# Model Question Paper-I with effect from 2021 (CBCS Scheme)

USN

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### First Semester B.E Degree Examination Calculus and Differential Equations (21MAT11)

#### TIME: 03 Hours

Max. Marks: 100

Note: Answer any FIVE full questions, choosing at least ONE question from each MODULE.

|       |     | Module -1  | Marks<br>06 |  |  |  |
|-------|-----|--|-------------|--|--|--|
| Q.01  | 2   | With usual notations prove that $\tan \varphi = r \frac{d\theta}{dr}$  |             |  |  |  |
|       | ь   | Alf-   |             |  |  |  |
|       | c   | Show that the radius of curvature at any point of the cycloid $x = a(\theta = \sin \theta), y = a(1 - \cos \theta)$ is $4a \cos \left(\frac{\theta}{2}\right)$ | 07          |  |  |  |
|       | -   | OR   |             |  |  |  |
| Q.02  | a   | If p be the perpendicular from the pole on the tangent, then show that $\frac{1}{p^2} = \frac{1}{r^2} + \frac{1}{r^4} \left(\frac{dr}{d\theta}\right)^2$       | 06          |  |  |  |
|       | ь   | Find the pedal equation of the curve $r^{m} = a^{m}(\cos m\theta + \sin m\theta)$  | 07          |  |  |  |
|       | c   | Find the radius of curvature of the curve $x^3 + y^3 = 3axy$ at $\left(\frac{3a}{2}, \frac{3a}{2}\right)$  | 07          |  |  |  |
| 1.00  | 100 | Module-2   |             |  |  |  |
| Q. 03 | a   | Expand e <sup>sinx</sup> by Maclaurin's series up to the term containing x <sup>4</sup>  | 06          |  |  |  |
|       | ь   | If $u = f(2x - 3y, 3y - 4z, 4z - 2x)$ , show that $6u_x + 4u_y + 3u_x = 0$   | 07          |  |  |  |
|       | c   | Examine the function $f(x,y) = xy(1-x-y)$ for extreme values   | 07          |  |  |  |
| 7 15  |     | OR   |             |  |  |  |
| Q.04  | a   | Evaluate (i) $\lim_{x\to 0} \left(\frac{\tan x}{x}\right)^{\frac{1}{x^2}}$ (ii) $\lim_{x\to 0} (\cos x)^{\frac{1}{x^2}}$                                       | 06          |  |  |  |
|       | ь   | If $z = e^{ax+by} f(ax - by)$ , show that $b \frac{\partial z}{\partial x} + a \frac{\partial z}{\partial y} = 2abz$   | 07          |  |  |  |
|       | e   | If $x + y + z = u$ , $y + z = uv$ and $z = uvw$ , find $\frac{\partial(x,y,z)}{\partial(u,v,w)}$   | 07          |  |  |  |

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