Name: **Enrolment No:**	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, May 2019

Course: Signals & Systems — **Semester: IV**

Program: B.Tech ASE+AVE — **Time 03 hrs.**

Course Code: ECEG 2022 — **Max. Marks: 100**

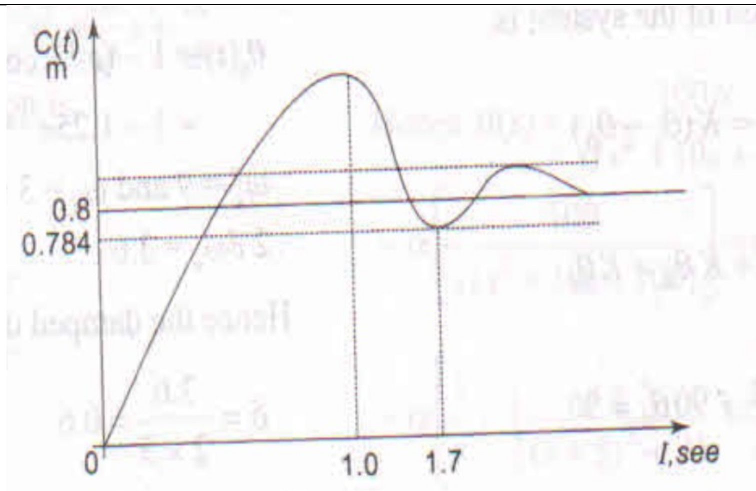
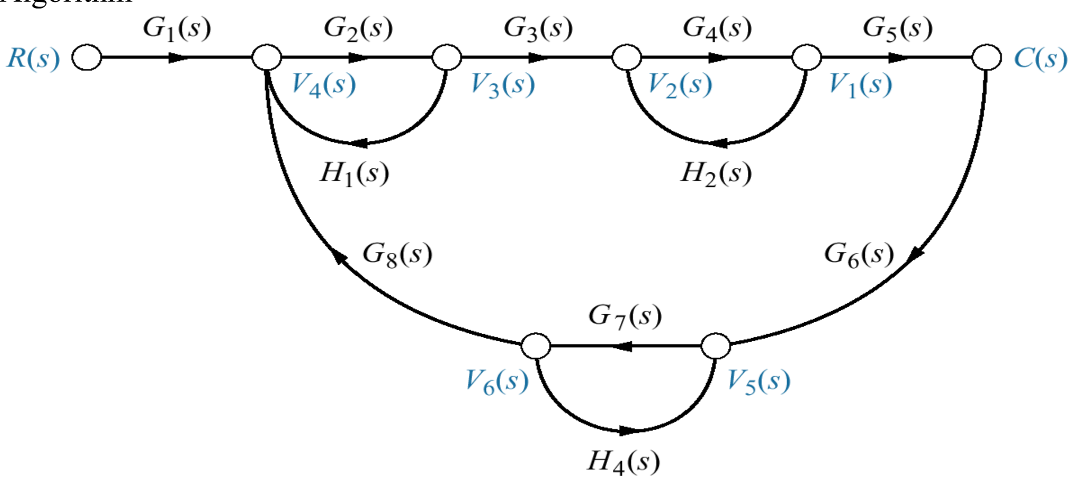
Instructions:

SECTION A

S. No.		Marks	CO
Q 1	Discuss independent and discrete variable signals with suitable examples.	**4**	**CO1**
Q 2	Estimate the Inverse Laplace Transform of $X(S)=\frac{s^4}{s^4+4a^4}$	**4**	**CO 2**
Q 3	Discuss rise time, delay time and peak overshoot in time response analysis. Write down the equations.	**4**	**CO 3**
Q 4	Define Fourier transform and explain how it is useful in defining the energy transformation from one domain to others	**4**	**CO 4**
Q 5	Define the condition of system stability over *s*-plane.	**4**	**CO 4**

SECTION B

Q 6	Tha maximum overshoot for a ufb having its forward path transfer function as $G(s)=K/s(sT+1)$ is to be reduced from 60% to 20%. The system input is unit step function. Determine the factor by which K should be reduced to achieve aforesaid reduction.	**10**	**CO3**
Q 7	The unit step response of a second order-underdamped system is as shown in Figure 1. Determine the transfer function of the system	**10**	**CO 4**

	 Figure 1		
Q 8	Design the transfer function model of the SFG as shown in Figure 2 using M-G Algorithm  Figure 2	**10**	**CO 2**
Q 9	The characteristic polynomial of a system is $S^7+5S^6+9S^5+9S^4+4S^3+20S^2+36S+36=0$ Determine the location of roots on the s-plane and hence the stability of the system. ***OR*** Determine the stability of a system whose overall transfer function is given below $\frac{C(s)}{R(s)}=\frac{2s+5}{s^5+1.5s^4+2s^3+4s^2+5s+10}$	**10**	**CO4**

SECTION-C			
Q 10	Derive the transfer function model of second order system. Draw its closed loop schematic diagram. Differentiate between close loop and open loop system behavior. Distinguish between damped and natural frequencies. Classify the systems based on the value of damping coefficient Derive the unit step response for the second order system with the unity step input data. Deduce the relationship for peak overshoot and peak time. ***OR*** The overall transfer function of a system is given by $\frac{C(s)}{R(s)}=\frac{16}{s^2+1.6s+16}$ It is desired that the damping ratio to be 0.8. Determine rise rime, peak time, and maximum overshoot, steady state error for the unit step input without and with feedback control.	**20**	**CO3**
Q 11	Explain the term "System". Describe its application in practical significant life with one example in brief. Also define the concept of positive and negative feedback system. Derive the relation between input and output for the both feedback systems for the following in positive and negative types of control systems. Forward path transfer function (G) and Feedback transfer function (H) Forward path transfer function (G) and unity feedback.	**20**	**CO 1**

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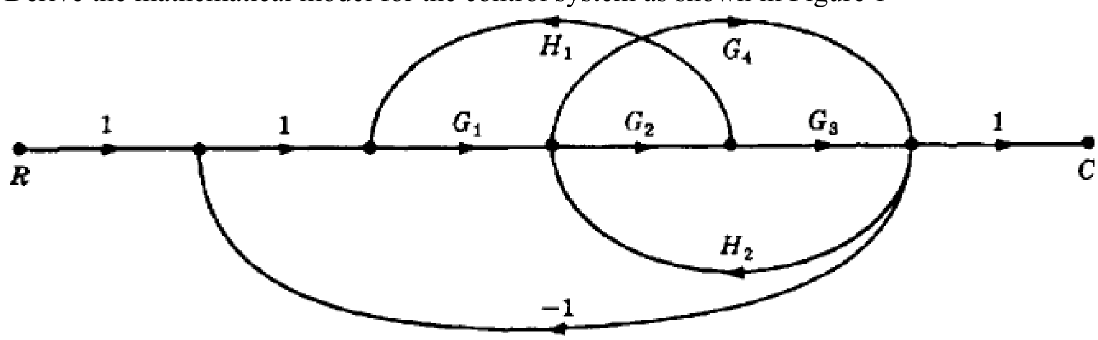
Instructions:

SECTION A

S. No.		Marks	CO
Q 1	Differentiate Signum, Sinc and Gaussian functions with the suitable diagram	4	CO1
Q 2	Calculate the Inverse Laplace Transform of $X(S)=\frac{s^2+3s+4}{s^3+5s^2+7s+3}$	4	CO 2
Q 3	Define peak time, % peak overshoot and rise time. Write down the expression for it.	4	CO 3
Q 4	Represent the trigonometric form of Fourier series.	4	CO 4
Q 5	Define Fourier transform and explain how it is useful in defining the energy transformation from one domain to others	4	CO 4

SECTION B

Q 6	A second order system is represented by a transfer function as given below: $\frac{\theta}{T}=\frac{1}{Js^2+fs+K}$ Where $\theta$the propotional output and T is is the input torque. A step input of 10Nm is	10	CO3

	applied to the system and test results are given below: (a) M_P=6%, (b) tp=1 sec, and (c) steady state value of the output is 0.5radians. Determine the value of *J*,*f*, and *K*.		
Q 7	The forward path gain of unity feedback control system is, $$G(s)=\frac{3(s+2)}{s^2(s^2+3s+9)}$$ Identify the type of the system and find the static error constants and associated steady-state errors. Also, check the stability of the system using Routh-Hurwitz algorithm.	**10**	**CO 4**
Q 8	Explain the term "System". Define the concept of positive and negative feedback system. Derive the relation between input and output for the both feedback systems for the following in positive and negative types of control systems. Forward path transfer function (G) and Feedback transfer function (H) ***OR*** Explain the term "size of the signal". How energy and power signals are represented in the form of Laplace transformation and in the generic terms. Define SNR and Noise Figure for the input out energy ratio.	**10**	**CO 1**
Q 9	Derive the mathematical model for the control system as shown in Figure 1  Figure 1	**10**	**CO2**
SECTION-C			
Q 10	For a control system open loop transfer function consist of: $$G(S)H(S)=\frac{K}{S^2(S+2)(S+3)}$$ Find the value of "K" to limit steady state error to 10, when input to system is $\{1+10t+20t^2\}$. Here't' is the time.	**20**	**CO4**
Q 11	Derive the transfer function model of second order system. Draw its closed loop	**20**	**CO 3**

	schematic diagram. Differentiate between close loop and open loop system behavior. Distinguish between damped and natural frequencies. Classify the systems based on the value of damping coefficient Derive the unit step response for the second order system with the unity step input data. Deduce the relationship for peak overshoot and peak time. ***OR*** A closed loop control system is represented by the differential equation. $\frac{d^2c}{dt^2}+4\frac{dc}{dt}=16e$ Where $e = r - c;$ is the error signal. Determine the undamped natural frequency, damping ratio and percentage maximum overshoot for a unit step input.		