Reg. No. | | | | | | | | |

**G. VENKATASWAMY NAIDU COLLEGE (AUTONOMOUS), KOVILPATTI – 628 502.**

**UG DEGREE END SEMESTER EXAMINATIONS - NOVEMBER 2024.**

(For those admitted in June 2023 and later)

**PROGRAMME AND BRANCH: B.Sc., MATHEMATICS**

| SEM | CATEGORY | COMPONENT | COURSE CODE | COURSE TITLE |
|---|---|---|---|---|
| I | PART - III | CORE-2 | U23MA102 | DIFFERENTIAL CALCULUS |

**Date & Session: 12.11.2024 / FN** **Time : 3 hours** **Maximum: 75 Marks**

| Course Outcome | Bloom's K-level | Q. No. | **SECTION – A (10 X 1 = 10 Marks)**<br>**Answer ALL Questions.** |
|---|---|---|---|
| CO1 | K1 | 1. | If $y = e^{ax}$ then $y_n$ = _____.<br>a) $e^{ax}$ b) $e^{ax/a}$ c) $a\,e^{ax}$ d) $a^n e^{ax}$ |
| CO1 | K2 | 2. | If $\sqrt{x} + \sqrt{y} = 5$, then $y_2$ = _____.<br>a) $\frac{1}{10}$ b) $\frac{25}{x^{\frac{3}{2}}}$ c) $\frac{5}{2x^{\frac{3}{2}}}$ d) 0 |
| CO2 | K1 | 3. | A partial differential equation requires _____.<br>a) Exactly one independent variable<br>b) Two or more independent variables<br>c) More than one dependent variable<br>d) Equal number of dependent and independent variables |
| CO2 | K2 | 4. | If f (x, y, z) = 0, then the value of $\frac{\partial x}{\partial y}, \frac{\partial y}{\partial z}, \frac{\partial z}{\partial x}$.<br>a) 1 b) -1 c) 0 d) none of these |
| CO3 | K1 | 5. | What is the minimum value of the function $\lvert x + 3\rvert - 2$.<br>a) 1 b) -2 c) 2 d) -5 |
| CO3 | K2 | 6. | The degree of the function $f(x, y) = x^3 - 2x^2y + 3xy^2 + y^3$.<br>a) 1 b) 2 c) 3 d) 4 |
| CO4 | K1 | 7. | A curve which touches each member of a given family of curves is called _____ of that family.<br>a) Envelope b) Parameter c) Curvatures d) Centre of curvatures |
| CO4 | K2 | 8. | Envelope is --------- to all the curves in a family of curves.<br>a) Normal b) Parallel c) Tangent d) Perpendicular |
| CO5 | K1 | 9. | The locus of the center of curvature of a curve is called _____.<br>a) Evolute b) Involute c) Center d) Radius of curvature |
| CO5 | K2 | 10. | The radius of curvature of a flat surface is _____.<br>a) 0 b)1 c) -1 d) Infinity |
| **Course Outcome** | **Bloom's K-level** | **Q. No.** | **SECTION – B (5 X 5 = 25 Marks)**<br>**Answer ALL Questions choosing either (a) or (b)** |
| CO1 | K3 | 11a. | If $xy = ae^x + be^{-x}$. Prove that $xy_2 + 2y_1 - xy = 0$<br>**(OR)** |
| CO1 | K3 | 11b. | Find $y_n$ where $y = \frac{3}{(x+1)(2x-1)}$. |

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|---|---|---|---|
| CO2 | K3 | 12a. | Find the partial differential co.efficients of u = sin (ax + by +cz). **(OR)** |
| CO2 | K3 | 12b. | If $x^3 + y^3 + 3axy = 0$, find dy/dx. |
| CO3 | K4 | 13a. | Verify Euler's theorem when $u = x^3 + y^3 + z^3 + 3xyz$. **(OR)** |
| CO3 | K4 | 13b. | Find the maximum or minimum values of $2(x^2 - y^2) - x^4 + y^4$. |
| CO4 | K4 | 14a. | Find the envelope of the family of circles $(x - a)^2 + y^2 = 2a$ where a is the parameter. **(OR)** |
| CO4 | K4 | 14b. | Find the envelope of the family of a straight lines $y + tx = 2at + at^3$, the parameter being t. |
| CO5 | K5 | 15a. | Determine the radius of the curvature of $x^4 + y^4 = 2$ at the point (1, 1) **(OR)** |
| CO5 | K5 | 15b. | Find the co-ordinates of the centre of curvature of the curve xy = 2 at ( 2,1). |

| **Course Outcome** | **Bloom's K-level** | **Q. No.** | **SECTION – C (5 X 8 = 40 Marks)**<br>**Answer ALL Questions choosing either (a) or (b)** |
|---|---|---|---|
| CO1 | K3 | 16a. | Find the $n^{th}$ differential coefficient of $\cos^5\theta \sin^7\theta$. **(OR)** |
| CO1 | K3 | 16b. | If $y = \frac{\log x}{x^2}$ , show that $x^3y_3 + 6x^2y_2 + 4xy_1 - 4y = 0$. |
| CO2 | K4 | 17a. | If $z = e^x$ ( x cos y – y sin y), show that $\frac{\partial^2 z}{\partial x^2} + \frac{\partial^2 z}{\partial y^2} = 0$. **(OR)** |
| CO2 | K4 | 17b. | If $u = tan^{-1} \frac{x^3 + y^3}{x - y}$ , prove that $x\frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = \sin 2u$. |
| CO3 | K4 | 18a. | Transform $\frac{\partial^2 v}{\partial x^2} + \frac{\partial^2 v}{\partial y^2}$ into polar coordinates. **(OR)** |
| CO3 | K4 | 18b. | A tent having the form of a cylinder surmounted by a cone is to contain a given volume. If the canvass required is minimum, Show that the altitude of the cone is twice that of the cylinder. |
| CO4 | K5 | 19a. | Find the envelope of family of straight lines ax + by=1, where a and b are parameters connected by the relation ab = 1. **(OR)** |
| CO4 | K5 | 19b. | Determine the envelope of $x\sin\theta - y\cos\theta = a\theta$ , where θ being the parameter. |
| CO5 | K5 | 20a. | Find the evolute of the ellipse. **(OR)** |
| CO5 | K5 | 20b. | Find the radius of the curvature of the curve $r^n = a^n \cos n\theta$. |