FINAL EXAM 2021 – 2022

Program	Year	Semester	Paper
BPE	1	1	MAIN

MODULE NAME:	PROCESS INSTRUMENTATION & CONTROL		
MODULE CODE:	PT-TPIC	SUBMISSTION DATE:	18 /01/22
TEACHER'S NAME:	Dr. ALDRIN	DURATION:	… Hrs

Questions to be answered on:	Allowed requirements	Number of pages
Space provided on the question paper	Pen, Pencil, Calculator, Personal Computer, Mobile Devices	(Incl. Cover Page): …

Points of Attention:

- For each question, the maximum earned points are mentioned between brackets at the end of each question.
- Write very clearly! Answers that are not readable are not marked and don't get points!
- Make sure your answers are written to the point.
- All answers should be written **in English**.
- Write all the answers **in blue or black pen only (NO pencil)**.
- Answers can also be **typed in MS Word** using proper formatting instruction provided in the question paper.
- Answer written in **Pencil** will not be marked.
- Use **pencil or Computer graphics** only for **diagrams, graphs & drawing**.
- Show all the calculation steps in the given space..
- Any cheating/copying may result in an instant failing of the examination.

STUDENT NAME:	
STUDENT ID:	

FINAL MARKS	
	40
	10

Number of answer scripts: ……

Teacher: …….…….....

Student's signature: ……

Time of receipt: …….....

SECTION A CONTROLLES

1. Draw the diagram of closed loop control system and derive the output of proportional controller. **[5]**

2. Calculate the output of the controller as per the date given in the table below. **[2]**

Controller type	*Integral -Pressure*	Integral gain	*0.25%*
Integral time	*4 seconds*	Initial output	*24%*
Proportional gain	*0.15%*	Range	*1-15 bar*
Setpoint	*8 bar*	Measured variable	*9.2 bar*

3. Differentiate between the following **[3]**

   a) Integral and differential Control
   b) Multi step multivariable control
   c) Proportional gain and proportional band

4. The pressure in a pipeline must be controlled at 50 psi with a tolerance of ±0.3 % error. A process operator is assigned to perform this task with the help of a local controller. The measured pressure in the pipeline is 100 psi. Discuss the merits and demerits of this type of control. Draw a diagram and show the connections for installation of the controller. **[4]**

SECTION B FINAL CONTROL ELEMENTS

5. Recommend a suitable control valve and actuator for ON-OFF application and explain with a neat diagram and with brief explanation for each component in the diagram. **[5]**

6. A control valve has maximum flow of 100 cm^3/s and minimum flow of 5 cm^3/s. If the full valve travel is 9 cm, determine the flow rate when the valve opens at 3 cm. **[2]**

7. A table specifying the problems experienced by control valves and the associated causes are given below. Recommend any ten suitable solutions to minimize control valve failures. **[5]**

S.No.	Reasons for failures	Solutions and preventive measures
i.	Valve cavitation	
ii.	Inadequate air pressure	
iii.	External corrosion	
iv.	Positioner out of range	
v.	Operator error	
vi.	Lack of controller demand signal	
vii.	External leakage	
viii.	Sticking	
ix.	Water in airline	
x.	I/P out of range	

SECTION C PROCESS INSTRUMENTS

8. A Liquid level control system converts displacement of 2 to 14 m into 4-20 m A control signal. Controller gives open or close signal for the inlet valve which closes at 18 mA and opens at 12 mA. Calculate the maximum and minimum displacement and displacement gap in meter. **[4]**

9. Recommend a process instrument for measuring liquid flow rate and explain the physics of measurement with neat diagram. **[4]**

10. Recommend a suitable process instrument for measuring temperature range of 1200 ^{O}C to 1500 ^{O}C of gas combustion chamber and explain the physics of measurement with a neat sketch. **[4]**

11. Determine the volume & mass flow rate of orifice flow meter as per the data given below. **[2]**

Process instrument	**Orifice flow meter**
Pipe diameter	18 cm
Hole diameter	8 cm
Density of fluid	1000 kg/m^3
Flow coefficient	0.6
Upstream pressure	35 Pa
Downstream pressure	11 Pa.

Reference

Simons, S. (2002). Process Plant Instrumentation. London: Delmar Cengage Learning

William Dunn, (2009). Fundamentals of Industrial instrumentation and control, New Delhi: McGraw Hill education, Indian edition