higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

INSTRUMENT TRADE THEORY N3

5 APRIL 2018

This marking guideline consists of 5 pages.

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QUESTION 1

1.1 1.1.1 C

1.1.2 B

1.1.3 C

1.1.4 D

1.1.5 D

1.2 1.2.1 True

1.2.2 True

1.2.3 False

1.2.4 True

1.2.5 False

(10 × 1) **[10]**

QUESTION 2

2.1 L

2.2 K

2.3 H

2.4 B

2.5 M

2.6 F

2.7 A

2.8 J

2.9 C

2.10 I

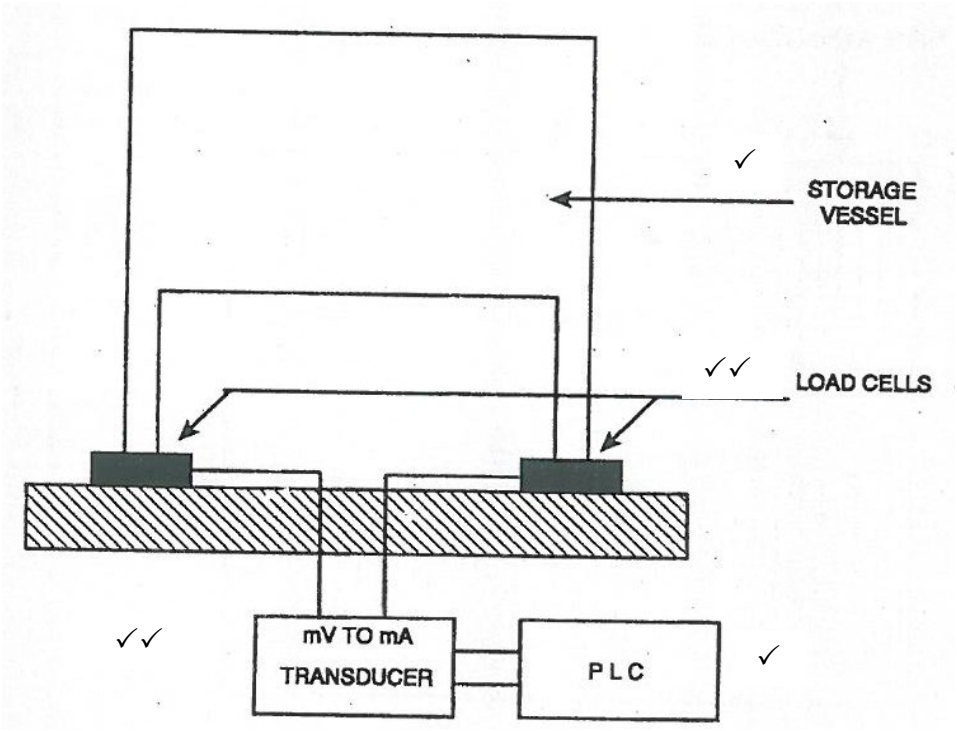
(10 × 1) **[10]**

TOTAL SECTION A: 20

QUESTION 3

3.1 3.1.1 Unbounded strain gauge (1)

3.1.2

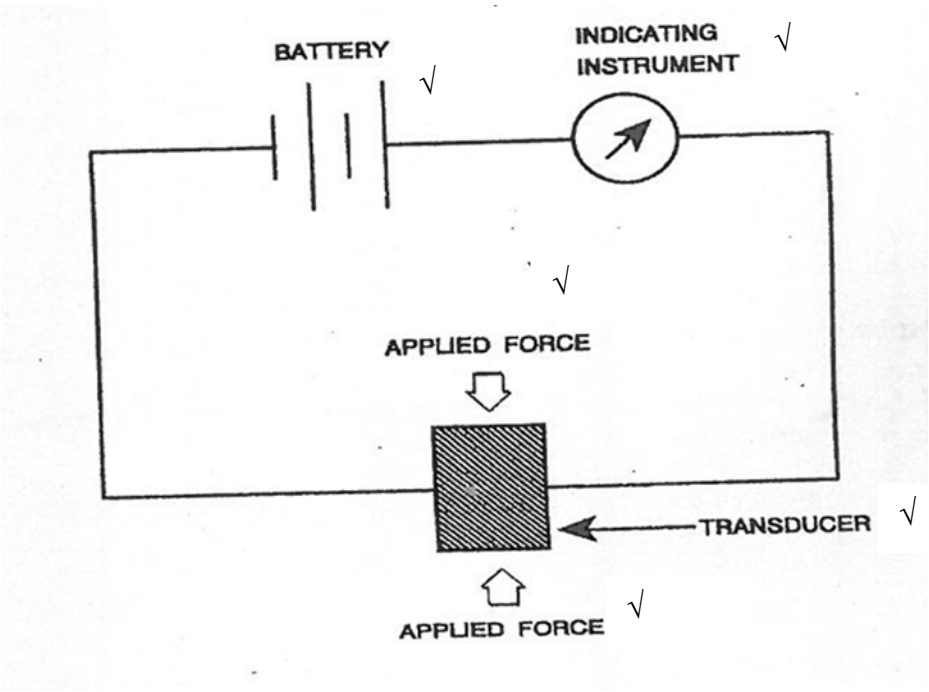


(5)

3.1.3
- Industrial scales
- Platform scales
- Laboratory balances (Any 2 × 1) (2)

3.2 3.2.1 When certain rare earth materials are mixed with zirconium tetrachloride✓, the resulting mixture undergoes a large change in electrical resistance when pressure is applied to it✓ (2)

3.2.2



(5)

3.2.3
- Negligible hysteresis effects
- They can withstand high pressures and overload
- Temperatures effects are very small
- They have very good frequency response
- High accuracy and repeatability (5)

[20]

QUESTION 4

4.1 4.1.1
A: Capillary tube
B: Invar rod inside steel chamber
C: Steel chamber and mercury
D: Outer casing
E: Capillary tube (5)

4.1.2 When there is a change in ambient temperature√, there is a change in volume of the annular space√, due to the expansion of the outer casing.√ This change is sufficient to compensate for the expansion√ and thus will not exert any pressure on the bourdon tube√ (5)

4.2 4.2.1
Rt = R1 + R2
= 16 + 16√
= 32 Ω√ (2)

4.2.2 $\frac{R_1}{R_3 + R_{L1} + R_{L2}} = \frac{R_2}{R_t + R_{L3} + R_{L4}}$ √

$\frac{16}{16 + 4 + 4}$ √ $= \frac{16}{R_t + 4 + 4}$ √

$R_t + 8 = \frac{16\,(16 + 4 + 4)}{16}$

$R_t + 8 = 24$ √

$R_t = 24 - 8$

$R_t = 16\Omega = R3$ √

(5)

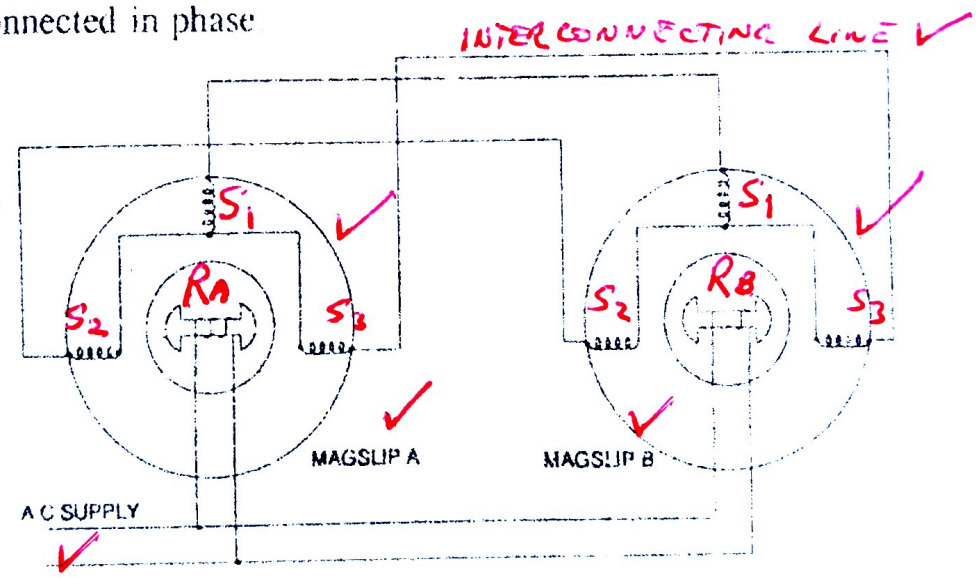
4.2.3
- R1 = R2
- Bridge must be in balance
- R3 = Rt

(3)

[20]

QUESTION 5

5.1 connected in phase



(6)

5.2

- The basic form of magslip transmission system consists of two magslip units with their rotors excited from a common ac supply and their stator windings interconnected in phase. √
- Owing to the alternating magnetic fields set up by the electric currents flowing in the rotors, √ voltage will be induced in each of the three stator windings of both magslip units, their magnitude depending upon their angular position of each rotor√
- When the rotors of the two units are in the same angular positions√, the voltages induced in their corresponding stator windings are equal√, and in the same phase√, so that no current flow between the stators√
- If the rotor of magslip A is displaced with respect to that of magslip B√, the condition of balance is upset and currents will flow and produce a magnetic field √ which reacting with the magnetic field set up by the rotor current will produce torque tending to restore the rotors of magslips to same angle. √ (10)

5.3

- Output not linear
- Large time lag
- Sensitive to vibration
- Nozzle may become blocked
- Variations in supply pressure (Any 4 × 1) (4)

[20]

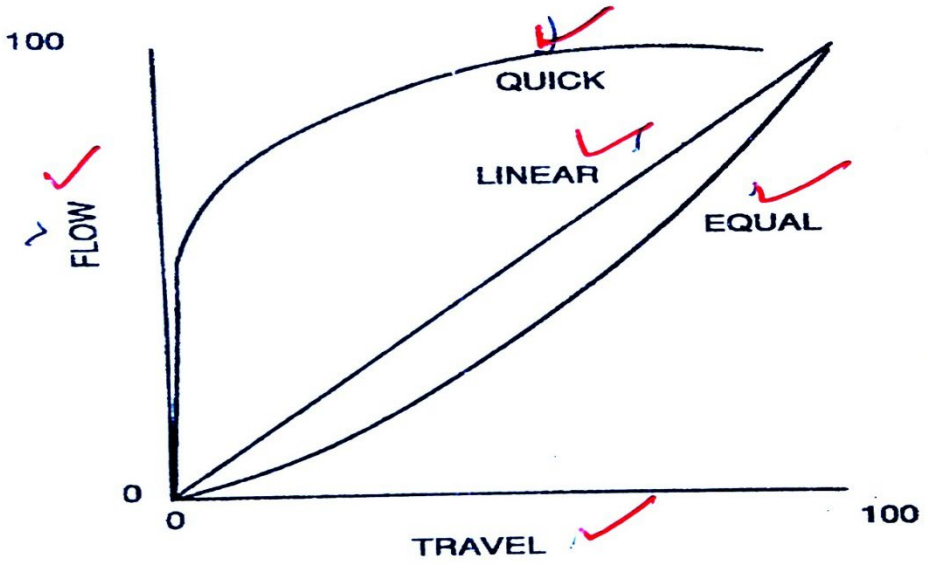
QUESTION 6

6.1 6.1.1 The relationship between the valve opening and flow plots a straight line (2)

6.1.2 Equal increments of the stem motion produce equal percentage change in flow (2)

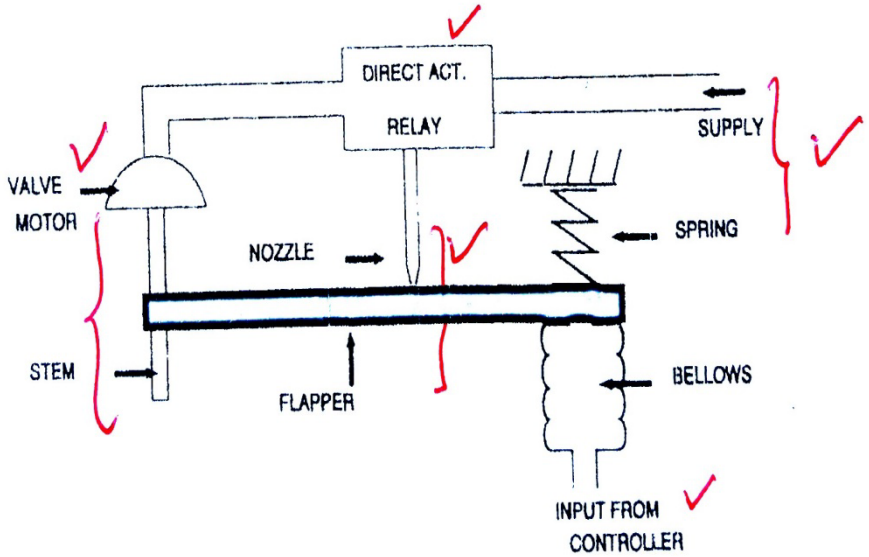
6.1.3 A small percentage valve opening will result in a large amount of flow (2)

6.2



(5)

6.3



(5)

6.4

- Basic forces
- Pressure load
- Weight load
- Inertia load
- Friction load (Any 4 × 1) (4)

[20]

TOTAL SECTION B: 80

GRAND TOTAL: 100