

MANIPAL INSTITUTE OF TECHNOLOGY MANIPAL A Constituent Institution of Manipal University

## V SEMESTER B.TECH. (MECHATRONICS ENGINEERING) END SEMESTER EXAMINATIONS, DEC 2016/JAN 2017

SUBJECT: DIGITAL SIGNAL PROCESSING [MTE 3105] REVISED CREDIT SYSTEM

## Time: 3 Hours

MAX. MARKS: 50

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## Instructions to Candidates:

- ✤ Answer ALL the questions.
- Missing data may be suitable assumed.
- 1A. Using the properties of z transform compute  $x[n] = nsin\left(\frac{\pi}{2}n\right) u[-n]$
- **1B.** A linear system H has input-output pairs as shown in **Fig.Q1(B)(a)**



## Fig.Q1(B)(a)

- i) Comment on the causality of the system?
- ii) Determine whether the given system is memory/memoryless?
- iii) Compute the output from the system H for input x(t) shown in **fig.Q1(B)(b)**



1C. Sketch the waveform of the following signal y(t) = r(t+2) - r(t+1) - r(t-1) + r(t-2) 2A. In the linear time-invariant system shown in **fig.Q2**(A) blocks labeled D represent unit delay 6 elements. Find the expression for y[n] and also determine the transform function Y(z)/X(z) in the z domain for system shown in fig. Q2(A)



- **2B.** The system **y**(**t**)=**tx**(**t**) has input x(t) and output y(t).Determine whether the system is 4 (i)memoryless,(ii)stable,(iii)causal,(iv)linear,(v)time invariant, (vi) Invertible
- 3A. 'Noise' is a high frequency signal. When passed through a low pass filter most of the noise is 6 removed and a clear sound is produced. Electronic low-pass filters are used on inputs to subwoofers and other types of loudspeakers, to block high pitches. Using Bilinear transformation design a digital low pass filter with following specifications:
  - $0.8 \le |H(ej\omega)| \le 1$  for  $0 \le f \le 0.8 KHz$
  - $|H(ej\omega)| \le 0.2$  for  $2.4KHz \le f \le 4$  KHz Assume T=2 seconds
- **3B.** Explain any 2 addressing modes of DSP processor.
- **4A.** Find the 8 point DFT of the given sequence x(n)=[1,2,3,2,1,2,1,3] using DIF FFT algorithm. 5
- **4B.** Use unilateral z transform to determine the forced response, natural response and complete **5** response of the system described by following difference equation with given input and initial condition.

$$y[n] - \frac{1}{3}y[n-1] = 2x[n]$$
,  $y[-1]=1, x[n] = \left(-\frac{1}{2}\right)^n u[n]$ 

- 5A. Design a high pass FIR filter using rectangular window to meet the following specifications
  6 Cut-off frequency =250Hz Sampling frequency fs=1KHz Filter length=7
- **5B.** Compute the 4 point DFT of the sequence x[n]=[1, 0, 1, 0]. Also find  $x(n-2)_4$

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