

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-V (NEW) EXAMINATION – WINTER 2018

Subject Code: 2150909

Date: 27/11/2018

Subject Name: Control System Engineering

Time: 10:30 AM TO 01:00 PM

Total Marks: 70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

MARKS

- Q.1**
- (a) Describe the basic three objectives of any control system. **03**
- (b) By applying the final-value theorem, find the final value of $f(t)$ whose Laplace transform is given by **04**

$$F(s) = \frac{10}{s(s+1)}.$$

Also verify the result by taking inverse Laplace transform method.

- (c) Simplify the block diagram shown in Fig. I using block diagram reduction technique and obtain $\frac{C(s)}{R(s)}$. **07**

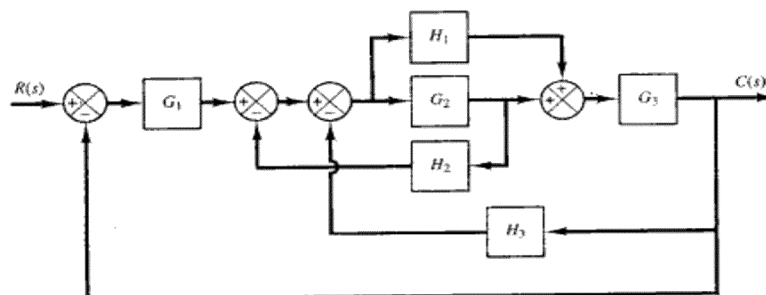


Figure I

- Q.2** (a) Draw Signal Flow graph for following set of equations. **03**

$$x_1 = -x_2 - 3x_3 + 3$$

$$x_2 = 5x_1 - 2x_2 + x_3$$

$$x_3 = 4x_1 + x_2 - 5x_3 + 5$$

- (b) When defining the transfer function, what happens to initial conditions of the system? Give suitable examples. **04**
- (c) Find the transfer function C/R shown below for the system using Mason's gain Formula shown in Figure II. **07**

OR

- OR**

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Q.4	(a) Define Magnitude Plot and Phase plot of bode plot.	03
	(b) Define Gain Margin and Phase margin from Nyquist plot.	04
	(c) Consider the following Characteristic equation	07

Determine the range of K for stability.

OR

- $$G(s) = \frac{k(s+2)}{s^2 + 2s + 3}$$

- Q.5** (a) Determine the roots $s = -1.5$, $s = -1.8$ and $s = -4$ is a part of root locus or not for the given transfer function using angle criterion. **03**

$$\frac{K(s+2)(s+3)}{s(s+1)}$$

- (b) Define the Gain margin and phase Margin when Gain and Phase cross-over frequency is zero and infinity in bode plot. **04**
- (c) Draw the Bode plot and find Gain Margin and Phase margin for the given transfer function. **07**

$$G(s) = \frac{k}{s(1+0.1s)(1+0.5s)}$$

OR

- Q.5** (a) Comment on the stability using Nyquist plot with the encirclement around the point $-1+j0$. **03**
- (b) Explain the significance of proportional control. **04**
- (c) Draw a Nyquist plot for the given transfer function **07**

$$G(s) = \frac{k}{s^2(1+sT1)}$$
