

SECOND SEMESTER UG DEGREE EXAMINATION, APRIL 2026

(FYUGP)

(Regular/Supplementary/Improvement)

CC24UMAT2CJ101 - INTEGRAL CALCULUS

(Mathematics - Major Course)

(2024 Admission onwards)

Time: 2.0 Hours

Maximum: 70 Marks

Credit: 4

Part A (Short answer questions)Answer **all** questions. Each question carries 3 marks.

- Evaluate (a) $\int 5 \sec x \tan x \, dx$ and (b) $\int \frac{2}{3} \sec^2 \frac{x}{3} \, dx$. [Level:2] [CO1]
- State the mean value theorem for definite integrals. [Level:1] [CO1]
- Suppose that $\int_{-1}^1 f(x) \, dx = 5$, $\int_1^4 f(x) \, dx = -2$, $\int_{-1}^1 h(x) \, dx = 7$. Then evaluate (a) $\int_{-1}^1 [2f(x) + 3h(x)] \, dx$ and (b) $\int_{-1}^4 f(x) \, dx$. [Level:2] [CO1]
- Use substitution method to evaluate $\int_0^1 t^3(1+t^4)^3 \, dt$. [Level:3] [CO2]
- Find (a) $\frac{d}{dx} \ln 2x$ and (b) $\frac{d}{dx} \ln(x^2 + 3)$. [Level:2] [CO2]
- Evaluate the integral $\int \frac{dx}{\sqrt{-x^2 + 4x - 3}}$ [Level:3] [CO3]
- Find $\int x \cos x \, dx$ [Level:2] [CO4]
- Evaluate the integral $\int_0^1 \frac{16x}{8x^2 + 2} \, dx$. [Level:3] [CO4]
- Find a formula for the area $A(x)$ of the cross section of the solid lies between planes perpendicular to the x -axis at $x = -1$ and $x = 1$. The cross sections are circular disks with diameters in the xy -plane and the cross sections perpendicular to the x -axis between the planes run from the semicircle $y = -\sqrt{1-x^2}$ to the semicircle $y = \sqrt{1-x^2}$ [Level:2] [CO5]
- Find the volume of the solid generated by revolving the region bounded by the curve $y = x^2$ and the lines $y = 0, x = 2$ about the x -axis [Level:3] [CO5]

(Ceiling: 24 Marks)

Part B (Paragraph questions/Problem)

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

11. Evaluate (a) $\sum_{k=1}^4 (k^2 - 3k)$, (b) $\sum_{k=1}^3 (k + 4)$ and (c) $\sum_{k=1}^2 \frac{6k}{k+1}$. [Level:2] [CO1]
12. Evaluate (a) $\int (x + 2)^5 dx$ and (b) $\int \cos(7\theta + 5) d\theta$. [Level:3] [CO1]
13. Evaluate (a) $\int_0^2 \frac{2x}{x^2 - 5} dx$ and (b) $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \frac{4 \cos \theta}{3 + 2 \cos \theta} d\theta$. [Level:2] [CO2]
14. Solve the initial value problem $\frac{dy}{dt} = e^t \sin(e^t - 2)$, $y(\ln 2) = 0$. [Level:3] [CO2]
15. Compute $\lim_{x \rightarrow 0^+} x^{-1/\ln x}$. [Level:3] [CO3]
16. Using Method of partial fractions evaluate $\int \frac{dt}{t^3 + t^2 - 2t}$. [Level:3] [CO4]
17. Find the length of the curve $x = (y^3/3) + 1/(4y)$ from $y = 1$ to $y = 3$. [Level:3] [CO5]
18. Determine the area of the region between the line $y = x$ and the parabola $x = y^2$ [Level:3] [CO5]

(Ceiling: 36 Marks)

Part C (Essay questions)

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

19. Prove the first part of the Fundamental Theorem of Calculus. [Level:3] [CO2]
20. Consider the graph of $y = x^2$ on the interval $0 \leq x \leq 2$. Compute the area of the surface of revolution formed by revolving this graph about the y -axis. [Level:3] [CO5]

(1 × 10 = 10 Marks)
