**22SSP318**

**PSG COLLEGE OF ARTS & SCIENCE**
(AUTONOMOUS)

**MSc(SS) DEGREE EXAMINATION MAY 2024**
(Third Semester)

Branch – **SOFTWARE SYSTEMS (five year integrated)**

**TRANSFORMATION TECHNIQUES**

Time: Three Hours | Maximum: 50 Marks

**SECTION-A (5 Marks)**
Answer **ALL** questions
**ALL** questions carry **EQUAL** marks (5 x 1 = 5)

1. Laplace transform of f(t) is _______.
   (a) $\int_0^t e^{-st} f(t)\,dt$ (b) $\int_0^\infty e^{-st} f(t)\,dt$
   (c) $\int_0^t e^{st} f(t)\,dt$ (d) $\int_0^\infty e^{st} f(t)\,dt$

2. Inverse Laplace transform of $\frac{3}{s}$ is ______.
   (a) $e^{3t}$ (b) $e^{-3t}$ (c) 3t (d) 3

3. The sequence $(k) = 1$ , $k \in N$ is called _____ sequence.
   (a) Kronecker delta (b) Unit ramp (c) Unit step (d) Arithmetic

4. If $F(w)$ is the Fourier transform of $f(t)$ then $F[e^{jat} f(t)] =$ ___.
   (a) $F(w-a)$ (b) $F(w+a)$ (c) $aF(w-a)$ (d) $\frac{1}{a}F(w-a)$

5. The circular cross correlation of two periodic sequences $f[n]$ and $g[n]$, each of period N is defined as _____.
   (a) $\sum_{m=0}^{\infty} f[m]\,g[m-n]$ for $n = 0, 1, 2, \dots\dots, N-1$
   (b) $\sum_{m=0}^{\infty} f[m]\,g[m-n]$ for $n = 0, 1, 2, \dots\dots \infty$
   (c) $\sum_{m=0}^{N-1} f[m]\,g[m-n]$ for $n = 0, 1, 2, \dots\dots, N-mn$
   (d) $\sum_{m=0}^{N-1} f[m]\,g[m-n]$ for $n = 0, 1, 2, \dots\dots, N-1$

**SECTION - B (15 Marks)**
Answer **ALL** Questions
**ALL** Questions Carry **EQUAL** Marks (5 x 3 = 15)

6. (a) Determine Laplace transform of (i) $\cos(\frac{4t}{3})$ (ii) $\frac{cos7t}{e^{5t}}$.

   **(OR)**

   (b) Verify Final value theorem for $f(t) = e^{-3t}cost + 5$.

7. (a) Find the inverse Laplace transform of (i) $\frac{s+1}{s^2+1}$ (ii) $\frac{2}{(s+1)^2}$.

   **(OR)**

   (b) Find the inverse Laplace transform of $\frac{2s+3}{s^2+6s+13}$.

**Cont...**

8. (a) Find the sequence whose z transform is $\frac{1}{z^2(z-1)^2}$.

**(OR)**

(b) Use binomial theorem to expand $(1-\frac{1}{z})^{-3}$ upto the term $\frac{1}{z^4}$. Hence find the sequence with z transform $F(z) = \frac{z^3}{(z-1)^3}$.

9. (a) Use the properties of the delta function to deduce its Fourier transform.

**(OR)**

(b) Find the convolution of $f(t) = \begin{cases} \frac{2}{3}t & 0 \le t \le 3 \\ 0 & otherwise \end{cases}$ and $g(t) = \begin{cases} 4 & -1 \le t \le 3 \\ 0 & otherwise \end{cases}$

10. (a) Find the discrete fourier transform of the sequence $f[n] = 1, 2, -5, 3$.

**(OR)**

(b) Find the linear convolution $f * g$ where $f[n]$ is the sequence $3, 9, 2, -1$, and $g[n]$ is the sequence $-4, 8, 5$.

**SECTION -C (30 Marks)**

Answer **ALL** questions

**ALL** questions carry **EQUAL** Marks (5 x 6 = 30)

11. (a) State First shifting theorem. Find Laplace transform of $e^{-3t}t\ sin5t$.

**(OR)**

(b) Given the Laplace transform of $f(t)$ is $F(s)$, $f(0) = 2, f'(0) = 3$ find the Laplace transform of $3f'' - f' + f$

12. (a) Find $e^{-2t} * e^{-t}$. Use the convolution theorem to find the inverse Laplace transforms of $\frac{1}{(s+2)(s+3)}$.

**(OR)**

(b) Solve $x'' + 2x' + 2x = e^{-t}$ , $x(0) = x'(0) = 0$ using Laplace transform.

13. (a) The sequence $f(k)$ is defined by $f(k) = \begin{cases} 0 & k = 0,1,2,3 \\ 1 & k = 4,5,6,\ldots\ldots \end{cases}$

Write down the sequence $f[k+1]$ and verify that $Z\{f[k+1]\} = zF(z) - z f[0]$ where $F(z)$ is the $z$ transform of $f[k]$.

**(OR)**

(b) Find the inverse z transform of $\frac{(2z^3+z)}{(z-3)^2(z-1)}$.

14. (a) Find the Fourier transform of $f(t) = \begin{cases} 1-t^2 & |t| \le 1 \\ 0 & |t| > 1 \end{cases}$

**(OR)**

(b) Calculate the correlation of $f(t) = u(t)e^{-t}$ and $g(t) = u(t)e^{-2t}$, where u(t) is the unit step function. Also verify the correlation theorem for these functions.

15. (a) Find the matrix representing a three-point d.f.t. Also use the matrix to find d.f.t. of the sequence $f[n] = 4, -7, 11$.

**(OR)**

(b) Supose $f[n] = 7, 2, -3$ and $g[n] = 1, 9, -1$. Assume both sequences f and g start at $n = 0$. Find the linear cross-correlation $f * g$. Also develop a graphical interpretation of this process.

Z-Z-Z END