



**PRESIDENCY UNIVERSITY  
BENGALURU**

**SCHOOL OF COMPUTER SCIENCE & ENGINEERING  
END SUMMER TERM EXAMINATION -  
AUGUST 2024**

**Semester:** SUMMER TERM

**Course Code:** MAT1002

**Course Name:** Transform techniques, partial differential equation and their Applications

**Program:** SOCSE/SOE/CSE

**Date:** 16.08.2024

**Time:** 9:30AM-12:30PM

**Max Marks:** 100

**Weightage:** 50%

**Instructions:**

- (i) Read all questions carefully and answer accordingly.
- (ii) Question paper consists of 3 parts.
- (iii) Scientific and non-programmable calculator are permitted.
- (iv) Do not write any information on the question paper other than Roll Number.

**Part A**

**Answer ANY FOUR Questions. Each question carries FIVE marks.**

**(5Qx 4M=20M)**

1. Obtain the Fourier series for  $f(x) = x^3$  in  $-\pi \leq x \leq \pi$ . (CO1) [Knowledge]
2. Find the Laplace transform of  $(\sin t - \cos t)^2$ . (CO2) [Knowledge]
3. Find the Laplace transform of  $t \cos at$  (CO2) [Knowledge]
4. Find the Z-transform of  $(n + 1)^2$  (CO3) [Knowledge]
5. (i)  $Z^{-1} \left[ \frac{Z}{(Z-1)^2} \right] =$  (ii)  $Z^{-1} \left[ \frac{Z^2+Z}{(Z-1)^3} \right] =$  (iii)  $Z^{-1} \left[ \frac{Z^3+4Z^2+Z}{(Z-1)^4} \right] =$  (CO3) [Knowledge]
6. Form the PDE by eliminating the arbitrary constants  $a, b,$  and  $c$  of  $z = ax + by + cxy$  (CO4) [Knowledge]
7. Write the order and degree of given equations (i)  $\frac{\partial z}{\partial t} = \frac{\partial^2 z}{\partial x^2}$ , (ii)  $Z_{xx} + Z_y + \cos x$  (CO4) [Knowledge]

**Part B**

**Answer ANY FIVE Questions. Each question carries TEN marks.**

**(5Qx 10M=50M)**

8. Obtain the Fourier series of  $f(x)$  up to second harmonic from the table of values given below

$x^0$	0	$\frac{\pi}{3}$	$\frac{2\pi}{3}$	$\pi$	$\frac{4\pi}{3}$	$\frac{5\pi}{3}$	$2\pi$
$f(x)$	1	1.4	1.9	1.7	1.5	1.2	1

(CO1)[Comprehension]

9. Find half range Fourier cosine series for  $f(x) = (x-1)^2$  in  $0 < x < 1$ . (CO1) [Comprehension]

10. Find the inverse Laplace transform of  $3\cosh 5t - 4\sinh 5t$  (CO2) [Comprehension]
11. Find the inverse Laplace transform of  $\frac{s^2-3s+4}{s^3}$  (CO2) [Comprehension]
12. Find the Z -transform of  $3n - 4 \sin\left(\frac{n\pi}{4}\right) + 5a$  (CO3) [Comprehension]
13. Form the PDE by eliminating the arbitrary functions from the following  
 (i)  $z = f(x^2 - y^2)$  (ii)  $z = f(x) + e^y g(x)$  (CO4) [Comprehension]
14. Solve  $x^2(y - z)p + y^2(z - x)q = z^2(x - y)$  (CO4) [Comprehension]

### Part C

Answer ANY TWO Questions. Each question carries FIFTEEN marks.

(2Qx 15M=30M)

15. Obtain the Fourier Series for  $f(x) = \frac{\pi-x}{2}$  in  $0 \leq x \leq 2\pi$  and hence deduce that

$$\frac{\pi}{4} = 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \dots$$

(CO1) [Application]

16. Using the Z-transform, solve  $u_{n+2} + 4u_{n+1} + 3u_n = 3^n$ ,  $u_0 = 0$  and  $u_1 = 1$

(CO3) [Application]

17. Solve  $x^2 \frac{\partial u}{\partial x} + y^2 \frac{\partial u}{\partial y} = 0$ , by the method of separation of variables.

(CO4) [Application]