K22U 3633

Reg. No. : .....

Name : .....

Third Semester B.Sc. Degree (CBCSS – OBE – Regular/Supplementary/ Improvement) Examination, November 2022
(2019 Admission Onwards)
COMPLEMENTARY ELECTIVE COURSE IN MATHEMATICS
3C03 MAT-PH : Mathematics for Physics – III

Time : 3 Hours

Max. Marks : 40

PART – A

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

1. Evaluate $\int_1^2 \int_0^4 2xy \, dy \, dx$.
2. Find a vector parallel to the line of intersection of the planes $3x - 6y - 2z = 15$ and $2x + y - 3z = 5$.
3. Let $r(t) = (t^2 + 1)i + (2t - 1)j - 2tk$ be the position of a particle in space at time t. Find particles velocity and acceleration vectors.
4. Find the Laplace transform of e^{at}.
5. What is the fundamental period of $f(x) = \sin 2\pi x$?

PART – B

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

6. Find the volume of the prism whose base is the triangle in xy plane bounded by the x – axis and the lines $y = x$ and $x = 1$ and whose top lies in the plane $z = 3 - x - y$.
7. Find the average value of $f(x, y) = x \cos xy$ over the rectangle $R : 0 \le x \le \pi, 0 \le y \le 1$.
8. Find the area enclosed by the lemniscate $r^2 = 4\cos 2\theta$.
9. Find an equation for the plane through A(0, 0, 1), B(2, 0, 0) and C(0, 3, 0).

P.T.O.

10. Find the distance from S(1, 1, 3) to the plane $3x + 2y + 6z = 6$.

11. Find the unit tangent vector of the curve $r(t) = (1 + 2\cos t)i + (2\sin t)j + \sqrt{3}tk$.

12. Find the derivative of $f(x, y, z) = x^3 - xy^2 - z$ at $P_0(1, 1, 0)$ in the direction of $V = 2i - 3j + 6k$.

13. Find the inverse Laplace transform of $\dfrac{6s + 7}{2s^2 + 4s + 10}$.

14. Find $L(t)$ if $f(t) = \cos^2 \omega t$.

15. Find $e^{-t} * e^{t}$.

16. Find the Fourier series of the function $f(x) = x + \pi$ if $\pi < x < \pi$ and $f(x + 2\pi) = f(x)$.

PART – C

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

17. Find the volume of the wedge like solid that lies beneath the surface $z = 16 - x^2 - y^2$ and above the region R bounded by the curve $y = 2\sqrt{x}$, the line $y = 4x - 2$, and the x-axis.

18. Using triple integrals find the volume of the region cut from the cylinder $x^2 + y^2 = 4$ by the plane $z = 0$ and the plane $x + z = 3$.

19. Find the arc length of the curve $r(t) = (t \sin t + \cos t)i + (t \cos t - \sin t)j$ from $t = \sqrt{2}$ to $t = 2$.

20. Using Laplace method solve the initial value problem $y'' + y' + 9y = 0$, $y(0) = 0.10$, $y'(0) = 0$.

21. Apply convolution theorem to find $f(t)$ if $L(f) = \dfrac{2\pi s}{(s^2 + \pi^2)^2}$.

22. Find the Fourier series for $f(x) = \begin{cases} x & \text{if } -\pi < x < 0 \\ \pi - x & \text{if } 0 < x < \pi \end{cases}$.

23. Find the Fourier series of the function $f(x) = \begin{cases} 0 & \text{if } -2 < x < 1 \\ k & \text{if } -1 < x < 1 \\ 0 & \text{if } 1 < x < 2 \end{cases}$, with period $p = 4$.

PART – D

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

24. Evaluate $\int_0^3 \int_0^4 \int_{x=\frac{y}{2}}^{x=\frac{y}{2}+1} \left(\frac{2x-y}{2}+\frac{z}{3}\right) dxdydz$ by applying the transformation $u=\frac{2x-y}{2}, v=\frac{y}{2}, w=\frac{z}{3}$ and integrating over an appropriate region in uvw-space.

25. Find T, N and K for $r(t)=(\cos^3 t)i+(\sin^3 t)j, 0<t<\frac{\pi}{2}$.

26. Using Laplace transform solve
$y_1'-2y_1+3y_2=0,\ y_2'-y_1+2y_2=0, y_1(0)=1, y_2(0)=0$.

27. Find the two half range expansions of the function

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