BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: BE **SEMESTER : IV**
BRANCH: BIOTECH **SESSION : SP/19**

SUBJECT: BT6027 PROCESS MEASUREMENT AND CONTROL

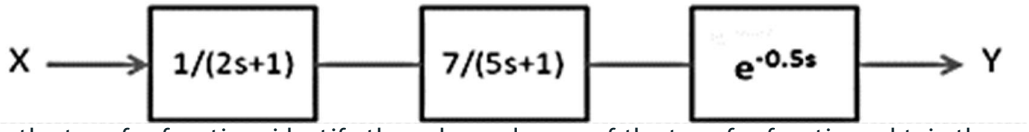
TIME: 3 Hours **FULL MARKS: 60**

INSTRUCTIONS:
1. The question paper contains 7 questions each of 12 marks and total 84 marks.
2. Candidates may attempt any 5 questions maximum of 60 marks.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

Q.1(a) What is the need of a process control? [2]

Q.1(b) Take an example of a simple liquid level control system for a vessel. Draw the block diagram for the closed loop control. Identify the input, output, manipulating variable and disturbance for this case. [4]

Q.1(c) For the given open loop system: [6]



Derive the transfer function, identify the poles and zeros of the transfer function, obtain the process response for an impulse change at t=5, determine the ultimate response at $t \to \infty$, to a sinusoidal input sin (2t).

Q.2(a) Explain the physical reason behind generation of time delay. Why time delay is not so prevalent in process control systems? Justify. [2]

Q.2(b) Differentiate interacting and non-interacting systems with the help of a suitable example. [4]

Q.2(c) The liquid level system as shown in fig.1, is initially at steady state with an inlet flow rate of 1 cfm. At time zero, one ft^3 of water is suddenly added to the tank; at t=1, one ft^3 is added and so on. In other words, a train of unit impulses is applied to the tank at intervals of one minute. Ultimately the output wave train becomes periodic as shown in the Fig.1. Determine the maximum and minimum value of this output and determine the level at t = 0.5, 1 and 1.5. Data: Area= 1 ft^2; Time constant=1 [6]

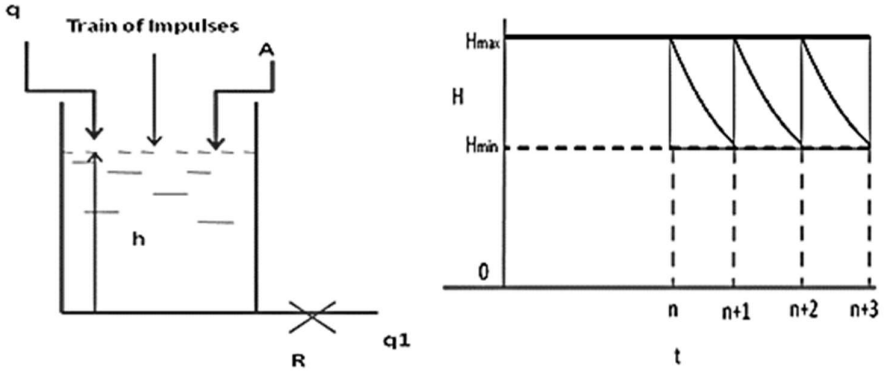


Fig. 1: The liquid level system and periodic output wave train

Q.3(a) Discuss the time shifting property of a Laplace transform. [2]

Q.3(b) Draw the circuits to realize P, PI and PID control schemes. [4]

Q.3(c) Explain the working of simple pressure to electrical signal converter with a neat diagram. [6]

Q.4(a) Explain different types of disturbances which contribute to the net error, involved in a process control. [2]

Q.4(b) Differentiate the feed forward and feed back control schemes with the help of neat block diagram. [4]

Q.4(c) Consider a blending system where two streams are blended; one is uncontrolled wild stream (disturbance) and another is controlled that acts as a manipulated variable. Design a special type of Feedforward controller in the context of control of blending process and derive the transfer function model for the system. [6]

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Q.5(a)	List any two evaluation criteria to evaluate the performance of a controller. Also give their analytical expressions.	[2]
Q.5(b)	Explain the working of a pneumatic actuator with positioner.	[4]
Q.5(c)	Design a master slave controller for controlling the kettle temperature for a jacketed kettle system and obtain the closed loop transfer function for the system.	[6]
Q.6(a)	Discuss model reference adaptive control with block diagram.	[2]
Q.6(b)	Discuss Override control with an example and obtain its transfer function.	[4]
Q.6(c)	Draw a neat block diagram of a computer supervisory control; explain its operation considering an example of strongly interacting process.	[6]
Q.7(a)	Explain the control of heat exchanger.	[2]
Q.7(b)	Explain with an example the fuzzy logic control.	[4]
Q.7(c)	Write short notes on 1) Control of distillation column 2) bioreactor control system analysis	[6]

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