



Complete, fold and seal
(see note 2 below)

SURNAME: Neale

FORENAME(S): Matthew

Examination Answer Books

12 Pages

Instructions to Candidates

1. Please give the information requested in the boxes below.
2. Enter your name in the space provided to the right, fold over and seal down (using the label provided) to hide your name.
3. The answers must be legibly written. The Examiners can either ignore illegible script or have it typed and the expense of typing charged to the candidate.
4. Write your answers in ink.
5. Begin each answer on a fresh page. Do all rough work in the answer book and cross it through.
6. No part of this book is to be torn out; it must be handed in complete.
7. If more books than one are used, fasten them together using the tags available from the invigilator(s).
8. Every book must be handed in. In no circumstances may answer books, used or unused, be taken out of the examination venue.

1	Student Number	NEA 20856038
2	Title of Examination Paper	Design of electrical installations
3	Module Code	GOEE 4001
4	Date and Time of Examination	07/05/2024 11.15 AM
5	Examination Venue	68860 ward 2 hill house
6	Seat Number	B4
7	Number of Answer Books handed in	1

List the numbers of the questions you have attempted	Office Use
1	9
2	5
3	6
4	3
5	6
Total	29

50

58% *Matthew*

1) a) Length = 14×40 $UF = 0.8$
 $Lux = 370$ $MF = 0.7$
 $Lumens = 16,000$

$$N = \frac{E \times A}{F(UF \times MF)} = \frac{Lux \times length}{Lumens(UF \times MF)}$$

$$= \frac{370 \times (14 \times 40)}{16,000(0.8 \times 0.7)} = 23.125 \text{ (Rounded to 24 lamps)}$$

(5)

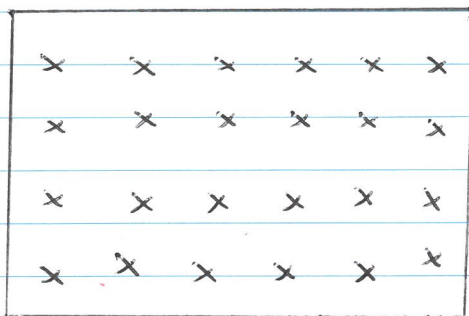
b) $I = 8000 \text{ cd}$
 $d = 8 \text{ m}$

$$L = \frac{I}{d^2} = \frac{8000}{8^2}$$

(3)

$$= \frac{8000}{64} = 125 \text{ Lux below one of the lights}$$

c) Standard 6×4 pattern



(6 x 4 = 24)

(1)

Q1

$$\frac{9}{10}$$

✓

2) a) 8m long, 2 bends

6 x 1.5mm² Solid PVC BS6004

6 x 2.5mm² Solid PVC BS6004

12 x 6mm² Stranded Thermoset BS7211

12 x 10mm² Stranded Thermoset BS 7211

Factors x number of each

$$1.5 - 8 \times 6 = 48 \quad \checkmark$$

$$2.5 = 11.9 \times 6 = 71.4 \quad + \quad \checkmark$$

$$6 = 22.9 \times 12 = 274.8 \quad \checkmark$$

$$10 = 36.3 \times 12 = 435.6 \quad \checkmark$$

$$\text{Total Factor} = 829.8 \quad \checkmark$$

Next value

$$\text{available} = 993 \quad \checkmark$$

$$= \text{Trunking Size of } 100 \times 25 \text{ mm} \quad \checkmark$$

$$100 \text{ mm} \times 25 \text{ mm} \quad \checkmark$$

Q2

5
5

(3)

b) 10mm² BS 7271 Thermoset (Stranded)

Trunking size = 100mm x 25mm

max Factor = 993 $\checkmark$

$$1 \times 10 \text{ mm} = 36.3 \quad \checkmark$$

10

$$\frac{993}{36.3} = \text{max allowed cables} \quad \checkmark$$

$$= 27.35 \quad \checkmark$$

max number of 10mm² cables is 27 $\checkmark$

$$\text{as } 27 \times 36.3 = 980.1$$

(2)

3) a) Neutral current = $\sqrt{(I_a^2 + I_b^2 + I_c^2) - (I_a \times I_b) - (I_b \times I_c) - (I_a \times I_c)}$

a = 150 Amp Brown phase

b = 200 Amp Black phase

c = 60 Amp Grey phase

$$= \sqrt{(150^2 + 200^2 + 60^2) - (150 \times 200) - (200 \times 60) - (150 \times 60)} \checkmark$$

$$= \sqrt{(66100) - (30,000) - (12,000) - (9,000)} \checkmark$$

$$= \sqrt{15,100} \checkmark$$

$$= 122.88 \text{ Amps} \checkmark$$

(6)

b) If the loads were partly reactive
It would affect the calculation as the
stated values won't be the same as the actual
values if there was a current spike. x

(0)

c) In order to balance the loads you could
re-arrange the circuits onto different phases to get
enough of a balance to power the room from a
single one of the phases. x

(0)

Q3

$\frac{6}{10}$

✓

- 4) 34A rated load 70°C PVC Singles
~~BSSB~~ BSSB-2 Fuse (Ref method B)
 20m length 2 other circuits (3 total)
 Temp of 34° - No insulation TVE-S
 $Z_e = 0.58 \Omega$

$$I_b = 32A \text{ (Load)}$$

$$I_2 = \frac{I_b}{C_a \times C_g \times 1 \times 1} = \frac{32}{0.94 \times 0.65} = 52.37A$$

$C_a = 0.94$
 $C_g = 0.65$

Cable conductor size

$$= 10 \text{ mm}^2 \text{ up to } 57 \text{ Amps}$$

$$R_1 + R_2 = \frac{(R_1 + R_2) \times \text{length}}{1000} \quad \checkmark$$

$$= \frac{3.66 \times 1.2 \times 20 \text{ m}}{1000} = 0.087 \Omega$$

$$Z_s = Z_e + (R_1 + R_2)$$

$$= 0.58 \Omega + 0.087 \Omega = 0.667 \Omega$$

$$I_f = \frac{V_{oc}}{Z_s} = \frac{230}{0.667} = 344.827 \quad \checkmark$$

$$S = \frac{\sqrt{I_f^2 \times T}}{k} = \frac{\sqrt{344.83^2 \times 0.1}}{115}$$

$$I = I_f = 0.948 \text{ mm}^2$$

T = disconnection time = 0.1

k = constant = 115

(3)

Q4

$$\frac{3}{15}$$

Minimum CPC Size = 1mm^2 as calculated value
is lower at 0.948mm^2

Minimum live conductor size = 10mm^2
as it holds up to 57A ~~generally 44A~~
and max here is 52.37A

5) a) Fault current

$$I_f = \frac{V_{oc}}{Z_s}$$

$$Z_s = Z_e + (R_1 + R_2)$$

$$R_1 + R_2 = \frac{(R_1 + R_2) \times m \times \text{Length}}{1000}$$

Correct method used.

$$Z_e = 0.35$$

Length = 30m

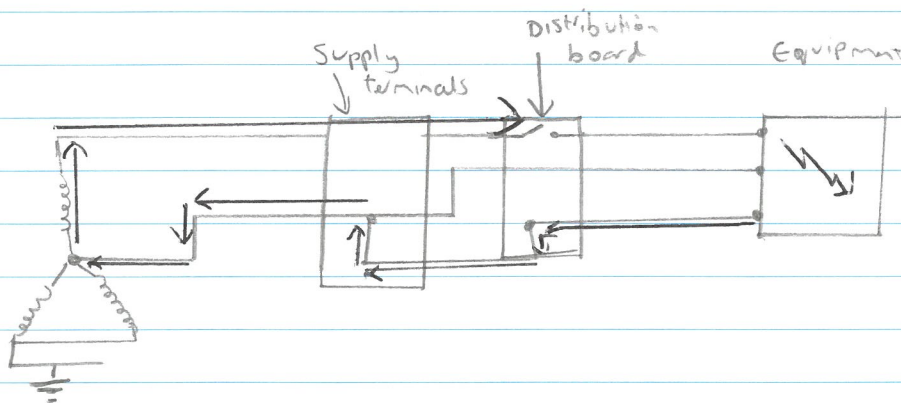
$$= \frac{3.66 \times 1.2 \times 30}{1000}$$

$$R_1 + R_2 = 0.132 \Omega$$

$$\text{So } Z_s = 0.35 \Omega + 0.132 \Omega = 0.482 \Omega$$

$$I_f = \frac{230V}{0.482 \Omega} = 477.18 A$$

b) The path is called ~~an~~ an earth fault loop



The fault goes from the equipment all the way back to the supply and then goes back to the distribution board to trip the fuse.