higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

APPLIED ENGINEERING TECHNOLOGY
NQF LEVEL 4

(6021024)

4 December 2020 (X-paper)
09:00–12:00

Non-programmable scientific calculators may be used.

This question paper consists of 8 pages.

285Q1N2004

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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/s².
6. 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 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 Newton's first law of motion states that …

A a body keeps exerting a force upon a second body.
B a body will keep its position or in uniform motion in a straight line unless an external force or forces changes this state.
C a man is travelling by car.
D for every action there is an equal and opposite reaction.

1.1.2 Inertia is the …

A tendency of an object to resist acceleration.
B distance between two points.
C leakage of a water pump due to worn seals.
D atmospheric pressure.

1.1.3 The SI unit of force is …

A kilogram.
B meter.
C centimeter.
D newton.

1.1.4 Disadvantage of friction:

A Ignites safety matches
B Lubricates two components
C Produces wear between moving parts.
D Creates a frictional force against motion

1.1.5 Coefficient of friction is …

A the relation between a normal force and a frictional force
B the ability to perform work.
C the movement of a piston.
D a kilojoule.

1.1.6 Types of load bearings are required to handle:

A Friction
B Substances
C Shaft
D Radial and axial movement

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1.1.7 Material used to manufacture journal bearings:

A Wood
B Bronze
C Gold
D Diamond

1.1.8 Differentiate between a piston and a plunger:

A Plunger is longer than its stroke length and piston is shorter than its stroke length
B Plunger is shorter than its stroke length and piston is longer that its stroke length.
C Plunger is a one - way valve and a piston is a two-way valve
D Piston does not create a vacuum, but a plunger does during suction stroke.

1.1.9 Pressure that is registered on a gauge:

A Atmospheric pressure
B Positive pressure
C Gauge pressure
D Absolute pressure

1.1.10 Pressure arising when a force of 1 Newton is applied over, and perpendicular to, an area of 1 $m^{2:}$

A Pascal
B Power
C Friction
D Mass

(10 × 1) (10)

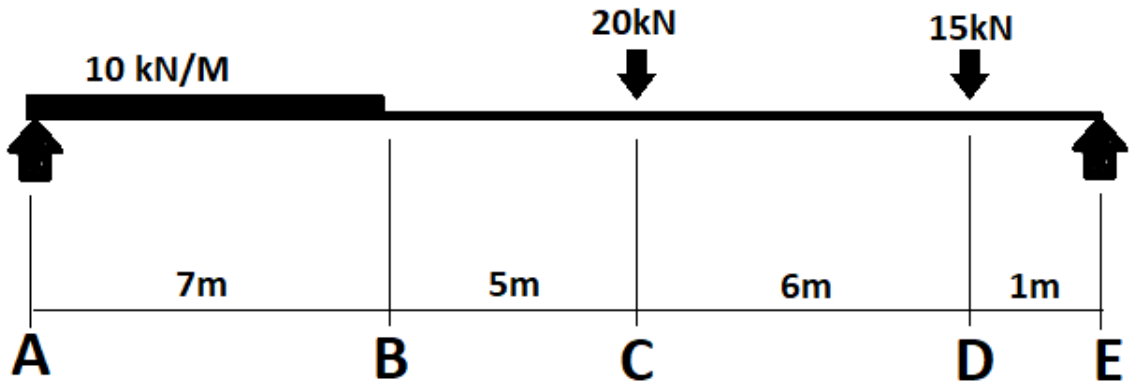
1.2 State FIVE reasons which causes rotary pumps to fail in delivering water. (5)

1.3 Calculate the coefficient of friction if a mass of 40 kg requires a horizontal force of 130 N to pull it at a constant velocity over a horizontal plane. (5)

[20]

QUESTION 2

Study the diagram below and answer the questions.



2.1 Calculate the reactions at supports **A** and **E** and test your answer. (5)

2.2 Use scale 1 mm:1 kN and draw the shear-force diagram. Indicate all values on the diagram in your answer book. (5)

2.3 Calculate the bending moments at points **A**, **B**, **C**, **D** and **E**. (5)

2.4 Use scale 1 mm: 20 kNm and draw the bending moment diagram. Indicate all values on the diagram in your answer book. (5)

2.5 Calculate the position and magnitude of the maximum bending moment. (3)

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QUESTION 3

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

COLUMN A		COLUMN B	
3.1.1	Compresses gas by rotating a vane impeller located eccentrically within cylindrical casing	A	lubrication
3.1.2	Small pumping engine operated by an engine	B	self-aligning bearing
3.1.3	System used to transfer heat between two or more fluids	C	liquid ring pump
3.1.4	Type of transmission utilising two wheels to transfer power to driving wheels rather than chain and sprockets system	D	positive pressure
3.1.5	Recommended when alignment of shaft and housing is difficult or when shaft may bend during operation	E	steam pump
3.1.6	Pressure in system that is greater than environment surrounding that system	F	throttle valve
3.1.7	Action of applying substance such as oil or grease to engine or component so to minimise friction and allow smooth movement operation	G	non-return valve
3.1.8	Used to dampen torque or vibrations and to compensate shaft displacement	H	flexible couplings
3.1.9	Allows medium to flow in only one direction	I	frictional drive
3.1.10	Component that regulates the supply of fuel to the engine	J	heat exchanger
		K	gear
		L	shaft

(10 × 1) (10)

3.2 State FIVE steps for solving design challenges during the design phase of engineering systems. (5)

[15]

QUESTION 4

4.1 Draw and label a refrigeration cycle in a refrigerator. (8)

4.2 The pressure in a cylinder with a diameter of 120 mm is 10 kPa.

Calculate the force that is exerted on the plunger rod by using the given formulae. Answer must be in Newton. $Pressure = \frac{F}{A}$ (4)

4.3 List FIVE factors to consider when using chain drives. (5)

4.4 Name the THREE methods of heat transfer from one body to another. (3)
[20]

QUESTION 5

5.1 State FOUR steps in the design process of a prototype. (4)

5.2 Define each of the components below used in basic electrical equipment:

5.2.1 Resistor

5.2.2 Capacitor

5.2.3 Light-emitting diode (LED)

5.2.4 Transistor

5.2.5 Inductor

(5 × 2) (10)

5.3 Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (5.3.1–5.3.8) in the ANSWER BOOK.

5.3.1 The time during which a machine, or computer, is out of action or unavailable for use is called downtime.

5.3.2 Heat is a form of mechanical energy used to drive engineering systems.

5.3.3 Effective housekeeping help to control or eliminate workplace hazards.

5.3.4 A control loop is the fundamental building block of industrial control systems.

5.3.5 Engine blocks are the smallest casings that contains a battery.

5.3.6 Torque is the measurement of a force that cannot cause an object to rotate about an axis.

5.3.7 In electrical engineering, an armature is the power-producing component of an electric machine.

5.3.8 The workplace must have a maintenance programme to ensure that all equipment and machines are in a safe working condition.

(8 × 1) (8)

[22]

TOTAL: 100

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