Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

FOURTH SEMESTER BTECH. (E & C) DEGREE END SEMESTER EXAMINATION

JULY 2022

SUBJECT: DIGITAL SIGNAL PROCESSING (ECE - 2255)

TIME: 3 HOURS **MAX. MARKS: 50**

Instructions to candidates

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

Q. No.	Questions	M*	C*	A*	B*
1A.	Use unilateral z transform to find the response y(n)≥0, for the system described by the difference equation y(n)=x(n-1)+0.5y(n-1) with $x(n) = 0.25^n u(n)$ *and* $y(-1) = 1$.	5	1	1,2	3
1B.	Given two 8 point sequence x_1(n)=[A,C,A,D,E,M,I,C] and x_2(n)=[E,M,I,C,A,C,A,D] with 8 point DFT's X_1(K) and X_2(K). Express X_2(K) in terms of X_1(K) in a simplified form.	3	2	1.2	3
1C.	Mention the procedure of overlap save method for filtering of long data sequences.	2	2	1,2	2
2A.	Develop DIFFFT algorithm for N=8. Compute 8-point DFT of a sequence $x(n) = \{3, 2, 1, 0, 1, 2\}$ using DIFFFT algorithm.	5	2	1,2	3
2B.	Explain how the Goertzel algorithm exploits the periodicity of the complex phase factor and obtain realization of the system to compute the DFT as a linear convolution.	3	2	1,2	2
2C.	Obtain the direct form-II structure for the following system $y(n) = \frac{3}{4}y(n-1) - \frac{1}{8}y(n-2) + x(n) + \frac{1}{3}x(n-1)$.	2	3	1,2	3
3A.	Determine the system function of a second order analog Chebyshev type-1 low pass filter with pass band cut-off frequency 200 Hz at sampling frequency of 1000Hz. The allowable ripple in the pass band is 2dB.	5	3	1,2	3
3B.	Determine the order of a lowpass Butterworth filter that has a -3dB bandwidth of 500Hz and a stopband attenuation of -40dB at 1000Hz.	3	3	1,2	3

3C.	Derive the equation for phase response of an odd antisymmetric linear phase FIR filter.	2	4	1,2	2
4A.	A low pass filter is to be designed with the following desired frequency response: $$H_d(e^{jw}) = \begin{cases} e^{-j3w}, & for -\frac{\pi}{2} \le \omega \le \frac{\pi}{2} \\ 0, & for \frac{\pi}{2} \le \omega \le \pi \end{cases}$$ Determine the filter coefficients for M=7 using Hanning window.	5	4	1,2	3
4B.	For the above question given in Q4A, determine the transfer function H(z) and the frequency response $H(e^{jw})$ of the designed filter.	3	4	1,2	3
4C.	Explain the zero-location symmetry property of linear-phase FIR filter.	2	4	1,2	2
5A.	Obtain the lattice ladder structure for $y(n) = -0.1y(n-1) + 0.72y(n-2) + x(n) - 0.8x(n-1) + 0.15x(n-2)$	5	3	1,2	4
5B.	Describe Welch method of PSD estimation. Highlight the computation requirement of this method.	3	5	1,2 ,18	2
5C.	List the AR model estimation methods.	2	5	1,2 ,18	2

M*--Marks, C*--CLO, A*--AHEP LO, B* Blooms Taxonomy Level