higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

ENGINEERING SYSTEMS
NQF LEVEL 2

(6021022)

21 November 2023 (Y-paper)
13:00–16:00

This question paper consists of 9 pages.

211Q1N2321

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)
ENGINEERING SYSTEMS
NQF LEVEL 2
TIME: 3 HOURS
MARKS: 100

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. Start each section on a new page.
5. Use only a blue or black pen.
6. Write neatly and legibly.

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QUESTION 1

Various options are given as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question number (1.1–1.10) in the ANSWER BOOK.

1.1 The current that flows in one direction in an electrical circuit:

A Direct current
B Alternating current
C Electromagnetic current
D Currency

1.2 In a hydraulic system, the force that is applied at one point is transmitted to another using …

A a compressible fluid
B an incompressible fluid
C a cold compress
D a hot compress

1.3 Ratio of the distance moved by the effort, to the distance moved by the load is known as …

A backlash
B mechanical advantage
C efficiency
D velocity ratio

1.4 The document that details the work done on a machine and shows the costs involved.

A Manufacturer's manual
B Service manual
C Job card
D Diary book

1.5 The opposition of a material to the flow of electric current.

A Current
B Resistance
C Voltage
D Potential difference

1.6 An example of a hydraulic-operated machine.

A A trolley jack
B A resistor
C An insulator
D A pencil grinder

1.7 Bearings that are designed to support a high axial load.

A Sleeve bearing
B Thrust ball bearing
C Needle roller bearing
D Cylindrical roller bearing

1.8 A valve that allows the flow of fluid in one direction only.

A Check valve
B Flow control valve
C Pressure control valve
D Pressure relief valve

1.9 A factor that influences the resistance of a material.

A Motor
B Single-pole switch
C Conductor
D Cross-sectional area

1.10 A hydraulic system needs to contain…

A compressible fluid
B incompressible fluid
C air bubbles
D water bubble

(10 × 1) **[10]**

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QUESTION 2

2.1 Draw the following electrical components.

2.1.1 Resistor

2.1.2 Battery

2.1.3 Earth

2.1.4 Ammeter

2.1.5 Electrical switch in an open position

(5 × 1) (5)

2.2 Explain the difference between an *electrical control* device and an *electrical protection device* and give TWO examples of each. (6)

2.3 FIGURE 1 shows THREE resistors of 5 Ω, 10 Ω and 15 Ω connected in parallel across a 12V supply.

Calculate the following:

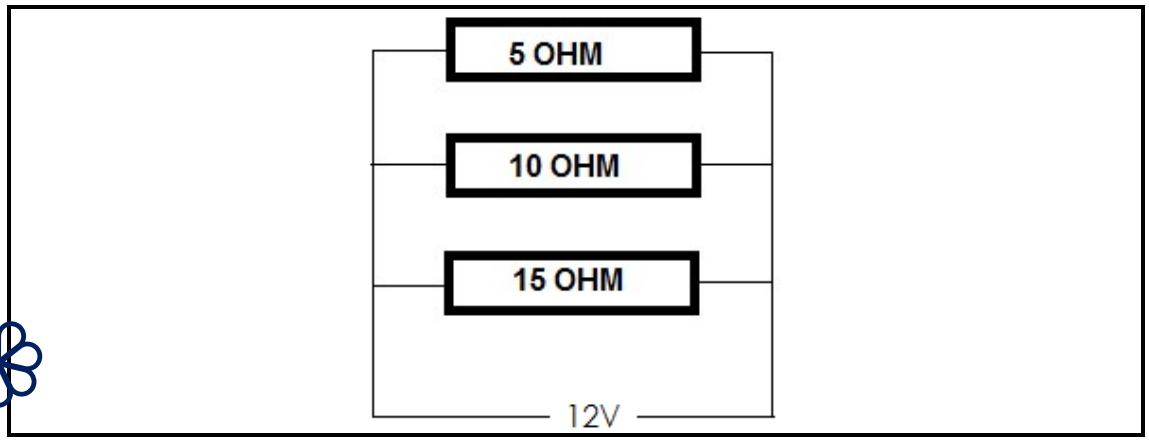


FIGURE 1

2.3.1 The total resistance of the circuit (3)

2.3.2 The total current through the circuit (2)

2.3.3 The current flowing through a 15 Ω resistor (2)

2.3.4 The power used by the 15 Ω resistor (2)

Hint: $\frac{1}{R_P}=\frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3}$; $V=I\times R$; $P=V\times I$

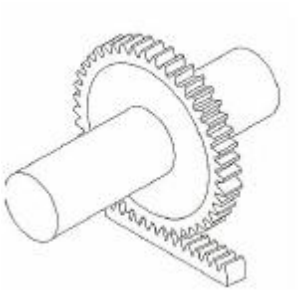
[20]

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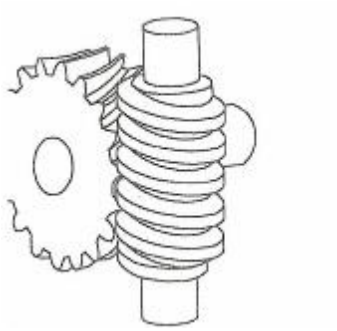
QUESTION 3

3.1 Name the different gear arrangements shown in the drawings below.

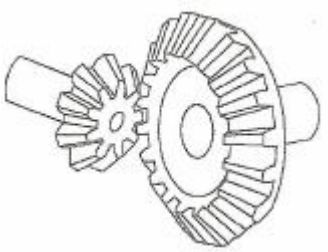
3.1.1



3.1.2



3.1.3



(3 × 1) (3)

3.2 FIGURE 2, shows THREE gears in mesh.
Gear “A” is connected to a Drive Motor and Gear “B” rotates in a clockwise direction.

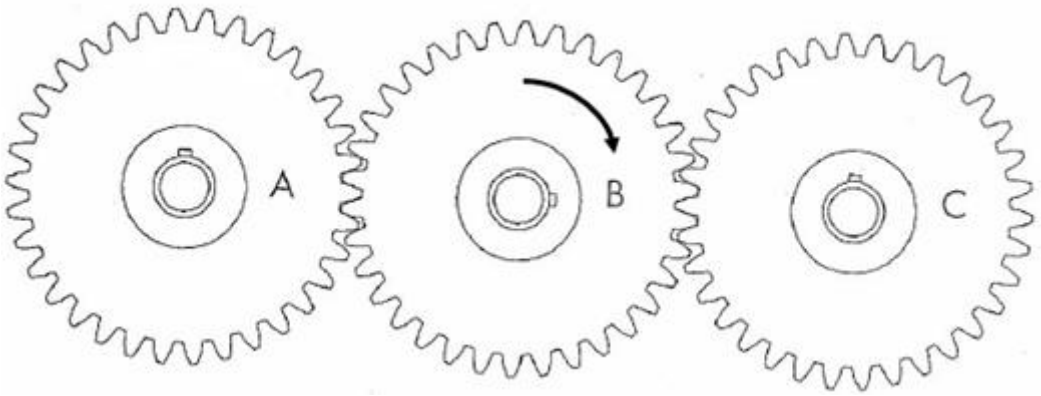


FIGURE 2

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3.2.1 Give the direction of rotation of gears “A” and “C” (2)

3.2.2 Name gears A, B and C. (3)

3.2.3 Give the function of Gear “B”. (1)

3.3 The correct backlash between gears during meshing is important as the efficiency and lifespan of gears are increased.

3.3.1 State the meaning of backlash. (2)

3.3.2 List TWO effects each, of too much and too little backlash which can influence the lifespan of gears. (4)

3.3.3 Name the measuring instrument that can be used to measure the backlash between meshed gears. (1)

3.4 Draw a neat figure showing the difference between a *helical* and *a double helical gear.* (4)

[20]

QUESTION4

4.1 FIGURE 3, shows a Hydraulic Press.

List THREE safety precautions that must be adhered to when operating the press to avoid damage to equipment. (3)



FIGURE 3

4.2 List TWO checks that must be done on the following equipment before starting a hydraulic system.

4.2.1 Pipes

4.2.2 Cylinders

4.2.3 Reservoirs

(3 × 2) (6)

4.3 Give FOUR differences between hydraulic and pneumatic systems. (4)

4.4 Name FOUR types of braking systems. (4)

4.5 List THREE *disadvantages of hydraulic systems*, when compared to pneumatic systems. (3)

[20]

QUESTION 5

5.1 Name the tools/equipment that is used for the tasks listed below:

5.1.1 To measure resistance in an electrical component.

5.1.2 To remove solid particles from lubricating oil.

5.1.3 To remove the circlip on the inside of a hub.

5.1.4 To measure the end float of a shaft.

5.1.5 To tighten bolts and nuts according to specification.

(5 × 1) (5)

5.2 List TWO reasons why the manufacturer's manual must be consulted when performing maintenance on equipment. (2)

5.3 List THREE methods used to reduce friction between two moving surfaces. (3)

[10]

QUESTION 6

6.1 State the difference between *routine maintenance* and *preventative maintenance.* (4)

6.2 Maintenance of machinery is a common practice in the industry that can increase the life span of equipment and reduce downtime.

6.2.1 List TWO consumable items that must be considered during maintenance on the machines. (2)

6.2.2 State TWO benefits of a good maintenance plan. (2)

6.2.3 Give THREE items that must be included in a post-maintenance report. (3)

6.3 Give THREE reasons for the importance of recording all the tasks performed on the equipment on the job card during maintenance. (3)

6.4 Explain how a good maintenance program impacts the following aspects of a business:

6.4.1 Risk of physical injury

6.4.2 Efficiency of equipment

6.4.3 Profit margins of the organisation

(3 × 2) (6)

[20]

TOTAL: 100

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