K24U 3432

Reg. No. : ....

Name : ....

III Semester B.Sc. Degree (C.B.C.S.S.– O.B.E.– Regular/Supplementary/ Improvement) Examination, November 2024
(2019 to 2023 Admissions)
COMPLEMENTARY ELECTIVE COURSE IN MATHEMATICS
3C03 MAT-PH : Mathematics for Physics – III

Time : 3 Hours Max. Marks : 40

PART – A

Answer **any four** questions from this Part. **Each** question carries **1** mark. **(4×1=4)**

1. Define double integral of a function f over a region R.
2. Define the average value of an integrable function f over a region R.
3. Write the standard parametric equation of the line through a point P parallel to a vector v.
4. When can you say that a vector function r(t) is continuous at a point $t = t_0$ in its domain ?
5. If f(x) has period p then find the period of f(nx).

PART – B

Answer **any 7** questions from this Part. **Each** question carries **2** marks. **(7×2=14)**

6. Evaluate the iterated integral $\int_1^2 \int_0^4 2xy\,dy\,dx$.
7. Evaluate double integral $\int\int_R \frac{\sqrt{x}}{y^2}\,dA$ over the rectangle R : $0 \le x \le 4, 1 \le y \le 2$.
8. Find the area of the region R bounded by $y = x$ and $y = x^2$ in the first quadrant.

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9. Find the volume of the solid region bounded above by the paraboloid $z = 9 = x^2 - y^2$ and below by the unit circle in the xy-plane.

10. Find the point where the line $x = \frac{8}{3} + 2t, y = -2t, z = 1 + t$ intersects the plane $3x + 2y + 6z = 6$.

11. Find the distance from the point S(1,1,5) to the line L: $x = 1 + t$, $y = 3 - t$, $z = 2t$.

12. Let u and v be differentiable vector functions of t, then find $\frac{d}{dt}[u(t).v(t)]$.

13. Is $L[f(t)g(t)] = L[f(t)]L[g(t)]$? Explain.

14. Show that sum of two odd function is odd.

15. Find the Laplace transform of $f(t) = e^{at} \sin wt$.

16. Write down the Euler formula for calculating the Fourier coefficient.

PART – C

Answer **any 4** questions from this Part. **Each** question carries **3** marks. **(4×3=12)**

17. Find the volume of the region bounded above by the elliptical paraboloid $z = 16 - x^2 - y^2$ and below by the square $R : 0 \leq x \leq 2, 0 \leq y \leq 2$.

18. Integrate $F(x,y,z) = 1$ over the tetrahedron D with vertices (0,0,0), (1,1,0), (0,1,0) and (0,1,1) in the order dzdydx.

19. Find the velocity, speed, and acceleration of a particle whose motion in space is given by the position vector $r(t) = 2\cos t i + 2\sin t j + 5\cos 2t k$.

20. Find the curve's unit tangent vector of $r(t) = 2\cos t i + 2\sin t j + \sqrt{5} t k$. Also, find the length of the curve in the portion $0 \leq t \leq \pi$.

21. Find the Laplace transform of the integral $\int_0^t te^{-4t} \sin 3t dt$.

22. Show that the Laplace transform is a linear operator.

23. Express $f(x) = \frac{1}{2}, \text{if } 0 < x < \pi$ and $f(x) = 0, \text{if } x > \pi$ as a Fourier sine integral.

PART – D

Answer **any 2** questions from this Part. **Each** question carries **5** marks. **(2×5=10)**

24. Evaluate $\int_0^1 \int_0^{1-x} \sqrt{x+y}\,(y-2x)^2\,dydx$.

25. Find the curvature for the helix $r(t) = (a\cos t)i + (a\sin t)j + btk$, $a, b \geq 0$, $a^2 + b^2 \neq 0$.

26. If $L[f(t)] = F(s)$, then show that $L[f(t-a)u(t-a)] = e^{-as}F(s)$.

27. Obtain the half range Fourier cosine series for the function $f(x) = \cos x$ if $0 < x < \frac{\pi}{2}$ and $f(x) = 0$ if $\frac{\pi}{2} < x < \pi$ in the interval $(0, \pi)$.