higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

APPLIED ENGINEERING TECHNOLOGY
NQF LEVEL 4

(6021024)

15 November 2024 (X-paper)
09:00–12:00

Non-programmable scientific calculators may be used.

This question paper consists of 7 pages.

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APPLIED ENGINEERING TECHNOLOGY
NQF LEVEL 4
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. Round off the answers to THREE decimals where applicable.
5. Use only a black or blue pen.
6. All sketches must be neat, clear, and in good proportion.
7. 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 Which one of the following statements defines *resultant*?

A The force that is exerted outward when an object rotates
B A single force that acts on an object with the sum of separate forces having the same magnitude and direction
C Force is produced when two bodies roll or slide over each other
D The total amount of force reacting on the body along with the direction of the body

1.1.2 A radial load acts at a right angle to the … axis of the shaft.

A vertical
B horizontal
C rotating
D combined

1.1.3 Which one of the following is not a component of a chain drive system?

A Sprocket
B Chain
C Pulley
D Bush

1.1.4 … couplings can only be used where accurate alignment of the connecting shaft can be guaranteed.

A Flexible
B Machine
C Flywheel
D Rigid

1.1.5 Choose the correct formula to calculate frictional force.

A $T=F \times r$
B $F= \mu N$
C $W = m \times g$
D P=$F \times V$

1.1.6 A/an … is an instrument that can be used to find an electrical fault.

A circuit breaker
B amperage
C multimeter
D emergency switch

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1.1.7 What is the boiling temperature for water at sea level?

A 75°
B 120°
C 100°
D 10°

1.1.8 The main use of a … box is to stop liquid in the cylinder from escaping past the shaft

A sealing
B stuffing
C plastic
D synthetic

1.1.9 All safety signs must be … approved.

A OHSA
B NOSA
C SBBS
D SABS

1.1.10 … occurs when a vapour changes back to liquid.

A Evaporation
B Radiation
C Condensation
D Vaporisation

(10 × 1) (10)

1.2 List the THREE alignment errors that can occur when aligning a rigid coupling incorrectly. (3)

1.3 State the FOUR disadvantages of ball bearings. (4)

1.4 What is the function of spoon valves? (2)

1.5 The ram of a shaper has a mass of 20 kg and is moving in slides. The coefficient of friction between the ram and the slides may be taken as 0,08.

Calculate the horizontal force needed to move the ram. (5)

1.6 A block of mild steel with a mass of 40 kg is to be moved across a horizontal aluminium support.

1.6.1 Calculate the force required to keep the block moving. (5)

1.6.2 Calculate the force needed just before the motion starts. (5)

HINT: Use the table below to find the coefficient of friction.

Coefficient of sliding friction (clean surfaces)			
Material 1	**Material 2**	**Static**	**Kinetic**
Aluminium	Aluminium	1,05	1,4
Aluminium	Mild steel	0,61	0,47
Copper	Mild steel	0,53	0,36
Nickel	Mild steel	-	0,64
Cast iron	Cast iron	1,1	0,15

1.7 Name the type of pump that is a positive displacement pump. (1)
[35]

QUESTION 2

Study the loaded beam in FIGURE 1 below and answer the questions that follow.

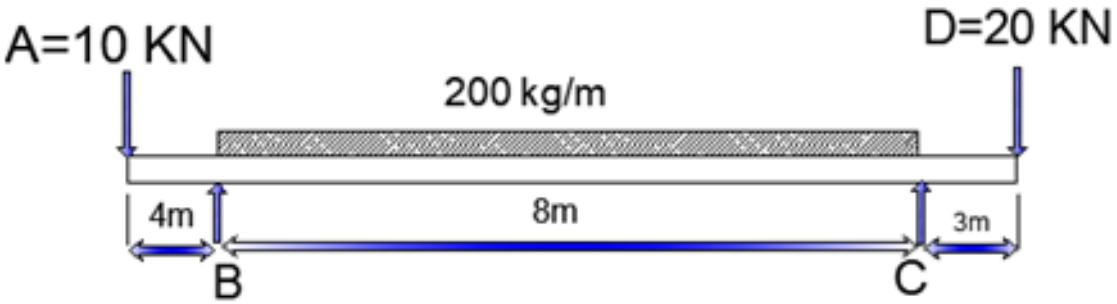


FIGURE 1

2.1 Calculate the reaction at support B and C. (12)

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

2.3 Draw the shear-force diagram and show all values. (5)

2.4 Calculate bending moments at A, B C, and D. (4)
[23]

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	A lever that changes the direction of action of force	A	body and frame
3.1.2	Main shaft of an engine	B	schematic
3.1.3	To provide protection and accommodation for passengers	C	stepper
3.1.4	They are used to stop vehicles	D	shunt
3.1.5	A system that operates with compressed air	E	batteries
3.1.6	Converts electrical into mechanical motion	F	crankshaft
3.1.7	A switching device that is made up of many copper segments	G	linkages
3.1.8	A motor that is useful when a high starting torque is needed	H	brakes
3.1.9	It is not used for continuous rotation but rather for accurate circular movement	I	pneumatics
3.1.10	Master drawing from which the engineer or designer can make other drawings for each component	J	electric motors
		K	commutators
		L	series-wound

(10 × 1) (10)

3.2 The liquid pressure in a cylinder of 150mm is 5,5 kPa.

Calculate the force on the plunger rod when the rod moves forward. (4)

3.3 State the test that can be used to test the corrosion resistance of various metals and chemical coatings. (1)

3.4 With the aid of a diagram, illustrate the design process. The diagram must be labelled to indicate all the steps of the design process. Use the arrows to indicate the correct order of the design process step-by-step. (10)

[25]

QUESTION 4

4.1 When using an automatic washing machine, state any FOUR things that happen during the washing cycle. (4)

4.2 What does the acronym *LDR* stand for? (3)

4.3 State the function and working principal of a photoelectric smoke detector. (2)

4.4 You are a skilled person and want to modify a system that has operational faults.

4.4.1 Who must permit you to modify the system? (1)

4.4.2 State SIX checks that must be recorded for evaluation. (6)

4.5 Draw the symbol for a thermistor. (1)

[17]

TOTAL: 100

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