Reg.No. \_\_\_\_\_\_\_\_\_\_\_\_



**UNIVERSITY**

(Karunya Institute of Technology & Sciences)

(Declared as Deemed-to-be University under Sec.3 of the UGC Act, 1956)

**End Semester Examination – Nov/Dec – 2016**

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|  |  | **Semester :** | **2016-17 ODD** |
| **Code :** | **14EC3072** | **Duration :** | **3hrs** |
| **Sub. Name :** | **ADVANCED DIGITAL SIGNAL PROCESSING** | **Max. marks :** | **100** |

**ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)**

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| **Q. No.** | **Sub Div.** | **Questions** | **Course**  **Outcome** | **Marks** |
| 1. | a. | From each of the following input/output relationships, determine whether thecorresponding system is linear/non-linear, time in-variant/time variant, causal/non causal.  y(t) = t2 x(t-1)  y[n] = x[n+1] – x [n-1]  y[n] = x2  [n-2] | CO1 | 10 |
| b. | Let g[n] and h[n] be even and odd real sequences. Determine if x[n] = g[n]h[n] is even or odd. | CO1 | 5 |
| c. | Compare digital signal processing with analog signal processing highlighting the advantages and disadvantages | CO1 | 5 |
| (OR) | | | | |
| 2. | a. | Evaluate y[n] = x[n] \* h[n]  x[n] = δ[n] - 2δ[n-1] + δ[n-2], h[n] = u[n] – u[n-3] | CO1 | 10 |
| b. | Check whether the following signals are energy signal or not.  i) *x(t) = e-3t u(t)* ii) *x(n) =* | CO1 | 6 |
| c. | Determine whether x[n] = 5 sin[6πn/35] is periodic, and if it is, find the fundamental period. | CO1 | 4 |
| 3. | a. | The following signals are defined on the interval n = 0, 1, 2, 3: x1[n] = (1/2)n  and x2[n] = (-1)n. Compute the 4 point circular convolution y[n] = x1[n] Θ x2[n] | CO1 | 10 |
|  | b. | Consider two systems described by the following linear constant coefficient difference equations:  *y[n] = 0.2y[n-1] + x[n] – 0.3x[n-1] + 0.02x[n-2]*  *y[n] = x[n] – 0.1x[n-1].*  Prove that the two systems are equivalent. | CO1 | 10 |
| (OR) | | | | |
| 4. | a. | A system has an impulse response h[n] and input x[n] as shown in figure below.    Determine the response of the system. Is the system causal? Why? | CO1 | 10 |
|  | b. | Prove the following properties of convolution operation  i. x[n]\* h[n] = h[n]\*x[n] (4)  ii. x[n]\*{h1[n] + h2[n]} = x[n]\* h1[n] + x[n]\* h2[n] (4)  iii.{x[n] \* h1[n]} \* h2[n] = x[n]\* {h1[n] \* h2[n]} (6) | CO1 | 10 |
| 5. | a. | Consider the system below    i.Find the DFT Heff[k] linking the input x and the output y[n].  ii.Find heff[n] using IDFT. | CO2 | 10 |
|  | b. | Determine the inverse Z transform of X(z) =  by partial fraction expansion method if the ROC s are a) |z|>3 b) |z|< 1/2  c) ½ <|z|< 3 | CO2 | 10 |
| (OR) | | | | |
| 6. | a. | Determine the 8 point DFT of the real valued sequence x[n] = δ [n-3]. | CO2 | 10 |
|  | b. | Determine the transfer function and impulse response for the causal LTI system described by the difference equation y[n] - (1/4)y[n-1] - (3/8)y[n-2] = -x[n] + 2x[n-1] | CO2 | 6 |
|  | c. | Prove that IDFT can be calculated using DFT algorithm | CO2 | 4 |
| 7. | a. | Design a linear phase High Pass FIR Filter with a cut-off frequency of 0.5π radians/sample using a finite rectangular window of length 9 samples. | CO3 | 10 |
|  | b. | Derive the expression of bilinear transformation and hence deduce the relationship between analog frequency Ω and the digital frequencyω. Also explain the concept of frequency warping. | CO3 | 10 |
| (OR) | | | | |
| 8. | a. | Obtain the direct form I, direct form II and Cascade realization of the LTI system  H (z) = | CO3 | 10 |
|  | b. | Write the steps to design an FIR filter using frequency sampling technique. | CO3 | 4 |
|  | c. | For the analog transfer function H(s) = , determine H(z) using bilinear transformation. Assume T= 1 sec. | CO3 | 6 |
|  | | **Compulsory:** |  |  |
| 9. | a. | Explain with block diagram the implementation of Audio-Sub band Coding and Decoding system. | CO3 | 10 |
|  | b. | The sampling rate of a signal x[n] is to be reduced, by decimation, from 96 kHz to 1 kHz. The highest frequency of interest after decimation is 450 Hz. Design the specification of filters LPF1 and LPF2 for a two stage decimation as shown in fig. below with an overall pass band ripple of δp = 0.01 and stop band deviation δs = 0.001. | CO3 | 10 |

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