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Name of Examination : **Winter 2020** - (Preview)

Course Code & Course Name : **ET303 - Digital Signal Processing**

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Maximum Marks : **60**

Duration : **3 Hrs**

[Edit](#) [Print](#) [View Answer Key](#) [Close](#) **Answer Key Submission Type:** Marking scheme with model answers and solutions of numerical

Instructions:

1. Solve any four questions.
2. Illustrate your answer with suitable figures/sketches wherever necessary.
3. Assume suitable additional data; if required.
4. Use of logarithmic table, drawing instruments and non programmable calculators is allowed.
5. Figures to the right indicate full marks.

- 1) a) What are the merits of digital signal processing over analog signal processing? Draw and explain block diagram of digital signal processing system. [8]
 b) Convert the analog filter with system function $H_a(s) = \frac{(s+0.2)}{(s+0.2)^2+9}$ into a digital filter by means of impulse invariant technique. Assume $T=1$ s. [7]
- 2) a) An analog signal $x_a(t) = \sin(480\pi t) + 3\sin(720\pi t)$ is sampled 600 times per second [7]
 Determine-
 1. Nyquist sampling rate.
 2. Folding frequency
 3. What are the frequencies in radian in the resulting discrete time signal $x(n)$?
 b) Given $x(n) = \{0, 1, 2, 3, 4, 5, 6, 7\}$ Find $X(k)$ using DITFFT algorithm. [8]
- 3) a) Design a Butterworth digital IIR lowpass filter using bilinear transformation to satisfy following specifications: [8]
 $0.6 \leq H(e^{jw}) \leq 1.0 \quad 0 \leq w \leq 0.35\pi$
 $H(e^{jw}) \leq 0.1 \quad 0.7\pi \leq w \leq \pi$
 Use $T=0.1$ s.
 b) State and prove convolution property of Z transform. [4]
 c) Compare between Bilinear transformation method and impulse invariant method. [3]
- 4) a) Obtain direct form II and cascade realizations for the system: [4]
 $y(n) = -0.1y(n-1) + 0.2y(n-2) + 3x(n) + 3.6x(n-1) + 0.6x(n-2)$
 b) What is Gibb's phenomenon? How is it reduced? [4]
 c) A low pass filter is to be designed with the following desired frequency response [7]
 $H_d(e^{jw}) = \begin{cases} e^{-j2w}, & -\frac{\pi}{4} \leq w \leq \frac{\pi}{4} \\ 0, & \frac{\pi}{4} < |w| \leq \pi \end{cases}$
 Determine the filter coefficients $h_d(n)$ if the window function is
 $w(n) = \begin{cases} 1, & 0 \leq n \leq 4 \\ 0, & \text{otherwise} \end{cases}$
 Also determine the frequency response $H(e^{jw})$ of the designed filter.
- 5) a) Explain any four factors that influence selection of a digital signal processor. [4]
 b) If the impulse response of the system is $h(n) = [(0.5)^n + n(0.2)^n]u(n)$ [4]
 1. Compute the transfer function
 2. Obtain the difference equation of the system
 c) Perform circular convolution of sequence $x_1[n] = \{1, 3, 5, 3\}$, $x_2[n] = \{2, 3, 1, 1\}$ [4]
 Show the graphical representation for all combinations.
 d) Write short note on linear filtering using overlap add method. [3]

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