DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Winter Examination – 2022

Course: B. Tech. **Branch: Electronics Engg.** **Semester: V**

Subject Code & Name: Digital Signal Processing (BTEXC502)

Max Marks: 60 **Date:31/01/2023** **Duration: 3 Hr.**

Instructions to the Students:

1. *All the questions are compulsory.*
2. *The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in ( ) in front of the question.*
3. *Use of non-programmable scientific calculators is allowed.*
4. *Assume suitable data wherever necessary and mention it clearly.*

		(Level/CO)	Marks
Q. 1	**Solve Any Two of the following.**		**12**
A)	List out the advantages and drawbacks of Digital Systems over Analog Systems.	**Remember**	**6**
B)	Determine the Nyquist rate corresponding to following signals 1. $x(t) = 5sin(100\pi t) - 8cos(250\pi t) - 15sin(400\pi t)$ 2. $x(t) = sinc(200\pi t) + sinc(400\pi t)$	**Evaluate**	**6**
C)	Illustrate the sampling theorem along with concept of oversampling and under sampling.	**Understand**	**6**
Q.2	**Solve Any Two of the following. `**		**12**
A)	Illustrate any three properties of N-point DFT.	**Understand**	**6**
B)	Evaluate the output of Discrete system represented with system input given as x(n) = {2, -1, 4, 8} & system's impulse response h(n) = {2} Use N-point DFT & IDFT.	**Evaluate**	**6**
C)	Determine 8-point DFT X[k], If $x(n) = \{3, 4, 6, 4, 3, 4, 6, 4\}$. Use 8-point DIT-FFT Radix-2 algorithm.	**Evaluate**	**6**
Q. 3	**Solve Any Two of the following.**		**12**
A)	Evaluate the system transfer function H(z) and impulse response h(n) of the system represented with its difference equation as: $y(n) = x(n) + y(n-1) + 2y(n-2)$	**Evaluate**	**6**
B)	Evaluate the Z-transform of given signal $x(n) = \cos w_0 n * u(n)$.	**Evaluate**	**6**
C)	Determine Inverse Z-Transform of given Z-transform of signal: $X[z] = \frac{2z^2}{z^2 - 5z + 6}$ ROC: |z| < 2 Use Partial Fraction Method.	**Evaluate**	**6**

Q.4	**Solve Any Two of the following.**		**12**
A)	Digital IIR Butterworth Filter is to be designed with the following specifications using Impulse Invariance method: $$0.8 \leq \mid H(e^{jw}) \mid \leq 1 : 0 \leq w \leq 0.2\pi$$ $$\mid H(e^{jw}) \mid \leq 0.2 : 0.6\pi \leq w \leq \pi$$ Assume Ts=1 sec Determine: 1. Order of the Filter (N) 2. Cut-ff Frequency of the Filter (Ωc)	**Evaluate**	**6**
B)	Relate IIR Filters with FIR Filters.	**Remember**	**6**
C)	A digital filter with 3 dB bandwidth of 0.25π is to be designed from the analog filter whose system function is: $$H(s) = \frac{\Omega_c}{s + \Omega_c}$$ Use Bilinear Transformation and evaluate H(z).	**Evaluate**	**6**
Q. 5	**Solve Any Two of the following.**		**12**
A)	Design Digital FIR LPF with following specifications: $$H(e^{jw}) = e^{-j3w} : \frac{-\pi}{2} \leq w \leq \frac{\pi}{2}$$ $$H(e^{jw}) = 0 : Otherwise$$ Use Rectangular window. Assume Filter length N=7.	**Create**	**6**
B)	For a Linear Phase FIR Filter represented with its difference equation: $$y(n) = 2x(n) + \frac{2}{3}x(n-1) + \frac{4}{5}x(n-2) + \frac{4}{5}x(n-3) + \frac{2}{3}x(n-4) + 2x(n-5)$$ Develop Direct form and Linear Phase realization structures of given system.	**Apply**	**6**
C)	Illustrate the use of Multi-rate Digital Signal Processing in the following applications: 1. Implementation of a narrow-band Low Pass Filter 2. Filter banks	**Understand**	**6**

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