



K23U 2827

Reg. No. :

Name :

V Semester B.Sc. Degree (CBCSS – Supplementary)
Examination, November 2023
(2017 and 2018 Admissions)
Core Course in Mathematics

5B07 MAT : DIFFERENTIAL EQUATIONS, LAPLACE TRANSFORMS AND
FOURIER SERIES

Time : 3 Hours

Max. Marks : 48

SECTION – A

All the first 4 questions are **compulsory**. They carry **1 mark each**.

- Find the curve through the point (1, 1) in the xy plane having at each of its points the slope $\frac{-y}{x}$.
- Solve $y'' - 4y' + 4y = 0$.
- Find the Laplace transform of $\cos^2 \omega t$.
- Find the smallest period p of $\sin \frac{2\pi x}{k}$. (4x1=4)

SECTION – B

Answer **any 8** questions from among the questions 5 to 14. These questions carry **2 marks each**.

- Solve $2xyy' = y^2 - x^2$.
- Show that $ye^x dx + (2y + e^x)dy = 0$, $y(0) = -1$ is exact and solve it.
- Reduce to first order and solve $2xy'' = 3y'$.
- Find a real general solution of $x^2 y'' - 2.5xy' - 2y = 0$.
- Find a second order homogeneous linear differential equation for which 1 and e^{-2x} are solutions.
- Find $\mathcal{L}(\sinh t \cos t)$. P.T.O.

K23U 2827



- Find Laplace transform of $f(t) = t \sin \omega t$.
- Let $\mathcal{L}(f) = \frac{1}{s^2(s^2 + \omega^2)}$. Find $f(t)$.
- What are the Euler's formulas ?
- What is the Fourier integral representation ? (8x2=16)

SECTION – C

Answer **any 4** questions from among the questions 15 to 20. These questions carry **4 marks each**.

- Using Picard's iteration, find an approximate solution to the initial value problem $y' = 1 + y^2$, $y(0) = 0$.
- Solve the boundary value problem $y'' + 4y = 0$, $y(0) = 3$, $y\left(\frac{\pi}{2}\right) = -3$.
- Solve the initial value problem $y'' + y = 2x$, $y(0) = -1$, $y'(0) = 8$.
- Using the Laplace transform, solve $y'' + 6y' + 8y = e^{-3t} - e^{-5t}$, $y(0) = 0$, $y'(0) = 0$.
- Find the Fourier cosine series of the function $f(x) = \pi - x$ in $0 < x < \pi$.
- Find the Fourier cosine integral of $f(x) = e^{-kx}$. (4x4=16)

SECTION – D

Answer **any 2** questions from among the questions 21 to 24. These questions carry **6 marks each**.

- Solve $y'' + 3y' + 2y = 0$ by converting into a system of two first order differential equations.
- Find the general solution of $y'' + 9y = \csc 3x$.
- Solve the initial value problem $y'' - 3y' + 2y = 4t$, $y(0) = 1$, $y'(0) = -1$ using Laplace transform.
- Find the Fourier series of the function $f(x) = 1 - x^2$, $-1 < x < 1$, $p = 2$. (2x6=12)