higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

APPLIED ENGINEERING TECHNOLOGY
NQF LEVEL 4

(6021024)

10 November 2022

This question paper consists of 8 pages.

197Q1N2210

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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. All sketches must be neat, clear and in proportion.
5. Use g = 9,81 m/s^2.
6. Start each question on a new page.
7. Use only a blue or black pen.
8. Write neatly and legibly.

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QUESTION 1

1.1 Various options are given as possible answers to the following questions. Choose the correct answer and write only the letter (A–D) next to the question number (1.1.1–1.1.10) in the ANSWER BOOK.

1.1.1 When making modifications on a control system, … is/are required.

A replacement parts
B negative feedback
C an input variable
D a battery

1.1.2 Motion in an object occurs when ….

A the object remains in the same position.
B the object changes its velocity.
C the distance between two points changes.
D the object changes position with respect to a reference plane.

1.1.3 Vibrations in a machine can be caused by …

A tight parts
B loose parts
C new parts fitted to the machine
D rotation

1.1.4 Which type of seals are used where there is relative motion between surfaces?

A Gasket seals
B Dynamic seals
C Labyrinth seals
D O-ring seals

1.1.5 Valves in hydraulic systems are used to …

A increase the friction in fluid carrying pipes
B direct and regulate the flow of a fluid inside a system of pipes
C build up heat inside a system of pipes
D move fluids in only one direction

1.1.6 If the co-efficient of friction of an object changes from 0.51 to 0.31, it indicates that …

A the object was moving and came to a stop
B the object was moved from a position of rest
C the object's speed is decreasing
D the object is standing still

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1.1.7 When an object slides across a floor, there will be …

A no friction between the object and the floor surface.
B less friction between the object and the floor surface.
C static friction between the object and the floor surface.
D static friction equal to kinetic friction.

1.1.8 A thermometer is used to …

A measure the air pressure in components.
B measure the speed of water.
C measure the temperature of matter.
D measure the clearance between moving parts.

1.1.9 The function of the condenser found in a domestic refrigerator is …

A to change the refrigerant from a gaseous state to into a liquid state
B to cool down the inside of the refrigerator
C to control the temperature inside the refrigerator
D to pump the refrigerant through the system and compress it

1.1.10 A cylinder in an internal combustion (IC) engine is …

A a container to store water for wiper blades
B a chamber within which a piston moves up and down
C an oil tank found under the chassis of the vehicle
D the chamber where the valves are situated

(10 × 1) (10)

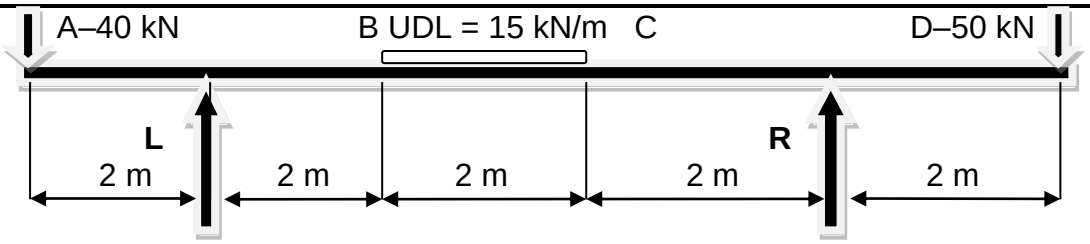
1.2 List the FIVE main components of an electrical motor. (5)

1.3 According to the Occupational Health and Safety Act (OHSA), employees must comply with regulations that ensure a safe working environment.

List FIVE of the guidelines that must be applied to promote safety in the workplace. (5)

[20]

QUESTION 2



NOTE: The UDL is spread between points B and C.

2.1 Calculate the reactions at points L and R. (6)

2.2 Check your answer by equating the upward and downward forces (2)

2.3 Draw the shear force diagram. Use a scale of 1 cm = 10 kN. (5)

2.4 Calculate the bending moments at points A; L; R and D. (4)

2.5 Explain the meaning of each of the following:

2.5.1 Cantilever (1)

2.5.2 Shear force (1)

2.5.3 Uniformly Distributed Load (UDL) (1)

[20]

QUESTION 3

3.1 Choose a term from COLUMN B that matches a description in COLUMN A. Write only the letter (A–M) next to the question number (3.1.1–3.1.10) in the ANSWER BOOK.

COLUMN A		COLUMN B	
3.1.1	The transfer of heat from one body to another	A	gearbox
3.1.2	The unit of power	B	actuator
3.1.3	An electrical switch that reverses the current in an electric motor causing the armature to move	C	differential
3.1.4	It is mainly used for speed variation	D	professionalism
3.1.5	It allows the wheels to turn at different speeds but with the same torque	E	Kilo Watt
3.1.6	One of the factors informing the decision of the control system design	F	commutator
3.1.7	It sends commands to the actuators	G	personal protective equipment
3.1.8	A device that puts the process information into action	H	controller
3.1.9	The process of replacing stale air with fresh air	I	steering wheel
3.1.10	Safety equipment that protects your body while you are working	J	conduction
		K	functionally dependent mechanisms
		L	clutch
		M	ventilation

(10 × 1) (10)

3.2 Name TWO couplings that are used when shafts need to be perfectly aligned. (2)

3.3 List THREE functions of the valves in hydraulic systems. (3)

[15]

QUESTION 4

4.1 List THREE negative effects of friction on engineering systems and components. (3 × 2) (6)

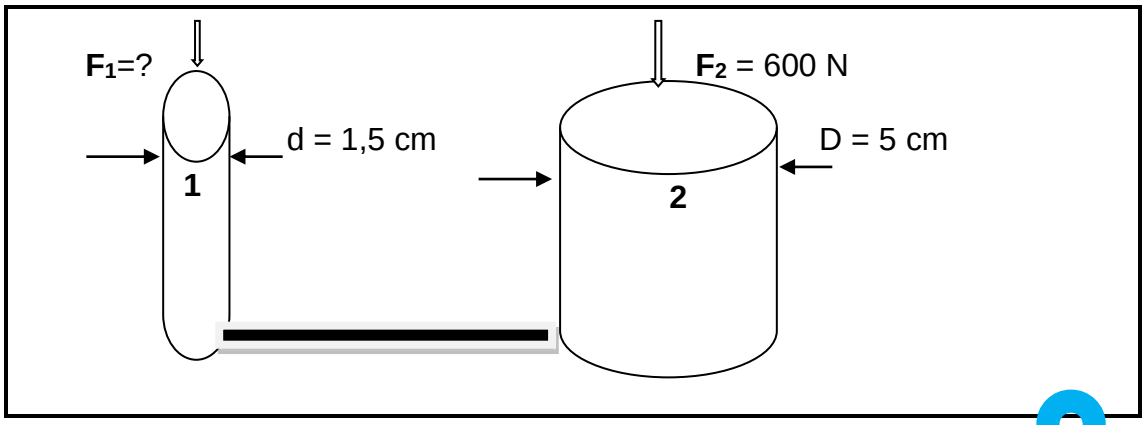
4.2 A block of copper with a mass of 60 kg is moved across a horizontal cast iron surface

Calculate the force required to keep the block moving. Also, calculate the force needed just before motion starts.

Given: $\mu_s = 1,05$; $\mu_k = 0,29$
(HINT: W = m × g) (2 × 3) (6)

4.3 Below are two hydraulic cylinders linked to each other by means of a hydraulic pipe.

Calculate the force applied by the piston F_1 (HINT: $F_1/A_1 = F_2/ A_2$)



(5)

4.4 List THREE types of lubrication. (3)
[20]

QUESTION 5

5.1 There are different types of control systems found in equipment.

5.1.1 Name TWO types of control systems. (2)

5.1.2 In which form are control systems represented? (1)

5.1.3 Control systems can use different operating methods.

List the FOUR operating methods. (4)

5.2 List FOUR causes of problems in a control system. (4)

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5.3 Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'True' or 'False' next to the question number (5.3.1–5.3.6) in the ANSWER BOOK.

5.3.1 Architectural appeal means a design that is attractive to customers.

5.3.2 Flexible couplings accept minor misalignments between the drive motor and the driven members.

5.3.3 Belt drives create more noise than chain drives.

5.3.4 Static friction occurs when a body is being moved.

5.3.5 The co-efficient of kinetic friction is always lower than static friction

5.3.6 Torque is a force that moves in a rotational direction

6 x 1 (6)

5.4 With the aid of a diagram, illustrate the refrigeration cycle. The diagram must be labelled to indicate the four main components. Use arrowheads to clearly indicate the direction of flow, and clearly indicate the pressure and state of the refrigerant at the different stages of the cycle. (8)

[25]

TOTAL 100

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