BTECH
(SEM III) THEORY EXAMINATION 2021-22
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.	What do you mean by energy and power signals?
b.	Explain conjugate symmetry and conjugate asymmetry.
c.	What do you mean by auto and cross correlation functions?
d.	Show that the product of two even signals or of two odd signals is an even signal and that the product of an even and an odd signal is an odd signal.
e.	Consider the discrete time signal $\boldsymbol{x[n] = 1 - \sum_{k=3}^{\infty} \delta[n-1-k]}$. Determine the values of integers **M** and $\mathbf{n_o}$ so that $\boldsymbol{x[n]}$ may be expressed as $\boldsymbol{x[n] = u[Mn - n_o]}$.
f.	What do you mean by region of convergence?
g.	Define auto co-relation function.
h.	What do you mean by Eigen signal and Eigen value?
i.	What do you mean by over damped, under damped and critically camped system?
j.	Define rise time and band width of a second order continuous time system.

SECTION B

2. Attempt any *three* of the following: 10x3=30

a.	If $\boldsymbol{X(s) = \frac{2S+3}{(S+1)(S+2)}}$. Find $\boldsymbol{x(t)}$ for **i.** System is stable **ii.** System is causal **iii.** System is stable and causal.
b.	Determine whether the following signal is periodic? If periodic then determine the period: **i.** $\boldsymbol{x(t) = 2\,sin\left(\frac{2}{3}\right)t + 3cos\left(\frac{2\pi}{5}\right)t}$ **ii.** $\boldsymbol{x(t) = 3\,sint + 3cos\left(\frac{4}{3}\right)t}$ **iii.** $\boldsymbol{x(n) = cos\left(\frac{\pi n}{7}\right) sin\left(\frac{\pi n}{7}\right)}$ **iv.** $\boldsymbol{x(n) = e^{j\frac{\pi n}{16}} cos\left(\frac{\pi n}{17}\right)}$
c.	If input x[n] and output y[n] are related by $\boldsymbol{y[n] = x[n]\{g[n] + g[n-1]\}}$ **i.** If $\mathbf{g[n] = 1\ \forall\ n}$, show that this system is time invariant. **ii.** If $\mathbf{g[n] = n\ \forall\ n}$, show that this system is time variant. **iii.** If $\mathbf{g[n] = 1 + [-1^n]\ \forall\ n}$, show that this system is time invariant.
d.	Find the inverse Z transform of the following for all possible cases of ROC. $$\boldsymbol{X(Z) = \frac{(Z+2)}{2Z^2 - 7Z + 3}}$$

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e.	Find the continuous time Fourier transform of the Gate /Rectangular signal. Also plot its magnitude response.

SECTION C

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

a.	Using Fourier transform, find the convolution of following signals $x_1(t) = e^{-2t}u(t)$ $x_2(t) = e^{-3t}u(t)$
b.	Find the convolution of two rectangular pulses of amplitudes A and duration T. Also plot the result with time.

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

a.	Define the systems with the following characteristics: i. Static or Dynamic ii. Linear or Non-Linear iii. Causal or Non-Causal iv. Time variant or In-variant
b.	Calculate the DTFT of the following using properties of DTFT. i. $x(n) = u(n+3) - u(n-3)$ ii. $x(n) = u(n)$

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

a.	Solve the difference equation using Z transform method: $x(n-2) - 9x(n-1) + 18x(n) = 0$ Initial conditions are $x(-1) = 1, x(-2) = 9$.
b.	Determine whether the following signal is energy or power signal. $x(n) = u[n] - u[n-6]$

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

a.	A continuous time system is described by differential equation $y''(t) + 3y'(t) + 2y(t) = x(t)$. Find the impulse response of the system. If the input is $x(t) = 4e^{-2t}u(t)$, determine the system output corresponding to this input.
b.	Analyze the first order continuous time low pass filter with its pole zero location and response.

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

a.	State and prove the various properties of Laplace Transform.
b.	Prove the following properties of Z transform: i. Linearity ii. Time invariance iii. Parseval's relation iv. Convolution