higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

ENGINEERING SYSTEMS
NQF LEVEL 2

(6021022)

8 November 2018 (X-Paper)
09:00–12:00

This question paper consists of 9 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. Write neatly and legibly.

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QUESTION 1

Choose a term from COLUMN B that matches a description in COLUMN A. Write only the letter (A–J) next to the question number (1.1.–1.10) in the ANSWER BOOK.

COLUMN A		COLUMN B	
1.1	Used mainly on round components such as shafts to prevent longitudinal or lengthways movement	A	velocity ratio
1.2	Caused by incorrect alignment of belts and pulleys	B	backlash
1.3	Small amount of free movement between screw and nut of machine tool	C	mechanical advantage
1.4	Used to control coupling between two shafts	D	external circlip
1.5	Acts as sieve and used to clean oil or air	E	excessive belt wear
1.6	Ratio of load to effort	F	downtime
1.7	Ratio of distance moved by effort to distance moved by load	G	routine maintenance
1.8	Machine is stopped due to breakdown	H	pressure relief valve
1.9	Upkeep of machinery or equipment at set intervals	I	filter
1.10	Device used to protect components in hydraulic system against excessive oil pressure	J	clutches

(10 × 1) **[10]**

QUESTION 2

2.1 Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'True' or 'False' next to the question number (2.1.1–2.1.5) in the ANSWER BOOK.

2.1.1 Hydraulic braking systems are the most commonly used braking system in modern motor cars.

2.1.2 The reservoir or tank of a hydraulic system is used as a control valve to alert, generate or cancel signals.

2.1.3 A transistor has two legs and both legs have the same function.

2.1.4 A capacitor stores and releases electrical energy.

2.1.5 A light-emmiting diode is a semiconductor that lights up when current flows through it.

(5 × 1) (5)

2.2 When an LED is connected to a power source (galvanic cell) photons are given out from the semiconductor substance. These photons are seen as light.

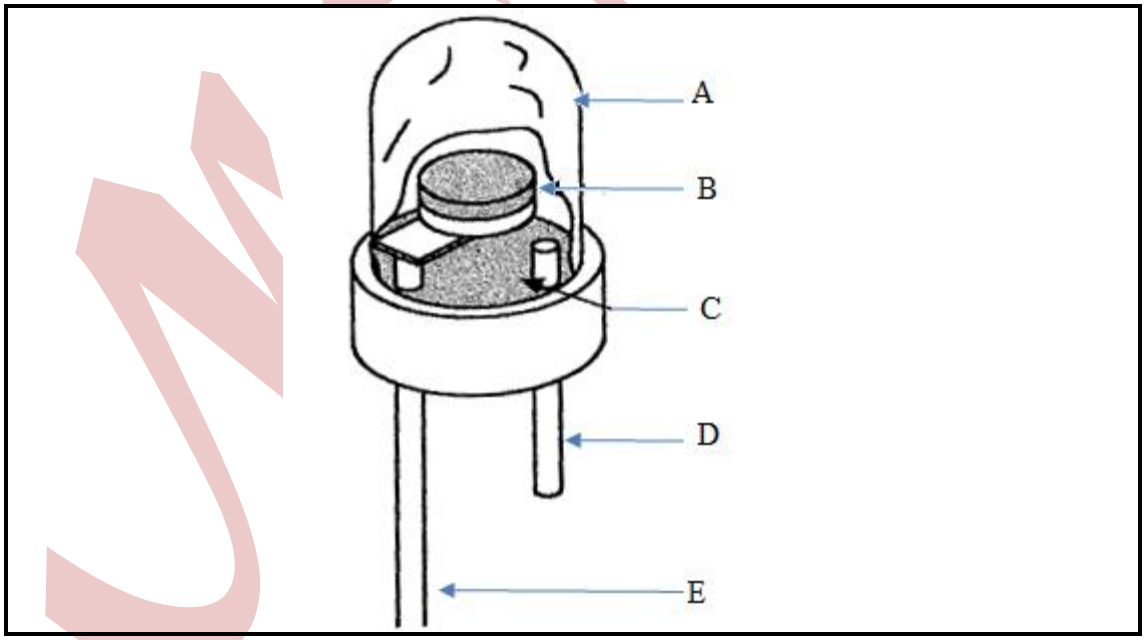


FIGURE 1

2.2.1 Identify the labelled components of the LED in FIGURE 1 by writing the answer next to letter A–E in the ANSWER BOOK. (5)

2.2.2 What does *LED* stand for? (1)

2.3 Draw a neat sketch of each of the following electrical components:

2.3.1 Ammeter

2.3.2 Cell

2.3.3 Air-core transformer

2.3.4 Resistor

(4 × 1) (4)

2.4 Give ONE difference between a c*onductor* and an *insulator* in an electrical system and give ONE example of each. (2 + 2) (4)

2.5 Two resistors of 4 Ω and 12 Ω are connected in parallel in an electric circuit.

2.5.1 Make a sketch to show how the resistors are connected. (2)

2.5.2 Calculate the total resistance of the circuit. (4)

[25]

QUESTION 3

3.1 FIGURE 2 shows a cross-sectional view of a V-belt.

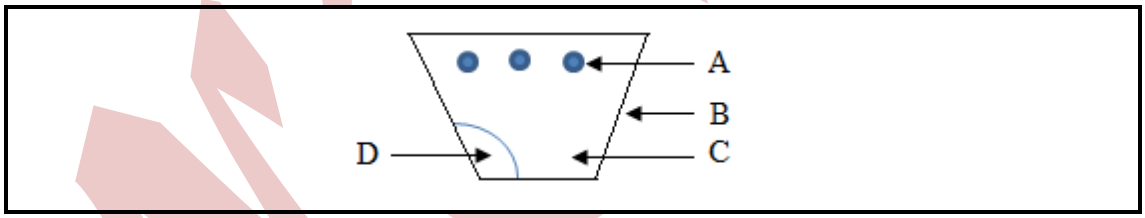


FIGURE 2

3.1.1 Identify the labelled parts by writing the answer next to the letter A–D in the ANSWER BOOK. (4)

3.1.2 Give ONE purpose of A. (1)

3.2 Explain why belt drives cannot be lubricated. (4)

3.3 Give TWO reasons why chain drives are fitted with idler sprockets. (2)

3.4 Explain why chain drives are more efficient than belt drives. (4)

3.5 Make a neat, labelled sketch of a chain drive and include the driver sprocket with fewer teeth, the driven sprocket, the idler sprocket and tight and slack sides. (5)

[20]

QUESTION 4

4.1 FIGURE 3 shows three gears in mesh, with gear Q rotating in a clockwise direction as indicated by the arrow.

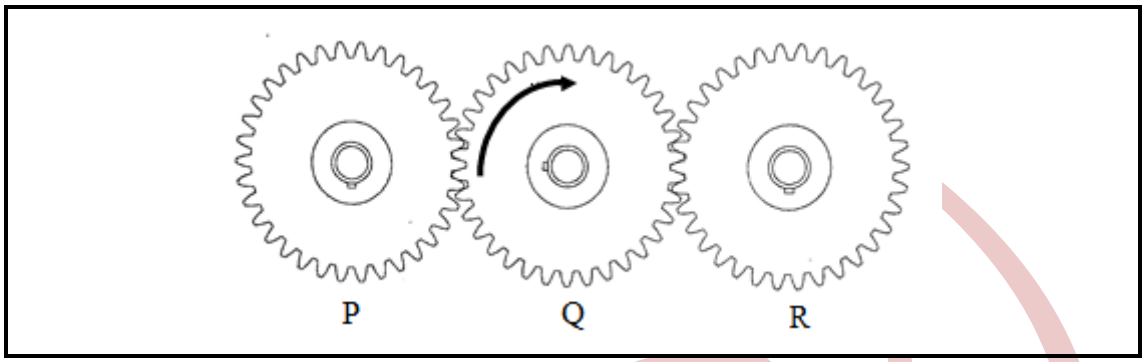


FIGURE 3

4.1.1 Give the rotation direction of gear P.

4.1.2 Give the rotation direction of gear R.

4.1.3 Which gear is an idler or intermediate gear?

(3 × 1) (3)

4.2 List FIVE types of gear used in engineering systems. (5)

4.3 FIGURE 4 shows a simple gear drive. The speed of gear X is 800 r/min while gear Y has 200 teeth and rotates at 120 r/min.

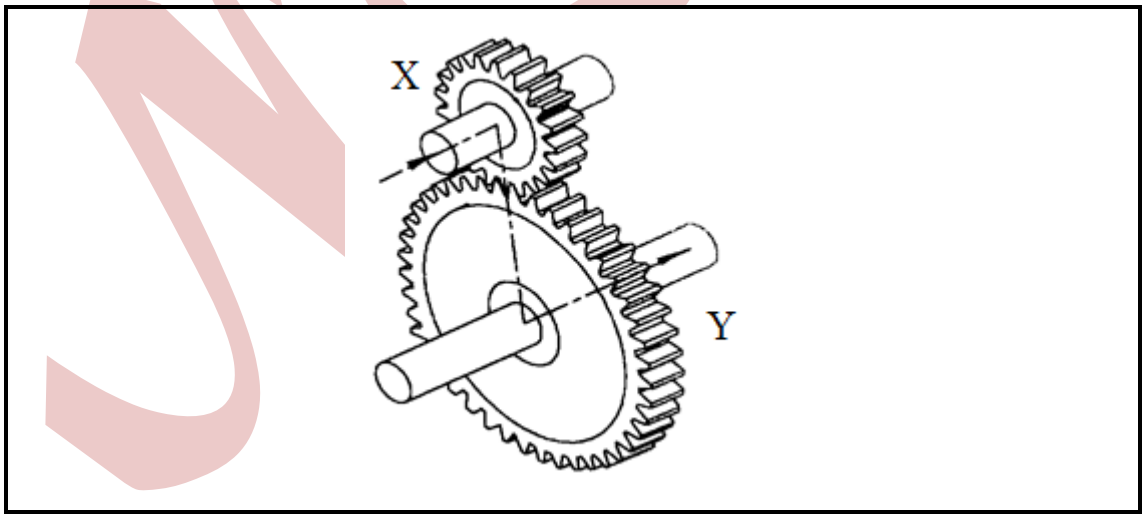


FIGURE 4

Calculate the number of teeth for gear X.

HINT: $N_X.T_X = N_Y.T_Y$ (3)

4.4 With the aid of TWO sketches, illustrate the difference between *spur* and *double-helical gears*. (4)
[15]

QUESTION 5

5.1 State the main difference between *hydraulic* and *pneumatic* systems. (2)

5.2 An electronic control system consists of an input, a process and an output. The input is information supplied to a microprocessor by a sensor.

List THREE types of sensors used in engineering applications. (3)

5.3 List FIVE steps to follow when putting a machine back into operation after a service. (5)

5.4 Give ONE advantage of an electromagnetic brake in the event of a power failure. (1)

5.5 Name ONE application which uses electromagnetic brakes. (1)

5.6 List THREE types of brake systems that can be used in engineering systems. (3)
[15]

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QUESTION 6

6.1 As maintenance technician you have to inspect the components of the machine shown in FIGURE 5.

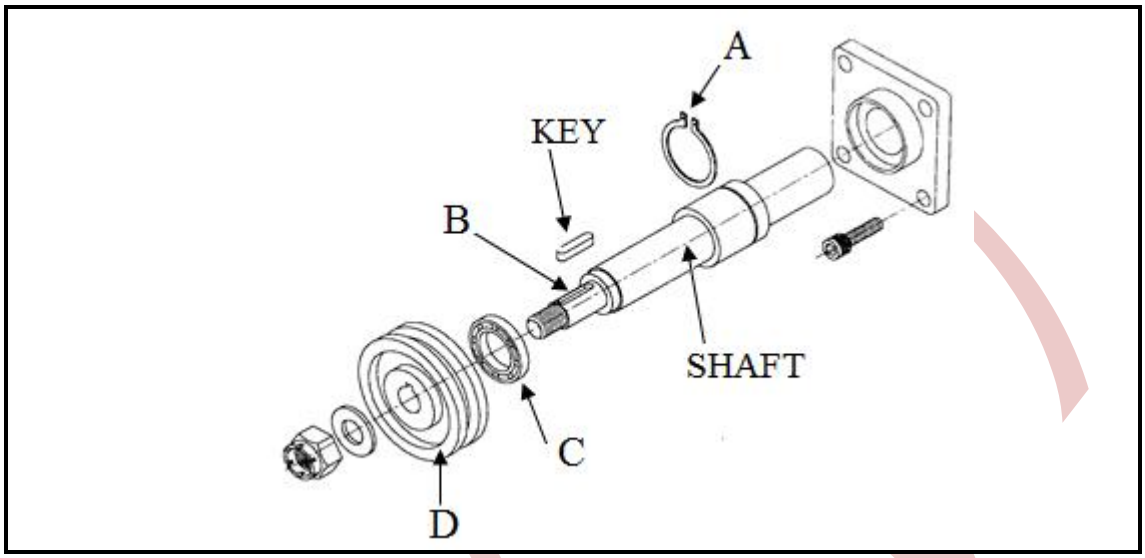


FIGURE 5

6.1.1 Identify the labelled parts by writing the answer next to the letter (A–D) in the ANSWER BOOK. (4)

6.1.2 State what you would inspect on each of the following components:

(a) Key

(b) Shaft

(2 × 1) (2)

6.2 State the tool or tools used to complete each of the following maintenance tasks:

6.2.1 Measuring the inside diameter of a drilled machine part

6.2.2 Measuring the resistance in an electrical component

6.2.3 Tightening bolts and nuts to a certain specification

(3 × 1) (3)

6.3 Name TWO benefits of a good maintenance plan. (2)

6.4 Give ONE function of a control system. (1)

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6.5 State how a good maintenance program impacts on each of the following aspects of a business:

6.5.1 Productivity

6.5.2 Profit margins of the company

6.5.3 Risk of physical injury

(3 × 1) (3)
[15]

TOTAL: 100

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