



**higher education  
& training**

Department:  
Higher Education and Training  
**REPUBLIC OF SOUTH AFRICA**

## **MARKING GUIDELINE**

**NATIONAL CERTIFICATE  
CONTROL SYSTEMS N6**

**6 September 2021**

**This marking guideline consists of 8 pages.**

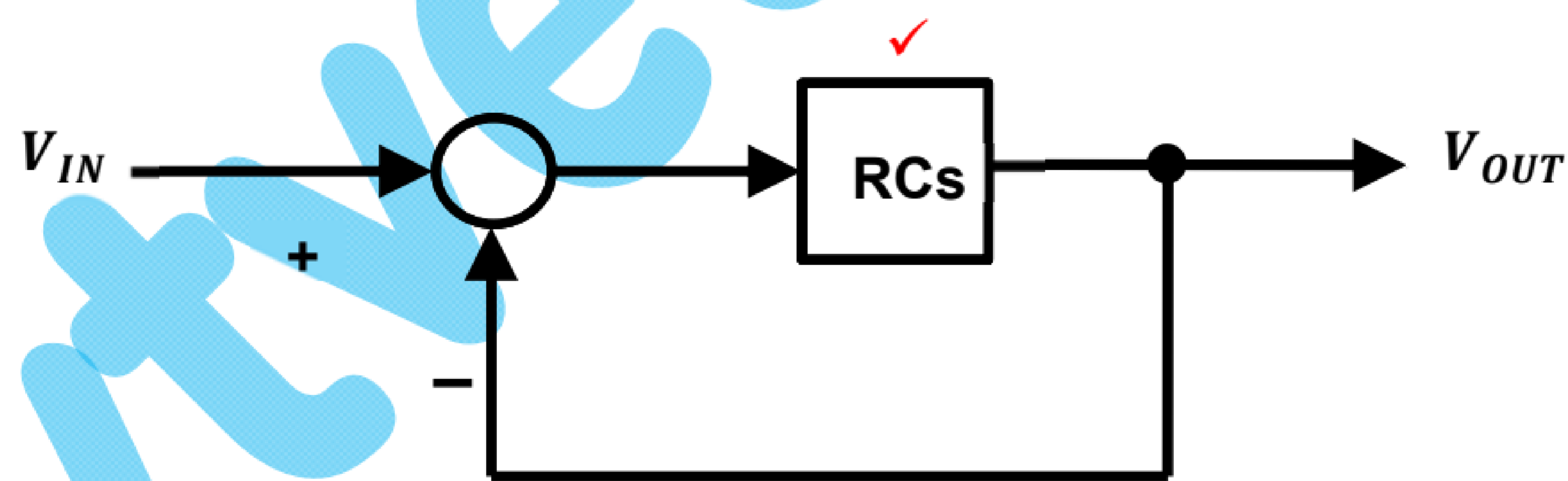
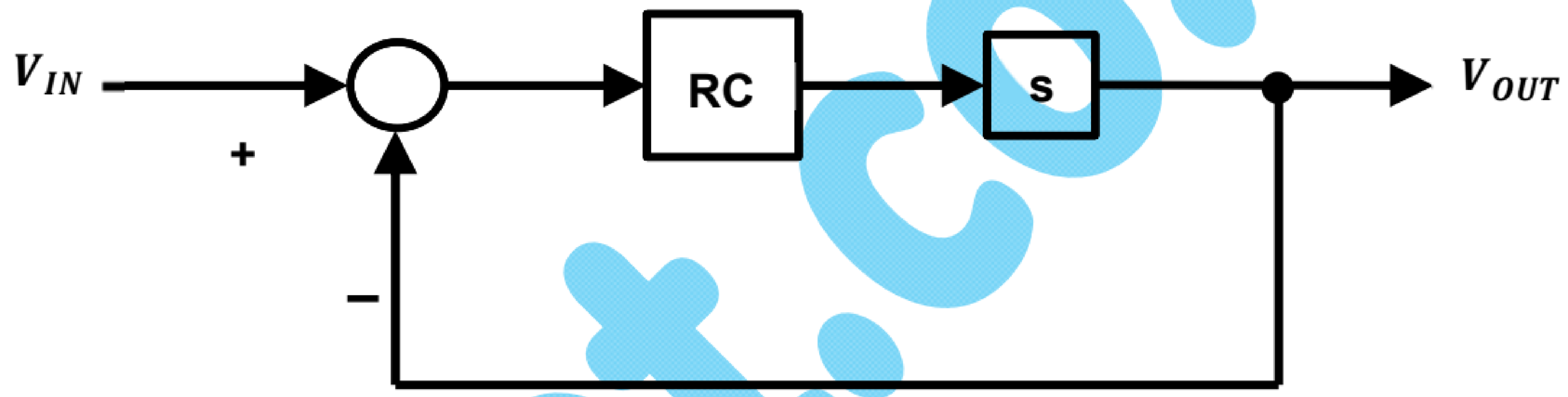
**QUESTION 1**

- 1.1 Control system
- 1.2 Unit step function
- 1.3 Disturbance
- 1.4 Total response
- 1.5 Transfer function
- 1.6 Impulse function
- 1.7 System gain factor
- 1.8 Resonance frequency
- 1.9 Damping factor
- 1.10 Drift

(10 × 1) [10]

**QUESTION 2**

2.1



$$\frac{V_O}{R_{IN}} = \frac{G}{1 \pm GH} \checkmark$$

$$\frac{V_O}{R_{IN}} = \frac{RCs}{1 + RCs} \checkmark\checkmark$$

$$\frac{V_O}{R_{IN}} = \frac{\tau s}{1 + \tau s} \checkmark$$

(5)

2.2  $F(t) = 4 \sin 3t$

$$F(s) = \frac{A\omega}{s^2 + \omega^2}$$

$$= \frac{4 \times 3}{s^2 + 3^2} \checkmark$$

$$F(s) = \frac{12}{s^2 + 9} \checkmark \quad (2)$$

2.3  $F(s) = \frac{32}{S(S+2)(S+4)}$

$$F(t) = \frac{A}{ab} \left[ 1 + \frac{ae^{-bt} - be^{-at}}{b-a} \right]$$

$$= \frac{32}{2 \times 4} \left[ 1 + \frac{2e^{-4t} - 4e^{-2t}}{4-2} \right] \checkmark \checkmark$$

$$F(t) = 4 [1 + e^{-4t} - 2e^{-2t}] \checkmark \quad (3)$$

**[10]**

**QUESTION 3**

3.1 See graph on 3-cycle semi logarithmic graph paper below. (5)

3.2 3.2.1 There is no phase crossover frequency – the phase plot does not cross the  $-180^\circ$  line.

3.2.2 8 rad/s

3.2.3 0,1 rad/s

3.2.4  $43^\circ$

3.2.5 The gain margin is not determinable due to not having a phase crossover frequency

(5 × 1) (5)  
**[10]**