**Registration no:**

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**Total Number of Pages: 02**

**B.TECH**
**PCEC4304**

# 6th Semester Regular / Back Examination 2016-17
# DIGITAL SIGNAL PROCESSING

**BRANCH(S): CSE, ELECTRICAL,MECH**
**Time: 3 Hours**
**Max Marks: 70**
**Q. CODE: Z683**

**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)** Which standard discrete signal is usually used to analyze discrete time system? Justify with necessary mathematical expression using Z-transform

**b)** Derive the relation between Z-transform and Laplace transform.

**c)** Determine the pole-Zero plot for the signal

$$x(n) = a^n u(n)$$

**d)** A signal $x(t) = 22sin(1500\pi t)$ is sampled with a sampling period of 120 micro second and passed through a ideal low pass filter with 3-dB frequency of 10 kHz.. Find out the frequencies that will appear at the output of low pass filter**?**

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

**f)** What is meant by radix-2 FFT?

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

**h)** Why IIR filter do not have linear phase?

**i)** Why FIR filters are inherently stable?

**j)** What is Gibbs phenomenon?

**Q2** **a)** Determine the phase and magnitude of the system **(5)**

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

**b)** Plot pole zero pattern and stability test of the following impulse response system. **(5)**

$$Y(n) = y(n-1) - 0.52y(n-2) + x(n) + x(n-1)$$

**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)** Prove that if x(n) is a real sequence and $x(n) = -x(N-n)$ then its DFT is purely imaginary **(5)**

**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)** Obtain H(z) using bilinear transformation of the following transfer functions with T=1 sec. **(5)**

$$h(s) = \frac{s}{s^2 + 2s + 1}$$

**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)** Find the impulse response of LTI system whose frequency response is described as **(4)**

$$H(e^{jw}) = 1 \quad \text{For } |w| < \pi/4$$
$$= 0 \quad \text{otherwise}$$

Is such LTI system practically realizable? Justify your answer.

**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 domain using DFT. **(5)**

**Q7** **a)** Explain Decimation in time 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)** Symmetric and asymmetric condition of FIR filter

**c)** Adaptive filter

**d)** FIR filter using windowing technique