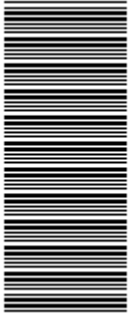


0000000000



higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T1050(E)(J23)T
AUGUST EXAMINATION

NATIONAL CERTIFICATE

MECHANOTECHNOLOGY N3

(8190373)

23 July 2014 (Y-Paper)
13:00–16:00

Calculators may be used.

This question paper consists of 7 pages, 1 table and 1 formula sheet.

DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA
NATIONAL CERTIFICATE
MECHANOTECHNOLOGY N3
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 drawings must be large, clear, neat and in good proportion.
 5. Keep questions and subsections of questions together.
 6. Write neatly and legibly.
-

QUESTION 1: POWER TRANSMISSION

1.1 A 35 kW electrical motor, with a speed of 1 200 r/min, drives a compressor by means of a wedge belt, which rotates at 570 r/min. A centrifugal clutch is used for the heavy start between the two units for a medium-duty operation period of eleven hours.

Calculate the following:

- 1.1.1 The speed ratio (2)
- 1.1.2 Refer to TABLE 1 (attached) and determine the service factor for the drive (1)
- 1.1.3 The minimum pulley diameter, if the larger pulley has a diameter of 960 mm (2)
- 1.1.4 The torque developed by the electric motor (3)
- 1.2 Describe THREE disadvantages of single helical gears. (3)
- 1.3 Describe FOUR advantages of multi-disc clutches. (4)
- 1.4 Define the following terms with regard to belt drives:
- 1.4.1 Correction factor (3)
- 1.4.2 Soft start of an electric motor (2)
- [20]**

QUESTION 2: BRAKES

- 2.1 State TWO disadvantages of an electromagnetic braking system. (2)
- 2.2 Describe THREE advantage of a mechanical brake system. (3)
- [5]**

QUESTION 3: BEARINGS

3.1 Each anti-friction bearing has an identification number. The basic number consists of three figures.

What is the meaning of each of these three figures in the following order:

3.1.1 First figure

3.1.2 Second figure

3.1.3 Third figure

(3 x 1) (3)

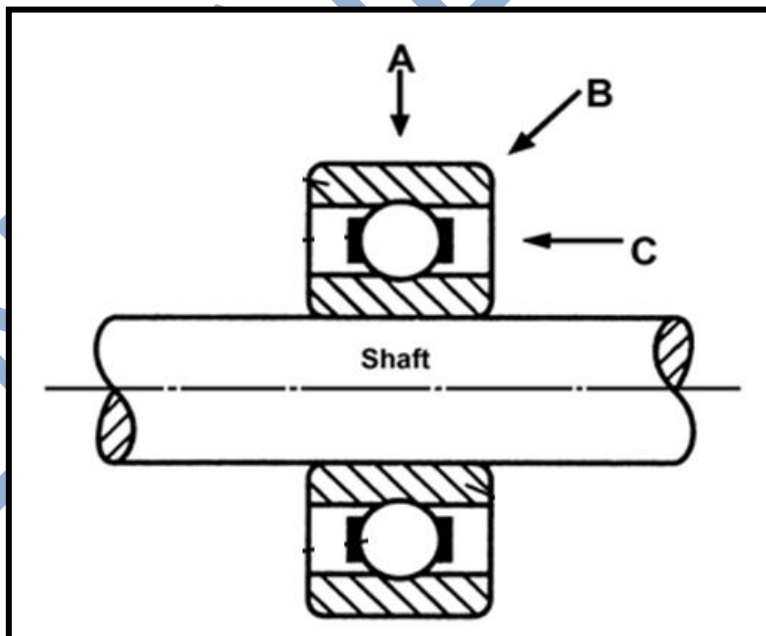
3.2 There is a limit to the speed at which bearings can operate due to the heat generated from the speed.

State FOUR factors that will influence the permissible speed at which an anti-friction bearing can operate.

(4)

3.3 Refer to FIGURE 1 below and name the different types of bearing loads marked A–C. Write only the answer next to the letter (A–C) in the ANSWER BOOK.

[Hint: A = Vertical load; B = Diagonal load and C = Horizontal load]



(3)
[10]

FIGURE 1

QUESTION 4: WATER PUMPS, COOLING AND LUBRICATION

4.1 Lubricants can be classified in THREE main groups.

Name the THREE main groups. (3)

4.2 Give THREE reasons why it is necessary to cool welding machines. (3)

4.3 Pump slip can be defined as the difference between the theoretical and real flow rate.

Give FIVE reasons for pump slip. (5)

4.4 The diagram in FIGURE 2 is applicable to the operation of centrifugal pumps.

Label the curves **A**, **B** and **C** and point **D** indicated on the diagram by writing only the answer next to the letter (**A–D**) in the ANSWER BOOK.

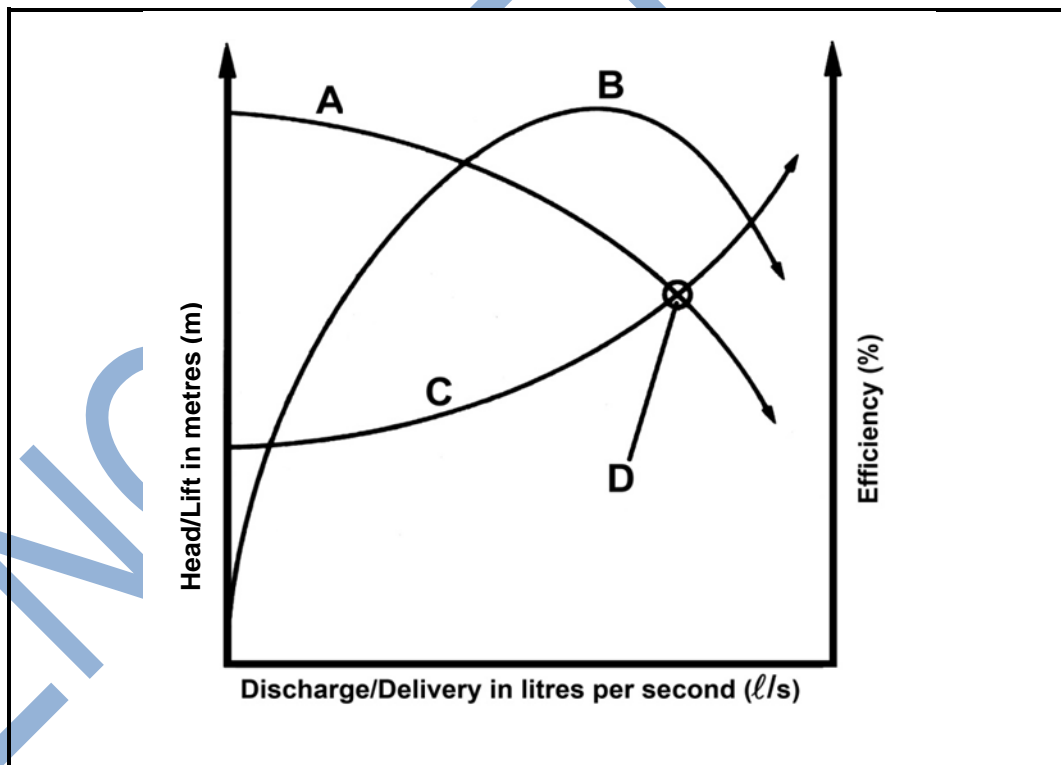


FIGURE 2

(4)
[15]

QUESTION 5: HYDRAULICS AND PNEUMATICS

- 5.1 A hydraulic braking system consists of a hydraulic cylinder and four hydraulic hoses that are equal in diameter. During the braking operation, the plunger moves a distance of 80 mm inside the cylinder. The cylinder has a diameter of 50 mm.

Calculate:

- 5.1.1 The volume of the hydraulic fluid displaced in m^3 in one of the four hoses during the movement of the plunger. (3)
- 5.1.2 The magnitude of the equilibrium force in the cylinder if the pressure is 2 500 kPa.

Express the answer in Kn. (2)

- 5.2 Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'true' or 'false' next to the question number (5.2.1–5.2.2) in the ANSWER BOOK.

5.2.1 The overall efficiency of compressors and pneumatic actuators is higher in contrast to that of hydraulic pumps and hydraulic actuators.

5.2.2 The working operation of hydraulic systems is slower when compared to that of pneumatic systems due to changes in fluid viscosity.

(2 x 1) (2)

- 5.3 FIGURE 3 is a line diagram of a basic hydraulic system. Label the different parts as indicated. Write only the answer next to the letter (A–C) in the ANSWER BOOK.

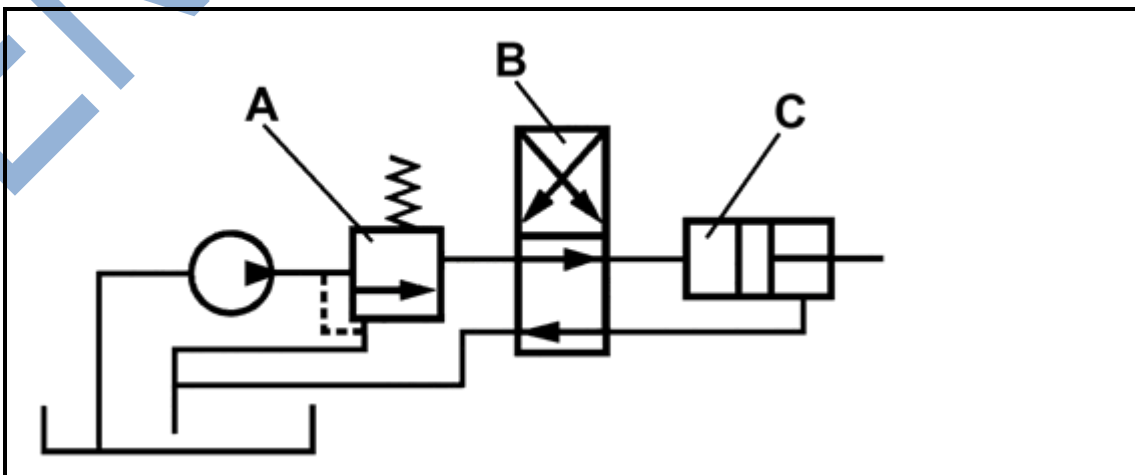


FIGURE 3

(3)
[10]

QUESTION 6: INTERNAL COMBUSTION ENGINES

- 6.1 Describe FOUR disadvantages of diesel engines. (4)
- 6.2 Indicate whether the following statement is TRUE or FALSE. Write only 'true' or 'false' next to the question number in the ANSWER BOOK.

During the compression stroke of four stroke diesel engine a mixture of air and diesel are compressed in the combustion chamber. (1)
[5]

QUESTION 7: CRANES AND LIFTING MACHINES

- 7.1 Describe FOUR advantages of the climbing-type tower crane. (4)
- 7.2 When inspecting steel ropes there is certain information that must be recorded in a logbook.
- List FOUR of these items that must be recorded. (4)

[8]

QUESTION 8: MATERIAL AND MATERIAL PROCESSES

- 8.1 Describe the general behaviour of copper when gas welding is applied to it. (4)
- 8.2 Give THREE reasons for the tempering of metal as a heat treatment process.

(3)
[7]**QUESTION 9: INDUSTRIAL ORGANISATION AND PLANNING**

- 9.1 Communication has certain aims within a business. List FIVE of these aims. (5)
- 9.2 Name TWO types of non-verbal communication. (2)
- 9.3 List FIVE technological factors that will improve productivity. (5)

[12]

QUESTION 10: ENTREPRENEURSHIP

- 10.1 Explain the term *entrepreneurship*. (4)
- 10.2 Explain the term *service business opportunity* as applicable to a small business enterprise. (4)

[8]

TOTAL: 100

TYPES OF DRIVEN MACHINES	TYPES OF PRIME MOVERS					
	'Soft' starts			'Heavy' starts		
	Hours per day duty			Hours per day duty		
	10 and under	Over 10 to 16	Over 16	10 and under	Over 10 to 16	Over 16
Class 1 – Light duty Blowers and fans Centrifugal compressors and pumps Belt conveyors (uniformly loaded)	1,0	1,1	1,2	1,1	1,2	1,3
Class 2 – Medium duty Blowers and fans Rotary compressors and pumps Belt conveyors (not uniformly loaded) Generators	1,1	1,2	1,3	1,2	1,3	1,4
Class 3 – Heavy duty Brick machinery Compressors and pumps (reciprocating) Conveyors (heavy duty) Hammer mills Punches and presses	1,2	1,3	1,4	1,4	1,5	1,6
Class 4 – Extra heavy duty Crushers Mills	1,3	1,4	1,5	1,5	1,6	1,8

TABLE 1

SERVICE FACTORS FOR THE SELECTION OF WEDGE BELTS

MECHANOTECHNOLOGY N3**FORMULA SHEET**

Any applicable formula may also be used.

1. *Design power* = *Power (electrical motor)* × *service factor*
2. *Corrected power per belt* = (*basic power per belt* + *power increment per belt*) × *correction factor*
3. *Belt length (L)* = [(*Pitch diameter of larger pulley* + *Pitch diameter of smaller pulley*) × 1,57] + (2 × *Centre Distance*)
4. *Force (F)* = *Pressure (P)* × *Area (A)*
5. *Work done (W)* = *Force (F)* × *Distance (s)*
6. *Volume (V)* = *Area of base (A)* × *Perpendicular height (⊥h)*