Registration no: | | | | | | | | | | |

Total Number of Pages: 2 **B.Tech**
FECS6401

7th Semester Regular / Back Examination 2016-17
INTRODUCTION TO DIGITAL SIGNAL PROCESSING
BRANCH: CSE, IT, ITE
Time: 3 Hours
Max Marks: 70
Q.CODE: Y137

Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

Q1 **Answer the following questions:** **(2 x 10)**

a) Determine whether or not the following signal is periodic. In case periodic specify its fundamental period.
$x(n) = \cos(n/8)\cos(\pi n/8)$

b) Determine the z- transform of the signal $x(n) = u(-n)$

c) Sketch the signal $x_a(t) = 3\sin(100\pi t)$ for $0 < t < 30$ms.

d) State and prove the differentiation property of z Transform.

e) How many complex multiplications and additions are required for computing N-point DFT.

f) Write down the properties of convolution.

g) What is the minimum sampling rate of the signal $f(t) = 10\cos(20\pi t)\cos(200\pi t)$.

h) Compute the N-point DFT of $x(n) = \delta(n-n_0)$ $0<n_0<N$

i) Differentiate between linear convolution and circular convolution.

j) Find out the even and odd component of the signal given by
$x(n) = \{2,3,4,5,6\}$
$\uparrow$

Q2 **a)** Calculate the energy and power of an unit impulse signal. **(2)**

b) By means of DFT and IDFT determine the response of the FIR filter with impulse response $h(n) = \{1,2,3\}$ and the input sequence $x(n) = \{1,2,2,1\}$. **(8)**

Q3 **a)** Determine the z-transform of the following signals. **(5)**
i) $x_1(n) = n(-1)^n u(n)$
ii) $x_2(n) = na^n \sin\omega_0 n u(n)$

b) Compute the zero state response for the following pair of system and input signal. **(5)**
$h(n) = (1/2)^n u(n)$
$x(n) = (1/3)^n u(n)+(1/2)^{-n} u(-n-1)$

Q4 **a)** Compute the convolution y(n) = x(n)*h(n) **(5)**
x(n) = u(n+1) – u(n-4) – δ(n-5)
h(n) = [u(n+2) – u(n-3)] .(3 - |n|)

b) Examine the discrete time system y(n) = x(-n+2) with respect to the properties like static or dynamic, linear or non-linear, time invariant or time varying, causal or non-causal and stable or unstable. **(5)**

Q5 **a)** Determine the causal signal x(n) if its z-Transform X(z) is given by **(5)**

i) $X(z) = \frac{1+3z^{-1}}{1+3z^{-1}+2z^{-2}}$

ii) $X(z) = \frac{z^{-6}+z^{-7}}{1-z^{-1}}$

b) Determine all possible signals that can have the following z- Transform. **(5)**

$$X(z) = \frac{1}{1-1.5z^{-1}+0.5z^{-2}}$$

Q6 **a)** Find the DFT of the sequence x(n) = {4,3,2,1} using DIF-FFT algorithm. **(5)**

b) Convert the analog filter with system function $H_a(s) = \frac{s+0.1}{(s+0.1)^2+16}$ into digital IIR filter by means of Bilinear transformation method. The digital filter is to have a resonant frequency of $\omega_r = \pi/2$. **(5)**

Q7 By means of DFT and IDFT determine the circular convolution of the sequences $x_1(n) = \{1,2,3,1\}$ $x_2(n) = \{4,3,2,2\}$ **(10)**

Q8 **Write short answer on any TWO:** **(5 x 2)**

a) Impulse Invariance Method

b) Circular Convolution

c) DFT as a linear Transformation

d) Overlap save Method