Graphic Era HILL UNIVERSITY
Established by an Act of the State Legislature of Uttarakhand (Adhinyam Sankhya 12 of 2011)
University under section 2(f) of UGC Act, 1956

End Term (Even) Semester Examination May-June 2025

Roll no.....

Name of the Program and semester: B-Tech ECE, VI Semester
Name of the Course: *Digital Signal Processing*
Course Code: TEC-602
Time: 3 hour **Maximum Marks: 100**

Note:
(i) **All the questions are compulsory.**
(ii) **Answer any two sub questions from a, b and c in each main question.**
(iii) **Total marks for each question is 20 (twenty).**
(iv) **Each sub-question carries 10 marks.**

Q1. **CO1 (2X10=20 Marks)**
a. **Explain the methods for efficient computation of the DFT of 2N-Point real sequences.**
b. **Differentiate between DTFS & DTFT based on few important properties.**
c. **Find the 8-point DFT of the sequence x(n)= cos (nπ/4).**

Q2. **CO2 (2X10=20 Marks)**
a. **Determine the IDFT of X(k) = {1, (1 + j), 2, (2 – j)}.**
b. **Given x(n) = {0, 1, 2, 3, 4, 5, 6, 7}, find X(k) using DIT FFT algorithm**
c. **Given $x(n) = 2^n$ and N = 4, find X(k) using DIT FFT algorithm.**

Q3. **CO3 (2X10=20 Marks)**
a. **Compare direct form-I and direct form-II realization of a third-order IIR filter. Which among the two is canonic and why ?**
b. **Obtain a cascade realization of the system characterized by the transfer function.**

$$H(z) = \frac{2z^{-3}(1+2z^{-1})}{(1-0.1z^{-1})(1+0.5z^{-1})(1+0.4z^{-1})}$$

c. Determine the parallel realization of the IIR digital filter transfer function:

$$H(z) = \frac{3z(5z-2)}{(z+\frac{1}{2})(3z-1)}$$

Q4. **CO4 (2X10=20 Marks)**
a. **Design a digital Butterworth filter that satisfies the following constraint using bilinear transformation. Assume T = 1 s.**

$$0.9 \le |H(e^{j\omega})| \le 1 \qquad 0 \le \omega \le \pi/2$$
$$|H(e^{j\omega})| \le 0.2 \qquad 3\pi/4 \le \omega \le \pi$$

b. **Explain any two most efficient windowing techniques for FIR filter design.**

c. **Determine H(z) using the impulse invariant technique for the analog system**

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Function:

$$H(s) = \frac{1}{(s+0.5)(s^2+0.5s+2)}$$

Q5. **CO5 (2X10=20 Marks)**

a. Discuss multi rate signal processing and its applications.
b. What are the advantages of DSP processors in relation to general-purpose processors?.
c. Draw the schematic block diagram of the TMS320C5X processor architecture and explains the majors blocks.