



K23U 3432

Reg. No. : .....

Name : .....

III Semester B.Sc. Degree (C.B.C.S.S. – O.B.E. – Regular/Supplementary/  
Improvement) Examination, November 2023

(2019 to 2022 Admissions)

COMPLEMENTARY ELECTIVE COURSE IN MATHEMATICS

3C03MAT – PH : Mathematics for Physics – III

Time : 3 Hours

Max. Marks : 40

PART – A

Answer **any four** questions. **Each** question carries **1** mark.

1. State the first form of Fubini's theorem.
2. Find an equation for the plane through  $P(-3, 0, 7)$  perpendicular to  $n = 5i + 2j - k$ .
3. Find the length of the indicated portion of the curve  $r(t) = 2 \cos t i + 2 \sin t j + \sqrt{5} t k$ ,  $0 \leq t \leq \pi$ .
4. Find the Laplace transform of  $\sinh at$ .
5. Find  $e^t * e^{-t}$ .

PART – B

Answer **any seven** questions. **Each** question carries **2** marks.

6. Evaluate the integral  $\int_0^1 \int_0^1 \int_0^1 (x^2 + y^2 + z^2) dz dy dx$ .
7. Find the volume of the region bounded by the elliptical paraboloid  $z = 10 + x^2 + 3y^2$  and below the rectangle  $R : 0 \leq x \leq 1, 0 \leq y \leq 2$ .
8. Evaluate  $\iint_R e^{x^2+y^2} dA$  where  $R$  is the semicircular region bounded by the x-axis and the curve  $y = \sqrt{1-x^2}$ .

P.T.O.





9. What is meant by TNB frame ?
10. Determine the velocity and acceleration of a particle, at  $t = 1$ , whose position vector is given by  $r(t) = (t + 1)i + (t^2 - 1)j$ .
11. Find a vector parallel to the line of intersection of the planes  $3x - 6y - 2z = 15$  and  $2x + y - 2z = 5$ .
12. Are the following functions even or odd or neither even nor odd. Justify your statement.
  - a)  $\sinh x$
  - b)  $e^x$
13. Find parametric equations for the line through  $(1, 1, 1)$  parallel to the x-axis.
14. Find the fundamental period of  $f(x) = \sin x$  and  $g(x) = \sin \pi x$ .
15. Show that the functions  $\cos x$  and  $\cos 3x$  are orthogonal on  $[-\pi, \pi]$ .
16. Find  $\mathcal{L}^{-1} \left\{ \frac{-2s+6}{s^2+4} \right\}$ .

## PART - C

Answer **any four** questions. **Each** question carries **3** marks.

17. Find the average value of  $f(x, y) = \sin(x + y)$  over the rectangle  $0 \leq x \leq \pi$ ,  $0 \leq y \leq \pi$ .
18. Calculate  $\iint_R \frac{\sin x}{x} dA$  where  $R$  is the triangle in the  $xy$  plane bounded by the x-axis, the line  $y = x$  and the line  $x = 1$ .
19. Find the curvature of the helix  $r(t) = a \cos t i + a \sin t j + btk$ .
20. Find the even periodic extension of the function.

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





21. Solve  $y'' - y = t$ ,  $y(0) = 1$ ,  $y'(0) = 1$ .

22. Solve by the Laplace transform  $y(t) + \int_0^t (t - \tau)y(\tau)d\tau = 1$ .

23. Using the Laplace transform solve the IVP

$$y'_1 = -y_1 + 4y_2$$

$$y'_2 = 3y_1 - 2y_2$$

$$y_1(0) = 3, y_2(0) = 4.$$

PART - D

Answer **any two** questions. **Each** question carries **5** marks.

24. Evaluate  $\int_0^3 \int_0^4 \int_{x=\frac{y}{2}}^{x=\frac{y}{2}+1} \left( \frac{2x-y}{2} + \frac{z}{3} \right) dx dy dz$  by applying the transformation

$$u = \frac{2x-y}{2}, v = \frac{y}{2}, w = \frac{z}{3} \text{ and integrating over an appropriate region in } uvw \text{ space.}$$

25. a) Find the distance from the point  $P(2, -3, 4)$  to the plane  $x + 2y + 2z = 13$ .

b) Determine the angle between the planes  $3x - 6y - 2z = 15$  and  $2x + y - 2z = 5$ .

26. Expand  $f(x) = \begin{cases} 0 & -\pi < x < 0 \\ \pi - x & 0 \leq x < \pi \end{cases}$  in a Fourier series.

27. Write the following functions using unit step function and find its transform.

$$f(x) = \begin{cases} 2 & \text{if } 0 < t < 1 \\ \frac{1}{2}t^2 & \text{if } 1 \leq t < \frac{\pi}{2} \\ \cos t & \text{if } t > \frac{\pi}{2} \end{cases}$$