QP CODE: 26802032

26802032

Reg No : .....

Name : .....

INTEGRATED M Sc DEGREE EXAMINATION APRIL 2026

Second Semester

INTEGRATED M Sc BASIC SCIENCES - PHYSICS

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

2021 Admission Onwards

4D4B1A8F

Time: 3 Hours Weightage: 30

Part A (Short Answer Questions)

*Answer any **eight** questions.*

*Weight **1** each.*

1. State the fundamental theorem of calculus part 2.
2. Find $\int_{-1}^{1} 3x^2\sqrt{x^3+1}\,dx$.
3. Find $\int_{1}^{2} \frac{4}{v^2}\,dv$.
4. What is Cavalieri's principle?
5. Define the area of the surface generated by revolving the curve $y = f(x)$ about the x-axis.
6. Write the formula for finding volume of a solid bounded above and below by the curves $x = h_2(y)$ and $x = h_1(y)$ and on the sides by $y = c, y = d$ in the plane $z = f(x, y)$.
7. What is the average value of an integrable function f over a region R in plane?
8. Find the fundamental period of the functions (a) $\cos(2\pi x)$ (b) $\sin(2x)$.
9. Define Odd function. Check whether the function $f(x) = \sinh x$ even or odd?
10. Find the Taylor polynomial of order 2 generated by $f(x) = \sin x$ at $a = 0$.

(8×1=8 weightage)

Part B (Short Essay/Problems)

*Answer any **six** questions.*

*Weight **2** each.*

11. Use definite integral to find the area of the region between the curve $y = \frac{x}{2} + 1$ and and the x-axis on the interval $[a, b]$
12. Find $\int \sin^2 x\,dx$.

13. The region bounded by the curve $y = x^2 + 1$ and the line $y = x + 3$ is revolved about the x-axis to generate a solid. Find the volume of the solid.

14. Find the volume of the solid by shell method: The region bounded by the lines $y = 3x,\ y = 0,\ x = 2$ about the y-axis.

15. Sketch the region of integration and evaluate $\int_1^2 \int_1^x xy^2\, dx\, dy$.

16. Find the area of the region R bounded by $y = 2x^2$ and $y^2 = 4x$.

17. Find the Fourier series expansion of

$$f(x) = \begin{cases} 1 & \text{if } -\pi < x < 0 \\ -1 & \text{if } 0 < x < \pi \end{cases}$$ in the interval $-\pi$ to π & $f(x + 2\pi) = f(x)$.

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

(6×2=12 weightage)

Part C (Essay Type Questions)

*Answer any **two** questions.*

*Weight **5** each.*

19. Find (a) $\int r^2(\frac{r^3}{18} - 1)^5 dr$
(b) $\int (2x + 1)^3 dx$

20. Find the volume of the solid generated by revolving the region bounded by $y = \sqrt{x}$ and the line $y = 1,\ x = 4$ about the line $y = 1$.

21. (a) Find the value of k if it is given that $\int_0^k \int_0^1 \int_0^1 (x^2 + y^2 + z^2)\, dz\, dx\, dy = 1$.

(b) Evaluate $\int_0^1 \int_0^\pi \int_0^\pi y \sin z\, dx\, dy\, dz$.

(c) What is the additivity property of triple interals?

22. (a) Find the Fourier series expansion of the function $f(x) = 1 - x^2,\ -1 \le x \le 1$ with period $p = 2L = 2$.

(b) Find the Fourier series expansion of the function

$$f(x) = \begin{cases} \frac{1}{2} + x & \text{if } -\frac{1}{2} \le x \le 0 \\ \frac{1}{2} - x & \text{if } 0 \le x \le \frac{1}{2} \end{cases}$$ with period $p = 2L = 1$.

(2×5=10 weightage)