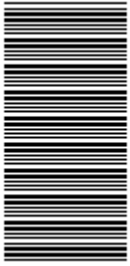


00000000



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

**ELECTRICAL PRINCIPLES AND PRACTICE
NQF LEVEL 2**

NOVEMBER EXAMINATION

(12041002)

**18 November 2015 (X-Paper)
09:00–12:00**

This question paper consists of 5 pages and 1 formula sheet.

**TIME: 3 HOURS
MARKS: 100**

INSTRUCTIONS AND INFORMATION

1. Read ALL the questions carefully.
 2. Answer ALL the questions.
 3. Number the answers according to the numbering system used in this question paper.
 4. Write neatly and legibly.
-

QUESTION 1

- 1.1 Determine the force required to accelerate a body with a mass of 750 g to 4 m/s^2 . (3)
- 1.2 If the prefix 'd' means 'deci' what do the following prefixes mean:
- 1.2.1 T
- 1.2.2 m
- 1.2.3 n
- 1.2.4 c
- 1.2.5 H (5 x 1) (5)
- 1.3 Convert the following:
- 1.3.1 2,5 km to metres
- 1.3.2 4 hours to seconds (2 x 1) (2)
- [10]**

QUESTION 2

- 2.1 An electric kettle with a power rating of 1,5 kW is connected across a 220 V supply.
Calculate the following:
- 2.1.1 The current drawn by the kettle from the supply (3)
- 2.1.2 The resistance of the kettle element (3)
- 2.1.3 The energy consumed by the kettle after 1 hour. Write your answer in MJ (4)
- 2.2 Name FOUR factors that influence the resistance of any material. (4)
- 2.3 State THREE advantages of a three-phase AC supply. (3)
- 2.4 Make a neat sketch showing the magnetic field around a bar magnet. (4)
- 2.5 Materials are classified as conductors, insulators, or semi-conductors according to their electric conductivity. Distinguish between *electrical conductors* and *insulators*. (4)
- [25]**

QUESTION 3

- 3.1 Two resistors with values of 3Ω and 6Ω are connected in parallel. This combination is then connected in series with a 4Ω resistor. The supply voltage of the whole circuit is 12 V.
- 3.1.1 Draw a neat, labelled diagram of the circuit using IEC symbols. (4)
- 3.1.2 Calculate the total resistance of the circuit. (4)
- 3.1.3 Calculate the total current flow through the circuit (3)
- 3.1.4 Will current flow through the 4Ω resistor if the 3Ω resistor is blown? Give a reason for your answer. (2)
- 3.2 Show by means of a wiring diagram how you would connect three households to a common three-phase, four-wire supply system to achieve a balanced load. (5)
- 3.3 Determine the voltage ratio of a transformer that has a secondary voltage of 33 kV and a primary voltage of 3,3 kV. (2)
- 3.4 Define the term *load balancing* as applicable to a three-phase, four-wire system. (2)
- 3.5 State THREE advantages of load balancing across the three-phase of a three-phase, four-wire system. (3)
- [25]**

QUESTION 4

- 4.1 Draw a circuit diagram to illustrate how a wattmeter is connected in a circuit. (5)
- 4.2 Name the measuring instruments that you would use in practice to measure the following quantities:
- 4.2.1 Current
- 4.2.2 Resistance
- 4.2.3 Voltage
- 4.2.4 Power
- (4 x 1) (4)

- 4.3 The ranges of ammeters and voltmeters are limited due to the current carrying capacity of the instrument.

Briefly explain how the range of the following meters can be increased:

4.3.1 Ammeter

4.3.2 Voltmeter

(2 x 2) (4)

- 4.4 What is the main reason for earthing of electrical appliances and installations?

(2)
[15]

QUESTION 5

- 5.1 Give the electrical wiring symbols for the following:

5.1.1 Two-way switch

5.1.2 Push-button switch

5.1.3 Earth connection

5.1.4 AC motor

5.1.5 Fuse

(5 x 1) (5)

- 5.2 Make a neat sketch of a geyser sub-circuit. Your sketch must include a ripple relay and an isolator. (6)

- 5.3 Draw a neat labelled sub-circuit diagram of two luminaires controlled by one switch. (4)

[15]

QUESTION 6

- 6.1 Name the TWO most commonly used armoured cables. (2)

- 6.2 Name FIVE types of DC sources known to you. (5)

- 6.3 Lightning arrestors are protective devices protecting a circuit against surge voltages due to lightning strikes and switching surges.

Briefly describe the operation of a lightning arrestor. (3)

[10]

TOTAL: 100

ELECTRICAL PRINCIPLES AND PRACTICE L2

FORMULA SHEET

1 $v = \frac{d}{t}$

2 $\bar{v} = \frac{d}{t}$

3 $a = \frac{\Delta v}{\Delta t}$

4 $F = m \times a$

5 $W = m \times g$

6 $w = F \times s$

7 $\tau = F \times r$

8 $\rho = \frac{m}{V}$

9 $P = \frac{F}{A}$

10 $E = V + Ir$

11 $V = IR$

12 $P = VI$

13 $P = I^2 R$

14 $P = \frac{V^2}{R}$

15 $E = P \times t$

16 $R = \frac{\rho \ell}{A}$

17 $A = \pi r^2$

18 $A = \frac{\pi D^2}{4}$

19 $R_t = R_0(1 + \alpha_0 T)$

20 $t = \frac{1}{f}$

21 $\beta = \frac{\phi}{A}$

22 $mmf = NI$

23 $H = \frac{mmf}{\ell}$

24 $H = \frac{NI}{\ell}$

25 $F = \beta I \ell$

26 $\frac{N_1}{N_2} = \frac{V_1}{V_2} = \frac{I_2}{I_1}$

27 $S = V_1 I_1 = V_2 I_2$

28 $R_T = R_1 + R_2 + R_3$

29 $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$

30 $R_T = \frac{R_1 \times R_2}{R_1 + R_2}$

31 $I_T = I_1 = I_2 = I_3$

32 $I_T = I_1 + I_2 + I_3$

33 $I_T = \frac{V_T}{R_T}$

34 $V_T = V_1 + V_2 + V_3$

35 $V_T = V_1 = V_2 = V_3$

36 $V_T = I_T R_T$

37 $E = V + Ir$

38 $P = VI$

39 $Q = I^2 R t$

40 $R_{sh} = \frac{I_m R_m}{I_{sh}}$

41 $V_m = I_m R_m$

42 $R_{se} = \frac{V}{I} - R_m$