



B.TECH DEGREE EXAMINATIONS: MAY 2018

(Regulation 2015)

Sixth Semester

BIOTECHNOLOGY

U15BTT603: Bioprocess Instrumentation and Control

COURSE OUTCOMES

- CO1:** Outline the basic principles of process control in bioprocesses.
CO2: Obtain the knowledge of basic instrumentation.
CO3: Select the measurement technique for a bioprocess system.
CO4: Distinguish various control configurations.
CO5: Differentiate the different types of controllers and final control element.
CO6: Design and apply different control schemes in bioprocess.

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Assertion (A): Measurement and monitoring are done by instruments CO1 [K₃]
Reason (R): The measured valued is brought to set point with the aid of controller
- a) Both A and R are true and R is the correct explanation of A b) Both A and R are false but R is not a correct explanation of A
c) A is false but R is true d) A is true but R is false
2. Select appropriate combination of the physical parameters for a cell cultivation system from CO1 [K₃]
the following
1. Temperature
 2. Bioreactor Pressure
 3. Optical Density
 4. Agitation Speed
 5. Gas Flow rate
 6. Cell Morphology
- a) 1,2,4,5 b) 2,3,5,1
c) 3,4,1,2 d) 3,5,4,2

PART B (10 x 2 = 20 Marks)

(Answer not more than 40 words)

- | | | |
|---|-----|-------------------|
| 11. List the physical parameters related to lab scale fermenter control. | CO1 | [K ₂] |
| 12. What are the objects of implementation of control to a process? | CO1 | [K ₂] |
| 13. Define dead time and state its disadvantages. | CO2 | [K ₁] |
| 14. What do you mean by precision? | CO2 | [K ₁] |
| 15. List the temperature measuring devices. | CO3 | [K ₂] |
| 16. What are the possible methods to increase the dissolved oxygen level in a bioreactor? | CO3 | [K ₃] |
| 17. Differentiate servo mechanism from regulatory mechanism. | CO4 | [K ₄] |
| 18. State the principle of feed forward mechanism. | CO4 | [K ₁] |
| 19. Term one application each for fail-open and fail-close valve. | CO5 | [K ₂] |
| 20. What do you understand from Master controller and slave controller? | CO6 | [K ₂] |

Answer any FIVE Questions:-

PART C (5 x 14 = 70 Marks)

(Answer not more than 300 words)

Q.No. 21 is Compulsory

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|---|------|-----|-------------------|
| 21. i) Draw a neat diagram and explain the cell-inputs and cell-outputs. | (7) | CO1 | [K ₃] |
| ii) Describe the basic components of block diagram with neat sketch. | (7) | | |
| 22. i) Derive the transfer function of a mercury filled-in thermometer. | (10) | CO1 | [K ₃] |
| ii) List the types of forcing functions used for response analysis. | (4) | | |
| 23. Discuss the principle, working and range of any three pressure measuring devices for online measurements. | | CO2 | [K ₄] |
| 24. Deduce the overall transfer function of the closed loop control system for | | CO4 | [K ₄] |
| (i) servo mechanism | (7) | | |
| (ii) regulatory mechanism | (7) | | |

25. Consider a bioreactor in which the broth temperature to be maintained at desired condition. Discuss the implementation of cascade control strategy for this case. CO6 [K₅]
26. i) Deduce the transfer functions of P,PD,PI and PID controllers. (9) CO5 [K₄]
ii) Compare the efficiency of the above said controllers with neat sketch. (5)
27. Enumerate the pneumatic control valve types and characteristics with neat diagram. CO5 [K₄]
