Reg. No.										

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

FOURTH SEMESTER BTECH. (E & C) DEGREE END SEMESTER EXAMINATION
JUNE 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.	Determine the location of poles and all possible impulse response associated with the system function $H(z) = \frac{5z^{-1}}{3-7z^{-1}+2z^{-2}}$. Indicate ROC of H(z) in each case	5	1	1,2	3
1B.	Using DFT-IDFT method determine the response of LTI system with impulse response h(n)= [1,2] to the input x(n)= [1,2,1].	3	2	1,2	3
1C.	Mention the procedure of overlap add method for filtering of long data sequences.	2	2	1,2	2
2A.	Develop DITFFT algorithm for N=8. Compute 8-point DFT of a sequence $x(n) = \{0.5,\ 0.5,\ 0.5,\ 0.5\}$ using DITFFT 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 parallel 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.	A second order low-pass Butterworth filter is required to meet the following specifications: $\omega_p = 0.3\pi$, $\omega_s = 0.7\pi$, -2dB ripple in the passband and a stopband attenuation of -20dB. Determine the pre-warped analog edge frequencies Ω_p *and* Ω_s, 3-dB cut off frequency Ω_c and transfer function H(s) of the filter, using bilinear transformation at 6Hz sampling.	5	3	1,2	3
3B.	For the above question given in Q3A, Obtain the digital filter system function H(z) using bilinear transformation at 6Hz sampling.	3	3	1,2	3

3C.	Derive the equation for phase response of an even symmetric linear phase FIR filter.	2	4	1,2	2
4A.	A low pass linear phase FIR filter is to be designed with the following desired frequency response: $$H_d(e^{jw}) = \begin{cases} e^{-j3w}, & for -\frac{\pi}{2} \leq \omega \leq \frac{\pi}{2} \\ 0, & for\ \frac{\pi}{2} \leq \omega \leq \pi \end{cases}$$ Determine the filter coefficients for M=7 using Hamming 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 limitation of rectangular window function for the design of FIR filters.	2	4	1,2	2
5A.	Obtain the lattice ladder structure for $H(z) = \frac{1+2z^{-1}+3z^{-2}+2z^{-3}}{1+0.9z^{-1}-0.8z^{-2}+0.5z^{-3}}$	5	3	1,2	4
5B.	Describe Bartlett method of Power spectrum estimation. Highlight the computation requirement of this method.	3	5	1,2 ,18	2
5C.	List the advantages of Non parametric methods.	2	5	1,2 ,18	2

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