

- NB: (1) Question no. 1 is compulsory  
 (2) Attempt any three questions of the remaining questions  
 (3) Assume suitable data where ever necessary

Q1 Attempt the following questions 20

a) Find the z transform and draw the ROC of

$x[n] = 0.5^n u(n) + 0.8^n u(-n-1)$   $\frac{z}{z-0.5} + \frac{z}{0.8-z}$   $0.8 > |z| > 0.5$

b) Find the initial value of

$X(s) = \frac{2s^2 + 5s + 12}{s^3 + 4s^2 + 14s + 20} = 2$

c) Plot the single sided spectrum of the given signal

$x(t) = 20 \cos(100\pi t + 20^\circ) + 6 \sin(50\pi t)$

	Amp	Freq	Phase
I	20	50	20
II	6	25	-90

d) Determine whether the following signals are periodic or not. If periodic, find the time period

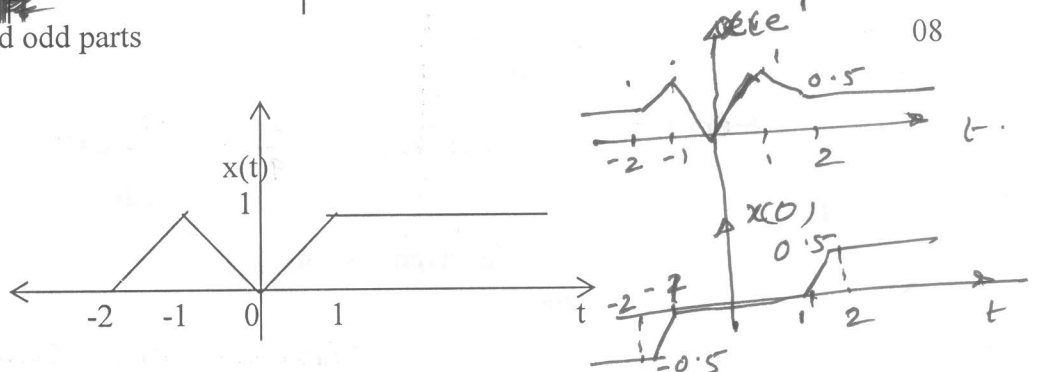
i.  $x(t) = 3 \cos(4t + \frac{\pi}{3})$  - Non Periodic

ii.  $x[n] = 2 \cos(\frac{\pi}{4}n) + \sin(\frac{\pi}{8}n) - 20 \cos(\frac{\pi}{4}n + \frac{\pi}{6})$  - Periodic  
 $N_1 = 8$   $N_2 = 16$   $N_3 = 8$

Q2 a) Find the convolution sum (Mathematically) 12

$x[n] = \{3, 2, 1, 0, 1, 2, 3\}$   $h[n] = \{2, 1, 0, 1, 2\}$   $\{6, 7, 4, 4, 10, 10, 10, 4, 4, 7, 6\}$

b) Find even and odd parts



Q3 a) Determine whether the given signals are power/ energy signals 05

i.  $X(t) = \cos(t)$  Power  $P = \frac{1}{2} W$

b)  $x[n] = \{1, 0, 2, 0, -1\}$ ,  $h[n] = \{2, 0, 2\}$ , compute the following 05

i.  $x[n] h[n]$   $\{2, 0, 2\}$

ii.  $X[n] h[n+2]$   $\{2, 0, 4, 0\}$

c) Find  $y(t)$ , if  $y(t) = x(t) h(t)$ ;  $x(t) = e^{2t} u(t)$ ,  $h(t) = u(t-3)$  06

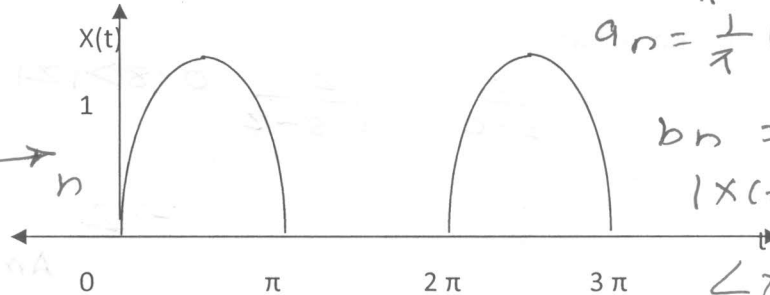
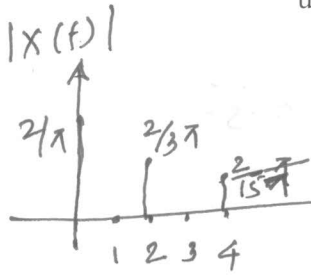
$y(t) = 0$   $t < 0$   
 $= \frac{1}{2} - \frac{e^{-2(t-3)}}{2}$   $t > 0$

SUBJ: SIGNALS & SYSTEMS (BIOMEDICAL)

d) Find DTFT of  $x[n] = a^n u[n]$  04

$$\frac{1}{1 - ae^{-j\omega}}$$

Q4 a) Find the Quadrature Fourier series fourier coefficients of the following signal using and sketch the spectrum 10



$$a_0 = \frac{1}{\pi}$$

$$a_n = \frac{1}{\pi} \frac{(1 - (-1)^{n+1})}{1 - n^2}$$

$$b_n = 0$$

$$|X(t)| = \frac{2}{\pi(1-n^2)}$$

$$\angle X(t) = 0$$

~~Q4 a)~~ b)

Given  $x[n] \leftrightarrow z^2/(z^2-16)$  10

Using the properties of z-transform determine the following

$$x_1[n] = x[n] * x[-n] \quad x_2[n] = 2^n x[n] \quad \frac{-z^2}{z^2-64}$$

$$\frac{1}{(z^2-16)(z^{-2}-16)}$$

Q5 a) Find the Laplace transform of the signal and their ROC 10

$$x_1(t) = e^t u(-t) + e^{-3t} u(t) \quad \frac{1}{s+1} - \frac{1}{s-1} \quad -3 < \sigma < 2$$

$$x_2(t) = e^t \sin(400\pi t) u(t) \quad \frac{400\pi}{(s-1)^2 + (400\pi)^2} \quad \sigma > 1$$

b) Find IZT, 10

$$X[Z] = \frac{1 - \frac{1}{3}z^{-1}}{(1 - z^{-1})(1 + 2z^{-1})}; \text{ROC } |z| > 2$$

$$x(n) = \frac{2}{9} (1)^n u(n) + \frac{7}{9} (-2)^n u(n)$$

Q6 a) Prove the time shifting property of Laplace Transform 05

b) Determine whether the given system is causal/ non causal, Static/ Dynamic, 10

Variant/ Invariant

i.  $y(t) = x(t-2) + x(2-t)$  - linear, noncausal, static, time invariant

ii.  $y[n] = \cos(n\pi x[n])$  - nonlinear, causal, static, time invariant

c) Prove the differentiation property of Z transform 05