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PRESIDENCY UNIVERSITY BENGALURU

 SCHOOL OF ENGINEERING

 SUMMER TERM END TERM EXAMINATION - AUGUST 2024

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| **Semester : 4** | **Date :7-8-2024** |
| **Course Code : CSA3056**  | **Time :9:30AM- 12:30PM** |
| **Course Name : INTELLIGENT SIGNAL PROCESSING** | **Max Marks :100**  |
| **Program :BCA** | **Weightage :50%** |

**Instructions:**

1. *Read all questions carefully and answer accordingly.*
2. *Question paper consists of 3 parts.*
3. *Scientific and non-programmable calculator are permitted.*
4. *Do not write any information on the question paper other than Roll Number.*

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| **PART A** |
|  **ANSWER ANY 5 QUESTIONS 5Q X 4M=20M** |
| 1 | Signal processing is a field of engineering, mathematics, and computer science that deals with processing, analyzing, and manipulating analog and digital signals. What is aliasing during sampling ? | (CO 1) | [Knowledge] |
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| 2 | **Adaptive filtering** is a class of algorithms that can adapt to changing signals or environments. Multiply the two signals, $x\_{1}\left(n\right)=\{1, 2, 3, 4\}$ and $x\_{2}\left(n\right)=\{1, 2, 3, 4\}$. | (CO 1) | [Application] |
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| 3 | **Convolution** is an algorithm that is used to perform filtering, prediction, and smoothing of signals. Convolve the given two discrete signals using tabulation method, $x\_{1}\left(n\right)=\{1, 2,1,1\}$ and $x\_{2}\left(n\right)=\{1, 1, 1, 1\}$. | (CO 2) | [Application] |
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| 4 | Signal processing techniques are used in biomedical engineering to analyze and interpret signals from medical devices such as electrocardiograms (ECGs) and magnetic resonance imaging (MRI) scanners. Compare DIT- FFT and DIF FFT. | (CO 2) | [Knowledge] |
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| 5 | Signal processing techniques are used in a wide range of applications, including telecommunications, audio and video processing, image processing, speech recognition, and control systems. Why Fast Fourier Transform is needed? | (CO3) | [Knowledge] |
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| 6 | Feature Extraction is the process of identifying or estimating a desired representative signal component. Write about the compression modes of MPEG. | (CO 3) | [Knowledge] |
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| 7 | The disciplines of signal and image processing are concerned with the analysis and synthesis of signals and their interaction with systems. Why we need compression in digital data? | (CO 4) | [Knowledge] |

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| **PART B** |
|  **ANSWER ANY 4 QUESTIONS 4Q X 10M=40M** |
| 8 | Many signals and systems change over time, and modeling and analyzing these time-varying systems can be challenging. Perform circular convolution of the two sequences, $x\_{1}\left(n\right)=\{1, 1, 1, 2\}$ and $x\_{2}\left(n\right)=\{1, 1, 1, 1\}$. | (CO 1) | [Application] |
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| 9 | Control is a process of generating and injecting a signal to properly guide a system’s operation. Find whether the following signals are odd or even.1. $x\left(t\right)=t$ b) $y\left(t\right)=e^{-5t}$
 | (CO 1) | [Application] |
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| 10 | The bandwidth of a communication channel is the range of frequencies over which it can transmit signals. Explain in detail about sampling theorem. | (CO 2) | [Comprehension] |
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| 11 | Lossy compression, also known as irreversible compression, is a data compression method that reduces file size by permanently removing some information. Explain in details about predictive coding and variable length coding. | (CO 3) | [Comprehension] |
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| 12 | Coding is to convert a signal to a different format so that it may be more immune to interference, or better suited for storage or transmission. Find the 4-point DFT for the sequences, $x\left(n\right)=\{1, 1, 1\}$. | (CO 3) | [Application] |
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| 13 | The file format is the structure of a file that tells a program how to display its contents. Write about audio and video file formats with suitable examples. | (CO 4) | [Application] |

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| **PART C** |
|  **ANSWER ANY 2 QUESTIONS 2Q X 20M=40M** |
| 14 | A complex number has real and imaginary parts, complex number notation is also useful for compactly representing signals having two independent components. Compute 4-point DFT and 8-point DFT of causal three sample sequence is given by, $x\left(n\right)=\left\{\begin{array}{c}\frac{1}{3}; 0\leq n\leq 2\\0; else\end{array}\right\}$. | (CO 1) | [Application] |
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| 15 | Analog and digital signal processing are based on similar theories and mathematics; these include calculus, differential and difference equations, and complex numbers. Apply Shannon Fano coding and Huffman coding for the following source and its probabilities, P(A)= 0.30, P(B)= 0.10, P(C)= 0.02, P(D)= 0.15, P(E)= 0.40, P(F)= 0.03. | (CO 2) | [Comprehension] |
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| 16 | Analog signals are electrical representations of waveforms originally found in other forms, such as pressure or temperature. Explain in detail about MPEG Compression. | (CO 4) | [Comprehension] |