



# higher education & training

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Department:  
Higher Education and Training  
**REPUBLIC OF SOUTH AFRICA**

T1070(E)(A5)T  
**APRIL EXAMINATION**

NATIONAL CERTIFICATE

**MECHANOTECHNOLOGY N3**

(8190373)

**5 April 2016 (X-Paper)**  
**09:00–12:00**

**This question paper consists of 7 pages, 2 tables of 4 pages and 1 formula sheet.**

**DEPARTMENT OF HIGHER EDUCATION AND TRAINING**  
**REPUBLIC OF SOUTH AFRICA**  
NATIONAL CERTIFICATE  
MECHANOTECHNOLOGY N3  
TIME: 3 HOURS  
MARKS: 100

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**INSTRUCTIONS AND INFORMATION**

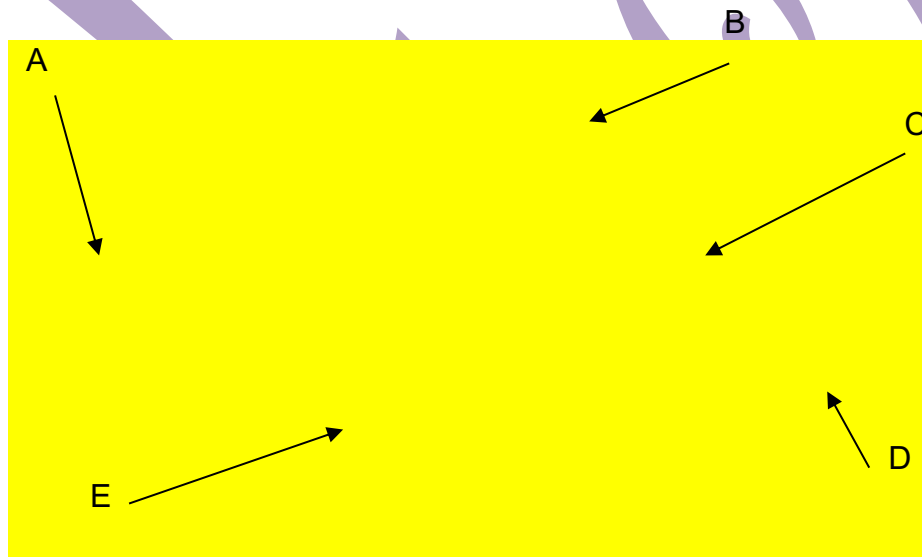
1. Answer ALL the questions.
  2. Read ALL the questions carefully.
  3. Number the answers according to the numbering system used in this question paper.
  4. Write neatly and legibly.
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**QUESTION 1: POWER TRANSMISSION**

- 1.1 A blower rotating at a speed of 700 r/min is driven by a 30 kW electric motor which rotates at 1 200 r/min. This is a medium-duty operation that performs an eleven hours duty per day. The type of start used for this drive is 'soft'

Refer to TABLE 1 and TABLE 2 and answer the following questions:

- 1.1.1 Calculate the speed ratio. (1)
- 1.1.2 Determine the service factor. (1)
- 1.1.3 Calculate the design power. (1)
- 1.1.4 Determine the minimum pulley diameter. (1)
- 1.1.5 Calculate the number of belts if the corrected power per belt is 20,89 kW. (2)
- 1.2 State FOUR advantages of worm and worm-wheel gear. (4 x 1) (4)
- 1.3 Refer to FIGURE 1 which shows a representation of a universal coupling and label the parts (A–E) in the ANSWER BOOK.



**FIGURE 1**

- (5 x 1) (5)
- 1.4 Give FIVE main factors that determine the use of a friction clutch. (5 x 1) (5)
- [20]**

**QUESTION 2: BRAKES**

State FIVE disadvantages of mechanical brakes.

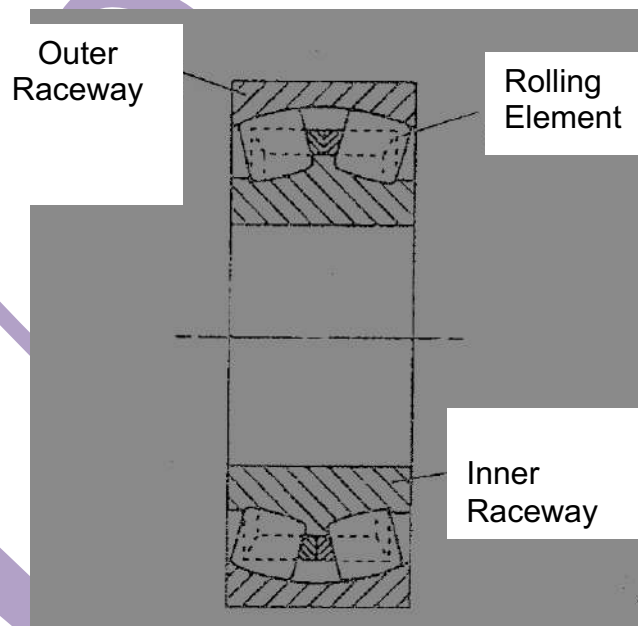
(5 x 1)

**[5]****QUESTION 3: BEARINGS**

3.1 Explain the difference between *friction bearings* and *anti-friction bearings*.

(2)

3.2 Refer to FIGURE 2 and answer the questions.

**FIGURE 2**

3.2.1 Name the type of bearing shown.

(1)

3.2.2 Name the types of loads the above bearing can carry.

(2)

3.2.3 State the main advantage of the bearing.

(1)

3.3 State FOUR features of the guide friction bearing.

(4)

**[10]****QUESTION 4: WATER PUMPS, COOLING AND LUBRICATION**

4.1 Explain the term *water hammer*.

(3)

4.2 Apart from using an oil can or a grease pot, list FIVE other methods that can be used to apply lubrication on machine parts and components. (5 x 1)

(5)

4.3 Explain the difference between a *piston* and a *plunger*.

(2)

4.4 Name FIVE possible causes of breakdowns in centrifugal pumps. (5 x 1)

(5)

**[15]**

**QUESTION 5: HYDRAULICS AND PNEUMATICS**

5.1 A hydraulic system consists of two hydraulic cylinders. In cylinder A the input side, a force of 1 200 N was applied on the plunger.

The following information is also known:

- The work done in cylinder A when the force was applied: 250 joules
- The diameter of cylinder A: 75 mm
- The diameter of cylinder B: 260 mm

NOTE: Use  $\pi = 3,1416$  and calculate the following:

5.1.1 The distance that the plunger in cylinder A moved.

Express the answer in millimetres (mm).

5.1.2 The volume of fluid displaced in cylinder A during the work done process.

Express the answer in cubic meter ( $m^3$ ).

(2 x 2) (4)

5.2 The fluid in a hydraulic system is vitally important.

State TWO characteristics of hydraulic fluid in this regard.

(2 x 1) (2)

5.3 Make neat drawings (NO freehand sketches) of the ISO symbols as applicable hydraulic systems of the following:

5.3.1 A directional control valve

5.3.2 A flow control valve (adjustable)

5.3.3 An actuator (linear)

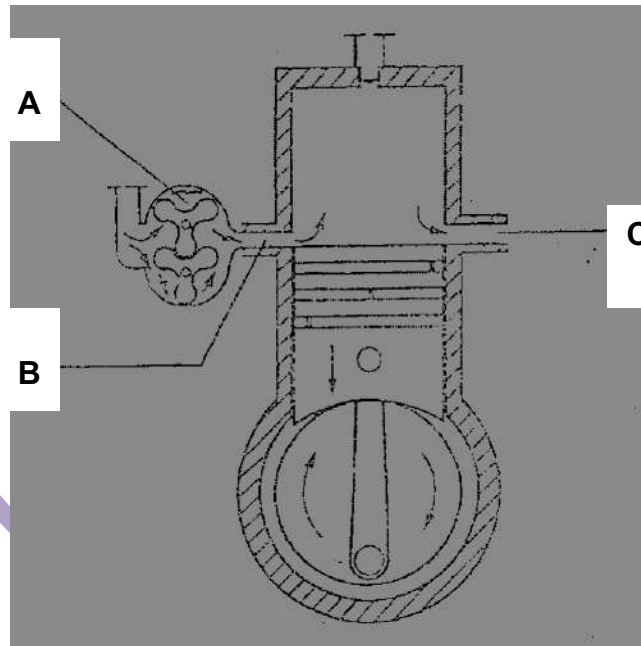
5.3.4 A flow control valve (fixed)

(4 x 1) (4)

**[10]**

**QUESTION 6: INTERNAL COMBUSTION ENGINES**

Refer to FIGURE 3 of a two-stroke diesel engine and answer the questions:



**FIGURE 3**

- 6.1 Name the components (A–C). (3)
  - 6.2 Name the TWO phases during the downwards stroke of a piston. (2 x 1) (2)
- [5]**

**QUESTION 7: CRANES AND LIFTING MACHINES**

- 7.1 Give FOUR advantages of using mobile cranes. (4 x 1) (4)
  - 7.2 A typical steel rope that is used in cranes can be describes as:  
30 mm diameter, 6 x 36 (9/9/1), fibre core, Langs lay.  
Explain the meaning of the numbers 6 x 36 steel rope. (2)
  - 7.3 State TWO characteristics of a steel rope with a wire core. (2 x 1) (2)
- [8]**

**QUESTION 8: MATERIAL AND MATERIAL PROCESSES**

- |       |  |         |            |
|-------|--|---------|------------|
| 8.1   | Describe THREE characteristics of non-ferrous metals.  | (3 x 1) | (3)        |
| 8.2   | Give TWO examples of non-ferrous metals.   | (2 x 1) | (2)        |
| 8.3   | State the basic characteristics from non-laboratory tests with reference to the hardness of the following: |         |            |
| 8.3.1 | Natural rubber (NR)  |         |            |
| 8.3.2 | Nylon  | (2 x 1) | (2)        |
|       |  |         | <b>[7]</b> |

**QUESTION 9: INDUSTRIAL ORGANISATION AND PLANNING**

- |     |  |         |             |
|-----|--|---------|-------------|
| 9.1 | List FIVE documents that form part of the production process and assist in managing the budget of an organisation.     | (5 x 1) | (5)         |
| 9.2 | List THREE methods that can be used to improve horizontal communication.   | (3 x 1) | (3)         |
| 9.3 | Employees fail to report incidents for various reasons.<br>Give FOUR reasons that make them not to report an incident. | (4 x 1) | (4)         |
|     |  |         | <b>[12]</b> |

**QUESTION 10: ENTREPRENEURSHIP**

- |      |  |         |            |
|------|--|---------|------------|
| 10.1 | State FIVE characteristics of an entrepreneur.   | (5 x 1) | (5)        |
| 10.2 | Name THREE sources that an entrepreneur can use to research or to explore possible business opportunities. | (3 x 1) | (3)        |
|      |  |         | <b>[8]</b> |

**TOTAL: 100**

**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)*



**TABLE 1****SERVICE FACTORS FOR THE SELECTION OF WEDGE BELTS**

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
<b>Class 1 - Light duty</b> Blowers and fans Centrifugal compressors and pumps Belt conveyors (uniformly loaded)	1,0	1,1	1,2	1,1	1,2	1,3
<b>Class 2 - Medium duty</b> 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
<b>Class 3 - Heavy duty</b> 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
<b>Class 4 - Extra heavy duty</b> Crushers Mills	1,3	1,4	1,5	1,5	1,6	1,8