23SSP314

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

MSc(SS) DEGREE EXAMINATION DECEMBER 2025
(Third Semester)

Branch- SOFTWARE SYSTEMS(five years Integrated)

TRANSFORMATION TECHNIQUES

Time: Three Hours Maximum: 75 Marks

SECTION-A (10 Marks)

Answer **ALL** questions

ALL questions carry **EQUAL** marks (10 × 1 = 10)

Question No.	Question	K Level	CO
1	$L(\cosh bt)$ is (a) $\frac{b}{s^2+b^2}$ (b) $\frac{s}{s^2+b^2}$ (c) $\frac{b}{s^2-b^2}$ (d) $\frac{s}{s^2-b^2}$	K1	CO1
2	$L(t \sin 5t)$ is (a) $\frac{10s}{s^2+25}$ (b) $\frac{10s}{(s^2+25)^2}$ (c) $\frac{10s}{s^2-25}$ (d) $\frac{10s}{(s^2-25)^2}$	K2	CO1
3	$L^{-1}\left(\frac{0.5}{(s+0.5)^2}\right)$ is (a) $\frac{te^{-t/2}}{2}$ (b) $\frac{e^{-t/2}}{2}$ (c) $\frac{e^{-t/2}}{2t}$ (d) $\left(\frac{e^{-t/2}}{2}\right)^2$	K1	CO2
4	Given $f = e^t$, $g = t$, then $f * g$ is (a) $t - 1 + e^t$ (b) $-t - 1 + e^t$ (c) $1 + e^t$ (d) $-1 + e^t$	K2	CO2
5	$\mathcal{Z}[ka^k]$ is (a) $\frac{a}{(z-a)^2}$ (b) $\frac{az}{(z-a)^2}$ (c) $\frac{a}{(z+a)^2}$ (d) $\frac{az}{(z+a)^2}$	K1	CO3
6	The inverse z transform of $\frac{e^z}{(ez-1)^2}$ is (a) $e^{-k}k$ (b) $e^k k$ (c) e^k (d) e^{-k}	K2	CO3
7	Second shift theorem (a) $\mathcal{F}[e^{iat} f(t)] = F(\omega - a)$ (b) $\mathcal{F}[f(t-\alpha)] = e^{-j\alpha\omega}F(\omega)$ (c) $\mathcal{F}[e^{at} f(t)] = F(\omega - ai)$ (d) $\mathcal{F}[f(it-\alpha)] = e^{j\alpha\omega}F(\omega)$	K1	CO4
8	The Laplace transform of $u(t)\, e^{-2t}$ is (a) $\frac{1}{s}$ (b) $-\frac{1}{s}$ (c) $\frac{1}{s-2}$ (d) $\frac{1}{s+2}$	K2	CO4
9	Given $\bar{F}(\omega) = T\sum_{n=0}^{N-1} f[n]e^{-j\omega nT}$ is periodic with period (a) $\frac{2}{\pi}$ (b) $\frac{1}{\pi}$ (c) $\frac{2\pi}{T}$ (d) none of these	K1	CO5
10	Linear convolution of $f[n]$ and $g[n]$ is (a) $f * g = \sum_{-\infty}^{\infty} f[n]g[n-m]$ (b) $f * g = \sum_{-\infty}^{\infty} f[m]g[n-m]$ (c) $f * g = \sum_{-\infty}^{\infty} f[n]g[n]$ (d) $f * g = \sum_{-\infty}^{\infty} f[m]g[m]$	K2	CO5

SECTION - B (35 Marks)

Answer **ALL** questions

ALL questions carry **EQUAL** Marks (5 × 7 = 35)

Question No.	Question	K Level	CO
11.a.	Find the Laplace transforms of the following (i) $5\cos 3t + 2\sin 5t - 6t^3$ (ii) $-e^{-t} + \frac{1}{2}(\sin t + \cos t)$	K2	CO1
	(OR)		
11.b.	State final value theorem and find the value of $f(t) = e^{-3t}\cos t + 5$ using this theorem.		

Cont...

12.a.	Find the inverse Laplace transform of the function using complex numbers $\left(\frac{s-1}{2s^2+8s+11}\right)$.	K4	CO2
	(OR)		
12.b.	Use convolution theorem to find the inverse Laplace transform of the following function (a) $\frac{1}{(s+2)(s+3)}$ (b) $\frac{3}{s(s^2+4)}$		
13.a.	(i) Find the z transform of $f(t) = e^{-t}$ sampled at $t = 0,0.1,0.2,\ldots$ (ii) Find the z transform of $f(t) = e^{-t}$ sampled at $t = 0,0.01,0.02,\ldots$ (iii) Express the sequence obtained in (i) and (ii) as series of weighted impulses.	K3	CO3
	(OR)		
13.b.	(i) Find the sequence whose z transform is $F(z) = \frac{2z^2-z}{(z-5)(z+4)}$ (ii) Use binomial theorem to expand $\left(1-\frac{1}{z}\right)^{-3}$ upto the term $\frac{1}{z^4}$. Also find the sequence with z transform $F(z) = \frac{z^3}{(z-1)^3}$		
14.a.	Use $f(t) = \frac{1}{2\pi}\int_{-\infty}^{\infty} F(\omega)\, e^{i\omega t} d\omega$ to find the Fourier integral representation of the function defined by $f(t) = \begin{cases} 0 & -1 \le t \le 1 \\ 0 & \lvert t\rvert > 1 \end{cases}$	K3	CO4
	(OR)		
14.b.	(i) Show that the Fourier transform of $f(t) = \begin{cases} 3 & -2 \le t \le 2 \\ 0 & otherwise \end{cases}$ is given by $F(\omega) = \frac{6\ sin\,2\omega}{\omega}$ (ii) Use first shift theorem to find Fourier transform of $e^{-jt}f(t)$ (iii) Verify the first shift theorem by obtaining the fourier transform of $e^{-jt}f(t)$ directly.		
15.a.	Use the convolution theorem to find $f \circledast g$ when $f[n] = 5,4$ and $g[n] = -1,3$.	K3	CO5
	(OR)		
15.b.	State and verify Rayleigh's theorem for the sequence $f[n] = 5,4$		

SECTION -C (30 Marks)

Answer **ANY THREE** questions

ALL questions carry **EQUAL** Marks (3 × 10 = 30)

Question No.	Question	K Level	CO
16	If the Laplace transform of the function is $\frac{e^{-3s}}{s^2}$, then find the function.	K2	CO1
17	Solve the simultaneous Differential equations using Laplace transform $x' + x + \frac{y'}{2} = 1,\ \frac{x'}{2} + y' + y = 0, x(0) = y(0) = 0.$	K4	CO2
18	(a) State first shift theorem of ztransform. (b) Given the sequence $f[k]$ is defined by $f[k] = \begin{cases} 0 & k = 0,1,2,3 \\ 1 & k = 4,5,6.\ldots \end{cases}$ Write down the sequence f[k+1] and verify that $z[f[k+1]] = zF(z) - zf[0]$ where $F[z]$ is the z transform of $f[k]$.	K3	CO3
19	Using the definition of correlation (a) 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. (b) Verify the correlation theorem for these function.	K3	CO4
20	(a) Find the discrete cosine transform $F[k]$ of the sequence $f[n] = 2,4,6$ (b) Apply the inverse discrete cosine transform to F[k] and show that the original sequence f[n] is obtained.	K3	CO5

Z-Z-Z END