A–1044

Total Pages : 3 **Roll No. .....**

MT-604

M.A./M.Sc. Mathematics (MAMT/MSCMT)

Integral Transforms

Examination, 2026 (Feb.)

Time : 2:00 Hrs. Max. Marks : 70

Note* :–** This paper is of Seventy (70) marks divided into Two (02) Sections 'A' and 'B'. Attempt the questions contained in these Sections according to the detailed instructions given therein. ***Candidates should limit their answers to the questions on the given answer sheet. No additional (B) answer sheet will be issued.

Section–A

Long Answer Type Questions 2×19=38

***Note* :–** Section 'A' contains Five (05) Long-answer type questions of Nineteen (19) marks each. Learners are required to answer any *two* (02) questions only.

1. A function $f(t)$ is sectionally continuous in every finite interval $0 \le t \le t_0$ and is of exponential order 'a', as $t \to \infty$, then $L[f(t) : p]$ exists $\forall p > a$.

2. Find the inverse Laplace transform of :

   (i) $\dfrac{p}{(p^2 + a^2)^2}$

   (ii) $\log\left(1 + \dfrac{1}{p^2}\right)$ or $\log\left(\dfrac{p^2 + 1}{p^2}\right)$

3. Solve :

   $(2D^2 + 3D - 2)y = 0$, $y(0) = 1$, $y(t) \to 0$ as $t \to \infty$.

4. Find the fourier sine and cosine transform of $f(t)$, if :

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

5. Discuss the Henkel transform of derivative.

Section–B

Short Answer Type Questions 4×8=32

***Note* :–** Section 'B' contains Eight (08) Short-answer type questions of Eight (08) marks each. Learners are required to answer any *four* (04) questions only.

1. Prove that :

$$M\{(1 + x)^{-a} : p\} = \frac{\Gamma(a)\Gamma(a - p)}{\Gamma(a)}, \quad 0 \le \mathrm{Re}(p) \le \mathrm{Re}(a)$$

2. Evaluate :

$$L[S_i(t); p] = p$$

where $S_i(t) = \int_0^t \frac{\sin u}{u} du$,

3. Evaluate :

$$L^{-1}\left\{\frac{1}{(p-4)^5} + \frac{5}{(p-2)^2 + 5^2} + \frac{p+3}{(p+3)^2 + 6^2}\right\}$$

4. Discuss two applications of Mellin transform.

5. If $f(t)$ has the Fourier transform $F(p)$, then $f(t)$ *cosat* has the fourier transform :

$$\frac{1}{2}[F(p-a) + F(p+a)]$$

6. What do you understand by Scaling in Laplace transform ?

7. Prove that :

$$H_1\{x^{-1} \sin ax; p\} = \frac{aU(p-a)}{p\sqrt{p^2 - a^2}}$$

8. Show that $f(t) = t^2$ is of exponential order 3.

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