**Session: 2023-24**          **Semester: I**          **Section: Common to All**

**Course Code: BAS-103**          **Course Name: Engineering Mathematics-I**

## Assignment 2

**Date of Assignment:**                                        **Date of submission:**

| S.No. | KL | CO | PI | Question | Marks |
|-------|-----|------|------|----------|-------|
| 1 | K3 | CO2 | 1.2.1,1.3.1 2.1.3,2.2.3 2.4.1,2.4.4 | If $I_n = \dfrac{d^n}{dx^n}(x^n \log x)$, then prove that $I_n = nI_{n-1} + (n-1)!$ . | 5 |
| 2 | K3 | CO2 | 2.4.1,2.4.4 3.1.1,4.1.1 4.3.1 | If $y = [\log(x + \sqrt{1+x^2})]$ , find all the derivative of $y$ for $x=0$. | 5 |
| 3 | K3 | CO2 | 2.4.1,2.4.4 3.1.1,4.1.1 4.3.1 | If $y = \left(\dfrac{1+x}{1-x}\right)^{1/2}$, prove that $$(1-x^2)y_n - [2(n-1)x + 1]y_{n-1} - (n-1)(n-2)y_{n-2} = 0.$$ | 5 |
| 4 | K3 | CO2 | 1.2.1,1.3.1 2.1.3,2.2.3 | If $y = \cos(m\sin^{-1}x)$, prove that $$(1-x^2)y_{n+2} - (2n+1)xy_{n+1} - (n^2 - m^2)y_n = 0 .$$ | 5 |
| 5 | K3 | CO2 | | If $y = (x^2 - 1)^m$, prove that $y_{2m} = 2m!$ | 5 |
| 6 | K3 | CO2 | 4.3.4 5.1.1,4.1.1 4.3.1 | If $u = \sin^{-1}\left(\dfrac{x^{\frac{1}{4}} + y^{\frac{1}{4}}}{x^{\frac{1}{6}} + y^{\frac{1}{6}}}\right)$, then evaluate $x^2 \dfrac{\partial^2 u}{\partial x^2} + 2xy\dfrac{\partial^2 u}{\partial x \partial y} + y^2 \dfrac{\partial^2 u}{\partial y^2}$ | 5 |

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|---|---|---|---|---|---|
| 7 | K3 | CO2 | 4.3.4 5.1.1,4.1.1 4.3.1 | If $z = f(x,y)$, where $x = e^u cosv$, $y = e^u sinv$, prove that $\left(\frac{\partial f}{\partial x}\right)^2 + \left(\frac{\partial f}{\partial y}\right)^2 = e^{-2u}\left[\left(\frac{\partial f}{\partial u}\right)^2 + \left(\frac{\partial f}{\partial v}\right)^2\right]$ | 5 |
| 8 | K3 | CO2 | 2.4.1,2.4.4 2.1.3,2.2.3 | If $u = f(2x-3y, 3y-4z, 4z-2x)$, prove that $\frac{1}{2}\frac{\partial u}{\partial x} + \frac{1}{3}\frac{\partial u}{\partial y} + \frac{1}{4}\frac{\partial u}{\partial z} = 0$ | 5 |
| 9 | K3 | CO2 | 1.2.1,1.3.1 2.1.3,2.2.3 2.4.1,2.4.4 | If $x = e^r cos\theta$, $y = e^r sin\theta$, show that $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = e^{-2r}\left(\frac{\partial^2 u}{\partial r^2} + \frac{\partial^2 u}{\partial \theta^2}\right)$ | 5 |
| 10 | K3 | CO2 | 10.3.1, 10.1.3 12.1.2 12.3.1 4.3.1.4.3.3 | If $y = \left[x + \sqrt{1+x^2}\right]^m$, find $y_n(0)$. | 5 |

**Answers:**

**2.** .

$when\, n\, is\, odd \quad , \quad y_n(0) = 0$

$when\, n\, is\, even \quad , \quad y_n(0) = (-1)^{\frac{n}{2}-1} 2.2^2.4^2.6^2................(n-2)^2$

6. $\frac{1}{144}\tan u\,(tan^2 u - 11)$

10. When n is even $y_n(0) = [m^2 - (n-2)^2][m^2 - (n-4)^2]\ ...\ ...\ (m^2 - 4^2)(m^2 - 2^2)m^2$ , when n is odd $y_n(0) = [m^2 - (n-2)^2][m^2 - (n-4)^2]\ ...\ ...\ (m^2 - 3^2)(m^2 - 1^2)m$