No of Pages : 2 **Course Code : 15XW33**

Roll No:
(To be filled in by the candidate)

PSG COLLEGE OF TECHNOLOGY, COIMBATORE - 641 004

SEMESTER EXAMINATIONS, NOVEMBER 2018

MSc - SOFTWARE SYSTEMS Semester : 3

15XW33 TRANSFORMS TECHNIQUES

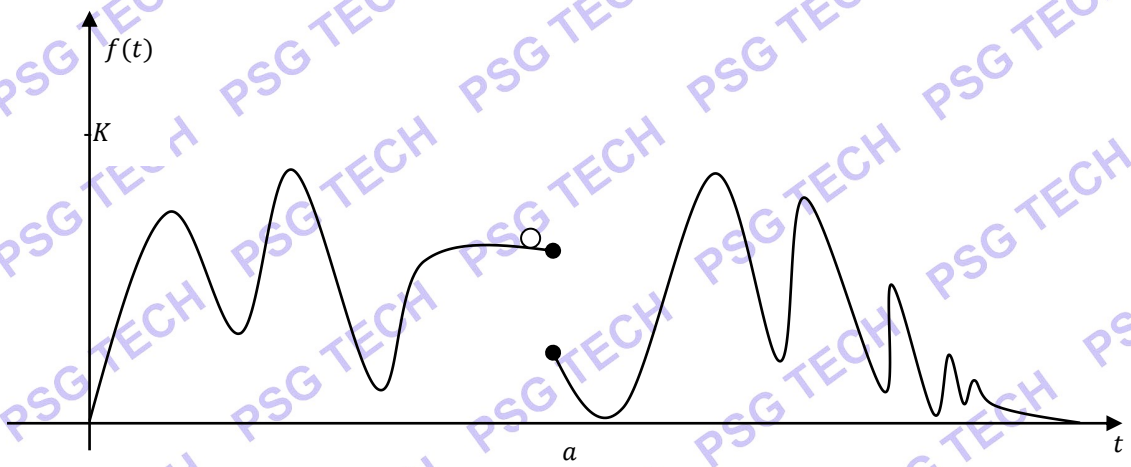
Time : 3 Hours **Maximum Marks : 100**

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.
3. Course Outcome : Table

Qn.1	CO1	Qn.2	CO2	Qn.3	CO3	Qn.4	CO4	Qn.5	CO5

1. a) Does the Laplace Transform of the function shown below exist? Justify your answer.



b) i) Consider a situation where a ship is hit by a high single wave in a small interval of time, what is the mathematical model of such situation? Also represent the model graphically. (3)

ii) State and prove s-shifting theorem in Laplace Transforms. Why it is called s-shifting? (4)

c) i) Solve $y'' - 4y' + 8y = e^{2t}, y(0) = 2, y'(0) = -2$ using Laplace Transform.

(OR)

ii) Solve the integral equation $y(t) = te^t - 2e^t \int_0^t e^{-\tau} y(\tau) d\tau$ using Laplace Transform technique.

2. a) Does the Inverse Laplace Transform of the function F(s) = $\ln\left(1 - \frac{a^2}{s^2}\right)$ exist? Justify.

b) i) Give the geometrical and physical meaning of convolution of two functions.

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ii) State and prove convolution theorem in Laplace Transform.

c) Find the Laplace Transform of the triangular wave $f(t) = \begin{cases} t & if\ 0 \le t \le a \\ 2a - t & if\ a \le t \le 2a \end{cases}$, given $f(t + 2a) = f(t)$.

3. a) Why Fourier integral representation is important in Science and Engineering?

b) i) What do you mean by self reciprocal function? Give an example of a function which is self reciprocal under Fourier Cosine Transform. (3)

ii) State and prove modulation property of Fourier Transforms. (4)

c) i) Find the Fourier Transform of $f(x) = \begin{cases} 1 - x^2 & for\ |x| < 1 \\ 0 & for\ |x| > 1 \end{cases}$. 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 Transforms of e^{-ax}. Hence find the following:

1) Fourier Sine and Cosine Transforms of xe^{-ax};

2) Cosine Transform of $e^{-|x|}$;

3) The value of the integrals $\int_0^\infty \frac{dx}{(a^2+x^2)^2}$, $\int_0^\infty \frac{x^2}{(a^2+x^2)^2} dx$.

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

b) i) Compute the linear convolution of the sequences $\mathrm{f(n)} = \{1, -1, 2\}$ and $\mathrm{g(n)} = \{1, 2\}$. (3)

ii) What do you mean by periodic sequences? Find the circular convolution of the periodic sequences $\{1, -1, 1, 3\}$ and $\{7, 2, 0, 1\}$. (4)

c) Find the Discrete Fourier Transform of $x(n) = \{1, -1, -1, -1, 1, 1, 1, -1\}$ using DIT-FFT algorithm.

5. a) What do you mean by energy function? State the admissibility condition.

b) i) What is the necessary and sufficient conditions for a function to be a wavelet. (3)

ii) For the discretely sampled signal $f = \{8, 4, 6, 8, 9, 7, 2, 4\}$ how will you arrive at the coarser signals $f^{'}$ and detail signal $d^{'}$ using the filter H. Hence write the expression for the continuous time signal for $f^{'}(t)$ in terms of the Haar scaling function $\phi_H(t)$. (4)

c) Construct Haar wavelet and Mexican-hat-Wavelet from their scaling functions. Also prove that the corresponding moments vanish.

FD/JU **/END/**