

PARUL UNIVERSITY
FACULTY OF ENGINEERING & TECHNOLOGY
B.Tech. Summer2021 - 22Examination

Semester: 8
Subject Code: 03109453
Subject Name: Control Engineering

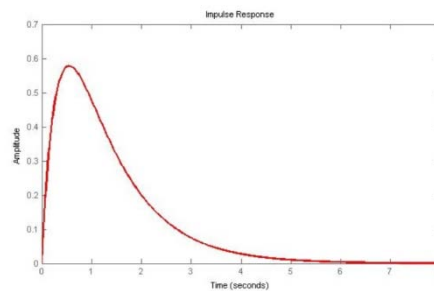
Date: 1-04-2022
Time: 10:30am To 1:00pm
Total Marks: 60

Instructions:

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

Q.1 Multiple Choice Questions -**(05)**

1. The impulse response of a second order system is shown in the figure. From the figure, it can be concluded that the system is a –



- | | |
|-----------------------------|-----------------------------------|
| a. Stable System | b. Unstable System |
| c. Marginally Stable System | d. Can't conclude from the figure |
2. While analyzing the systems in Control Engineering, the system is assumed to be a Linear system to make the analysis simple. A Linear system follows the principles of -

a. Homogeneity	b. Additivity
c. Superposition	d. All of the above
 3. The step error coefficient of a system $G(s) = 1/(s+2)(s+3)$ with unity feedback is-

a. 0	b. Infinite
c. 1	d. 1/6
 4. An 'm/n' DCV is being used in a hydraulic system. The 'm' stands for -

a. Number of ports	b. Number of positions
c. Type of Valve	d. Manufacturer's code
 5. Which of the following power transmission system is preferred in order to carry large load or obtain large torque at the output?

a. Electrical System	b. Mechanical System
c. Hydraulic System	d. Pneumatic System
	e.

Q.1 Fill in the blanks -**(05)**

1. The signal which adversely affect the value of the output of system is known as _____.
2. The system whose damping value is greater than 1 is known as _____.
3. FRL unit used in pneumatic system stands for _____.
4. The time taken by the response of a second order system to reach 50 % of its final value is known as _____.
5. The frequency at which the amplitude of the system becomes maximum is known as _____.

Q.1 True or False-**(05)**

1. The response of the hydraulic system is quicker than that of pneumatic system.
2. Poles are those values of 's' in the control system for which the transfer function of the control system becomes zero.
3. Feedback control systems are also referred to as closed-loop control systems
4. Open loop control systems have less issues in stability compared to Closed loop control systems.
5. For a mechanical spring-mass-damper system, the order of the governing mathematical equation is 2.

- Q.2** Answer the following questions. (Attempt any three) (15)
- A) What are the advantages of Frequency Response Analysis over Time Response Analysis?
- B) What do you mean by Root Locus? Explain in brief.
- C) Draw a simplified block diagram of the temperature control system used in air conditioner.
- D) Explain the basic components used in hydraulic systems.

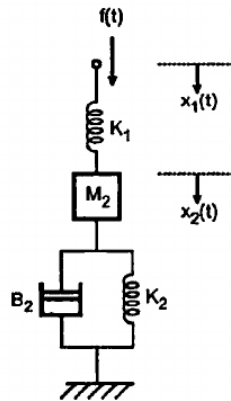
- Q.3** A) Compare the electrical, mechanical, hydraulic and pneumatic systems. (07)
- B) For the first order system given below, derive an expression for the response of the system when subjected to unit step input. Prove that the time taken by the system to reach 63% of the final output is equal to the Time Constant (T). (08)

$$G(s) = \frac{K}{Ts + 1}$$

OR

- B) Classify the second order control systems based on the value of damping ratio. Determine the location of poles for various values of damping ratio. (08)

- Q.4** A) Draw the equivalent mechanical system and analogous system based on Force- Voltage analogy. (07)



OR

- A) For the system given by the following transfer function, comment on the stability of the system using Routh-Hurwitz Criterion: (07)
- $$s^4 + 2s^3 + 6s^2 + 4s + 1 = 0$$
- B) Solve the following block diagram using Block Diagram Reduction Techniques and find the overall transfer function of the system: (08)

