higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

# NATIONAL CERTIFICATE:
# MULTIDISCIPLINARY DRAWING OFFICE PRACTICE

# ELECTRICAL DRAUGHTING

(8080625)

**3 December 2019 (X-Paper)**
**09:00–13:00**

**REQUIREMENTS: A4 drawing sheets**

**Calculators, computer-aided drawing software and/or drawing equipment may be used.**

**This question paper consists of 5 pages and 1 diagram sheet.**

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# DEPARTMENT OF HIGHER EDUCATION AND TRAINING
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NATIONAL CERTIFICATE:
MULTIDISCIPLINARY DRAWING OFFICE PRACTICE
ELECTRICAL DRAUGHTING
TIME: 4 HOURS
MARKS: 100

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**INSTRUCTIONS AND INFORMATION**

1. Answer ALL the questions.

2. Read ALL the questions carefully.

3. Number the answers according to the numbering system used in this question paper.

4. Answer ALL questions (theory and drawings) on the A4 DRAWING SHEETS. NO separate ANSWER BOOK is required.

5. Marks will be allocated for:
   - 4.1 Balanced layout and size
   - 4.2 Correctness
   - 4.3 Lettering
   - 4.4 Line work and neatness

   Write neatly and legibly.

6.

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## QUESTION 1: GENERAL THEORY

1.1 Choose the correct word or words from those given in brackets. Write only the word or words next to the question number (1.1.1–1.1.12) in the ANSWER BOOK.

1.1.1 The prefix *nano* means (× $10^{-3}$/× $10^{-6}$/× $10^{-9}$/× $10^{-12}$).

1.1.2 Armoured cables must be buried at a minimum depth of (0,5/0,75/1,0/1,5) meters below ground level unless suitably protected.

1.1.3 A (lagging/leading/unity/zero) power factor means apparent power equals active power in a circuit.

1.1.4 The direction of rotation of a/an (DC shunt/DC series/AC single-phase/AC three-phase) motor can be reversed by interchanging any two of the supply lines.

1.1.5 The contacts of an electric relay should always be drawn in the (open/closed/unenergised/energised) position.

1.1.6 Graphical symbols in an electrical diagram may be reversed or rotated to simplify the layout of the circuit, but only if (it does not change the electrical properties of the circuit/the changes are noted on the drawing/the circuit works from an AC supply/the circuit works from a DC supply).

1.1.7 When wiring premises, no more than (two/three/four/five) conductors may be connected together at any terminal point.

1.1.8 A diode is forward biased when the (emitter/gate/cathode/anode) is positive with respect to the rest of the device.

1.1.9 A transformer with a primary to secondary turns ratio of (smaller than one/one/bigger than one/zero) is generally known as a step-down transformer.

1.1.10 A negative temperature coefficient implies that the resistance of the substance will (increase/decrease/remain unchanged/become zero) if the temperature of the substance is increased significantly.

1.1.11 An AC ammeter measures the (effective/average/instantaneous/maximum) value of the current.

1.1.12 A stroboscopic light effect originates from the pulsating luminous output of a/an (infrared/incandescent/fluorescent/ultraviolet/discharge) lamp.

(12 × 1) (12)

1.2 Which conductor sizes ($mm^2$) are prescribed for each of the following circuits or subcircuits relating to the wiring of a premise:

1.2.1 Main supply

1.2.2 Cooking appliance (electrical stove)

1.2.3 Geyser

1.2.4 Socket outlet (power point)

1.2.5 Illumination

(5 × 1) (5)

1.3 An electrical circuit consists of two series-connected resistors ($R_1$ and $R_2$) of 2 ohms and 4 ohms respectively. The circuit is connected directly to a 12 volt DC power supply ($V_T$).

Calculate the total current flow ($I_T$) of the circuit as well as the voltage drop across each resistor ($V_1$ and $V_2$). (3)

**[20]**

## QUESTION 2: GRAPHICAL SYMBOLS AND ELECTRONIC DIAGRAMS

Draw the correct and complete graphical IEC symbol used in electrical diagrams for each of the following descriptions without copying the descriptions:

2.1 Battery

2.2 Transformer

2.3 Polarised capacitor

2.4 Light-sensitive resistor (photo-conductive device)

2.5 NTC thermistor

2.6 Light-emitting diode (LED)

2.7 Silicon control rectifier (SCR)

2.8 Bidirectional diode (Diac)

2.9 Incandescent lamp with TWO terminals

2.10 Relay

(10 × 2) **[20]**

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## QUESTION 3: GENERATION AND DISTRIBUTION OF ELECTRICITY

Draw a labelled graph to show the characteristics of a single-phase sine wave.

The drawing must include the following:

- Peak-to-peak value
- Amplitude
- Peak value
- Periodic time
- Average value
- RMS value

Use any suitable scale so that the graph and labelling will not cover more than an A4 DRAWING SHEET. **[20]**

## QUESTION 4: ELECTRICAL MOTORS AND CONTROL DEVICES

Draw fully labelled circuit diagrams of both a single-phase capacitor-start and capacitor-run motor. **[20]**

## QUESTION 5: WIRING OF PREMISES

The DIAGRAM SHEET (attached) shows a schematic layout of a single-phase distribution board for a typical domestic dwelling.

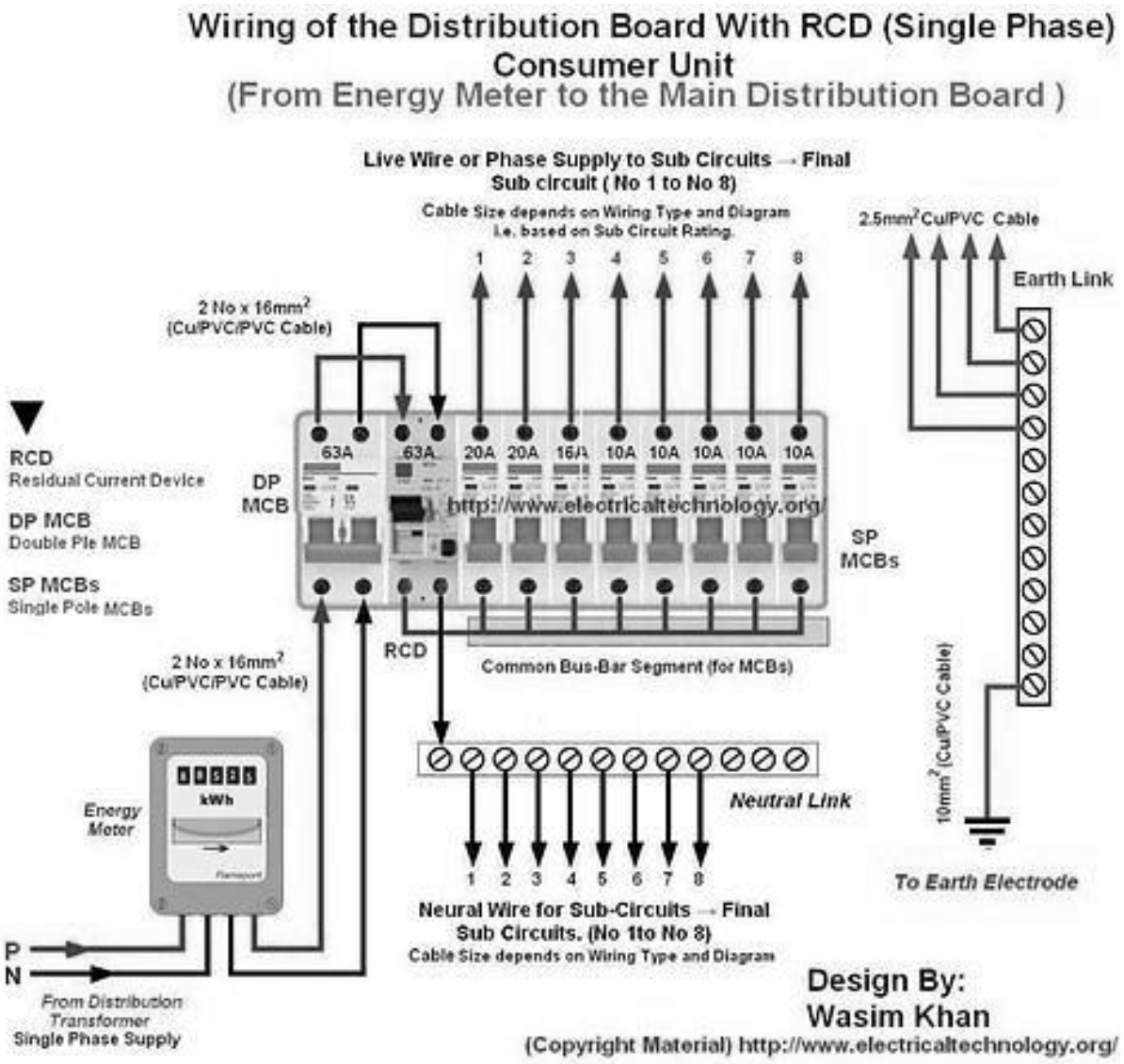
Use the given layout and draw a fully labelled electrical diagram of a single-phase distribution board by interconnecting the necessary graphical symbols. Add ALL required safety devices (e.g. circuit breakers, lightning arrestor and earth-leakage unit). Do NOT show any switches for any of the subcircuits (e.g. lights). A legend must accompany the drawing to declare ALL graphical symbols. **[20]**

**TOTAL: 100**

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**DIAGRAM SHEET**




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