1T01831 - F.E.(SEM I)(ALL BRANCHES) (Rev - 2019 C Scheme) / 58651 - Engineering Mathematics - I QP CODE: 10031556 DATE: 04/07/2023

(Time: 3 hours)

Max.Marks:80

5

5

N.B (1) Question No.1 is compulsory

(2) Answer any three questions from Q.2 to Q.6

(3) Use of Statistical Tables permitted

(4) Figures to the right indicate full marks.

Solve the equation 7 cosh x + 8 sinh x = 1, for real values of x.

b) Find
$$\alpha, \beta, \gamma$$
 when $A = \begin{bmatrix} 0 & 2\beta & \gamma \\ \alpha & \beta & -\gamma \\ \alpha & -\beta & \gamma \end{bmatrix}$ is orthogonal.

c) If
$$u = 3(ax + by + cz)^2 - (x^2 + y^2 + z^2)$$
 and $a^2 + b^2 + c^2 = 1$
show that $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial x^2} = 0$

d) Find nth derivative of
$$y = \frac{x}{x^2 + a^2}$$

2 a) If $\cos \alpha + 2\cos \beta + 3\cos \gamma = \sin \alpha + 2\sin \beta + 3\sin \gamma = 0$ then prove 6 that $\sin 3\alpha + 8\sin 3\beta + 27\sin 3\gamma = 18\sin (\alpha + \beta + \gamma)$

b) If
$$v = (x^2 - y^2) f(xy)$$
, show that $\frac{\partial^2 v}{\partial x^2} + \frac{\partial^2 v}{\partial y^2} = (x^4 - y^4) f''(xy)$

c) If
$$y = e^{n(\cos^{-1}x}$$
, then prove that
$$(1-x^2)y_{n+2} - (2n+1)xy_{n+1} - (n^2 + m^2)y_n = 0$$
. Find $y_n(0)$

3 a) Prove that
$$\sinh^{-1}(\tan x) = \log \left[\tan\left(\frac{\pi}{4} + \frac{x}{2}\right)\right]$$

b) Verify Euler's theorem for
$$u = \left(\frac{x^2 + y^2}{x + y}\right)$$

Examine the consistency of the system of equations
$$2x - y - z = 2$$
, $x + 2y + z = 2$, $4x - 7y - 5z = 2$ and solve then if found consistent.



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Ying Liu

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