higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T900**(E)**(A6)T

NATIONAL CERTIFICATE

INSTRUMENT TRADE THEORY N2

(11040452)

6 August 2019 (X-Paper)
09:00–12:00

Calculators may be used.

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

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
INSTRUMENT TRADE THEORY N2
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. Take 'g' = 10m/s²
5. Write neatly and legibly.

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QUESTION 1

1.1 Make a neat labelled sketch of a well or cistern-type manometer. (5)

1.2 Calculate the mercury displaced in the well of a well-type manometer if the following are given:

- P1 = 200 KPa
- P2 = 115 KPa
- Area of well = 60 mm²
- Area of narrow limb = 25 mm² (5)

[10]

QUESTION 2

2.1 Make a neat labelled sketch of a single-bell thick wall pressure gauge and describe its principles of operation. (10)

2.2 State TWO uses and TWO disadvantages of the McLeod gauge. (2 × 2) (4)

2.3 Make a neat labelled sketch of the dead weight tester. (6)

[20]

QUESTION 3

3.1 Sketch and describe the operation of a gas expansion thermometer. (10)

3.2 Name FOUR materials used for expansion thermometers. (4)

3.3 Draw a fully labelled sketch of the unbalanced wheatstone bridge and write down the applicable formula. (6)

[20]

QUESTION 4

4.1 Explain the term *cold junction compensation* and draw a sketch showing how it can be done by using ice. (8)

4.2 Name TWO of the most common types of thermocouples. (2)

4.3 Explain the term *intermediate temperatures*. (5)

4.4 Define the term *Peltier effect.* (5)

[20]

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QUESTION 5

5.1 Draw a labelled sketch of a dry gas volumetric flow meter. (5)

5.2 Draw a labelled sketch of the Dall tube differential pressure instrument. (5)
[10]

QUESTION 6

6.1 Draw a labelled sketch of the turbine flow meter. (5)

6.2 State THREE advantages and TWO disadvantages of the turbine flow meter. (5)
[10]

QUESTION 7

Draw a diagram of the conduction method of level measurement and explain its operation. **[10]**

TOTAL: 100

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INSTRUMENT TRADE THEORY N2

FORMULA SHEET

$P_G = Pabs - Pa$

$P_1 - P_2 = h \rho g$

$P_1 - P_2 = d\rho g \left(\frac{A_1}{A_2} + 1 \right) \quad OR \quad P_1 - P_2 = d\rho g \left(\frac{A_2}{A_1} + 1 \right)$

$p = \frac{Mg}{A}$

$\frac{Q_1}{Q_2} = \frac{k\sqrt{h_1}}{k\sqrt{h_2}}$

$Dry\ calibration = \frac{P_1 - P_2}{\rho g}$

$Wet\ calibration = \frac{P_1 - P_2}{(\rho_2 - \rho_1) g}$

$W.C. = \left(\frac{\rho_2}{\rho_2 - \rho_1} \right) \times D.C.$

$D.C. = \left(\frac{\rho_2 - \rho_1}{\rho_2} \right) \times W.C.$

$H = \frac{\Delta P}{\rho g}$

$H = h \left(\frac{\rho_2}{\rho_1} - \frac{1}{2} \right)$

$H = \frac{\rho_2}{\rho_1} h - \frac{h}{2} - H = \left(\frac{\rho_2}{\rho_1} - \frac{1}{2} \right) h - H_1$

$t°C = \frac{9}{5} t + 32°F$

$t°C = (t + 273{,}15)\ kelvin$

$t°F = \frac{5}{9} (t - 32)\ °C$

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