



**PROGRAM**

**BACHELAR OF ENGINEERING  
TECHNOLOGY**

**SUBJECT:**

**Process Automation 3 A – MAIN**

**CODE:**

**PCAELA3**

**DATE:**

27 May 2019

**DURATION:**

3 hours

**WEIGHT:**

40:60

**TOTAL MARKS:**

100

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**ASSESSOR:**

Mr. V Rameshar

**MODERATOR:**

Mrs. J Buisson-Street

**NUMBER OF PAGES:**

4 Pages

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**INSTRUCTIONS:**

NON-PROGRAMMABLE POCKET CALCULATOR  
MAY BE USED.

ALL SKETCHES MUST BE NEAT AND LABELLED

PLEASE WRITE CLEARLY

**PLEASE ANSWER ALL QUESTIONS**

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### **QUESTION 1**

- 1.1 Name and describe Quantifying Processes in Instrumentation. (6)
- 1.2 Radiation is expressed via different rays. Name the three main rays and show with a sketch the path they follow. (5)
- 1.3 In point form list 3 advantages and 3 disadvantages of radiation. (6)
- 1.4 How can radioactive material be controlled and limited? (6)

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### **QUESTION 2**

- 2.1 State three limiting factors of ultrasonic level measurement. (6)
- 2.2 Explain the DOPPLER effect as used in an ultrasonic flow measurement sensor. (5)
- 2.3 Name three (3) objects that must be present in the fluid for an ultrasonic flow meter to function optimally? (3)
- 2.4 Calculate the Time of Flight of the ultrasonic soundwave over a distance of 70m if the speed of sound is  $350\text{ms}^{-1}$ . (3)

$$TOF = \frac{d}{C}$$

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### **QUESTION 3**

- 3.1 Discuss in detail the laminar flow profile. (4)
- 3.2 With the aid of a sketch, describe a Flume and where it can be utilised. (6)
- 3.3 Define these terms:
- 3.3.1 Two Phase flow
  - 3.3.2 Cavitation
  - 3.3.3 Viscosity (6)

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#### **QUESTION 4**

- 4.1 Analogue systems in process automation can use two (2) types of signals. name these signals and provide their operating range. (4)
- 4.2 List four (4) types of input sensors and state their measurement capacity. (4)
- 4.3 List three (3) types of valves that you came across in process systems that you have studied. (3)
- 4.4 Name four (4) types of valve positioners. (4)
- 4.5 Provide suitable names for the respective symbols below:-
- 4.5.1  $C_V$
- 4.5.2  $q$
- 4.5.3  $G_f$  (3)
- 4.6 A choked flow is a critical indication of what in valves? Briefly describe what is meant by a choked flow. (5)

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**[23]**

#### **QUESTION 5**

- 5.1 Explain PID control in process automation. (4)
- 5.2 Name three (3) types of electrical means of temperature measurement. (3)
- 5.3 Name four (4) types of temperature indicators that are utilised in furnaces and kilns. (4)
- 5.4 Describe the operation of a thermocouple with respect to the SEEBECK effect. Please make use two neat sketches in your description. (10)

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**[21]**

**TOTAL = [100]**

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