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MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

V SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING)
MAKEUP EXAMINATIONS, DECEMBER 2019

DIGITAL SIGNAL PROCESSING [ELE 3102]

REVISED CREDIT SYSTEM

Time: 3 Hours **Date: 21 December 2019** **Max. Marks: 50**

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.

1A. An analog signal is given by, $x(t) = 2\sin(250\pi t) + 3\cos(400\pi t) - \sin(600\pi t) + 5\sin(750\pi t)$ If it is sampled at a rate of 500Hz, determine the generated discrete-time signal. Illustrate aliasing if any. ***(04)***

1B. Define circular convolution property of DFT. An LTI system has impulse response $h(n) = \sin(\frac{\pi n}{2})$ for 0 ≤ n ≤ 3 and input $x(n) = 2^{n-1}u(n-1)$ for 0 ≤ n ≤ 3. Using circular convolution compute the response of the system. ***(04)***

1C. The first 5 points of 8-point DFT of a real valued sequence are {28, -4+j9.565, -4+j4, -4+j1.656, -4}. Determine the remaining points. State the property of DFT used to solve this problem. ***(02)***

2A. Illustrate the over-lap add method for filtering long data sequence for x(n)= [**3**, – 1, 0, 1, 3, 2, 0, 1, 2, 1, -2, 3] and h(n) = [1, -1, 1]. Take length of the data block as 3. ***(03)***

2B. Signal $x(n) = 10\sin(20\pi t) + 20\cos(40\pi t)$ is sampled at 80Hz and 64 samples are collected. 64 point DFT, X(k) is then computed. At what k values, would you expect to see peaks in the DFT? ***(03)***

2C. Compute the 8-point DFT of the sequence x(n) = {0.5, 0.5, 0.5, 0.5, 0, 0, 0, 0} using DIF algorithm. Draw the signal flow graph and show all the intermediate values. ***(04)***

3A. Realize the lattice structure for the LTI system defined by the difference equation, $y(n) = x(n) + 2x(n-1) + 5x(n-2) - 4x(n-3)$ ***(04)***

3B. Obtain the parallel form and direct form-II structure realizations for the LTI system described by the system function,

$$H(z) = \frac{8z^3 - 4z^2 + 11z - 2}{(z - \frac{1}{4})(z^2 - z + \frac{1}{4})}$$

(04)

3C. Explain Gibb's phenomenon in FIR design using windows. ***(02)***

4A. Briefly explain pole-zero placement method for low-pass, high-pass and notch IIR filter design ***(03)***

4B. Explain the properties of Chebyshev type-I filter. Discus about pole location for low pass filter ***(03)***

4C. Design a linear phase FIR band stop filter having cut-off frequencies 100Hz and 200Hz. Choose sampling frequency, Fs=1KHz. Use 9 length rectangular window. ***(04)***

5A. Describe the digitization of analog filter using impulse invariance transformation technique ***(03)***

5B. Design a digital low pass Butterworth filter using Bilinear transformation method to meet the given specifications. Pass-band ripple must be less than or equal to 1.25dB at pass-band edge frequency of 200Hz. Stop-band attenuation must be greater than or equal to 15dB at stop-band edge frequency of 400Hz. Sampling frequency is 2KHz. ***(05)***

5C. With a neat block diagram, explain the digital signal process. ***(02)***