No. of Printed Pages : 04

Roll No.

H102

B. Tech. EXAMINATION, 2020

(Eighth Semester)

(B Scheme) (Re-appear Only)

(BME)

BME404B

BIOLOGICAL CONTROL SYSTEMS

Time : 2¹/₂ Hours]

[Maximum Marks : 75

Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

Note : Attempt *Four* questions in all. All questions carry equal marks.

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- (a) Briefly explain the concept of State variables. Explain the matrix representation of state equation.
 - (b) Define transition matrix. Enlist different properties of transition matrix.
- 2. (a) Find the transfer function of the system with state space representation :

$$q = \mathbf{A}q + \mathbf{B}u = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -3 & -4 & -2 \end{bmatrix} q + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u$$

$$y = \mathbf{C}q + \mathbf{D}u = \begin{bmatrix} 5 & 1 & 0 \end{bmatrix} + 0 \cdot u \,.$$

- (b) Discuss the concept of Eigen Values and Eigen Vectors.
- (a) Discuss the concept of Controllability and Observability.

(b) For a single input system : $\mathbf{X} = \mathbf{AX} + \mathbf{BU}$ $\mathbf{Y} = \mathbf{CX}$ $\mathbf{A} = \begin{bmatrix} 0 & 1 \\ -1 & -2 \end{bmatrix}; \mathbf{B} = \begin{bmatrix} 0 \\ 1 \end{bmatrix} \mathbf{01}; \mathbf{C} = \begin{bmatrix} 1 & 1 \end{bmatrix}$

Check the controllability and observability of the system.

- **4.** Discuss the dynamic response characteristics of pupil control system.
- What do you mean by thermoregulation ? Explain the mathematical model of the controlled process of the body.
- **6.** Elaborate the phenomena of modeling the body as compartments. Also discuss the multi-compartmental system with example.

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- Draw the block diagram representation of muscle stretch reflex system and explain.
- **8.** Draw the schematic block diagram of respiratory control and explain.

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