

**B.E. FOOD TECHNOLOGY AND BIO-CHEMICAL ENGINEERING FOURTH YEAR FIRST SEMESTER – 2019**

**Subject: INSTRUMENTATION & PROCESS CONTROL      Time: Three Hours      Full Marks: 100**

**Use Separate Answer Scripts for Part I and Part II**

**Part I (Marks-50)**

**Answer Q.1. and any four from rest**

Q.1. Write in short (any 4) (2.5X4=10)

- i) Define elements of a control system in food processing unit with example and block diagram
- ii) Give a brief comparison of open loop and closed loop system with diagram
- iii) Define system gain with positive feedback and give example with derivation
- iv) Derive Laplace transformation of impulse of 'A' with graphical presentation
- v) Define delay time in a first order system
- vi) Bode stability criterion

Q. 2.A. Explain how On-Off controller can be judiciously used in industry. Explain the modification needed in providing Dead band for such controller (3+2)

B. What is the controller gain of a temperature controller with a 60%PB, if its input range is 0°C to 40°C and its output is 4 mA to 20 mA? What are the limitations of proportional controller? (3+2)

Q.3. Explain transfer function for 2<sup>nd</sup> order systems with unit step input. Derive various possibilities arise in the solution and represent graphically. (10)

Q.4. A. Write in short about the system and find overall transfer function of i) Fig 1 and ii) Fig 2 (2.5X2)

B. Simplify and find overall transfer function in Figure 3 (see next page) (5)

Q.5. A. Derive and explain clearly the stability of the system i)  $1/(S^2+2S+1)$  ii)  $1/(S^2-2s+10)$  (5)

B. A first order system when subjected to a unit step input rises to 90% of its steady value in 20 s. Determine its time constant, delay time and rise time? (2+2+1)

Q6. A. Determine the asymptotic Bode plot for the system having the transfer function  $G(s) = 50(s+2)/[s(s+10)]$ . (7)

B. Write short notes on PLC & DCS (3)

[ Turn over

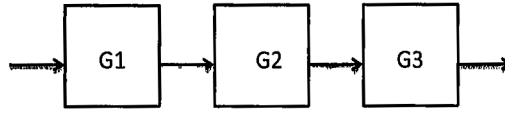


Figure 1

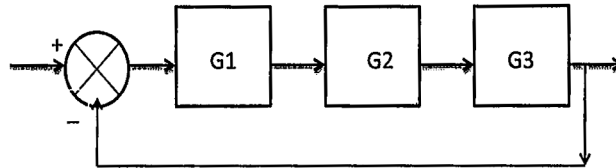


Figure 2

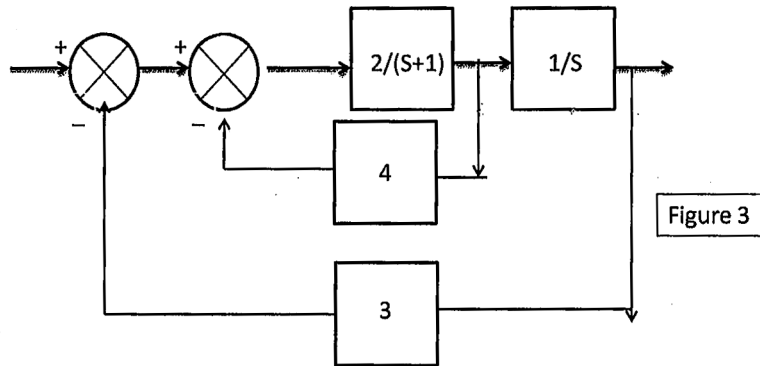


Figure 3

**B.E. FOOD TECHNOLOGY AND BIO-CHEMICAL ENGINEERING FOURTH YEAR  
FIRST SEMESTER – 2019**

**Subject: INSTRUMENTATION & PROCESS CONTROL      Time: Three Hours**

**Full Marks: 100**

**Use Separate Answer Scripts for Part I and Part II**

**Part II (Marks-50)**

**Group A**

Answer any **two** from Group A

10+10=20

1. What are the elements of an instrument system explain with a generalized schematic diagram. What do you mean by the drift, dead zone and threshold of an instrument? 4+6=10

2. Write the basic principle of a thermocouple. What are the criteria to choose materials for thermocouple?

The following table has been prepared from the calibration chart of iron-constantan thermocouple with reference temperature at 0 °C

Temp (°C)	15	30	40	-----	180	190	200	208	210
emf (mV)	0.778	1.56	2.11	-----	9.64	10.25	10.74	11.20	11.32

Temperature at hot junction is measured with the thermocouple with reference junction temperature at 30 °C. If voltage measured is 9.61 mV find the actual temperature of the hot junction. 3+3+4=10

3. Write the working principle, advantage and limitation of a Total Radiation Pyrometer.

4+3+3=10

**Group B**

Answer any **two** from Group B

15+15=30

4. Explain with diagram the working principle, advantage and limitation of any **two** type of pressure measuring device. 7.5+7.5=15

5. What is Piezoelectricity? What is direct and indirect method of liquid level measurement? Write the working principle of any one direct and indirect method each for liquid level measurement. 2+3+5+5=15

6. Name and describe the different parts of a pH measurement system. What is the working principle of Gas chromatography? How Gas solid chromatography differs from Gas liquid chromatography? Write one application each for Gas solid and Gas liquid chromatography. 5+5+3+2=15