

B A, BSC, BCOM DEGREE END SEMESTER EXAMINATION – MARCH 2026**UGP (HONS.) SEMESTER – 4: – DISCIPLINE SPECIFIC ELECTIVE****COURSE CODE -: 24UMATDSE203 – SPECIAL FUNCTIONS AND INTEGRAL****TRANSFORMS***(For Regular 2024 Admission)*

Time: 2 Hours

Max. Marks:70

PART A*Each question carries 2 marks. A maximum of 10 marks can be scored from this part.*

1. Define Laplace transform and find the Laplace transform of $\cos at$. [CO1]
2. Find $L\{e^{-3t} \cos 4t\}$. [CO1]
3. State Convolution Theorem. [CO2]
4. Find $L\{t \sin^2 (3t)\}$ [CO2]
5. Define even and odd functions with examples. [CO3]
6. Write the formula for half range cosine series? [CO3]
7. Define Fourier transform. [CO 4]
8. Write Fourier sine transform formula. [CO4]

PART B*Each question carries 5 marks. A maximum of 30 marks can be scored from this part.*

9. State and prove first shifting theorem and find the Laplace transform of $te^{-4t} \sin 3t$ [CO1]
10. Find $L^{-1}\left\{\frac{4s+15}{16s^2-25}\right\}$. [CO1]
11. Find $L\left(\frac{\cos at - \cos bt}{t}\right)$. [CO2]
12. State and prove Convolution property of Laplace transform. [CO2]
13. Find Fourier series of $f(x) = x^2$ in $(-\pi, \pi)$. [CO3]

14. Expand e^x in $(0, l)$ as half range sine series. [CO3]
15. Find Fourier cosine transform of e^{-x^2} . [CO4]
16. Express the function $f(x) = \begin{cases} 1 & \text{for } |x| < 1 \\ 0 & \text{for } |x| > 1 \end{cases}$, as a Fourier integral. Hence evaluate $\int_0^\infty \frac{\sin \lambda \cos \lambda}{\lambda} d\lambda$ [CO4]

PART C

Each question carries 15 marks. A maximum of 30 marks can be scored from this part.

17. a. Find the Laplace transform of $f(t)$ where $f(t) = \begin{cases} \cos t & 0 \leq t < 2\pi \\ 0 & t > 2\pi \end{cases}$
- b. Find the Laplace transform of $\int_0^t \frac{1}{t} \sin^2 t e^{-2t} dt$ [CO1,CO 2]
18. Solve $y'' + 4y' + 3y = e^{-t}, y(0) = y'(0) = 1$ [CO2]
19. Find Fourier series of $f(x) = e^{-x}$ in $(-l, l)$. [CO3]
20. Obtain Fourier transform of $f(x) = \begin{cases} 1 - x^2 & \text{if } |x| < 1 \\ 0 & \text{if } |x| > 1 \end{cases}$ [CO4]