higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

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AUGUST EXAMINATION

NATIONAL CERTIFICATE

MECHANOTECHNICS N4

(8190194)

31 July 2014 (Y-Paper)
13:00–16:00

This question paper consists of 6 pages.

DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
MECHANOTECHNICS N4
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 work done in pencil (excluding sketches, drawings and diagrams) will be regarded as rough work and will not be marked.
5. Write neatly and legibly.

QUESTION 1

1.1 The layout of a workshop involves placing of the various machines and related equipment in the different work areas, as well as arranging for storage space or stores, staff facilities and administrative offices. The placing of the machines on the floor of a workshop has to comply with six important requirements.

Name and briefly discuss these FIVE requirements. (10)

1.2 State SIX advantages and FOUR disadvantages of airless spray painting. (10)

1.3 Lubrication devices are used to provide a regulated quantity of a lubricant to machine parts.

1.3.1 Name FIVE general methods of lubrication. (5)

1.3.2 Make a labelled drawing of the sight-feed lubricator. (5)
[30]

QUESTION 2

Calculate the quantity of rock, in tonne per hour, which can be transported by a belt conveyor having the following particulars.

2.1 Maximum tension in the belt = 35,5 kN (1)

2.2 Contact angle of the belt on the driving pulley = 185° (2)

2.3 Friction force = 2,5 kN (3)

2.4 Belt speed = 95 m/min (2)

2.5 Delivery height = 35 m (2)

2.6 Coefficient of friction = 0,3 (4)
[14]

QUESTION 3

3.1 A grinding wheel with a diameter of 200 mm rotates at a speed of 2 500 r/min exerting the tangential force of 60 N on a work piece. If the motor driving the grinding wheel rotates at the speed of 1 500r/min with a machine efficiency of 85%, calculate the following:

3.1.1 The output power at the grinding wheel (3)

3.1.2 The input power of the motor (2)

3.1.3 The torque on the spindle of the motor (2)

3.2 A lathe is being driven by a motor providing a maximum output power of 3,5 kW at 1 750 r/min.
At the maximum power the machine efficiency is 80%
The maximum and the minimum revolutions of the lathe spindle are 3 500 r/min and 25 r/min respectively.

Determine the torque at maximum power:

3.2.1 At the driving shaft of the motor (2)

3.2.2 At the driving spindles of the lathe at maximum speed (3)

3.2.3 At the driving spindles of the lathe at minimum speed (2)
[14]

QUESTION 4

A tapered gauge with a taper of 1 in 5 on the diameter, as shown in FIGURE 1 (below) must be checked for accuracy by means of a 100 mm sine bar and a set of gauge blocks.

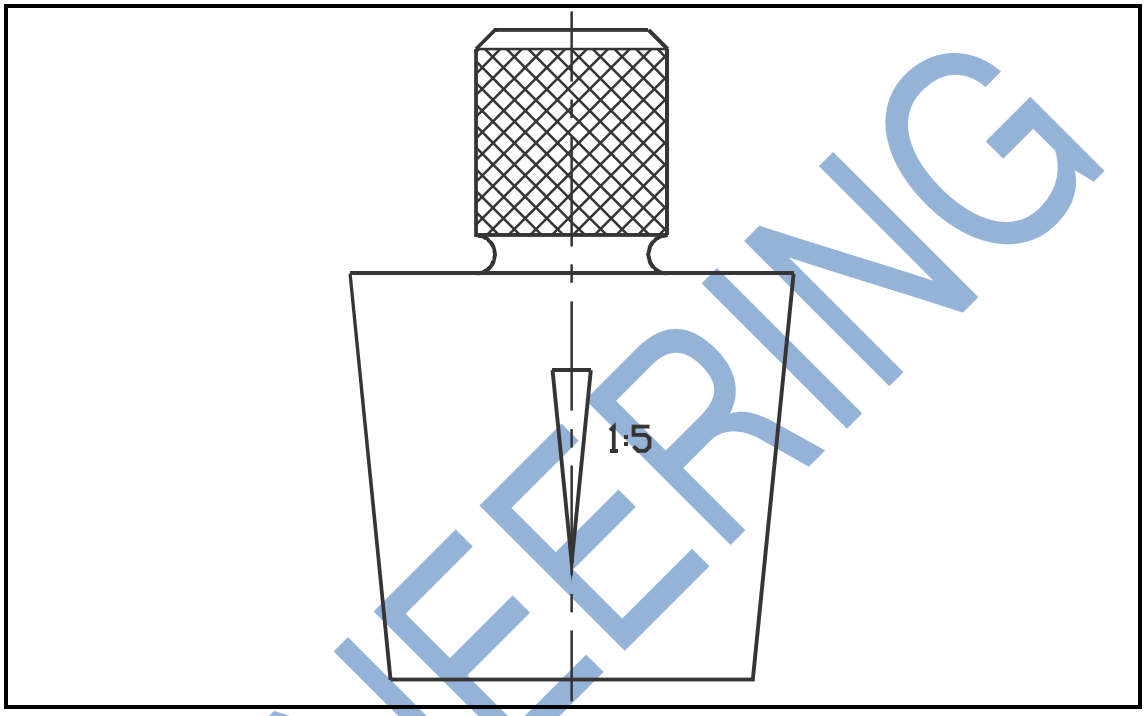

FIGURE 1

4.1 Calculate the included angle of the plug gauge. (5)

4.2 Make a neat drawing of the set-up of the plug gauge, sine bar and gauge blocks. (5)

4.3 Make use of the drawing and calculate the difference in height of the two rollers of the sine bar. (4)
[14]

QUESTION 5

FIGURE 2 (below) shows a motor attached to an epicyclic gearbox which consists of an annulus (A) having 64 teeth, a sun gear (C) having 28 teeth, two planetary gears (B) having 18 teeth each and an arm (D) driving two planetary gears.

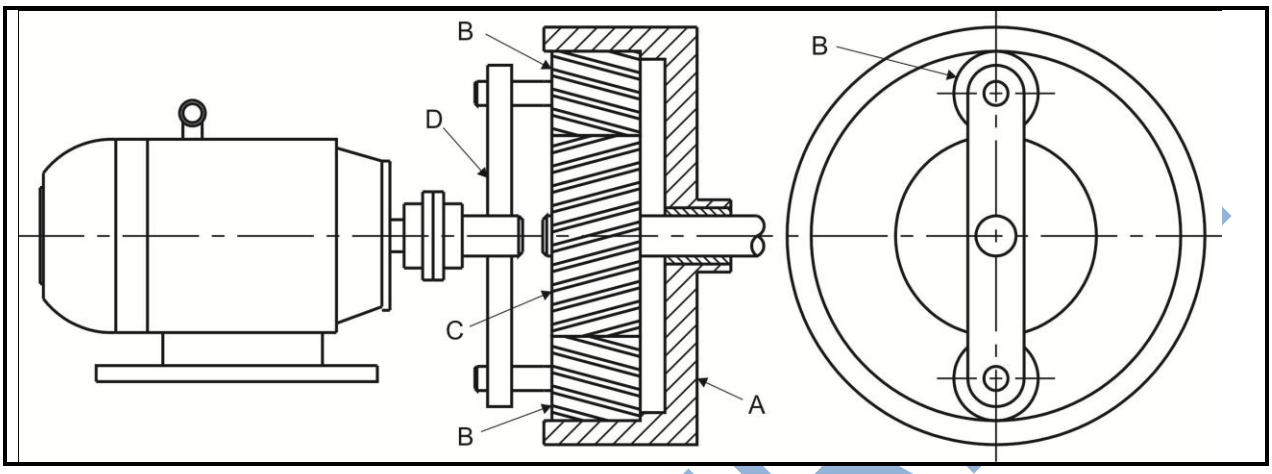

FIGURE 2

5.1 If arm (D) rotates at 150 r/min, calculate the rotational speed of the sun gear (C) when annulus (A) is fixed. (7)

5.2 Determine the speed of annulus (A) when the sun gear (C) is fixed and arm (D) rotates at 150 r/min. (7)

[14]

QUESTION 6

A sharp-edge orifice 50 mm in diameter in the side of a large tank, is discharging water under a constant pressure head of 3 m. The diameter of the vena contracta is 40 mm. If the horizontal distance of the water jet is 2,5 m and the jet falls 550 mm vertically, determine the following:

6.1 The theoretical area of the jet. (1)

6.2 The actual area of the jet. (1)

6.3 The theoretical flow velocity of the water. (1)

6.4 The actual flow velocity of the water. (1)

6.5 The theoretical delivery of the water. (2)

6.6 The actual delivery of the water. (2)

6.7 The coefficient of delivery (C_d). (2)

6.8 The coefficient of velocity ($C_{v)}$. (2)

6.9 The coefficient of contraction (C_c). (2)

[14]

TOTAL: 100