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Roll No:

(To be filled in by the candidate)

PSG COLLEGE OF TECHNOLOGY, COIMBATORE - 641 004

SEMESTER EXAMINATIONS,   APRIL (PHASE I) 2019

MSc - SOFTWARE SYSTEMS   Semester : 3

15XW33   TRANSFORM TECHNIQUES

Time : 3 Hours **Maximum Marks : 100**

INSTRUCTIONS:
1. Answer **ALL** questions. Each question carries 20 Marks.
2. Subdivision (a) carries 3 marks each, subdivision (b) carries 7 marks each and subdivision (c) carries 10 marks each.

1. a) Is the Laplace transform of $f(t) = \frac{1}{t}$ exists? Justify your answer.

   b) i) State t −shifting theorem in Laplace transforms. (3)

   ii) What do you mean by convolution? Give the geometrical interpretation of convolution of two functions. (4)

   c) i) Solve $y'' + 3y' + 2y = r(t), y(0) = y'(0) = 0$ where $r(t) = \begin{cases} 1 & if \ 1 < t < 2 \\ 0 & otherwise \end{cases}$ using Laplace transform.

(OR)

   ii) State and prove the convolution theorem and use it to find the inverse Laplace transform of $\frac{s}{(s^2+a^2)^2}$.

2. a) Without using actual integration evaluate $\int_0^\infty e^{-4t} sin^2 t \, dt$.

   b) Find the Laplace transform of $f(t) = \begin{cases} t & ,0 < t < 1 \\ -t & ,1 < t < 2 \end{cases}$ and $f(t+2) = f(t)$.

   c) Solve the integral equation $y(t) = t + \int_0^t y(\tau) \sin(t - \tau) \, d\tau$ using Laplace transform.

3. a) When a signal $x(t)$ is multiplied by $cos \, \omega t$ in the time domain, what is the result of the Fourier transform in frequency domain? Mention the name of this result.

   b) Find the Fourier transform of $e^{-ax^2}, a > 0$. Hence prove that $e^{-\frac{x^2}{2}}$ is self reciprocal under Fourier transform.

   c) i) Find the Fourier Transform $f(x) = \begin{cases} 1 - x^2 & for \ |x| < 1 \\ 0 & for \ |x| > 1 \end{cases}$. Hence evaluate $\int_0^\infty \left(\frac{\sin x - x \cos x}{x^3} \right) \cos \frac{x}{2} \, dx$.

(OR)

    ii) Find the Fourier sine and cosine transform of x^{n-1}. Hence deduce that $\frac{1}{\sqrt{x}}$ is self reciprocal under both the transformation. Also find the Fourier transform of $\frac{1}{\sqrt{|x|}}$.

4. a) Illustrate the computational efficiency of Fast Fourier Transform with an example.

    b) i) What do you mean by periodic sequence? Give an example.   (3)

       ii) Describe the two methods to find the convolution of two periodic sequences with their limitations. Compute the convolution of the following periodic sequences $\{1, 1, 0, 1\}$ and $\{1, 2, 3, 4\}$.   (4)

    c) Find the Discrete Fourier Transform of $\{1, -1, -1, -1, 1, 1, 1, -1\}$ using DIT-FFT.

5. a) What do you mean by wavelet? Why it is called so?

    b) i) How signal changes are detected using wavelet transform? Give an example with graphs and mention which wavelet transform is used in your example.   (3)

       ii) Explain the discritization process and the steps involved in the fast algorithm for the computation of Discrete Wavelet Transform.   (4)

    c) State the construction principle for wavelet. Construct the following wavelet with example: Haar wavelet, Mexican-hat-Wavelet and Morlet wavelet. Also give the existence conditions for the above.

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