QP CODE: 25802162

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Reg No : .....

Name : .....

# INTEGRATED MSC DEGREE EXAMINATION, APRIL 2025

## Second Semester

INTEGRATED MSC BASIC SCIENCE-PHYSICS

## COMPLEMENTARY - IPH2CM05 - MATHEMATICS - II INTEGRAL CALCULUS AND FOURIER SERIES

2021 Admission Onwards

3F62CA95

Time: 3 Hours Weightage: 30

### Part A (Short Answer Questions)

*Answer any **eight** questions.*

*Weight **1** each.*

1. State any three properties of definite integral
2. State the power rule in integral form.
3. Find $\int_0^1 (8s^3 - 12s^2 + 5)\, ds$.
4. How do we calculate the volume of a solid of revolution using Washer method?
5. Findd the length of the curve $x = \frac{y^{\frac{3}{2}}}{3} - y^{\frac{1}{2}}$ from y=1 to y=9
6. Sketch the reion of integration $0 \leq x \leq 3, 0 \leq y \leq 2x$ labelling each boundary curve and corner points.
7. Express the region as an iterated double inegral: the lines $y^2 = 4 - x, y^2 = x$
8. Find the fundamental period of the functions (a) $\cos(nx)$ (b) $\sin(2\pi nx)$.
9. Write the Fourier series expansion of an even function $f(x)$ of period $2L$. Also write the Fourier coefficients.
10. Define odd and even functions with examples.

(8×1=8 weightage)

### Part B (Short Essay/Problems)

*Answer any **six** questions.*

*Weight **2** each.*

11. Find the average value of $f(x) = \sqrt{4 - x^2}$ on $[-2, 2]$
12. Calculate the area bounded by the x-axis and parabola $y = 4 - x^2$.

13. A pyramid 3m high has a square base that is 3m on a side. The cross-section of the pyramid perpendicular to the altitude $x$m down from the vertex in a square $x$m on a side. Find the volume of the pyramid.

14. Find the length of the curve $x = \int_0^y \sqrt{\sin^4 t - 1}\, dt, \ -\pi/4 \leq y \leq \pi/4.$

15. Evaluate $\int\int_R y \sin(x+y) dA$ where R is given by $R: -\pi \leq x \leq 0, 0 \leq y \leq \pi.$

16. Find the volume of the solid in the first quadrant that is bounded by the co-ordinate planes, x=3 and the parabolic cylinder $z = 4 - y^2$.

17. Find the Fourier series expansion of the function

$$f(x) = \begin{cases} 0 & \text{if} -2 \leq x < -1 \\ k & \text{if} \ -1 \leq x < 1 \\ 0 & \text{if} \ 1 \leq x \leq 2 \end{cases} \quad \text{of period } p = 4.$$

18. Find the Maclaurin series generated by $\cos x$.

(6×2=12 weightage)

## Part C (Essay Type Questions)

*Answer any **two** questions.*

*Weight **5** each.*

19. (a) Find $\int_{-\sqrt{7}}^{0} t(t^2+1)^{1/3}\, dt.$

(b) Find $\int_1^4 \frac{10\sqrt{v}}{(1+v^{3/2})^2}\, dv.$

20. Find the volume of the solid generated by revolving the region bounded by the curve $y = \sqrt{x}$, the x-axis and the line $x = 4$ about (a) the x-axis (b) the y-axis using shell method.

21. Find the average value of $f(x,y) = x^2 + 9$ over the cube in the first octant bounded by the co-ordinate planes and the planes $x = 2, y = 2, z = 2$.

22. (a). Find the fourier sine series expansion of the function $f(x) = x^2, \ 0 < x < L.$

(b). Find the fourier cosine series expansion of the function $f(x) = \pi - x, \ 0 \leq x \leq \pi.$

(2×5=10 weightage)