higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T1060**(E)**(A1)T

NATIONAL CERTIFICATE

MECHANOTECHNOLOGY N3

(8190373)

1 August 2017 (X-Paper)
09:00–12:00

Calculators may be used

This question paper consists of 7 pages, 2 pages of tables 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. Write neatly and legibly.

QUESTION 1: POWER TRANSMISSION

1.1 A sandblasting machine operates by means of a wedge belt at a speed of 750 r/min. A soft-start drive is used to operate the machine, which is driven by a 38 kW electrical motor at a speed of 1 300 r/min. The operation is medium-duty and performs for ten hours per day. The corrected power per belt is 22 kW.

Refer to TABLE 1 and TABLE 2 in the ADDENDUM to determine the following:

1.1.1 The speed ratio (2)

1.1.2 The service factor for this drive (1)

1.1.3 The design power (1)

1.1.4 The minimum pulley diameter (1)

1.1.5 The number of belts used for the drive (2)

1.2 FIGURE 1 below shows a coupling used for power transmission.

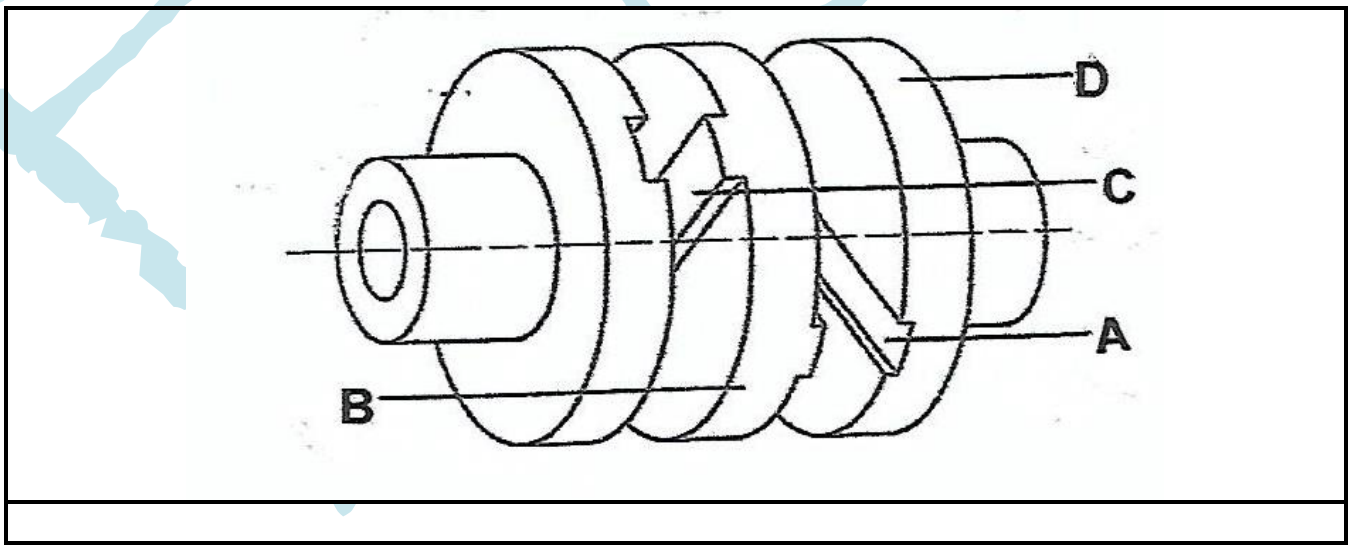

FIGURE 1

1.2.1 Identify the type of coupling shown in FIGURE 1. (1)

1.2.2 Label the parts of the coupling by writing only the answer next to the letter (A–D) in the ANSWER BOOK. (4)

1.3 List FOUR negative effects caused by a chain that is stretched too tightly. (4)

1.4 Name FOUR factors to consider when applying gear drives. (4)

[20]

QUESTION 2: BRAKES

FIGURE 2 below shows a braking system.

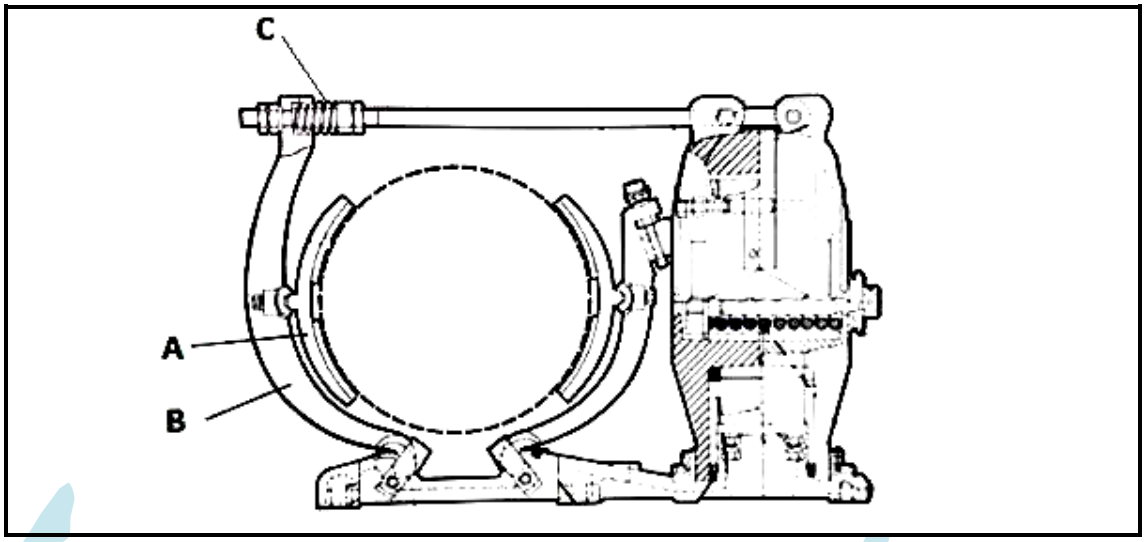

FIGURE 2

2.1 Name the braking system shown in FIGURE 2. (1)

2.2 Label the parts of the braking system by writing only the answer next to the letter (A–C) in the ANSWER BOOK. (3)

2.3 Give ONE disadvantage of the braking system shown in FIGURE 2. (1)
[5]

QUESTION 3: BEARINGS

3.1 Each anti-friction bearing has a designation/identification number that generally contains THREE figures.

Explain the meaning of each of these figures in the following order:

3.1.1 First figure

3.1.2 Second figure

3.1.3 Third figure

(3 × 1) (3)

3.2 Bearing life span can be greatly shortened if poorly managed.

Give SEVEN reasons why anti-friction bearings overheat. (7)
[10]

QUESTION 4: WATER PUMPS, COOLING AND LUBRICATION

4.1 Define the following terms:

4.1.1 Reciprocating movement

4.1.2 Water hammer

4.1.3 Pump

4.1.4 Pump slip

(4 × 2) (8)

4.2 Lubrication is necessary because it ensures that machine components, like gearboxes, bearings, pistons, etc., function efficiently for longer periods.

Name FIVE methods of lubrication. (5)

4.3 Give TWO reasons why it is necessary to cool electric motors. (2)
[15]

QUESTION 5: HYDRAULICS AND PNEUMATICS

5.1 A diameter of a plunger in a hydraulic cylinder is 36 mm and the length of the cylinder is 115 mm. During operation, a pressure of 305 kPa is exerted on the plunger.

Use π as 3,1416.

Calculate the following:

5.1.1 The cross-sectional area of the plunger in m^2 (1)

5.1.2 The force of the plunger in Newton (N) (2)

5.1.3 The work done by the plunger in Joules (J) if the plunger moved a distance of 90 mm (2)

5.2 Pneumatics comprises the use of compressed air to produce mechanical motion.

Briefly explain the function of an air service unit in a pneumatic system. (3)

5.3 Name TWO general categories of hydraulic valves. (2)
[10]

QUESTION: 6 INTERNAL COMBUSTION ENGINE

6.1 Give TWO reasons for the use of a turbo when fitted in a petrol or diesel engine. (2)

6.2 Give THREE disadvantages of a diesel engine when compared with a petrol engine. (3)
[5]

QUESTION 7: CRANES AND LIFTING MACHINES

7.1 Name FOUR general precautions to consider when operating a crane. (4)

7.2 State FOUR functions of the fibre core in a steel rope. (4)
[8]

QUESTION 8: MATERIAL AND MATERIAL PROCESSES

8.1 Briefly explain the function of the following metal properties:

8.1.1 Tensile strength

8.1.2 Plasticity

8.1.3 Malleability

8.1.4 Hardness

(4 × 1) (4)

8.2 The purpose of colour coding metals is to identify each type of steel manufactured.

Choose a colour from COLUMN B that matches a type of steel in COLUMN A. Write only the letter (A–D) next to the question number (8.2.1–8.2.3) in the ANSWER BOOK.

COLUMN A		COLUMN B	
8.2.1	Stainless steel	A	black
8.2.2	High carbon steel	B	grey
8.2.3	Pipeline steel	C	brown
		D	white

(3 × 1) (3)
[7]

QUESTION 9: INDUSTRIAL ORGANISATION AND PLANNING

9.1 Business communication is the process of sharing information between people within and outside the organisation with the intention to benefit the organisation.

State FOUR aims of communication in an organisation. (4)

9.2 Briefly describe the purpose of a grievance procedure. (4)

9.3 Define the term *capital budget.* (4)
[12]

QUESTION 10: ENTREPRENEURSHIP

10.1 Explain the term *entrepreneurship.* (4)

10.2 State FOUR rules that should be considered when brainstorming/generating business ideas. (4)
[8]

TOTAL: 100

TABLE 1: SERVICE FACTORS FOR THE SELECTION OF WEDGE BELTS

	TYPES OF PRIME MOVERS					
	Soft starts			Heavy starts		
TYPES OF DRIVEN MACHINES	Hours duty per day			Hours duty per day		
	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 2: MINIMUM PULLEY DIAMETER (mm)

Speeds faster than (r/min)	Minimum pulley diameter (mm)																			
	Design power (kW)																			
	To 1	3,0	4,0	5,0	7,5	10	15	20	25	30	40	50	60	75	90	110	130	150	200	250
500	67	90	100	112	125	140	180	200	212	236	250	280	280	315	375	400	450	475	500	560
600	67	85	90	100	112	125	140	180	200	212	224	250	265	280	300	335	375	400	475	500
720	67	80	85	90	90	106	132	150	160	170	200	236	250	265	280	300	335	375	450	500
960	67	75	80	85	95	100	112	132	150	180	180	200	224	250	280	280	300	335	400	450
1 200	67	71	80	80	95	95	106	118	132	150	160	180	200	236	236	250	265	300	335	355
1 440	67	67	75	80	85	85	100	112	125	140	160	170	190	212	236	236	250	280	315	335
1 800	67	67	71	75	80	85	95	106	112	125	150	160	170	190	212	224	236	265	300	335
2 800	67	67	67	67	80	80	85	90	100	112	125	140	160	170	180	212	224	236	-	-

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)*