



Indian Institute of Information Technology Allahabad Department of Electronics and Communication Engineering Digital Signal Processing 2022-2022

Date: 25/02/2022 **C1-Review Test** Max. Marks: 25*

10:00 AM -12.00 PM

Notes to the students:

1. Students must show all the steps while solving the questions. No marks shall be awarded for writing direct answer without showing all the necessary steps.

Submission Instructions: Answer each question. Write your name, ID Number on the first page of your answer sheet. Once your hand-written responses are prepared, scan the solution and convert it to a PDF file. Name the PDF file by your ID Number only and submit it through Google classroom. Please adhere to the submission deadline, as announced and also mention answer and page numbers properly.

- **Q.1.** a. Draw the waveform of the given signal: x(t) = u(t) 2u(t-1) + u(t-2).
 - **b.** Determine whether the given signal is periodic: $x(n) = \sum_{k=-\infty}^{\infty} [\delta(n-4k) \delta(n-1-4k)]$
 - c. Consider the continuous-time signal $x(t) = \delta(t+2) \delta(t-2)$.

Calculate the value of E_v (Energy) for the following signal: $\mathbf{y}(\mathbf{t}) = \int_{-\infty}^{\mathbf{t}} \mathbf{x}(\tau) d\tau$

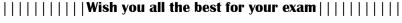
- **d.** Find the even and odd components of the signal $x(t) = e^{-2t} cos(t)$
- e. Determine the values of power and energy of the given signal: $x(n) = cos(\frac{\pi}{4}n)$
- Q.2. Check the following system using (i) static, (ii) stable, (iii) causal, (iv) linear or (v) time-invariant $y(t) = \begin{cases} 0, & t < 0 \\ x(t) + x(t-2), & t \geq 0 \end{cases}$ of the given signal:
- Q.3. a. Find the convolution of the two continuous-time signals $x(t) = 3\cos(2t)$, for all t and

$$h(t) = e^{-|t|} = \begin{cases} e^t, & t < 0 \\ e^{-t}, & t \ge 0 \end{cases}$$

- **b.** Find the autocorrelation function $R_{xx}(\tau)$ of the sine wave signal $x(t) = A \sin(w_0 t + \phi), w_0 = \frac{2\pi}{\tau}$
- **Q.4.** Consider the signal $x(n) = \alpha^n u(n)$
 - **a.** Determine the signal $g(n) = x(n) \alpha x(n-1)$.
 - b. Use the result of part (a) in conjugation with properties of convolution in order to determine a sequence h(n) such that $x(n) \circledast h(n) = \left(\frac{1}{2}\right)^n [u(n+2) - u(n-2)].$
- Q.5. a. Let x(n) be a periodic signal with period N=8 and Fourier series coefficients $X_k=-X_{k-4}$. A signal $y(n) = (\frac{1+(-1)^n}{2})x(n-1)$ with period N=8 is generated. Denoting the Fourier series coefficients of y(n) by Y_k , find a function such that $Y_k = f(k)X_k$
 - **b.** Let x(n) denote a causal, complex-valued sequence with Fourier transform

$$X(e^{jw}) = X_R(e^{jw}) + jX_I(e^{jw})$$
. If $X_R(e^{jw}) = 1 + \cos(w) + \sin(w) - \sin(2w)$, determine $X_I(e^{jw})$

***** Please make sure that your answers should not be plagiarized from any source and should be based on your own learning/research from the course ******



"Do the best you can until you know better. Then when you know better, do better."