

Fourth Semester FYUGP Degree (Reg) Examination April 2026

KU4DSCCMT201 - LAPLACE TRANSFORMS, FOURIER SERIES AND PARTIAL DIFFERENTIAL EQUATIONS

2024 Admission onwards

Time : 2 hours

Maximum Marks : 70

Section A

Answer any 6 questions. Each carry 3 marks.

- Find $1 * (-1)$
- Find Laplace transform of Dirac delta function.
- Write one dimensional wave equation.
- State the fundamental theorem on superposition of PDE.
- Write three dimensional Laplace equation.
- Find $\mathcal{L}(2t + 8)$.
- Find Laplace transform of $\cos 4t$
- Represent the function $f(t) = t$ if $0 < t < 2$ and 0 out side of this interval using unit step function.

Section B

Answer any 4 questions. Each carry 6 marks.

- Verify that the following functions are solutions of one dimensional wave equation
 - $u = x^2 + t^2$
 - $u = (\cos 4t)(\sin 2x)$
- Verify that the following functions are solutions of one dimensional wave equation
 - $u = (\sin kt) + (\cos kx)$
 - $u = (\sin at)(\sin bx)$
- Verify that the following functions are solutions of one dimensional heat equation
 - $u = e^{-t} \sin x$
 - $u = e^{-9t} (\sin \omega x)$
- Solve the initial value problem $y'' + 2y' - 3y = 0, y(2) = -3, y'(2) = -5$ using Laplace transform.

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13. Sketch the function

$$f(t) = \begin{cases} \cos 2t & \text{if } 0 < t < \pi \\ 0 & \text{otherwise} \end{cases} \text{ Also find Laplace transform of } f(t)$$

14. Sketch the function

$$f(t) = \begin{cases} t^2 & \text{if } 1 < t < 2 \\ 0 & \text{otherwise} \end{cases} \text{ Also find Laplace transform of } f(t)$$

Section C

Answer any 2 questions. Each carry 14 marks.

15. Find two half range expansion of the function

$$f(x) = \begin{cases} \frac{2k}{L}x & \text{if } 0 < x < \frac{L}{2} \\ \frac{2k}{L}(L-x) & \text{if } \frac{L}{2} < x < L \end{cases}$$

16. Find the Fourier series of the function

$$f(x) = \begin{cases} 0 & \text{if } -2 < x < -1 \\ k & \text{if } -1 < x < 1 \\ 0 & \text{if } 1 < x < 2 \end{cases} \text{ with period } p = 2L = 4, L = 2.$$

17. Solve the following initial value problems using Laplace transforms

$$\begin{aligned} \text{a) } y'' + 9y &= \delta(t - \frac{\pi}{2}), y(0) = 2, y'(0) = 0 \\ \text{b) } y'' + 16y &= 4\delta(t - 3\pi), y(0) = 2, y'(0) = 0 \end{aligned}$$