



V Semester B.Sc. Degree Examination, November/December 2019

MATHEMATICS

**Paper IX & (5.1) – Integral Transforms
(CBCS - New)**

Time : 3 Hours

Max. Marks : 70

Instructions : Answer **All** the Sections.

SECTION – A

Answer **any five** of the following :

(5 × 2 = 10)

1. Find $L[\cosh at]$.
2. Find $L[a^t]$.
3. Evaluate $L\left[\frac{\sin t}{t}\right]$.
4. Using Convolution theorem find $L^{-1}\left[\frac{1}{(s+1)(s+2)}\right]$.
5. If $f(x) = e^x$ in $(-\pi, \pi)$ find Fourier coefficient of a_0 .
6. Define infinite Fourier transform and inverse Fourier transform.
7. Find the Z-transform of e^{-an} .

SECTION – B

Answer **any five** of the following :

(5 × 6 = 30)

8. Evaluate $L[t^2 \sin at]$.
9. Find the Laplace transforms of the function
$$f(t) = \begin{cases} E & \text{for } 0 \leq t \leq T/2 \\ -E & \text{for } T/2 \leq t \leq T \end{cases}$$
and $f(t+T) = f(t)$ with period T .

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10. Find the Inverse Laplace transform of $\frac{1}{s(s+1)(s+2)(s+3)}$.
11. Solve the simultaneous differential equation $\frac{dx}{dt} + y = \sin t$; $\frac{dy}{dt} + x = \cos t$ with $x(0) = 2$, $y(0) = 0$.
12. Obtain the Fourier series for $f(x) = |x|$ in $-\pi < x < \pi$ and hence deduce that $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots = \frac{\pi^2}{8}$.
13. Express $f(x)$ as a half range cosine series $f(x) = x$, $0 \leq x \leq L$.

SECTION - C

Answer **any five** of the following :

(5 × 6 = 30)

14. Find the Fourier transform of

$$f(x) = \begin{cases} 1 & \text{for } |x| \leq 1 \\ 0 & \text{for } |x| > 1 \end{cases}$$

Hence evaluate $\int_0^{\infty} \frac{\sin x}{x} dx$.

15. Obtain the Fourier sine transform of the function

$$f(x) = \begin{cases} x & \text{for } 0 < x < 1 \\ 2 - x & \text{for } 1 < x < 2 \\ 0 & \text{for } x > 2 \end{cases}$$

16. [Modulation Property]

If $F_S[f(x)] = F_S(u)$ and $F_C[f(x)] = F_C(u)$ then

(a) $F_S[f(x)\cos ax] = \frac{1}{2}[F_S(u+a) + F_S(u-a)]$

(b) $F_S[f(x)\sin ax] = \frac{1}{2}[F_C(u-a) - F_C(u+a)]$.

Here $F_C(u)$ Fourier cosine and $F_S(u)$ Fourier sine transform.



17. Find the Z-transform of $\sin(3n + 5)$.
18. Find Inverse Z-transform of $\left[\frac{8Z - Z^3}{(4 - Z)^3} \right]$.
19. Solve $y_{n+1} + \frac{1}{4}y_n = \left(\frac{1}{4}\right)^n$ with $y_0 = 0$ by using Z-transform.
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