Roll No……..

Dr B R Ambedkar National Institute of Technology, Jalandhar

B Tech (Electrical Engineering)

EEPC–304, Digital Signal Processing

End Semester Examination, May 2021

Duration: 02 Hours Max. Marks: 40 Date: 11th May 2021

Marks Distribution & Mapping of Questions with Course Outcomes (COs)											
Question Number	1	2	3	4	5	6	7	8	9		
Marks	5	5	5	5	5	5	5	5	5		
CO No.	1	1	2	2	2	2	4	4	5		
Learning Level	1	2	2	3	2	1	3	3	1		

Note:

1. Attempt any 8 questions.
2. Write the answers in hard copy (on A4 sheet) using blue/black pen with your signature on top left and page number on top right corner of each page of the answer booklet.
3. The time allowed for writing examination is 02 hours. Extra 15 minutes are allowed for preparing the PDF file of Answer Booklet and submitting it.
4. Follow the instructions regarding submission of answer booklet as issued by the examination section.

1. Show that
   a) A discrete time sinusoid is periodic only if its frequency *f* is a rational number.
   b) Discrete time sinusoids whose frequencies are separated by an integer multiple of 2π are identical.
2. Consider the analog signal $x_a(t)=3\cos(x\pi t)$
   where (*x = 100 +* last two digits of your roll no.)
   a) Determine the minimum sampling rate required to avoid aliasing.
   b) Suppose that the signal is sampled at the rate $F_s=2x$ Hz. What is the discrete time signal obtained after sampling.
   c) Suppose that the signal is sampled at the rate $F_s=3x/4$, what is the discrete time signal obtained after sampling?

d) What is the frequency $0<F<F_s/2$ of a sinusoid that yields samples identical to those obtained in part (c)?

3. Determine the z-transform of the signal $x(n)=a^n \sin(\omega_0 n)u(n)$
4. Let $x(n)$ be a sequence with z-transform $X(z)$. Determine in terms of $X(z)$, the z-transform of the signal

$$x_1(n)=\begin{matrix} x(n/2), if\ n\ even \\ 0, if\ n\ odd \end{matrix}$$

5. The first five points of the eight-point DFT of a real valued sequence are $[0.35, 0.125+j0.3018, 10, 0.135-j0.518, 0]$. Determine the remaining three points.
6. Discuss the Decimation in Time FFT algorithm and hence evaluate the FFT of the sequence [1, 1, 1, 1, 0, 0, 0, 0].
7. Design a low pass FIR filter $h(n)$ of length 7 with a cut-off frequencies of $\omega_c=\pi/4\ radians/sample$.
8. Design a single-pole lowpass digital filter with 3-dB bandwidth of 0.5π radians/sample, using the bilinear transformation applied to the analog filter

$$H(s)=\frac{2\Omega_c}{s+\Omega_c}$$

where Ω_c is the 3-dB bandwidth of the analog filter.

9. Discuss the architecture of Digital Signal Processors.

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