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

Total Number of Pages: 02

B.TECH
PCEC4304

6th Semester Regular / Back Examination 2016-17

DIGITAL SIGNAL PROCESSING

BRANCH(S): AEIE, ECE, EEE, EIE, ETC, IEE

Time: 3 Hours
Max Marks: 70
Q. CODE: Z121

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) A LTI system with characteristics equation $Z^3 - 0.81\,Z = 0$ Find whether the system is stable or not.

b) A casual signal is represented as,

$$X(n) = \{2,\ 1,\ 0,\ 5\}\ .$$

Express the signal as the sum of impulse function δ(n).

c) With proper justification show that impulse function can be used as test signal for a DTS system.

d) Are the zeros of a stable linear phase FIR filters lie outside the unit circle of Z-plane? Justify.

e) Find out the real multiplication and real additions that are required to compute 16 point DFT using direct computation and FFT algorithm?

f) When DFT x (k) of a sequence x (n) is real?

g) Are the zeros of a stable linear phase FIR filters lie outside the unit circle of Z-plane? Justify.

h) Draw the basic structure of 1st order digital IIR filter.

i) Why FIR filters are inherently stable?

j) Why aliasing occurs most of the time when mapping of s-plane to z-plane is done using impulse invariance sampling method?

Q2 Find out the impulse response of the system **(10)**

$$y(n) = 1.5y(n-1) + 2y(n-2) + 0.25x(n) + 2x(n-1).$$

And then find out, whether the system is

I. Stable or unstable
II. FIR or IIR system using z-transform

Q3 **a)** The impulse response of LTI system is expressed as **(5)**

$$h(n) = 0.2^n u(n)$$

Find the value of A such that $h(n) - A\,h(n-1) = \delta(n)$

b) Determine Z-transform of the following signal using properties of z-transform **(5)**

(I) $x(n) = nu(n-1)$

(II) $x(n) = a^n u(n+1)$.

Q4 **(a)** Convert the analog filter with system function **(5)**

$$H(s) = \frac{s + 0.1}{(s + 0.1)^2 + 9}$$

Into a digital IIR filter using impulse invariance transformation method. The digital filter is to have resonant frequency of $\pi/2$.

(b) What are the limitations of impulse invariance transformation and bilinear transformation method of designing IIR filters. **(5)**

Q5 **(a)** Consider the casual system **(6)**

$$Y(n) = -0.5y(n-1) - 0.12y(n-2) + 0.7x(n) - 0.252x(n-2)$$

Justify whether the system is FIR or IIR and then obtain a transpose structure of the system.

(b) What are the differences in structure of FIR and IIR filter? Explain with suitable example. **(4)**

Q6 **(a)** Compare FIR with IIR filter with suitable example. **(5)**

(b) Prove that convolution of two signal in discrete time domain is equal to multiplication in discrete frequency domainusing DFT. **(5)**

Q7 **(a)** Explain Decimation in frequency FFT algorithm. **(5)**

(b) What are the practical difficulties in designing FIR filter? Explain with a suitable example. **(5)**

Q8 **Write short notes on (Any two)** **(5 x 2)**

(a) Circular convolution

(b) Overlap save method

(c) Discrete cosine transform (DCT)

(d) FIR filter using windowing technique