BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION MO/2022)

CLASS: BTECH **SEMESTER : V**
BRANCH: ECE **SESSION : MO/2022**

SUBJECT: EC305 SIGNAL PROCESSING TECHNIQUES

TIME: 03 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates**

Q.1(a) First five values of an 8-point DFT sequence $|H(k)|$ are given as {0.1, 0.2, 0.1, 0.25, 0.25}. Find the next three points of $|H(k)|$. [2]

Q.1(b) Find the IDFT of the sequence $Y(k) = \{1, 0, 1, 0\}$. [3]

Q.1(c) Verify the stability of the following system. [5]

$$y(n) - \frac{5}{2}y(n-1) + y(n-2) = x(n) - x(n-1)$$

Q.2(a) How many number of additions, multiplications and memory locations are required to realize a system $H(z)$ having M-zeros and N poles in a (i) Direct form -I structure (ii) Direct form -II structure. [2]

Q.2(b) What are the different quantization methods in digital signal processing. What is the effect of quantization on pole locations? Which realization is less sensitive to the process of quantization. [3]

Q.2(c) Realize the given filter function in parallel form. [5]

$$H(z) = \frac{3 + 3.6z^{-1} + 0.6z^{-2}}{1 + 0.1z^{-1} - 0.2z^{-2}}$$

Q.3(a) Discuss a method to derive an analog Band pass transfer function from a given analog Low pass transfer function. [2]

Q.3(b) Convert the given Low pass filter function to a high pass filter function. [3]

$$H(z) = \frac{1 + az^{-1}}{\left(1 + bz^{-1}\right)^2}$$

Q.3(c) Determine the order of the Low pass filter for the given specifications. Maximum passband attenuation $\alpha_p = 1\,dB$, minimum stop band attenuation $\alpha_s = 30\,dB$, pass band frequency $\Omega_p = 200 \quad rad/\sec$, and the stopband frequency $\Omega_s = 600 \quad rad/\sec$. [5]

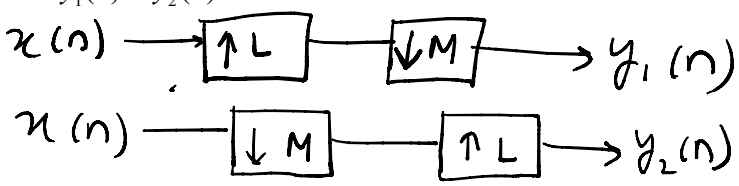
Q.4(a) Compare the different transformation techniques for designing IIR filters. [2]

Q.4(b) What is the need for employing window technique for FIR filter design? Draw the frequency response of N-point rectangular window. [3]

Q.4(c) Obtain the impulse response of digital filter corresponding to an analog filter with impulse response $h_a(t) = 0.5e^{-2t}$ and with a sampling rate of 1 Hz, using impulse invariance method. State, why impulse invariance method is not preferred in the design of IIR filter other than lowpass filter. [5]

Q.5(a) Define decimation and interpolation. What is the need for anti-aliasing filter prior to downsampling? [2]

Q.5(b) Show that $y_1(n) \neq y_2(n)$. [3]



Q.5(c) Describe a procedure for down sampling by a factor of 3 using polyphase arrangement. [5]

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