higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T1090**(E)**(A3)T

NATIONAL CERTIFICATE

MECHANICAL DRAWING AND DESIGN N6

(8090086)

3 August 2018 (X-Paper)
09:00–13:00

OPEN-BOOK EXAMINATION

This question paper consists of 4 pages and 1 diagram sheet.

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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. ALL calculations must have at least THREE steps, e.g. formula, substitution and answer.
5. Use g = 9,81 m/s^2.
6. Write neatly and legibly.

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QUESTION 1

The FIGURE on the DIAGRAM SHEET (attached) shows a line shaft driven by an electric motor directly beneath and a driver by means of a gear drive and transmits 80 kW at 900 r/min. A centrifugal clutch is introduced between the motor and the gears for a smooth movement, to reduce drive-related vibrations and allow the motor to reach enough torque to drive before engagement.

Driven shaft information:

The driven solid shaft is mounted on TWO bearings 1 metre apart. The driven gear is mounted 250 mm from the right-hand bearing. A pulley with a PCD of 400 mm is mounted 300 mm from the left-hand bearing. The flywheel, with a mass of 120 kg, is mounted at the midspan of the two bearings. The maximum bending and shear stresses induced in the shaft is 100 MPa and 60 MPa respectively.

Gear information:

The gears are made of cast steel. The basic stress for cast steel is 140 MPa. The pressure angle is 20°. The driving pinion A has a PCD of 120 mm and 20 teeth. The centre distance between the gears is 273 mm.

Belt information:

The belts are at an angle of 30° and parallel. The coefficient of friction between the belt and the pulley is 0,25. The angle of contact between the belt and pulley is 180°.

Bearing information:

Both bearings are journal bearings. The coefficient of friction between the bearing and the shaft is 0,08.

Clutch information:

The centrifugal clutch has FOUR shoes which slide radially on a spider key to the driving shaft. The coefficient of friction between the shoes and the clutch drum is 0,25. The clutch engages at 400 r/min. The mass of each shoe is 3,2 kg.

Calculate from the given information:

1.1	The number of teeth and the PCD of driven gear B	(6)
1.2	Whether there is no interference between the gears	(4)
1.3	The suitable face width using Lewis formula and check if it is within the limits	(15)
1.4	The maximum torque on the driven shaft (assume 15% overloading)	(4)
1.5	The maximum bending moment on the driven shaft	(36)

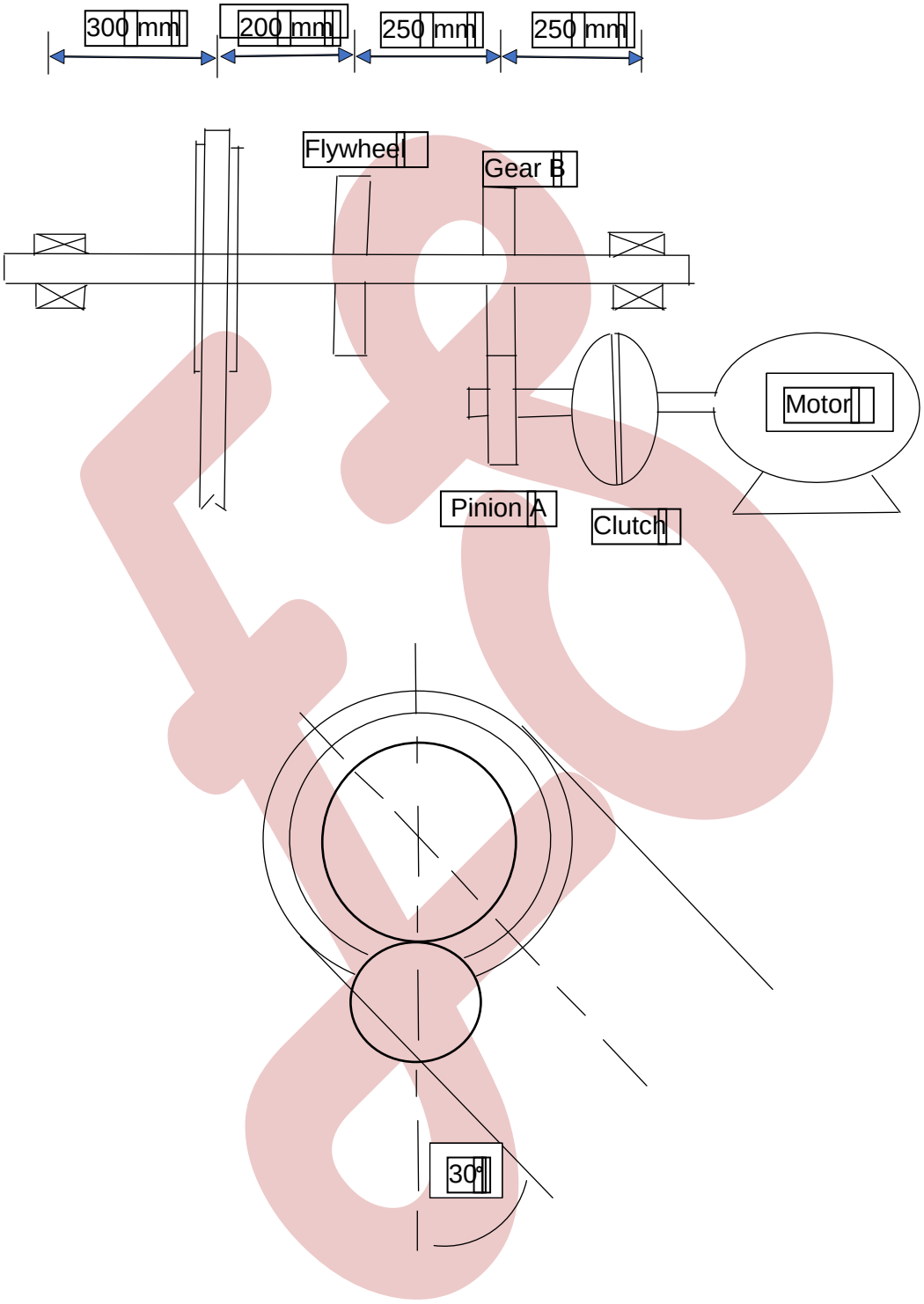
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1.6	The suitable driven shaft diameter (neglect the shock and fatigue factors)	(10)
1.7	The resultant radial load on both bearings	(4)
1.8	The frictional force, frictional toque and frictional power	(12)
1.9	The suitable internal diameter for the centrifugal clutch drum	(9)
		[100]

TOTAL: 100

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DIAGRAM SHEET



FIGURE

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