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Question Paper Code : 70428

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2021.

Third Semester

Electronics and Communication Engineering

EC 6303 — SIGNALS AND SYSTEMS

(Common to Biomedical Engineering, Medical Electronics Engineering)

(Regulations 2013)

(Also Common to : PTEC 6303 – Signals and Systems for B.E. (Part – Time) – Electronics and Communication Engineering – Second Semester – (Regulations – 2014))

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Determine whether the signal $x(t) = t\ u(t)$ is an energy signal or power signal.

2. Give an example of a continuous time dynamic system.

3. State and prove the time shifting property of continuous time Fourier transform.

4. Find the continuous time Fourier series coefficients of the signal $x(t) = 1 + \sin\frac{2\pi}{7}t$.

5. Given the differential equation representation of a continuous time system

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

Find the frequency response $H(j\Omega)$ of the system.

6. Given $h(t)$, what is the step response of a CTLTI system.

7. State the need for sampling a continuous time signal.

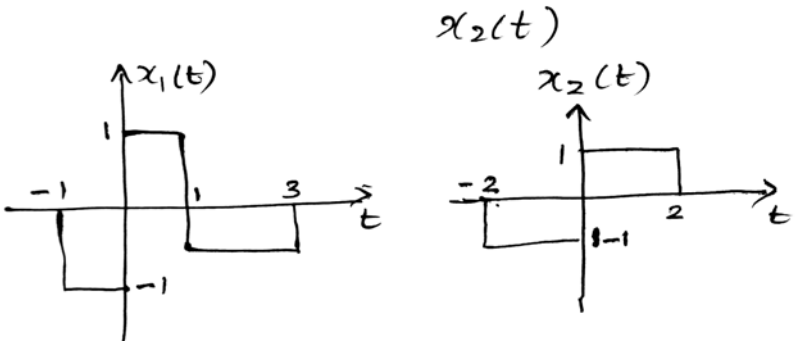
8. Find the Z-transform of $x[n] = \{1, \underset{\uparrow}{2}, -3, 4, 5\}$. Also specify its ROC.

9. Given $x(n) = \{1, 2, -1, 3\}$ and $h(n) = \{1, 2, 2\}$. Find the response $y(n)$.

10. Distinguish between recursive and non-recursive systems.

PART B — ($5 \times 13 = 65$ marks)

11. (a) Given $x_1(t)$ and $x_2(t)$



Plot the following signals

(i) $x_1(t) + x_2(t)$. (4)

(ii) $x_1(t) \cdot x_2(t)$. (4)

(iii) $x_1(-t/2 + 1)$. (5)

Or

(b) Determine whether the following system is causal, stable, linear and time invariant

$$y(t) = \frac{d}{dt} e^{-t} x(t).$$

12. (a) Sketch the spectrum of the signal $x(t) = e^{-a|t|}$, $a > 0$. (13)

Or

(b) Find the Laplace transform of the signal $x(t) = e^{-2t}u(t) + e^{-4t}u(t)$ and specify its ROC. (13)

13. (a) Given $x(t) = e^{-at}\,u(t)$ and $h(t) = u(t-1)$ Find the convolution of $x(t)$ and $h(t)$. (13)

Or

(b) Given the transfer function of a continuous time system

$$H(s) = \frac{2}{s^2 + 3s + 2}$$

(i) Find the differential equation relating the input and output. (4)

(ii) Find the impulse response $h(t)$. (6)

(iii) Determine whether the system is stable. (3)

14. (a) State and prove sampling theorem with necessary quantitative analysis and illustrations. (13)

Or

(b) State and prove any three properties of Z-transform. (13)

15. (a) Given $x(n) = u(n)$ and $h(n) = u(n-2)$. Find the response $y(n)$. (13)

Or

(b) Find the system function $H(z)$ and impulse response $h(n)$ given the difference equation, $y(n) = x(n) + 2x(n-1) - 3x(n-3) + x(n-4)$. Also determine whether the system is causal. (13)

PART C — (1 × 15 = 15 marks)

16. (a) System function of a discrete LTI system is given

$$H(z) = \frac{3z^2 - 4z}{z^2 - 3.5z + 1.5}$$

Specify the ROC of $H(z)$ and determine $h(n)$ for the following conditions.

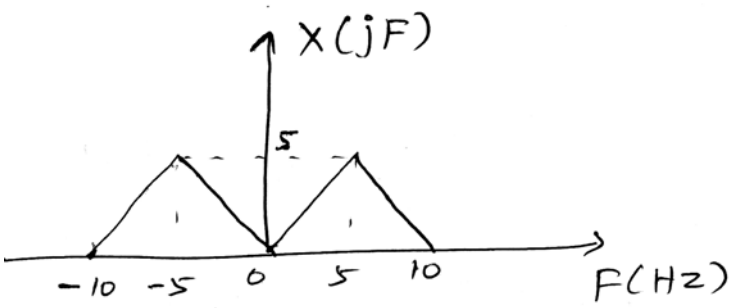
(i) when the system is stable

(ii) when the system is causal

(iii) when the system is non causal. (15)

Or

(b) The spectrum of a continuous time signal $x(t)$ is shown in Figure.



Plot the spectrum of the sampled signal for the sampling frequencies

(i) Fs = 15Hz

(ii) Fs = 20 Hz

(iii) Fs = 30 Hz.

Which of the three sampling frequencies are acceptable? Justify your answer. (15)