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| QP CODE: D2BMT2505                                                                                                                                                                                                         | (Pages: 2)        | Reg. No : ..... |
|                                                                                                                                                                                                                            |                   | Name : .....    |
| <b>SECOND SEMESTER FYUGP EXAMINATION, APRIL 2026</b><br><b>(Regular/Improvement/Supplementary)</b><br><b>Discipline Specific Core (DSC) Courses - Major</b><br><b>MAT2CJ101 : Integral Calculus</b><br><b>(Credits: 4)</b> |                   |                 |
| Time: 2 Hours                                                                                                                                                                                                              | Maximum Marks: 70 |                 |
| Section A                                                                                                                                                                                                                  |                   |                 |
| Answer the following questions. Each carries 3 marks (Ceiling: 24 marks)                                                                                                                                                   |                   |                 |
| 1. Prove that $\int_a^b kf(x) dx = k \int_a^b f(x) dx$ .                                                                                                                                                                   | BL1               | CO1             |
| 2. Evaluate $\int \cos^2 x dx$ .                                                                                                                                                                                           | BL1               | CO1             |
| 3. Evaluate $\int r^2 \left( \frac{r^3}{18} - 1 \right)^5 dr$                                                                                                                                                              | BL2               | CO1             |
| 4. Find $\frac{d}{dx} \ln 2x$ .                                                                                                                                                                                            | BL1               | CO2             |
| 5. Evaluate $\int_{\pi/6}^{\pi/3} (1 - \cos 3t) \sin 3t dt$                                                                                                                                                                | BL2               | CO1             |
| 6. Find $\frac{d}{dx} \sec^{-1}(-3x)$ .                                                                                                                                                                                    | BL2               | CO2             |
| 7. Evaluate the integral $\int \tan^{-1} y dy$ .                                                                                                                                                                           | BL2               | CO1             |
| 8. Compute $\lim_{x \rightarrow 0} \frac{3x - \sin x}{x}$                                                                                                                                                                  | BL2               | CO2             |
| 9. Find the area of the region in the first quadrant bounded by the line $y = x$ , the line $x = 2$ and the $x$ axis.                                                                                                      | BL2               | CO3             |
| 10. The region between the curve $y = \sqrt{x}$ , $0 \leq x \leq 4$ , and the $X$ - axis is revolved about the $X$ - axis to generate a solid. Find its volume.                                                            | BL2               | CO3             |
| Section B                                                                                                                                                                                                                  |                   |                 |
| Answer the following questions. Each carries 6 marks (Ceiling: 36 Marks)                                                                                                                                                   |                   |                 |
| 11. Give an example for a function with no Riemann integral and justify your answer.                                                                                                                                       | BL1               | CO1             |
| (PTO)                                                                                                                                                                                                                      |                   |                 |

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|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|
| 12. | Find the average value of $g(x) = - x $ over the interval $[-1, 1]$ . At what point or points in the given interval does the function assume its average value?      | BL2 | CO1 |
| 13. | Find $t$ if $e^{-0.01t} = 1000$ .                                                                                                                                    | BL2 | CO2 |
| 14. | State and prove Fundamental theorem of Calculus Part 2.                                                                                                              | BL2 | CO1 |
| 15. | Express $\frac{2x^3-4x^2-x-3}{x^2-2x-3}$ as a sum of partial fractions.                                                                                              | BL2 | CO1 |
| 16. | Using integration by parts compute $\int_1^2 x \ln x \, dx$ .                                                                                                        | BL2 | CO1 |
| 17. | Determine the area of the region between the line $y = x$ and the parabola $x = y^2$ .                                                                               | BL3 | CO3 |
| 18. | Let $f(x) = \sqrt{1-x}$ over the interval $[0, \frac{1}{2}]$ . Find the surface area of the surface generated by revolving the graph of $f(x)$ around the $X$ -axis. | BL2 | CO3 |

### Section C

**Answer any one question. Each carries 10 marks (1 x 10 = 10 Marks)**

|     |                                                                                                                                             |     |     |
|-----|---------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|
| 19. | a) Find $\frac{dy}{dx}$ if $y = \ln\left(\frac{(x^2+1)^5}{\sqrt{1-x}}\right)$ .<br>b) Evaluate $\int \frac{\sec y \tan y}{2 + \sec y} dy$ . | BL2 | CO2 |
| 20. | Find the length of the curve $x = \frac{y^4}{4} + \frac{1}{8y^2}$ from $y = 1$ to $y = 2$ .                                                 | BL2 | CO3 |

**CO : Course Outcome**

**BL : Bloom's Taxonomy Levels** (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)