22SSP318

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

MSc(SS) DEGREE EXAMINATION DECEMBER 2023
(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. The Laplace transform of 2^t is _____.
   (i) $\frac{1}{s-log2}$ (ii) $\frac{1}{s-2}$ (iii) $\frac{1}{2s}$ (iv) $\frac{1}{s}$

2. Inverse Laplace transform of $\frac{1}{s^5}$ is ____.
   (i) $\frac{t^5}{24}$ (ii) $\frac{t^4}{12}$ (iii) $\frac{t^4}{24}$ (iv) t^3

3. $f(k) = 1, k \in N$ is a _____ sequence.
   (i) Kronecker delta (ii) Unit step (iii) Unit ramp (iv) ramp

4. If $F(w)$ is the Fourier transform of f(t) then $F[f(t-\alpha)] =$_____.
   (i) $e^{j\alpha w}F(w)$ (ii) $e^{\alpha w}F(w)$ (iii) F(w) (iv) $e^{-j\alpha w}F(w)$

5. The discrete fourier transform F(k) is periodic with period N then _____.
   (i) $F(kN) = F(k)$ (ii) $F(k+N) = F(k)$
   (iii) $F(k+N) = kF(k)$ (iv) $F(k+N) = f(k^2)$

SECTION - B (15 Marks)
Answer **ALL** questions
ALL questions carry **EQUAL** Marks (5 × 3 = 15)

6. (a) Find Laplace transform of (i) $t\,sint$ (ii) $e^{-3t}sinh4t$
   (OR)
   (b) Find Laplace transform of (i) $\frac{1}{3}sin3t - 4\cos(\frac{t}{2})$ (ii) $sinh2t + 3cosh2t$

7. (a) Find the inverse Laplace transform of $\frac{6s-5}{(s+5)(s+3)}$.
   (OR)
   (b) Find the inverse Laplace transform of $\frac{2s+1}{s^2-2s+2}$.

8. (a) Find the z transform of the sequence defined by $f[k] = k, k \in N$.
   (OR)
   (b) Find the z transform of $e^{-2k}cosk$.

9. (a) Find the Fourier transform of the function $f(t) = u(t)e^{-t}$, where u(t) is the unit step function.
   (OR)
   (b) Find the Fourier transform of $f(t) = \begin{cases} 1-\frac{t}{2} & 0 \le t \le 2 \\ 1+\frac{t}{2} & -2 \le t \le 0 \\ 0 & otherwise \end{cases}$

Cont...

10. (a) Find the inverse discrete fourier transform of the sequence $F[k]$, for $k = 0, 1, 2, 3$ given by $F[k] = -4, 1, 0, 1$.

(OR)

(b) Calculate the circular convolution, $h[n] = f * g$, of the two periodic sequences $f[n] = 9, -1, 3$ and $g[n] = 7, 2, -4$.

SECTION -C (30 Marks)

Answer **ALL** questions

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

11. (a) State Final value theorem.Verify Final value theorem for $f(t) = e^{-t}sint$.

(OR)

(b) Find Laplace transform of $3y'' - y' + 2y = 0$ given that $y(0) = 3$, $y'(0) = 1$.

12. (a) (i) Find $f * g$ when $f = 1, g = t$
(ii) Use the convolution theorem to determine the inverse Laplace transform of $\frac{1}{s^2(s+1)}$.

(OR)

(b) Using Laplace transform solve $x'' - 5x' + 6x = 6t - 4$ given that $x(0) = 1, x'(0) = 2$

13. (a) The continuous signal $f(t) = \cos(\frac{\pi t}{2})$ is sampled at 1 second intervals starting from $t = 0$.
(i) Find the Laplace transform of the sampled signal $f^*(t)$.
(ii) Show that F*(s) has an infinity of poles.
(iii) Find the z transform of the sampled signal and show that this is just two poles.

(OR)

(b) Find the sequence whose z transform is
(i) $F(z) = \frac{2z^2 - z}{(z-5)(z+4)}$. (ii) $F(z) = \frac{z+3}{z-2}$

14. (a) Show that the Fourier transform of $f(t) = \begin{cases} 3 & -2 \le t \le 2 \\ 0 & elsewhere \end{cases}$ is given by $F(\omega) = \frac{6\sin 2\omega}{\omega}$. Use the first shift theorem to find the Fourier transform of $e^{-jt}f(t)$. Also verify the first shift theorem by obtaining the Fourier transform of $e^{-jt}f(t)$ directly.

(OR)

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

15. (a) Find the d.c.t., $F[k]$ of the sequence $f[n] = 2, 4, 6$. Also apply the inverse d.c.t. to $F[k]$ and show that the original sequence, $f[n]$, is obtained.

(OR)

(b) Use the (Circular) convolution theorem to find $f * g$ when $f[n] = 5, 4$ and $g[n] = -1, 3$.

Z-Z-Z END