higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

MECHANICAL DRAWING AND DESIGN N6

(8090086)

15 April 2020 (X-paper)
09:00–13:00

This question paper consists of 3 pages and 1 diagram sheet.

251Q1A2015

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
MECHANICAL DRAWING AND DESIGN N6
TIME: 4 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. Use only a black or blue pen.
5. Use *g* as 9,81 m/s^2.
6. Write neatly and legibly.

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QUESTION 1

The DIAGRAM SHEET (attached) shows a hoist system driven by an electric motor that transmits 40 kW at 1 000 r/min. The electric motor is coupled to the centrifugal clutch to give the motor a smooth and gradual loading. The gear system is introduced for speed reduction.

Shaft 2 information:

The shaft is mounted on two bearings 400 mm apart. Gear B is mounted 100 mm from the left-hand bearing and gear C is 100 mm from the right-hand bearing. The maximum bending and shear stresses induced in a shaft may not exceed 240 MPa and 180 MPa respectively. The maximum torque is 20% more than the mean torque. The shaft is subjected to minor shock and a fatigue factor of $K_B = 2$ and $K_T = 1,5$.

Gear information:

The gears are made of cast steel (basic stress for cast iron is 140 MPa). The pressure angle is 20°. The number of teeth on gears A, C and E are 20, 18 and 22 respectively. All meshing gears has a module of 6 mm. The centre distance between shafts 1 and 2 is 168 mm, 174 mm between shafts 2 and 3, and 180 mm between shafts 3 and 4.

Clutch information:

The centrifugal clutch has four shoes which slide radially in a spider, keyed to the driving motor shaft. The clutch starts engagement at 70% of the maximum speed of the motor. The drum internal diameter is 340 mm. The centre of gravity of each shoe is 150 mm from the centre of rotation. The coefficient of friction between the drum and the shoes is 0,3.

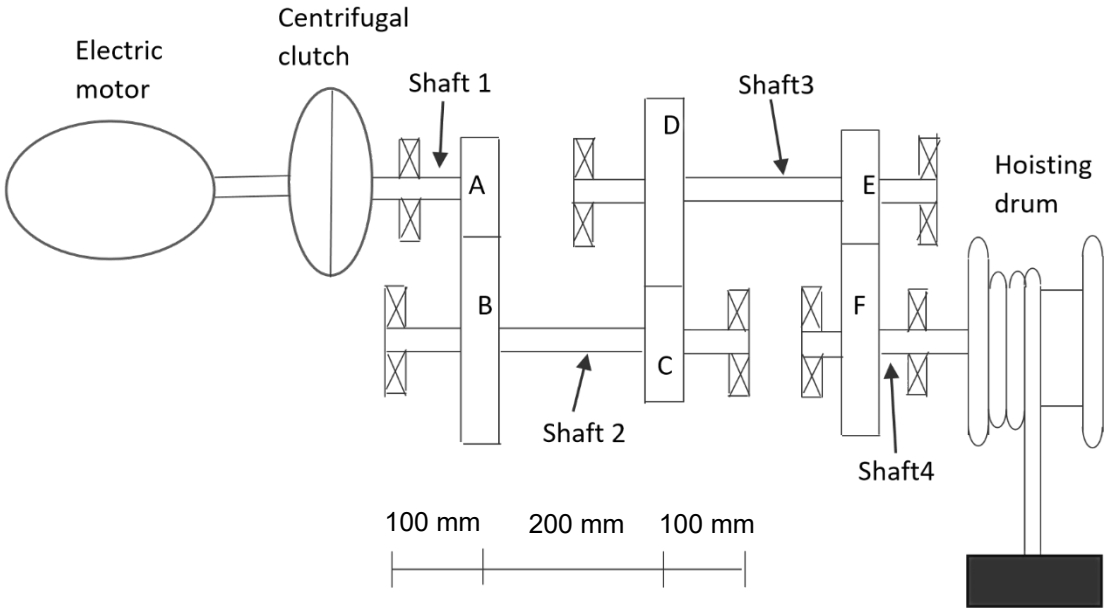
Calculate:

1.1	The input torque to the clutch	(2)
1.2	The mass of each shoe and the clutch centrifugal and spring forces	(12)
1.3	The rotational speed and torque transmitted by each shaft	(18)
1.4	If there is any interference taking place between all meshing gears	(18)
1.5	A suitable face width for meshing gears A and B by using the Lewis formula and check if it is within the limits	(14)
1.6	The maximum bending moment induced on shaft 2 assuming the belts to be vertical and parallel	(23)
1.7	The maximum torque transmitted by shaft 2	(2)
1.8	The suitable diameter for shaft 2	(11)
		[100]

TOTAL: 100

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DIAGRAM SHEET



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