higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

APPLIED ENGINEERING TECHNOLOGY
NQF LEVEL 4

(6021024)

27 February 2018 (Y-Paper)
13:00–16:00

A nonprogrammable calculator may be used.

This question paper consists of 5 pages.

NCV

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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 the sketches must be neat, clear and in proportion.
5. $g = 9{,}81\ m/s^2$
6. Write neatly and legibly.

NCV

QUESTION 1

1.1 People experience the effects of inertia on a daily basis.

1.1.1 Describe a real life situation, which illustrates how humans experience moments of inertia. (3)

1.1.2 Give a definition of *inertia*. (2)

1.2 All safety signs in the workplace must comply with international health and safety regulations.

Give Four functions of safety signs in the workplace. (4)

1.3 Give two advantages of radial thrust bearings. (2)

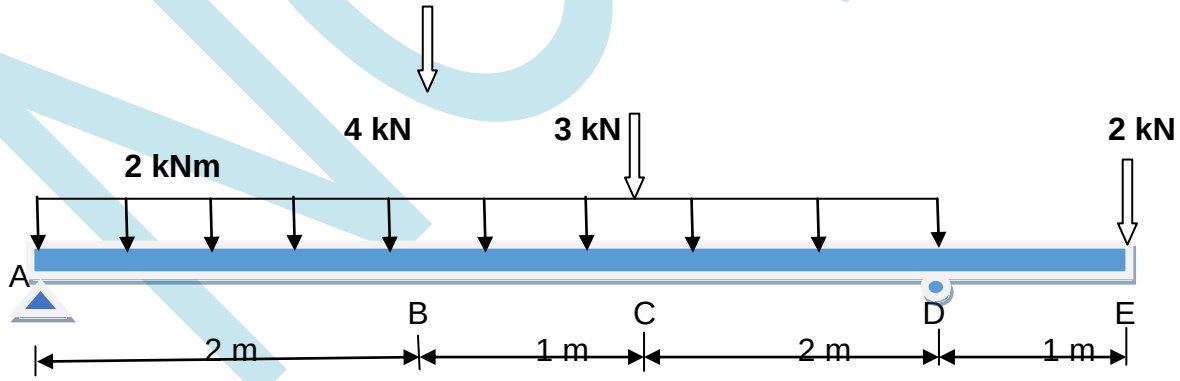
1.4 Explain the difference between *hydraulic valves* and *pneumatic valves*. (4)

1.5 The designer is responsible for choosing the surface finish that will work most effectively.

Give FIVE different types of finishes. (5)

[20]

QUESTION 2



2.1 Calculate the reactions at the supports and test your answer. (7)

2.2 Use a scale of 1 mm = 1 kN and draw the shear-force diagram. Indicate ALL the values on the diagram. (4)

2.3 Calculate the bending moments at points A, B, C, D and E. (6)

2.4 Use a scale of 1 mm = 1 kNm and draw the bending moment diagram. Indicate ALL values on the diagram. (8)

[25]

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QUESTION 3

3.1 Choose a description from COLUMN B that matches a term in COLUMN A. Write only the letter (A–K) next to the question number (3.1.1–3.1.7) in the ANSWER BOOK.

COLUMN A		COLUMN B	
3.1.1	Pressure relief valve	A	supports shafts which revolve horizontally
3.1.2	Flexible coupling	B	is used where pulleys have to rotate in opposite directions
3.1.3	Open-belt drive	C	connects shafts that are slightly misaligned
3.1.4	Footstep bearing	D	supports shafts rotating in a vertical position
3.1.5	Diaphragm pump	E	uses a flexible membrane to displace fluid
3.1.6	Pinion	F	is designed to open at a predetermined pressure to allow the hydraulic fluid to bypass the system safely until normal working pressure is restored
3.1.7	Evaporator	G	is used where the driver and driven pulleys have to rotate in the same direction
		H	a flexible diaphragm acting as a valve
		I	is the small gear
		J	is the large gear
		K	uses the cooling action of the vaporising refrigerant to cool the inside of the fridge

(7 × 1) (7)

3.2 Give FIVE general safety conditions that must be adhered to in the workplace, in order to ensure that OHS standards are maintained. (5)

3.3 Name FOUR advantages that flat belts have over other belt designs. (4)

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3.4 Define the term *thermodynamics*. (3)

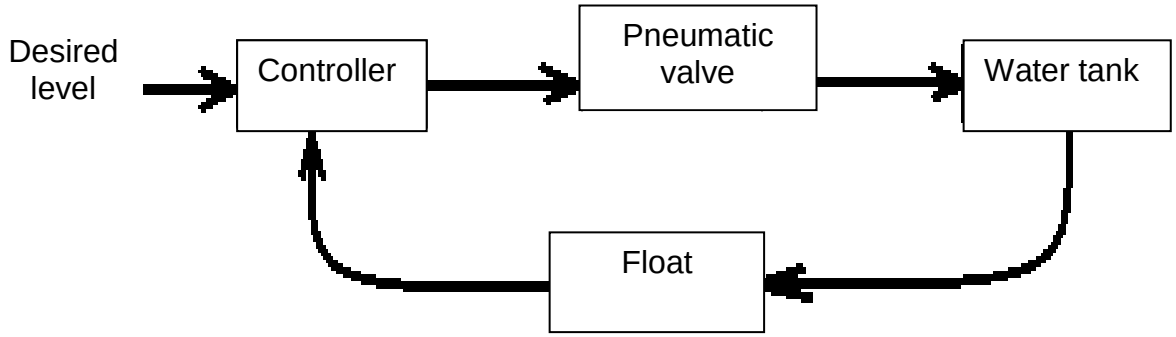
3.5 The liquid pressure in a cylinder with a diameter of 150 mm is 3,5 kPa.

Calculate the force on the piston rod when the rod moves forward. (6)
[25]

QUESTION 4

4.1

BLOCK DIAGRAM OF A CONTROL SYSTEM



The above control system consists of components that work together to achieve a predetermined goal.

Explain the operation of the block diagram of a control system. (10)

4.2 State the TEN steps that should be taken when designing and implementing a control system. (10)
[20]

QUESTION 5

5.1 Explain the following terms used in control systems:

5.1.1 Open-loop control system

5.1.2 Closed-loop control system

5.1.3 Actuator

(3 × 2) (6)

5.2 Describe the difference between an *analogue signal* and a *digital signal*. (4)
[10]

TOTAL: 100

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