

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code:2151908

Date:04/12/2018

Subject Name:Control 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) Draw a generalized closed loop feedback system with its components.	03
	(b) Define transfer function. List important characteristics of transfer function.	04
	(c) Explain Force-Voltage and Force-Current analogy.	07
Q.2	(a) Define:	03
	a) Control variable	
	b) Manipulated Variable	
	c) Process	
	(b) Simplify the block diagram shown in <u>figure-1</u> .	04
	(c) In a liquid-level system assume that the outflow rate Q m ³ /sec through the out flow valve is related to the head H m by $Q = K\sqrt{H} = 0.01\sqrt{H}$. Assume that when the inflow rate Q_i is 0.015 m ³ /sec the head stays constant. At $t = 0$ the inflow valve is closed and so there is no inflow for $t \geq 0$. Find the time necessary to empty the tank to half the original head. The capacity C of the tank is 2 m ² .	07
	OR	
	(c) Simplify the block diagram shown in <u>figure-2</u> . Obtain the transfer function relating $C(s)$ and $R(s)$.	07
Q.3	(a) Explain the ramp input mathematically and graphically.	03
	(b) For the following system: $G(s) = \frac{k(1+2s)}{s(1+s)(1+0.4s)^2}$ Find the value of k to limit the steady state error to 10% for input t .	04
	(c) Draw the signal flow graph for the following setoff algebraic equation: $y_2 = ay_1 - gy_3$; $y_3 = ey_2 + cy_4$; $y_4 = by_2 - dy_4$. Hence find the gain.	07
	OR	
Q.3	(a) Discuss the effect of time constant on first order system response for unit step input.	03
	(b) Give four points difference between Block diagram method and Signal Flow Graph method.	04
	(c) Find the time response of a second order system for Unit step Response.	07
Q.4	(a) Enlist limitations of Routh's stability criterion.	03
	(b) Prove that steady state error for Step input is gives as $E_{ss} = \frac{1}{1+K_p}$, $K_p =$ error constant	04
	(c) Using Routh criterion, discuss about the stability for the system having characteristics equation is given as $3s^7 + 9s^6 + 6s^5 + 4s^4 + 7s^3 + 8s^2 + 2s + 6 = 0$	07
	OR	
Q.4	(a) Write the draw backs of hydraulic system.	03
	(b) Plot the root locus for a unity feedback system whose forward transfer function is $G(s) = \frac{10(s+1)}{s(s-3)}$	04

- (c) A unity feedback control system with transfer function $\frac{k(s+13)}{s(s+3)(s+7)}$ is given. Using Routh-Hurwitz criterion calculate the range of k for which the system is
- Stable
 - Has its closed loop, poles more negative than -1.
- Q.5** (a) Write three rules for drawing Signal flow graph. **03**
 (b) With the help of neat diagrams, explain how the direction control valves are classified. **04**
 (c) Draw the schematic diagram of Hydraulic PID controller. Explain its working and derive its transfer function. **07**
- OR**
- Q.5** (a) Explain FRL unit. **03**
 (b) Write the comparison between a Pneumatic system and Hydraulic system. **04**
 (c) Draw the schematic diagram of Pneumatic PI controller. Explain its working and derive its transfer function. **07**

Figure-1

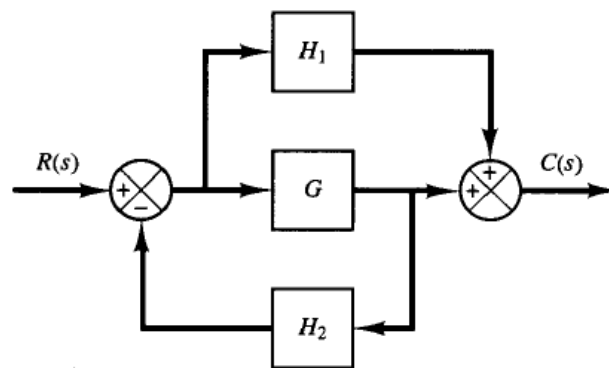


Figure-2

