No of Pages : 3 Course Code : 15XW33

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

PSG COLLEGE OF TECHNOLOGY, COIMBATORE - 641 004

SEMESTER EXAMINATIONS, NOVEMBER - 2016

MSc – SOFTWARE SYSTEMS Semester : 3

15XW33 TRANSFORM TECHNIQUES

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

INSTRUCTIONS:

1. Answer **ALL** questions from GROUP – I.
2. Answer any **FIVE** questions from GROUP – II.
3. Answer any **ONE** question from GROUP – III.
4. Ignore the box titled as **"Answers for Group III"** in the Main Answer Book.
5. Graph sheet is to be provided.

GROUP - I **Marks : 10 x 3 = 30**

1. Let $f(t) = te^{2t}\sin t$. Find $L[f(t)]$. Hence Find $L[u(t-3)f(t-3)]$ where $f(t) = te^{2t}\sin t$.
2. Find the inverse Laplace transform of $\frac{s^2}{(s^2+2)(s^2+4)}$.
3. If $F_s\left(e^{-2t}\right) = \frac{s}{s^2+4}$, find $F_s\left(\frac{t}{t^2+4}\right)$ where $F_s(s)$ in the Fourier Sine transform of $f(t)$.
4. Find the Fourier transform of the function $f(t)$ given by the graph in Fig.1.

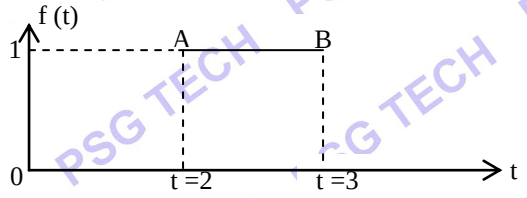

Fig.1

5. Prove that $F\left[\frac{d^n f(t)}{dt^n}\right] = (-is)^n F(s)$ where $F(s)$ is the Fourier transform of $f(t)$
6. Using matrix method find the Discrete Fourier Transform (DFT) of the sequence $f(n) = \{9, 3, -3, 3\}$.
7. Define the linear convolution of two real sequences of lengths N_1 and N_2. Hence or otherwise find the linear convolution of the sequences $f(n) = \{1, -1, 2\}$ and $g(n) = \{1, 2\}$.
8. Compare Wavelet Transform and Fourier Transform.
9. What is a Morlet Wavelet?
10. For the discretely sampled signal $f = [f_k]_0^7 = [8, 4, 6, 8, 9, 7, 2, 4]$ how will you arrive at the coarser signals $f' = [f'_k]_0^3$ and detail signal $d' = [d'_k]_0^3$ using filters H and G. Hence write the expression for the continuous time signal for $f'(t)$ in terms of the Haar scaling function $\phi_H(t)$.

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GROUP - II Marks : 5 x 10 = 50

11. a) Find the inverse Laplace transform of $F(s) = \tan^{-1}\left(\frac{s}{2}\right)$. [4]

b) Find the Laplace Transform of $f(t)$ given by $f(t) = \begin{cases} \frac{1}{h} & a \le t \le a+h \\ 0 & otherwise \end{cases}$

Hence find the Laplace Transform of the Dirac Delta function defined by $\delta(t) = \underset{h \to 0}{Lt}$ f(t) [6]

12. a) Show that $F_c\left[\frac{d}{dt} f(t)\right] = -\sqrt{\frac{2}{\pi}} f(0) + sF_s(s)$ where $F_c(s)$ and $F_s(s)$ denote the Fourier Cosine and Sine transforms of $f(t)$ respectively. [5]

b) Find the Laplace transform of $\left(\frac{1-e^t}{t}\right)$ [5]

13. Find the Fourier Transform of the function $f(t)$ defined by $f(t) = \begin{cases} 1-\frac{t}{2}, & 0 < t \le 2 \\ 1+\frac{t}{2}, & -2 < t < 0 \\ 0 & otherwise \end{cases}$

Hence find the Fourier transform of $e^{2it} f(t)$. [10]

14. Explain the procedure for finding Inverse Discrete Fourier Transform [I DFT] of a sequence F(k) to bring back the sequence f(n). Hence find the Inverse Fourier Transform of the sequence F(k) = {-4, 1, 0, 1} [10]

15. a) Show that for the Maxican hat wavelet $\Psi_{MH}(t) = \frac{2}{\sqrt{3}} \pi^{-1/4} (1-t^2) e^{-t^2/2}$ the first two moments vanish. [5]

b) Explain briefly the methods to find how signals are concentrated and compressed. Give sketches. [5]

16. a) How signal changes are detected using wavelet transform? Give an example with sketches and mention which wavelet transform was used in your example. [3]

b) Decompose a signal $f(t)$ as $f(t) = f'(t) + d'(t)$ where $f'(t)$ and $d'(t)$ are the coarse and detail signals respectively. Then show that the discrete wavelet transform of $d'(2,2k)$ is given by, $L\Psi_H d'(2,2k) = \sqrt{\frac{2}{c\Psi_H}} d'_K (k = 0,1,.....N-1\}$ [7]

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GROUP - III Marks : 1 x 20 = 20

17. a) Solve using Laplace Transform the differential equation $y''(t) + y'(t) - 2y(t) = -2$, given that $y(0) = 2$ and $y'(0) = 1$. [10]

b) Find the Laplace Transform of the periodic function given by

$$f(t) = \begin{cases} a \sin wt, & 0 \le t \le \pi/w \\ 0 & \pi/w < t \le 2\pi/w \end{cases}$$ and $f\left(t + 2\pi/w\right) = f(t)$, for all t. [10]

18. a) Explain the Fourier representations for different types of functions. Find the Discrete Fourier Transform of the sequence $f(n) = \{1, 2, 0, -1\}$. [10]

b) Explain periodic sequences and circular convolution of periodic sequences with their graphical representations. Find the circular convolution of the periodic sequences $f(n) = \{1, -1, 1, 3\}$ and $g(n) = \{7, 2, 0, 1\}$. [10]

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