

Seat No: _____

GANPAT UNIVERSITY
B.TECH SEM. V BIOMEDICAL & INSTRUMENTATION ENGINEERING
REGULAR EXAMINATION NOVEMBER/DECEMBER-2012
2BM501: PHYSIOLOGICAL CONTROL SYSTEMS AND MODELING

TIME: - 3 HOURS

TOTAL MARKS: - 70

INSTRUCTION: - 1 Write the answer of each section in separate answer sheet.

2 Figure to the right indicates full marks.

3 Assume suitable data if necessary.

SECTION-I

Que-1

- (a) Why the reflex is always fast? Explain the physiological example of muscle stretch reflex.
- (b) Give the linear models of physiological control system. For linear model of respiratory mechanics derive the TF.

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OR

Que-1

- (a) Which are generalized system properties for mathematical modeling? Explain one of these properties with various components is used in various systems.
- (b) Explain the super position principle for linear system.

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Que-2

- (a) Derive the mathematical model of cardiac output and explain the cardiac output curves with factors that affect slope and position.
- (b) Why it is important to study steady state response of the system? With open loop and closed loop system explain the how negative feedback is useful to achieve steady state operating point of the system

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OR

Que-2

- (a) Fig.1 shows the block diagram of a sophisticated biomedical device for regulating the dosage of anesthetic gases being delivered to a patient during surgery. Note that the plant and controller are themselves feedback control systems.
 - 1) Derive the expression for open loop gain
 - 2) Derive the expression for closed loop gain.
 - 3) If $G_1=1$, $G_2=2$, $H_1=1$ and $H_2=2$, what is the loop gain of overall system.
- (b) Explain the steady state analysis of glucose regulation under
 - (1) normal condition (2) type-1 diabetes and (3) type-2 diabetes

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Que-3

12

- (a) Explain the respiratory controller model of chemical regulation of ventilation.
- (b) Write the short note on the science and art of modeling.

Section – II

Que-4

12

- (a) Explain Heart Model with necessary Diagram and Equation.
- (b) Explain Physiological model of respiratory system and its Pneumatic analogy.

OR

Que-4

12

- (a) Explain Lung tissue Viscoelastance property with chest wall using suitable figure.
- (b) Explain cardiovascular Model development

Que-5

11

- (a) Explain short term cardiac regulation model with necessary diagram.
- (b) Explain Nyquist stability criterion with suitable example.

OR

Que-5

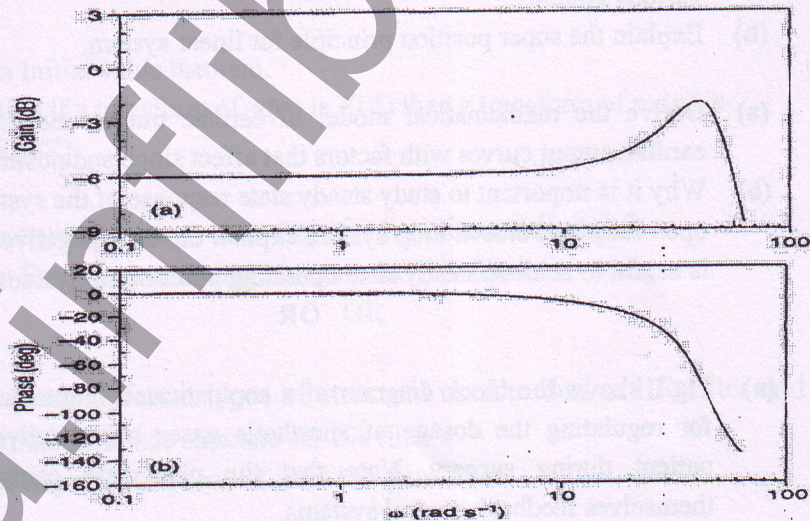
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- (a) Explain open loop frequency response for linearized respiratory mechanics.
- (b) Explain Cheyne-stokes breathing with necessary figure and equations.

Que-6

12

- (a) Convert following Bode plot to Nicholas chart.



- (b) Explain Relative stability using gain margin.
- (c) Draw pressure curve for different parts of cardiovascular system.

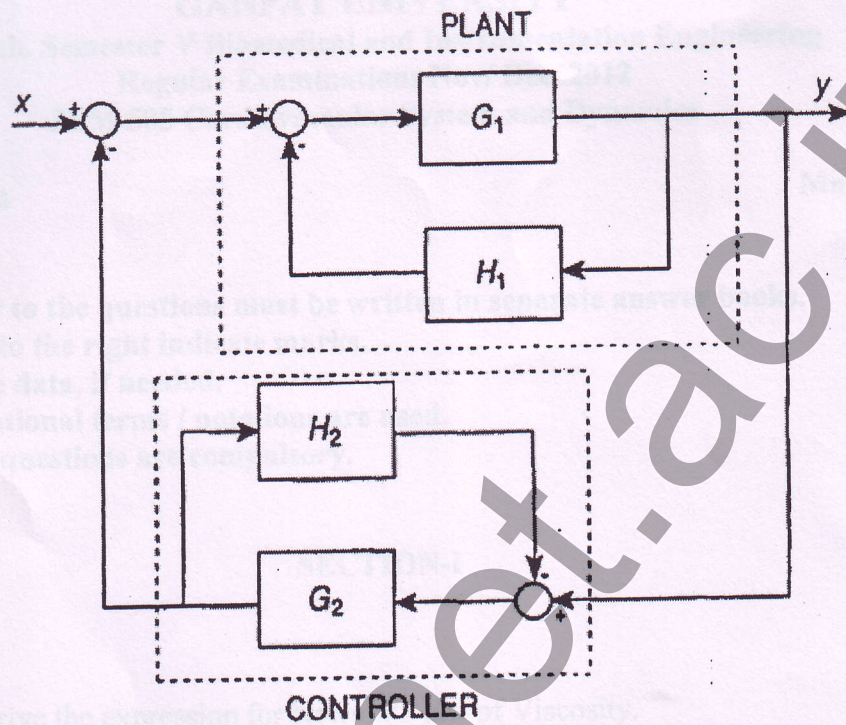


Fig.1

END OF PAPER