higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

APPLIED ENGINEERING TECHNOLOGY
NQF LEVEL 4

(6021024)

8 November 2018 (Y-Paper)
13:00–16:00

Nonprogrammable scientific calculators may be used.

This question paper consists of 6 pages.

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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. Ensure that ALL sketches are neat, clean and in proportion.
5. Please note: g = 9,81 m/s².
6. Write neatly and legibly.

ncv

QUESTION 1

1.1 Define the following terms:

1.1.1 Friction

1.1.2 Adhesion

1.1.3 Normal reaction

1.1.4 Centre of mass

1.1.5 Centrifugal force

(5 × 2) (10)

1.2 State why a vehicle consumes more fuel when it stop and drive as to when it drives at a constant speed. (1)

1.3 Explain the function of a reverse idler gear in a gear system. (2)

1.4 John is pulling a cardboard box with mass of 70 kg across a horizontal surface. A force of 170 N is required to pull it at a constant speed. Calculate the following:

1.4.1 The coefficient of friction. (4)

1.4.2 The angle of friction. (3)

1.4.3 The horizontal force that will be required if a similar box is placed on top of each other. (4)

1.5 State ONE way in which John can reduce friction. (1)

[25]

QUESTION 2

A beam, 10 m long, rests on two supports. The left support, labelled B, is 2 m from the left end that is labelled A. The right support, labelled D, is 2 m from the right end that is labelled E. The beam carries a point load of 200 N at the left end and of 300 N at the right end. In addition, the beam has a uniformly distributed load of 80 N/m between B and D. Lastly, a point load of 100 N is exerted at point C, which is at the centre of the beam.

2.1 Using a scale of 1 cm = 1 m to draw the beam. Indicate ALL the forces on the diagram. (3)

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

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2.3 Using a scale of 1 mm = 5 N to draw a shear-force diagram. Indicate ALL values on the diagram. (5)

2.4 Calculate the bending moments at points A, B, C, D and E. (5)
[20]

QUESTION 3

3.1 Bearings are essential components of kinds of in most modern machinery.

3.1.1 Define the term "*bearing"*. (2)

3.1.2 List TWO main parts of a roller bearing. (2)

3.1.3 Name FOUR materials used to manufacture journal bearings. (4)

3.2 Pumps are used to pump liquids against the force of gravity and to feed the lubrication between the moving parts of a machine.

Define the following terms related to pump technology:

3.2.1 Pressure

3.2.2 Suction lift

3.2.3 Flooded suction

(3 × 2) (6)

3.3 State FIVE important functions of safety signs in the workplace. (5)

3.4 In engineering, diagnostic analysis involves the use of tools and techniques to obtain information about problems.

State the name of the correct measuring instruments to measure the following:

3.4.1 Amperage tests

3.4.2 Vibration

3.4.3 Noise

3.4.4 Excess play

(4 × 1) (4)

3.5 Explain the importance of the Occupational Health and Safety (OHS) Act no. 85 of 1993. (2)
[25]

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QUESTION 4

4.1 Calculate the pressure in kPa on a 2 000 mm^2 surface area when you push an object using a force of 0,006 kN.

HINT: $Pressure = \frac{F}{A}$ (5)

4.2 Choose a description from COLUMN B that matches a word or words in COLUMN A. Write only the letter (A–K) next to the question number (4.2.1 – 4.2.10) in the ANSWER BOOK.

COLUMN A		COLUMN B	
4.2.1	Acceleration	A	if a force acts upon a body of a certain mass, it produces a change in the velocity of that body
4.2.2	Newton's second law		
4.2.3	Dynamic seals	B	device used to keep temperature constant, which can be adjusted to a desired level
4.2.4	Vaporisation		
4.2.5	Thermostat	C	is controlled directly by an input signal without the benefit of feedback
4.2.6	Tensile strength		
4.2.7	Flywheel	D	used where relative motion exists between surfaces
4.2.8	Electric motor		
4.2.9	Generator	E	smoothens out engine speed and keeps the crankshaft spinning between power strokes
4.2.10	Open-loop control system	F	converts mechanical motion into electrical energy
		G	ability of a material to withstand a pulling force
		H	the rapid change of a liquid or solid substance to a gas
		I	converts electricity to mechanical motion
		J	rate of change of velocity
		K	converts electrical energy into mechanical motion

(10 × 1) (10)

[15]

QUESTION 5

5.1 In any control system, at least four different basic functions are executed.

Name and explain the FOUR functions of a control system. (4 × 2) (8)

5.2 One of the biggest advances in control systems has been the introduction of the stepper motor.

Describe the operation of a stepper motor. (3)

5.3 List FOUR steps that need to be followed when designing and implementing a control system. (4)

[15]

TOTAL 100

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