



MACHAKOS UNIVERSITY

University Examinations 2017/2018

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

SECOND YEAR SECOND SEMESTER EXAMINATION DIPLOMA IN ELECTRICAL
ENGINEERING

EED 212: ELECTRICAL INSTALLATION TECHNOLOGY IV

DATE: 6/12/2017

TIME: 8.30-10.30 AM

INSTRUCTIONS

Attempt question ONE and any two questions

QUESTION ONE (COMPULSORY) (30 MARKS)

- (a) Define the following terms:-
- (i) Quantity of heat
 - (ii) Specific heat capacity (4 marks)
- (b) Differentiate between the following two terms, radiation and convection as used in heat transfer (2 marks)
- (c) (i) State the **FOUR** factors to be considered when designing methods of heating a room (4 marks)
- (ii) A Living Room, 20m by 15m with ceiling height of 5m, has three doors each of area 6 m^2 and five windows each of 1.5 m^2 . The living room is to have electric heating sufficient to maintain an average inside temperature of 19°C when the outside walls, ceiling and floor is 0°C

Given the following Heat transfer coefficients:

Floor – timber on concrete $0.85 \text{ W/m}^2 \text{ }^\circ\text{C}$

Ceiling – plaster $0.99 \text{ W/m}^2 \text{ }^\circ\text{C}$

Walls – brick and plaster $1.76 \text{ W/m}^2 \text{ }^\circ\text{C}$

Doors –wood $2.84 \text{ W/m}^2 \text{ }^\circ\text{C}$

Windows –double glazing $2.9 \text{ W/m}^2 \text{ }^\circ\text{C}$

Specific heat capacity $1010 \text{ J/kg }^\circ\text{C}$

Density of air 1.292 kg/m^3

Calculate the KW rating of the heaters assuming two complete changes of air per hour. (10 marks)

- (d) A water heater holds 30 litres of water. Calculate the rating in kW of the electric immersion heater which will raise the temperature of the water from 5°C to 90°C in 45 minutes, assuming an efficiency of 80 per cent. (Specific heat capacity of water is $4187 \text{ J/kg }^\circ\text{C}$). (6 marks)
- (e) State **any FOUR** requirements regarding electric fence installation (4 marks)

QUESTION TWO (20 MARKS)

- (a) State any TWO IEE regulations governing electric water heating circuits. (2 marks)
- (b) Differentiate between local storage and central storage electric water heating systems (2 marks)
- (c) With aid of well labeled diagram describe the pressure type water heating systems (10 marks)
- (d) A Water tank containing 90 litres of water at 10°C is heated at an efficiency of 90 per cent by 10 kW immersion heater. Find the time needed to raise the temperature of the water to 85°C . (Specific heat capacity of water is $4187 \text{ J/kg }^\circ\text{C}$ and 1kg of water equals to 1 litre) (6 marks)

QUESTION THREE (20 MARKS)

- (a) (i) Define the following terms in relation with hazardous area.
- I. zone 1
- II. Damp situation (4 marks)
- (ii) Distinguish between the following two terms hazardous area and flash point. (2 marks)
- (b) (i) State any three IEE regulation governing electric motors in agricultural and Horticultural installations. (3 marks)
- (ii) With aid of a well labeled diagram, describe the operation of mains operated fence controller circuit (11 marks)

QUESTION FOUR (20 MARKS)

- (a) Describe the following faults common found in underground cables.
- (i) Open circuit
 - (ii) Short circuit (4 marks)
- (b) With aid of a well labeled circuit diagram, describe the following procedure for locating faults in underground cables:
- (i) Null point detector
 - (ii) High Resistance fault. (8 marks)
- (c) In a distributor cable of 50 sq m of single core, there is an earth fault in a route of 365m. In a Murray loop test the constant resistance is 30 ohms whereas the value of the variable resistance is 63 ohms. The resistance per metre conductor of the cable is $0.4\Omega/\text{m}$. Find the location of the fault if the sound cable of the same size is also running long with this faulty cable. (8 marks)

QUESTION FIVE (20 MARKS)

- (a) Describe the following electric water heating systems:-
- (i) Electric geysers
 - (ii) Local storage (4 marks)
- (b) With aid of well labeled diagram describe the non - pressure type water heating systems. (12 marks)
- (c) A twin cable of length 1000 metres has developed a low resistance earth on one core. A fall of potential test is taken from both ends, P and Q. The readings taken at P are $V_1 = 15V$, and $I_1 = 3A$. The readings at Q are $V_2 = 30V$, and $I_2 = 3A$. Find the position of the fault. (4 marks)
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