higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

ENGINEERING SYSTEMS
NQF LEVEL 2

(6021022)

27 February 2020 (Y-paper)
13:00–16:00

This question paper consists of 8 pages.

107Q1S2027

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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. Start each section on a new page.
5. Use only a black or blue pen.
6. 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–K) next to the question number (1.1–1.10) in the ANSWER BOOK.

COLUMN A		COLUMN B	
1.1	Causes uneven wear and early premature chain failure	A	torque
1.2	Semi-conductor device used in electronics to amplify a current	B	piston rod
1.3	Stores hydraulic fluid until needed in the system	C	control valve
1.4	Controls the coupling and uncoupling between two shafts	D	sprocket misalignment
1.5	Changes hydraulic liquid pressure into mechanical movement	E	idler sprocket
1.6	Used in machines to convert rotary motion to linear motion	F	cam lobe
1.7	Disc with an irregular profile which drives a follower used for controlling valves	G	reservoir
1.8	Alerts, generates or cancels signals for the purpose of sensing, processing and controlling	H	transistor
1.9	Turning moment used to describe how much effort is used to rotate a shaft	I	clutch
1.10	Takes up any slackness in a chain when the gears are far apart	J	screw thread
		K	idler gear

(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 Belt drives must always be guarded when in operation.

2.1.2 Operating pressure in a hydraulic system must be checked regularly and not exceeded for components to be protected.

2.1.3 When a hydraulic system is switched off, the hydraulic fluid is usually no longer under pressure.

2.1.4 Mechanical advantage is the ratio of the distance moved by the effort to the distance moved by the load.

2.1.5 A pneumatic actuator converts energy in the form of compressed air into motion.

(5 × 1) (5)

2.2 Explain each of the following terms:

2.2.1 Electrical circuit

2.2.2 Power

2.2.3 Direct current

2.2.4 Step-down transformer

2.2.5 Circuit-breaker

(5 × 1) (5)

2.3 Explain ONE function of each of the following components in a hydraulic system:

2.3.1 Pump

2.3.2 Hydraulic fluid

2.3.3 Hydraulic pipes

2.3.4 Actuators

2.3.5 Reservoir

(5 × 1) (5)

[15]

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QUESTION 3

3.1 FIGURE 1 shows a hydraulic braking system.

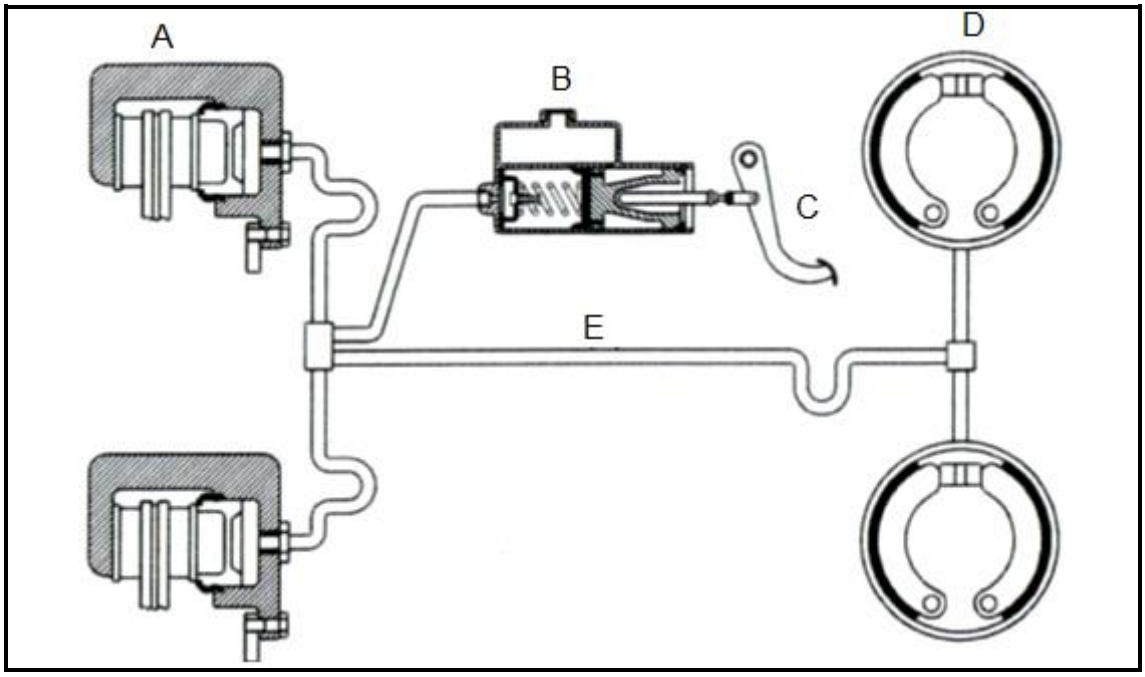


FIGURE 1

Label the parts of the hydraulic braking system by writing only the answer next to the letter (A–E) in the ANSWER BOOK. (5 × 1) (5)

3.2 Give THREE reasons why vehicles and machines are equipped with braking systems. (3)

3.3 Explain why lubrication cannot be used to reduce noise between the brake pads and the disc of a braking system. (3)

3.4 Explain why air tanks in a pneumatic system must be drained regularly. (4)

[15]

QUESTION 4

4.1 The ram of a hydraulic press developed a force of 780 N when a pressure of 150 N is exerted on the plunger with a diameter of 90 mm.

4.1.1 Calculate the diameter of the ram in (mm). (4)

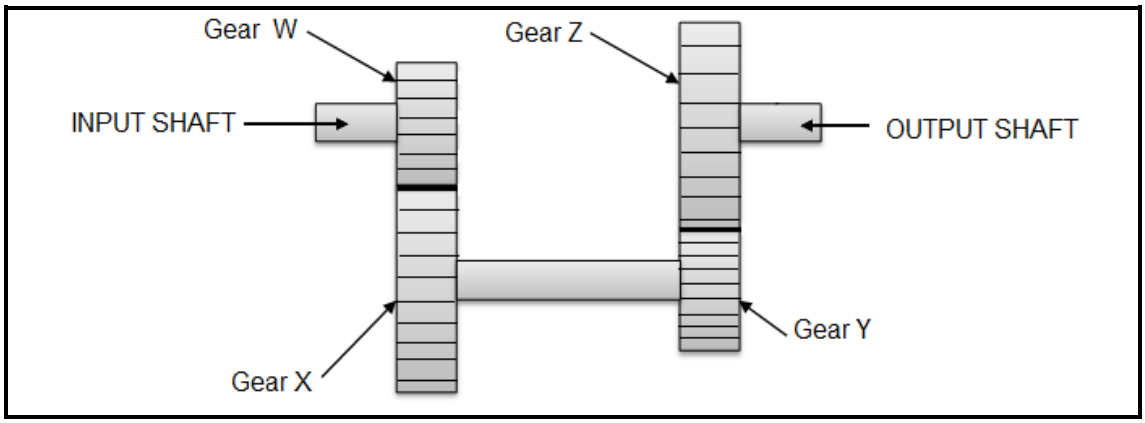
4.1.2 Calculate the fluid pressure. (3)

HINT: [$P = \frac{F}{A}$; $\frac{F_P}{A_P} = \frac{F_R}{A_R}$; $\frac{F_P}{d^2} = \frac{F_R}{D^2}$; $A = \frac{\pi}{4}d^2$]

4.2 FIGURE 2 shows a compound gear drive. The output shaft must rotate at 25 r/min and the speed of the motor shaft is 1 800 r/min. Gear W has 20 teeth, gear X has 120 teeth and gear Z has 160 teeth.

Calculate the number of teeth of gear Y.

HINT: [$N_A.T_A = N_B.T_B$]



(6)

FIGURE 2

4.3 Name the measuring equipment used to measure each of the following in electrical circuits:

4.3.1 Potential difference

4.3.2 Resistance

4.3.3 Current flow

(3 × 1) (3)

4.4 Draw a chain-drive system. Include an idler sprocket and show the tight and slack sides of the chain. (4)

[20]

QUESTION 5

5.1 Explain *backlash* between TWO gears. (1)

5.2 Name the tool that is used to check the backlash between gears. (1)

5.3 List TWO symptoms of each of the following gear drives:

5.3.1 Too much backlash. (2)

5.3.2 Too little backlash. (2)

5.4 List FIVE implications of non-conformance with the manufacturer's specifications when setting equipment with simple control systems. (5)

5.5 List the steps to follow when returning a machine back to operation after maintenance is completed. (5)

5.6 Explain FOUR functions of a control system. (4)
[20]

QUESTION 6

6.1 Name FOUR types of non-friction bearings. (4)

6.2 List THREE methods to check for faults on a bearing. (3)

6.3 State ONE cause of each of the following signs of belt failure in a belt-drive system:

6.3.1 Cracks

6.3.2 Abrasion

6.3.3 Excessive stretch

6.3.4 Loss in speed

(4 × 1) (4)

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6.4 FIGURE 3 shows a drive shaft of a belt-driven drilling machine.

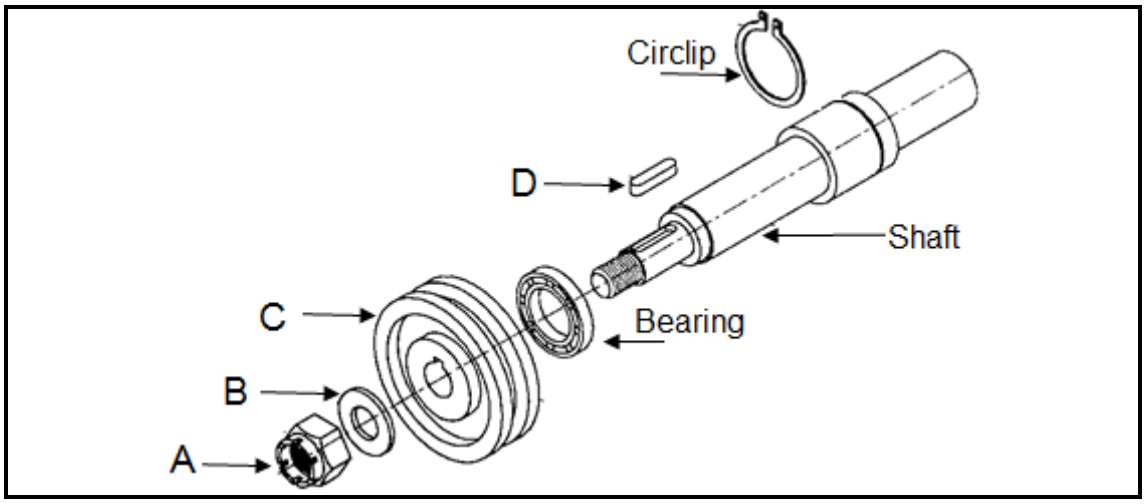


FIGURE 3

6.4.1 Label the parts of the drilling machine by writing only the answer next to the letter (A–D) in the ANSWER BOOK. (4 × 1) (4)

6.4.2 Give ONE visual inspection that must be done on each of the following parts.

(a) Circlip

(b) Bearing

(c) Shaft

(3 × 1) (3)

6.5 Explain the benefits of a good maintenance plan. (2)

[20]

TOTAL: 100

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