higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

ENGINEERING SYSTEMS
NQF LEVEL 2

(6021022)

27 February 2018 (X-Paper)
09:00–12:00

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

NC(V)

QUESTION 1

1.1 Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'true' or 'false' next to the question number (1.1.1–1.1.5) in the ANSWER BOOK.

1.1.1 Copper is a poor conductor of electricity and should therefore be used as an insulator in electrical systems.

1.1.2 Backlash is the free play between gears.

1.1.3 A PLC can control complex sequences.

1.1.4 A bush can be made from brass or plastic.

1.1.5 To save time one can make adjustments on machinery while it is in operation.

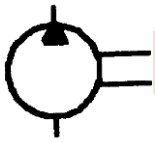
(5 × 1) (5)

1.2 List FIVE types of engineering systems used in engineering applications. (5)

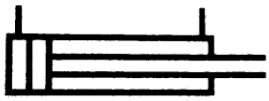
1.3 Name the hydraulic components indicated by the symbols below:

1.3.1  (1)

1.3.2  (1)

1.3.3  (1)

1.3.4  (1)

1.3.5  (2)

1.4 Name FOUR types of mechanical engineering systems used in engineering applications. (4)

[20]

QUESTION 2

Choose a term from COLUMN B that matches a description in COLUMN A. Write only the letter (A–J) next to the question number (2.1–2.10) in the ANSWER BOOK.

COLUMN A		COLUMN B	
2.1	Change the speed ratios between input and output speeds	A	transformer
2.2	Channel fluid under pressure from pump to actuators	B	idler sprocket
2.3	Used in small reciprocating pumps and small oil lines to allow oil flow in one direction only	C	gear trains
2.4	Change alternating current from one value to another	D	pressure relief valve
2.5	Chain drive component that is attached to the motor from which driving is performed	E	hydraulic fluid
2.6	To take up slackness in the chain	F	reservoir
2.7	Tank where hydraulic fluid is stored	G	ball valves
2.8	Lubricate parts of the hydraulic system	H	toggle switch
2.9	Break electric current or allow it to flow	I	pipes
2.10	Device used to protect components in a hydraulic system against excessive oil pressure	J	driver sprocket

(10 × 1) **[10]**

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QUESTION 3

3.1 FIGURE 1 below shows a three-pin plug. The wiring of a plug must be done correctly.

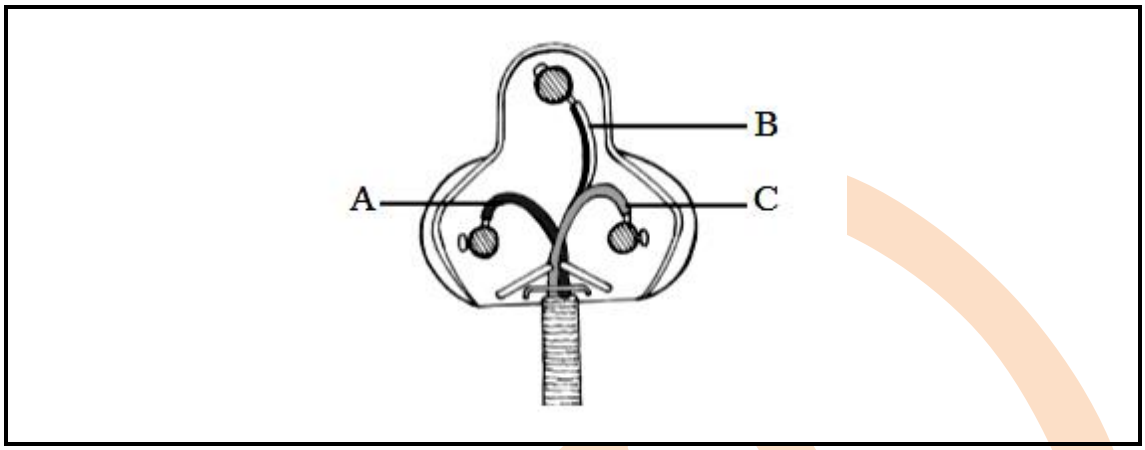


FIGURE 1

3.1.1 Label each of the THREE insulated wires (A–C). (3)

3.1.2 State the colour of each of the THREE wires. (3)

3.2 Draw neat, electrical symbols of the following components:

3.2.1 Voltmeter

3.2.2 Battery

3.2.3 Light-emitting diode

(3 × 1) (3)

3.3 Three resistors of 3 Ω, 6 Ω and 12 Ω respectively are connected in parallel in an electric circuit.

3.3.1 Draw a sketch to show how the resistors are connected. (3)

3.3.2 Calculate the total resistance of the circuit. (3)

[15]

QUESTION 4

4.1 FIGURE 2 shows a roller chain drive. Note that component A is connected to a motor.

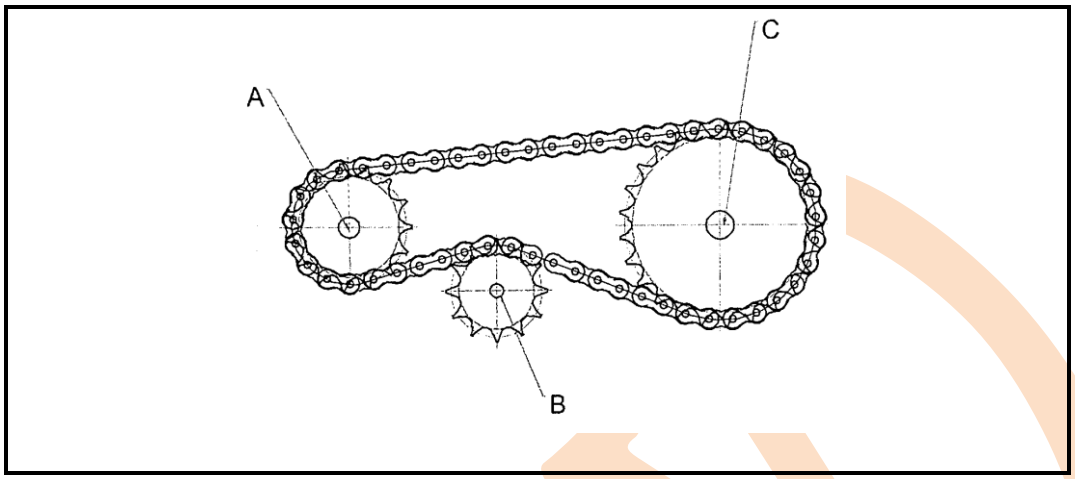


FIGURE 2

4.1.1 Label the components (A–C). (3)

4.1.2 Explain the function of component B. (2)

4.1.3 List THREE reasons why sprockets with spokes are sometimes used in chain drives systems instead of solid sprockets. (3)

4.1.4 A motor is connected to sprocket A that has 32 teeth. C has 80 teeth.

Calculate the rotational speed of the driven sprocket if the rotational speed of the driver sprocket is 720 r/min.

Hint: $N_A T_A = N_C T_C$ (3)

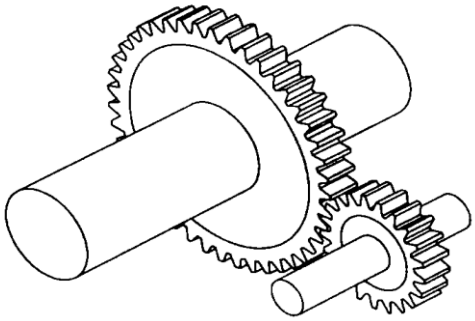
4.2 Explain why chain drives are more efficient than belt drives. (2 + 2) (4)

[15]

QUESTION 5

5.1 Name the gear types shown in the following diagrams:

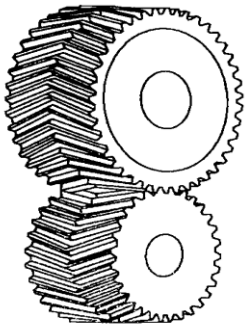
5.1.1



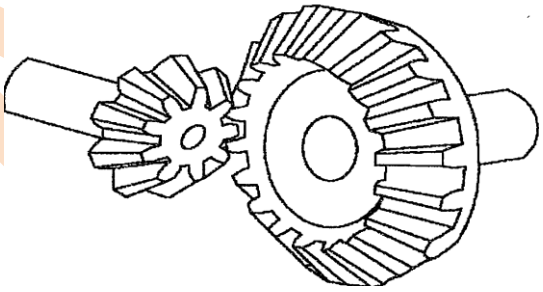
5.1.2



5.1.3



5.1.4



(4 × 1) (4)

5.2 A flat belt drive must be installed between two pulleys.

The following is given:

Driving pulley diameter = 200 mm
Driving pulley speed = 1 600 r/min
Driven pulley diameter = 1,2 m

Use the formulae shown below and calculate:

$$v = \frac{\pi.d.n}{60},\ d.n = D.N,\ P = \frac{2.\pi.N.T}{60}$$

5.2.1 The velocity of the belt in m/s

5.2.2 The speed of the driven pulley in r/min

5.2.3 The torque of the driven pulley if the input power is 30 kW

(3 × 2) (6)

5.3 List THREE checks that must be carried out on an air compressor before starting it. (3)

5.4 When servicing belt drives the technician must check for signs of belt failure.

List THREE signs that will indicate belt failure. (3)

5.5 State the tool that should be used to perform each of the following tasks:

5.5.1 Tighten bolts and nuts to a specific tightness

5.5.2 Cut internal screw threads

5.5.3 Check the backlash between gear teeth

5.5.4 Remove bearings from shafts

(4 × 1) (4)
[20]

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QUESTION 6

6.1 Explain why chain drives must be frequently lubricated. (2)

6.2 List FIVE implications of nonconformance to manufacturer's specifications when setting equipment with simple control systems. (5)

6.3 State how a poor maintenance program impacts the following aspects of a business:

6.3.1 Productivity

6.3.2 Profit margins of the company

6.3.3 Risk of physical injury

(3 × 1) (3)

6.4 Name ONE difference between preventative maintenance and condition-based maintenance. (2)

6.5 Give FOUR types of lubricants used to reduce wear on components. (4)

6.6 Planned maintenance is carried out on a regular basis.

List FOUR goals of a maintenance programme. (4)

[20]

TOTAL: 100

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