24U201 (Pages: 2) Name : .....

Reg. No : .....

SECOND SEMESTER UG DEGREE EXAMINATION, APRIL 2025

(FYUGP)

CC24UMAT2CJ101 - INTEGRAL CALCULUS

(Mathematics - Major Course)

(2024 Admission - Regular)

Time: 2.0 Hours Maximum: 70 Marks

Credit: 4

Part A (Short answer questions)

Answer ***all*** questions. Each question carries 3 marks.

1. Suppose that $\int_1^2 f(x)dx = -4$, $\int_1^5 f(x)dx = 6$, $\int_1^5 g(x)dx = 8$. Then evaluate (a) $\int_1^2 3f(x)dx$, (b) $\int_5^1 g(x)dx$. [Level:2] [CO1]

2. Evaluate (a) $\sum_{k=1}^{10} k$ and (b) $\sum_{k=1}^{10} k^3$. [Level:2] [CO1]

3. Evaluate $\int (x^2 - 2x + 5)\, dx$. [Level:2] [CO1]

4. Find (a) $\frac{d}{dx}\ln 2x$ and (b) $\frac{d}{dx}\ln(x^2+3)$. [Level:2] [CO2]

5. Evaluate $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \frac{4\cos\theta}{3+2\sin\theta} d\theta$. [Level:2] [CO2]

6. Compute $\lim_{x\to 0} \frac{\sqrt{1+x}-1}{x}$ [Level:3] [CO3]

7. Evaluate the integral $\int \frac{dx}{(x+1)\sqrt{x^2+2x}}$ [Level:3] [CO3]

8. Evalaute the integral $\int 3\sqrt{\sin v}\cos v\, dv$ [Level:3] [CO4]

9. Find the area between $y = \sec^2 x$ and $y = \sin x$ from 0 to $\pi/4$. [Level:2] [CO5]

10. Find the surface area when $y = 2x$ is revolved about the x -axis from $x = 0$ to $x = 3$ [Level:2] [CO5]

(Ceiling: 24 Marks)

Part B (Paragraph questions/Problem)

Answer ***all*** questions. Each question carries 6 marks.

11. Evaluate (a) $\int \sqrt{1+y^2}.2y\, dy$ and (b) $\int x^2 \sin(x^3)\, dx$ using substitution method. [Level:3] [CO1]

12. Find the average value of $f(x) = x^2 - 1$ on $[0, \sqrt{3}]$. At what points on the given interval does the function assumes its average value? [Level:2] [CO1]

13. Evaluate (a) $\int_{-1}^{1} 3x^2\sqrt{x^3+1}\,dx$ (b) $\int_{\frac{\pi}{4}}^{\frac{\pi}{2}} \cot\theta \csc^2\theta\, d\theta.$ [Level:3] [CO2]

14. Solve the initial value problem $\frac{dy}{dt} = e^t \sin(e^t - 2),\ y(\ln 2) = 0.$ [Level:3] [CO2]

15. Using integration by parts compute $\int_1^2 x \ln x\, dx$ [Level:3] [CO4]

16. Using method of partial fractions evaluate $\int \frac{x+4}{x^2+5x-6}\,dx$ [Level:3] [CO4]

17. Find the length of the curve $y = \frac{4\sqrt{2}}{3}x^{3/2} - 1, \quad 0 \le x \le 1$ [Level:3] [CO5]

18. Find the volume of the solid generated by revolving the region bounded by $y = \sqrt{x}$ and the lines $y = 1, x = 4$ about the line $y = 1$. [Level:3] [CO5]

(Ceiling: 36 Marks)

Part C (Essay questions)

Answer any ***one*** question. The question carries 10 marks.

19. (a) Find the area of the region between the x- axis and the graph of $f(x) = x^3 - x^2 - 2x, -1 \le x \le 2$. [Level:3] [CO2]

(b) Express the solution of the following initial value problem as an integral: $\frac{dy}{dx} = \tan x, y(1) = 5.$

20. Find the area of the region in the first quadrant that is bounded above by $y = \sqrt{x}$ and below by the $x-$axis and the line $y = x - 2$. [Level:3] [CO5]

(1 × 10 = 10 Marks)

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