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Sub Code: REC303

Paper ID: 3 0 0 9

B.TECH
(SEM III) THEORY EXAMINATION 2017-18
SIGNAL AND SYSTEM

Time: 3 Hours

Total Marks: 70

Note: Attempt all Sections. If require any missing data; then choose suitably.

SECTION - A

Q1. ATTEMPT ALL QUESTIONS IN BRIEF.**2 x 7 = 14**

- a). Check the periodicity of the signals given below. Determine the fundamental time period if signal is periodic:-
 $x(t) = \sin(10t - 1) - \sin(4t - 1)$
- b). Find the DTFT of the causal sequence $x(n) = a^n u(n)$; $|a| < 1$
- c). Check whether the given system are Time Variant and Causal $y(t) = tx(t)$
- d). State the convolution property for continuous and discrete time domain signal in z-transform.
- e). Determine the Laplace transform & find out ROC for $x(t) = e^{-t}u(t) + e^{-4t}u(t)$
- f). Draw the signal $x(t) = u(t) - u(t-2)$.
- g). Using final value theorem find final value of signal corresponding to Laplace transform

$$X(s) = \frac{s+1}{s(s+2)(s+8)}$$

SECTION-B

Q2. ATTEMPT ANY THREE PARTS OF THE FOLLOWING (3*7=21)

- a). Find and sketch the autocorrelation function $R_{xx}(\tau)$ for $x(t) = e^{-at}u(t)$, $a > 0$
- b). Find the convolution for given sequence

$$x[n] = \begin{cases} 1 & \text{for } n = -2, 0, 1 \\ 2 & \text{for } n = -1 \\ 0 & \text{else} \end{cases}$$

$$\text{and } h[n] = \delta[n] - \delta[n-1] + \delta[n-2] - \delta[n-3]$$

- c). Find the Fourier transform of the signals given below:-

$$\text{i) } x(t) = \begin{cases} A, & |t| < T_0 \\ 0, & |t| > T_0 \end{cases} \quad \text{ii) } x(t) = e^{-at}u(t)$$

Draw the magnitude and phase response of the transformed signal.

$$\text{d) If } X(s) = \frac{5s-7}{(s-1)(s+2)} \text{ with } -2 < R\{s\} < -1. \text{ Find } x(t)?$$

- e). state and prove sampling theorem and discuss the effect of under sampling.

Q3. ATTEMPT ANY ONE PART OF THE FOLLOWING 7*1=7

- a). i). What is signal? Give brief classification of signals.
 ii). Prove that power of energy signal is zero over infinite time.
 b). Plot $x(t) = u(t) - r(t-1) + 2r(t-2) - r(t-3) + u(t-4) - 2u(t-5)$. Find the even and odd parts of this signal.

Q4. ATTEMPT ANY ONE PARTS OF THE FOLLOWING 7*1=7

- a). Determine whether the following continuous time system $y(t) = x(t) \cos(100\pi t)$ is
 i) static or dynamic ii) linear or nonlinear iii) shift variant or shift invariant
 iv) causal or noncausal v) stable or unstable.
 b). Find energy and power of the signal
 i). $x(t) = \cos(t)$ ii) $x(t) = Ae^{-\alpha t} u(t)$, $\alpha > 0$

Q5. ATTEMPT ANY ONE PART OF THE FOLLOWING 7*1=7

- a). An LTI system with impulse response $h_1(n)$

$$h_1(n) = \left(\frac{1}{3}\right)^n u(n)$$

is connected in parallel with another causal LTI system with impulse response $h_2(n)$. The resulting parallel interconnection has the frequency response.

$$H(e^{j\omega}) = \frac{-12 + 5e^{-j\omega}}{12 - 7e^{-j\omega} + e^{-2j\omega}}$$

find the impulse response $h_2(n)$.

- b). Find the Fourier transform of the signal $x(t) = e^{-at} u(t)$ and plot its magnitude and phase spectrum.

Q6. ATTEMPT ANYONE PART OF THE FOLLOWING 7*1=7

- a). i) Show that if $x_3(t) = ax_1(t) + bx_2(t)$ then $X_3(S) = aX_1(S) + bX_2(S)$
 ii) If Laplace transform of $x(t)$ is $(s+2)/(s^2+4s+5)$. Determine Laplace transform of $y(t) = x(2t-1)u(2t-1)$

- b). A causal LTI system is described by difference equation.

$$y(n) = y(n-1) + y(n-2) + x(n-1)$$

Find the system function $H(z)$ for this system. Plot the poles zeros of $H(z)$ and indicate the region of convergence.

Q7. ATTEMPT ANY ONE PART OF THE FOLLOWING 7*1=7

- a). Consider the two continuous-time sinusoidal signals

$$x_1(t) = \cos(20\pi t) \quad \text{and} \quad x_2(t) = \cos(100\pi t)$$

Which are sampled at a rate $f_s = 40\text{Hz}$. Find the corresponding discrete time signals.

- b). Explain system bandwidth and rise time for low pass filter and prove that

$$t_r = 0.35/B$$