E/sem IV/ Biomed / Choice Based / Sem CS
4/6/18

Signals & Control Systems

(20)

(1)

Q. P. Code : 50562

Time : 3 hours

Marks : 80

Question No. 1 is Compulsory.

Answer any three questions from the remaining five questions.

Assume any data if needed, clearly mention the assumption.

Use graph sheet for Q6 (a) and semi log graph for Q6(b)

Q1)

a) Find whether the following signal is periodic or not , if periodic find the period (4)

$x(t) = 2\cos^2(2\pi t)$

b) Check whether the following system described by the impulse response $h(t) = 2e^{-t}u(t)$ (4)

is causal or not, stable or not ,Justify

c) Find the Fourier transform of the signal $x(t) = e^{-2|t|}$ .sketch the signal and its transform (4)

d) Find the initial value and final value of the signal $X(s) = \frac{s+10}{s^2+2s+3}$ (4)

e) Find the range of values of K ,so that the system characteristic equation given by (4)

$s^4 + 5s^3 + 5s^2 + 4s + K = 0$ is stable

Q2)

a) Find the energy and power of the signal $x(t) = 2\cos(3\frac{\pi}{4}t + \frac{\pi}{6})$ (6)

b) Sketch the signal $x(t) = 1 - |t|$ for $|t| \leq 1$; $x(t) = 0$, elsewhere. (2)

Sketch also i) $x(1-2t)$ ii) $x(\frac{t}{3} - 1)$ (6)

c) Find the output of the LTI system with impulse response $h(t) = u(t)$ and input (6)

$x(t) = e^{-2t}u(t)$, sketch the output

Q3)

a) Find whether the system given by input output relation is linear or not , (6)

time invariant or not , $y(t) = x(2t) + 3$: x(t) is the input ,y(t) the output

b) Find out whether the following set of signals are orthogonal or not in the interval (6)

$0 \leq t \leq \frac{2\pi}{\omega_0}$. $x_k(t) = e^{jk\omega_0 t}$ $-\infty \leq k \leq +\infty$

c) Calculate the trigonometric Fourier series co-efficients of a full wave rectifier (8)

output wave form when the input is a sine wave of frequency 50 Hz and amplitude is 'A'

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4/6/18

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Q4)

a) Find the Frequency response and impulse response of the system described by the differential equation (6)

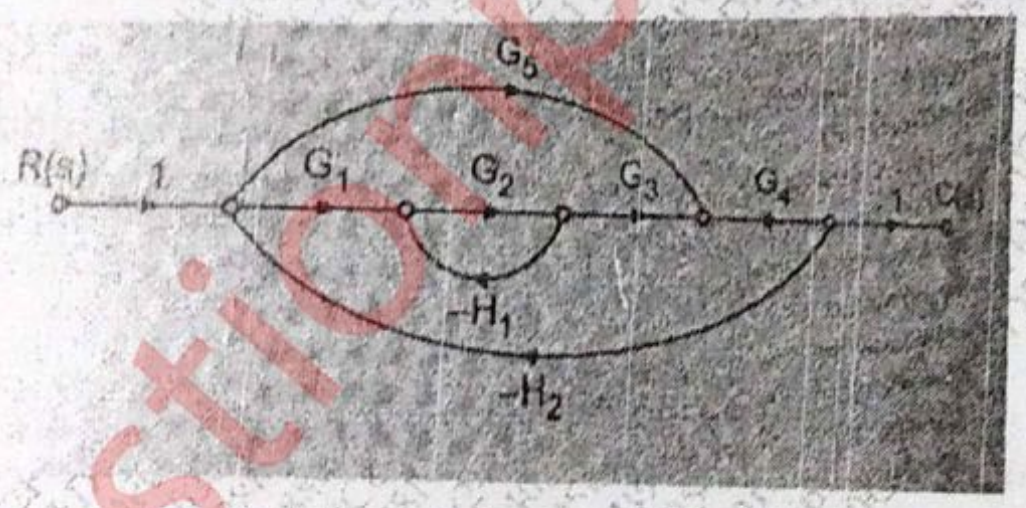
$$\frac{d^2y(t)}{dt^2} + 3\frac{dy(t)}{dt} + 2\,y(t) = 2\frac{dx(t)}{dt} + x(t)$$

b) Find the inverse Laplace transform of $X(s) = \frac{-5s-7}{(s+1)(s-1)(s+2)}$ for all possible ROC (8)

c) Find the Laplace transform of $x(t) = \frac{d^2(e^{-3(t-2)}\,u(t-2))}{dt^2}$; specify the ROC (6)

Q5)

a) Explain Mason's gain formula and find $\frac{C(s)}{R(s)}$ using Mason's formula for the signal flow graph shown below (8)



c) A unit step input is applied to the unity negative feedback system for which open loop Transfer function $G(s) = \frac{16}{s(s+8)}$ find i) its closed loop transfer function ii) Natural frequency of oscillation ω_n iii) Damping ratio' ξ' Iv) damped frequency of oscillation ω_d (6)

d) Explain the term Gain Margin and Phase margin (6)

Q6)

a) Sketch the root locus for the system having $G(s)\,H(s) = \frac{k(s+5)}{s^2+4s+20}$ (10)

b) A unity feed back control system is having $G(s) = \frac{80}{s(s+2)(s+20)}$ Draw the bode plot and comment on the stability of the feed back system (10)

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