE: FRIDAY 13/12/2024 **11.30 A.M. – 1.30 P.M.**

INSTRUCTIONS:

- This paper consists of **four** questions.
- Attempt Question **one** and any other **two**

QUESTION ONE: (COMPULSORY) (30 MARKS)

(a) (i) With the aid of a diagram show the physical structures of a paper insulated lead sheathed steel wire armored 3-core copper cable and state any ONE special I.E.E regulations with reference to its installation

(ii) State any TWO factors that affect the choice of wiring cables **(6 marks)**

(b) For the following type of electrical circuits, state the applicable cable size and the size of protective device to be used for each:

(i) Four lighting points controlled by one gang one-way 5A single pole switch

(ii) Three radial socket-outlets

(iii) An electric water heater unit connected through a switch **(3 marks)**

(c) (i) State any TWO advantages of digital- over analogue- electrical measuring Instruments

(ii) A moving coil ammeter has a full-scale deflection of 5A and a resistance of 0.035Ω. Determine the shunt required to be connected with the

ammeter to read 150A **(4 marks)**

(d) Draw a labelled wiring circuit diagram of two lighting points controlled independently from two positions, using one gang two-way switches connected through a 30A junction box, state in sequence the main tests which should be carried if the circuit is installed **(6 marks)**

(e) A commercial premise have the following maximum loads:

-Twelve, 15A power points with expected maximum load 100% of three socket outlets + 40% of the remainder.

-Six, 5A socket outlets with expected maximum load 100% of two socket outlets + 40% of the remainder.

-Lighting points 10A with expected maximum load of 66%

- Water heater 6A with expected maximum load of 100%

- Four, air conditioners 8A with expected maximum load of 30%

- Water pump 4A with expected maximum load of 30%

- Two, equipment 6A with expected maximum load of 50%.

Determine the:

(i) Total maximum load current

(ii) Connected load current and comment on the importance of the use of diversity factor in electrical wiring installations. **(6 marks)**

(e) (i) State any TWO reasons for earthing electrical installations

(ii) Draw of a protective multiple earthing system and state one main advantage of the system **(5 marks)**

QUESTION TWO (20 MARKS)

(a) With reference to I.E.E. regulations on cable sizes and ratings, explain how the following factors affect the current carrying capacity in cables

(i) Ambient temperature

(ii) Rating factor

(iii) Voltage drops **(6 marks)**

(b) A 230V, 50Hz heating tank contains 4,000 litres of water. Calculate the current taken from the supply to raise the from the initial temperature of 19.5^0C to the final temperature of 100^0C in 6hours. Assume that the tank has an overall efficiency of 85% and the specific heat capacity of water as 4,190J/kg^{o}C **(5 marks)**

(c) (i) With the aid of electrical symbols distinguish between three phase-fuse switch and switch fuse

(ii) Draw a labelled block diagram of the sequence of control equipment at the consumer's intake points of a single-phase ac power **(9 marks)**

QUESTION THREE (20 MARKS)

(a) With reference to current protection in electrical circuits distinguish between the following factors, stating how they are applied in electrical installations

(i) Close- and Coarse- excess current protection

(ii) Diversity- and Discrimination- factors **(5 marks)**

(b) (i) Draw a complete wiring circuit diagram of combination of parallel and series lighting system controlled independently from three positions through intermediate switching and mini-trunking

(ii) With the aid of a suitable diagram explain the voltmeter-ammeter method of test for earth electrode resistance **(11 marks)**

(c) Draw neat diagrams of the following types of accessories and state their applications:

(i) 13A Top plug

(ii) Angle batten lamp holder **(4 marks)**

QUESTION FOUR (20 MARKS)

(a) Explain the following types of electrical wiring systems and give ONE application of each:

(i) Surface or cleat pvc sheathed system

(ii) Conduit system

State any TWO factors that determine the choice of wiring systems **(10 marks)**

(b) (i) With the aid of circuit diagrams explain the principles of operation of Thermal-magnetic controlled miniature circuit breaker

(ii) Distinguish between tolerance and thermal stability as applied to resistors and state their effect on resistance

(iii) An electrical circuit supplied by 230V, 50Hz ac supply consists of two capacitors of 2.5μF, 5.0μF in series and three resistors of 15Ω, 10Ω and 200Ω connected across them in parallel. Determine the total current in the circuit **(10 marks)**

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