higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

INSTRUMENT TRADE THEORY N3

31 JULY 2018

This marking guideline consists of 7 pages.

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QUESTION 1

1.1	1.1.1	B
	1.1.2	A
	1.1.3	D
	1.1.4	B
	1.1.5	A

(5 × 1) (5)

1.2	1.2.1	False
	1.2.2	True
	1.2.3	True
	1.2.4	False
	1.2.5	True

(5 × 1) (5)
[10]

QUESTION 2

2.1	D
2.2	A
2.3	I
2.4	H
2.5	J
2.6	L
2.7	E
2.8	B
2.9	G
2.10	C

(10 × 1) **[10]**

TOTAL SECTION A: 20

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SECTION B

QUESTION 3

3.1 3.1.1

- The electrical resistance of a wire changes proportionally when stress or pressure is applied to it.A change in pressure cause an change in length,resulting in change in resistance
- The equation for the resistance of wire with realtion to its dimension is as follows:

$$R = \frac{\rho l}{A}$$

Where : R = resistance
L = length
A = area
$\rho = resistivity$ (5)

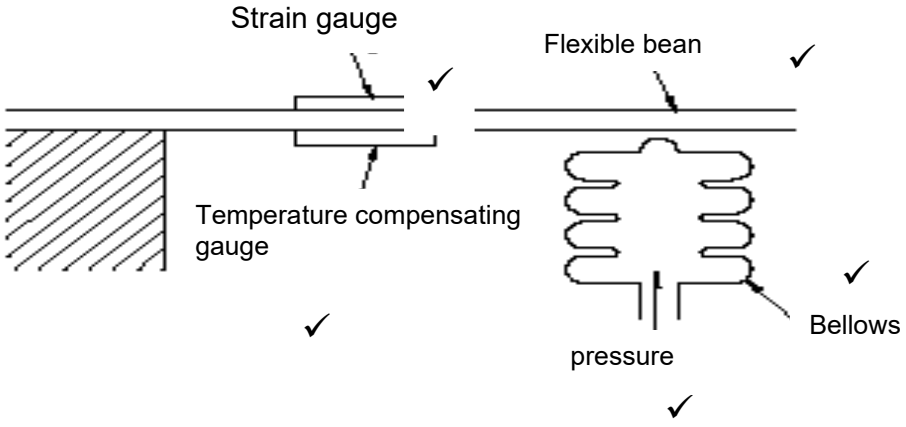
3.1.2 Nonbonded strain gauge
Strain gauges that are not cemented to a structure but consist of wire which is wound around cores and structures.✓✓

Bonded strain gauge
It consists of length of very thin wire formed into a grid pattern and bonded (glued) to a backing material suitable to withstand the temperature and other conditions under which it is likely to operate.✓✓ (4)

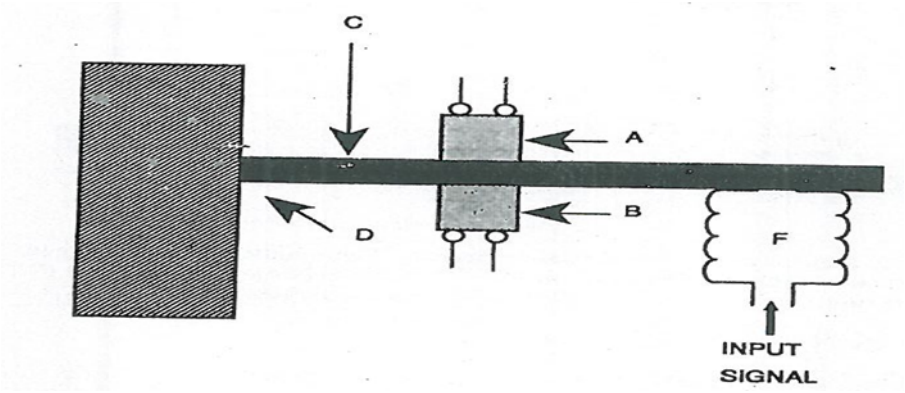
3.1.3 Is the ratio of relative change in electrical resistance, to the mechanical strain.

$$K = \frac{\Delta R/R}{\varepsilon}$$ (1)

3.2 3.2.1

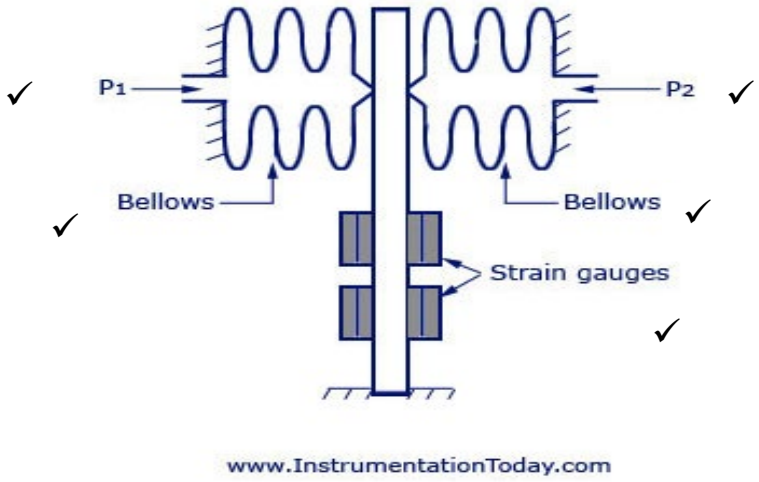


OR

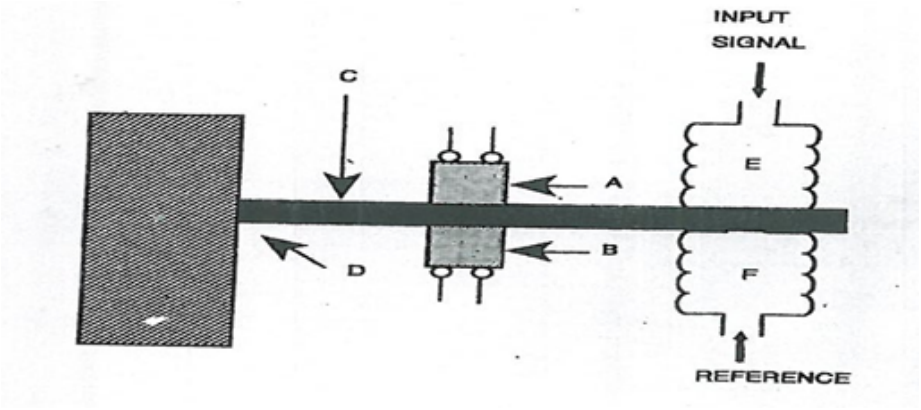


A = Active strain gauge
B = Compenstating gauge
F = Bellow
C= Flexible beam (5)

3.2.2



OR



A = Active strain gauge
B = Compenstating gauge
F & E = Bellows
C = Flexible beam (5)
[20]

QUESTION 4

4.1 4.1.1 $R_t = R_o (1 + \grave{\alpha}T + \beta T^2)$✓
$R_t = 38 (1 + (3.92 \times 10^{-3} \times 500) + (-5.88 \times 10^{-7} \times 500^2)$✓
$R_t = 38 (1 + 1.96 – 0.147)$
$R_t = 106.894\Omega$✓ (3)

4.1.2 $R_t = R_o (1 + \grave{\alpha}T)$✓
$R_o = R_t/(1 + \grave{\alpha}T)$
$R_o = 150/(1 + 0.00392 \times 25)$
$R_o = 150/1.098$
$R_o = 136.61\Omega$✓ (2)

4.2 4.2.1 Phenomenon in which a temperature difference between two dissimilar electrical conductors or semiconductors✓ produces a voltage difference between the two substances.✓ (2)

4.2.2 Effect whereby heat is given out or absorbed✓ when an electric current passes across a junction between two materials.✓ (2)

4.3 4.3.1
- Cold junction resistor✓
- The emf produced by the temperature of the cold junction subtracts from the emf of the hot junction resulting in an error.✓
- This must be accounted for by adding a voltage equal to the emf at the cold junction.✓
- The value of this resistor must change with temperature since the room temperature changes all the time.✓ (4)

4.3.2
- The current flowing in the circuit when the battery runs dry
- The current through the sensitivity resistor is adjusted until the galvanometer is balanced

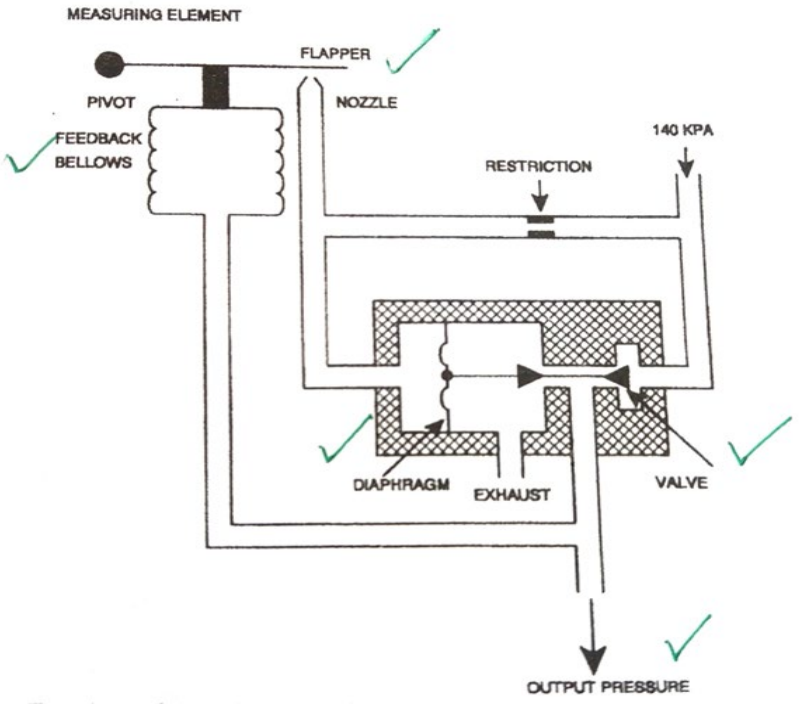
(2)

4.3.3
- The standard cell is periodically connected to the sensitivity resistance and the current through this resistor is adjusted by the variable resistor until the galvanometer is balanced.✓✓
- The voltage applied to the potentiometer is then correct.✓ (3)

4.3.4 To shunt the slider wire resistance to the required value, thus allowing us to use the whole slider without damaging it. (2)
[20]

QUESTION 5

5.1 5.1.1



(5)

5.1.2
- When the flapper moves towards the nozzle, the nozzle back pressure increases.
- This will cause the pressure acting in the diaphragm of the valve to increase, thus opening the valve more.
- The feedback pressure and the output pressure will increase proportionally.
- The feedback bellow will expand, thus repositioning the flapper.
- The output pressure will decrease and stabilised. (5)

5.1.3
- Output not linear
- Large time lag
- Variations in supply pressure
- Sensitive to vibration
- Nozzle may become blocked (Any 4 × 1) (4)

5.2
- Supply voltage variations✓
  A regulator called a barretter lamp or cross coil instrument can be used.✓
- Load resistor✓
  To compensate for this, the load resistance is larger than the potentiometer resistance.✓
- Lead wires✓
  To compensate for this, the resistance value of the receiver is high.✓ (6)

[20]

QUESTION 6

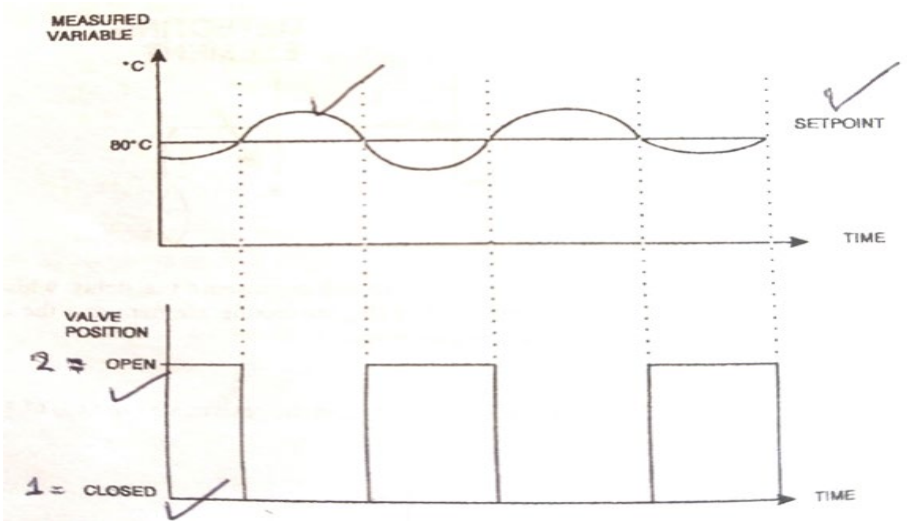
6.1
A Proportional
B Integral
C Derivative
D Proportional and integral
E Proportional and derivative
F Proportional integral and derivative (6)

6.2 6.2.1
- Open-loop control system
- Requires the operator to take corrective action. (2)

6.2.2 Two-step control action or ON–OFF control action (2)

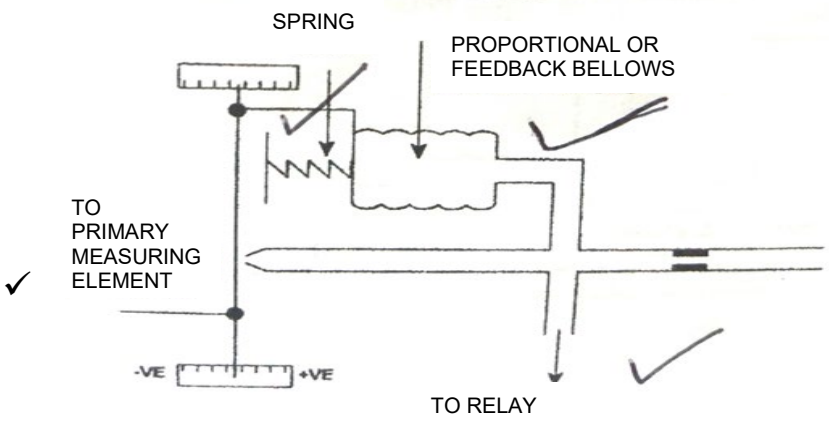
6.2.3 A two-step control is when the controller controls between two extreme outputs, e.g. open or closed. (2)

6.2.4



(4)

6.3



(4)
[20]

TOTAL SECTION B: 80
GRAND TOTAL: 100

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