Student Exam No._____

# GANPAT UNIVERSITY

## B. Tech. Semester: VI Electrical Engineering

## Regular Exam May 2014

## 2EE 613: DIGITAL SIGNAL PROCESSING

**Time:** 3 Hours **Total Marks: 70**

**INSTRUCTIONS:**
1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

### Section - I

**Que. – 1**

| | | | |
|---|---|---|---|
| | A | Explain the various methods of representing discrete-time signal with examples | 6 |
| | B | Draw the examples of (i) Continuous & Discrete-time signal, (ii) Periodic & Aperiodic signal and (iii) Even & Odd signal. | 6 |

**OR**

**Que. – 1**

| | | | |
|---|---|---|---|
| | A | Define ROC for one finite and one infinite discrete-time signals. | 6 |
| | B | What is impulse response? Explain its significance. | 6 |

**Que. – 2**

| | | | |
|---|---|---|---|
| | A | Find the z-transform : $x(n) = n\,a^{(n-1)}$ | 5 |
| | B | Define the frequency spectrum of a discrete-time signal in terms of Fourier transform and discuss its significance. | 6 |

**OR**

**Que. – 2**

| | | | |
|---|---|---|---|
| | A | Prove with the derivation that the frequency spectrum of a discrete-time signal obtained by sampling a continuous-time signal is given by the infinite sum of frequency shifted and amplitude scaled spectrum of continuous-time signal. | 5 |
| | B | Draw the practical specifications of lowpass and highpass filters and explain all the terms. | 6 |

**Que. – 3**

| | | | |
|---|---|---|---|
| | A | Discuss the realization and implementation issues of a digital filter. | 6 |
| | B | Obtain the direct form-I and direct form-II realization for the second order filter given by | 6 |

$$y(n) = 2b\cos\omega_0\; y(n-1) - b^2\; y(n-2) + x(n) - b\cos\omega_0\; x(n-1)$$

## Section – II

**Que. – 4**

**A** Compute 2-point and 4-point DFT of the given sequence and sketch the magnitude of DFT in both the cases: **6**

$$x(n) = u(n) - u(n-2)$$

**B** Find the output spectrum of an LTI system if input **6**

$$x(n) = 2/3 \quad ; \ -1 \le n \le 1$$
$$= 0 \quad ; \ \text{else}$$

and the impulse response

$$h(n) = a^n \quad ; \ n \ge 0$$
$$= 0 \quad ; \ \text{else}$$

**OR**

**Que. – 4**

**A** Compute the DTFT of the sequence: **6**

$$x(n) = a^{|n|} \quad ; \ -1 < a < 1$$

**B** Use the four point DFT and IDFT to determine the circular convolution of following sequences: **6**

$$x(n) = \{\underset{\uparrow}{1}, 2, 3, 1\} \text{ and } h(n) = \{\underset{\uparrow}{4}, 3, 2, 2\}$$

**Que. – 5**

**A** Check whether the following systems are linear or not **5**

a) $y(n) = n^2 x(n)$ b) $y(n) = Bx(n) + C$

**B** Write down the steps and expressions for designing a lowpass digital Butterworth filter. **6**

**OR**

**Que. – 5** **11**

Design a second order discrete-time Butterworth filter, with cut-off frequency of 0.5 kHz and sampling frequency of 1000 samples/sec, by bilinear transformation.

**Que. – 6** **12**

Design a linear phase highpass FIR filter using Hamming window, with a cut-off frequency $\omega_c = 0.6\,\pi$ rad/sample and N=9 (samples).

Given, Hamming window function $W_H(n) = 0.54 + 0.46 \cos\left(\frac{2\pi n}{N-1}\right)$

END OF PAPER