Paper / Subject Code: 40105 / Signals and Control Systems

S.E. (BioMed) / Sem IV / Choice based (1)

Q. P. Code : 50564

(18)

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 paper for Q6a and semilog paper for Q6b

Q1

a) Find the energy and power of the signal $x(t) = 2\,Sin(6\pi t+\pi/3)$ (4)

b) Check whether the system described by the input output relation $y(t) = 3\ x(t) + 2$, Is i) linear or not ,ii) time invariant or not : x(t) is the input and y(t) is the output (4)

c) Prove the convolution property of continuous time Fourier transform (4)

d) Find the initial and final value of the signal whose Laplace transform is given by $X(s) = \frac{s+5}{s^2+3s+2}$ using initial value and final value theorem (4)

e) Comment on the stability of the system with the characteristic equation $S^6 + 2S^5 + 8s^4 + 12S^3 + 20S^2 + 16S + 16 = 0$ using Routh array method (4)

Q2)

a) Sketch the signal given by $x(t) = u(t+3) - 2u(t-2) + u(t-4)$, sketch also i) $x(2t-1)$ ii) $x(1-\frac{t}{2})$ (6)

b) Find the fundamental period of the signal given by $x(t) = 10 \sin(12\pi t) + 14 \sin(18\pi t)$ (4)

c) Find the even and odd part of the signal $x(t) = 1 - 2\sin(t) + 3\cos(2t) + 6\sin(6t)\,Cos(2t)$ (4)

d) Find whether the system described by the impulse response is i) stable or not, ii) causal or not (6)
iii) Static or dynamic , $h(t) = 3e^{-2t}u(t)$, Justify your answer

Q3)

a) Find the output of the LTI system given by the impulse response $h(t) = u(t+1) - u(t-1)$ when excited by the input $x(t) = u(t+0.5) - u(t-0.5)$ sketch the output (8)

b) Find exponential Fourier series co efficients of half wave rectified sine wave of amplitude 'A' and frequency 50 Hz (8)

c) Explain Dirichlet conditions for the existence of Fourier transform (4)

Q4)

a) Find Laplace transform of the signal $x(t) = e^{-2t}\,u(t) + e^{-t}Cos(3t)\,u(t)$: specify the ROC (6)

b) Determine the natural response , forced response and output of the system described by the differential equation $\frac{dy(t)}{dt} + 3\,y(t) = 4\,x(t)$ in response to the input $x(t) = Cos(2t)\,u(t)$ and initial condition $y(0) = -2$ (8)

c) Find the inverse Fourier transform of $X(j\omega) = 2\,Cos(\omega)$: $|\omega| \le \pi$ (6)

$= 0$; $|\omega| > \pi$

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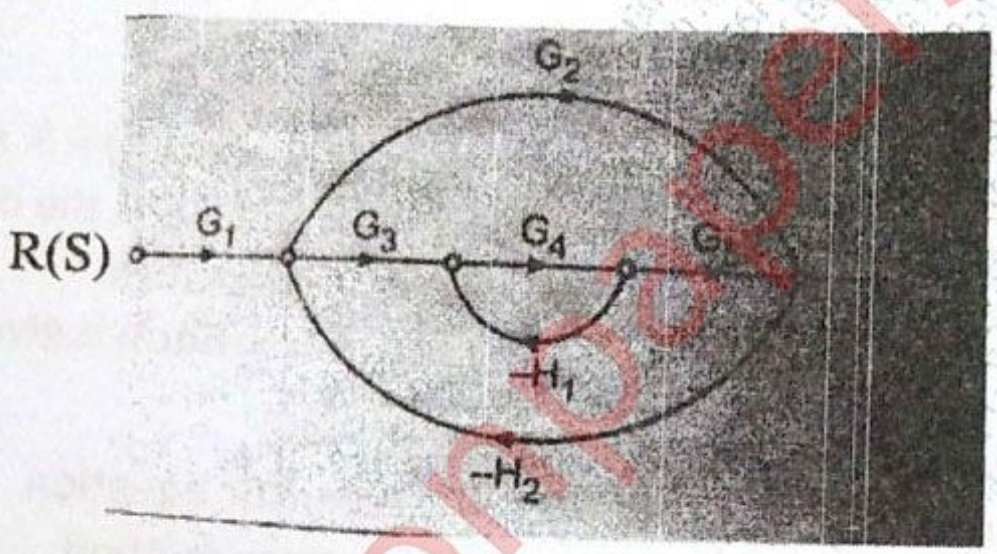
Q5)

a) Compare open loop and closed loop control system (4)

b)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) Explain the terms related to the response of a second order system with unit step input

i) delay time ii) rise time iii) Peak time iv) peak overshoot time v) settling time (08)

Q6)

a) Sketch the root locus for the system with G(s) H(s) = $\frac{K(s+4)}{s(s^2+2s+2)}$ (10)

b) A unity feedback control system has G(s) = $\frac{100}{s(s+0.5)(s+10)}$. Draw the Bode plot. Determine Gain margin and Phase margin and comment on the stability of the system (10)

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