

B-TECH
(SEM IV) THEORY EXAMINATION 2022-23
SIGNAL SYSTEM

Time: 3 Hours

Total Marks: 100

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

SECTION A

1. Attempt all questions in brief.

2 x 10 = 20

- (a) Determine whether it is energy or power signal $x(t) = tu(t)$
- (b) Find even and odd component of the following signal $x(t) = 1 + 2t + 3t^2 + 4t^3$
- (c) What is the difference between cross correlation and auto correlation?
- (d) Determine the initial value for the given laplace transform

$$X(s) = \frac{4}{s^2 + 3s + 8}$$

- (e) What is the significance of ROC
- (f) Write time shifting property of Laplace transform
- (g) What is the condition of z transform to exist
- (h) Draw ROC of two sided sequence in z transform
- (i) What is meant by anti-aliasing filter
- (j) Find sampling frequency of signal: $2 \cos(2\pi \times 10^3 t) \cos(4\pi \times 10^3 t)$

SECTION B

2. Attempt any three of the following:

10x3=30

- (a) Check whether the given system is Static, Linear, Causal and Time invariant system or not $y(t) = at^2x(t) + bt x(t - 4)$
- (b) Consider a causal LTI system with frequency response $H(\omega) = \frac{1}{4+j\omega}$. For a particular input $x(t)$ the system is observed to produce the output $y(t) = e^{-2t}u(t) - e^{-4t}u(t)$. Find the input $x(t)$
- (c) Find the Fourier transform of a signal $x(t) = \frac{1}{a^2+t^2}$
- (d) Find the Z- transform and ROC of $X(z)$ for

$$x(n) = 3 \left(\frac{5}{7}\right)^n u(n) + 2 \left(-\frac{1}{3}\right)^n u(n)$$

- (e) State and prove sampling theorem

SECTION C

3. Attempt any one part of the following:

10x1=10

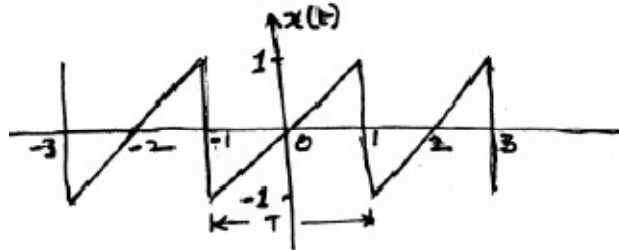
- (a) Sketch the following signal
 - (i) $2u(t + 2) - 2u(t - 3)$
 - (ii) $r(t) - r(t - 1) - r(t - 3) + r(t - 4)$
- (b) Check whether the following digital systems are BIBO stable or not
 - (i) $y(n) = ax(n) + b$
 - (ii) $y(n) = e^{-x(n)}$

4. Attempt any one part of the following: 10x1=10

- (a) Find the convolution of the following signal by graphical method
 $x(t) = e^{-3t}u(t); h(t) = u(t + 3)$
- (b) Using Fourier transform, find the convolution of the signals
 $x_1(t) = e^{-2t}u(t)$ and $x_2(t) = e^{-3t}u(t)$

5. Attempt any one part of the following: 10x1=10

- (a) Determine the exponential fourier series for the waveform shown



- (b) Find the Fourier transform of the signal $x(t) = e^{-a|t|}sgn(t)$

6. Attempt any one part of the following: 10x1=10

- (a) Find inverse Z-Transform of

$$X(z) = \frac{2z - 7}{z^2 - 5z + 6}; ROC; |z| < 2$$

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

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

Find the system function and frequency response of the system. Plot the poles and zeroes and indicate ROC. Also determine the stability and impulse response of the system

7. Attempt any one part of the following: 10x1=10

- (a) Solve $y[k+2] + 5y[k+1] + 6y[k] = 3f[k+1] + 5f[k]$

If the initial conditions are $y[-1] = 11/6$, $y[-2] = 37/36$ and the input $f[k] = 2^{-k} V[k]$ and indicate zero input and zero state component in the output $y[k]$.

- (b) Determine the Nyquist sampling rate and Nyquist sampling interval for

i) $x(t) = sinc(100\pi t) + 3sinc^2(60\pi t)$