Course: MAT3011 (Calculus for Engineers)

Slot: G1 & G2

Max. Marks: 10

Due Date: .10.04.2021

Signature:_______________

Answer all the questions

Guidelines to be Followed:

1. Download this PDF file and write the answers with corresponding question numbers.

2. The Answers should follow the next page onwards

3. First solve these problems on a rough sheet and then write the answers in detail in the specified space neatly without any corrections.

4. Fill the details with your name reg. no. and your signature.

5. Take clear and visible snapshot of your filled-in answer sheet carefully and make a SINGLE PDF FILE ONLY and then UPLOAD it through log-in portal (VTOP).

6. Uploading of answers in any other format is not acceptable. Do not send different image files or zipped files. Do not send the answer sheet to my e- mail address.

7. The uploaded file will not be accepted after the due date, and the marks awarded will be automatically zero for those who do not submit in time. Do not postpone your task until the last date of submission.

8. Follow the guidelines strictly. Any deviation from the above instructions will lead to the reduction in marks.

1. Find the value of $\frac{\partial x}{\partial z}$ at the point $(1, -1, -3)$ if the equation $xz + y\ln x - x^2 + 4 = 0$ defines x as a function of the two independent variables y and z and the partial derivative exists.

2. Suppose that we substitute polar coordinates $x = r\cos\theta$ and $y = r\sin\theta$ in a differentiable function $w = f(x, y)$.

   1. Show that $\frac{\partial w}{\partial r} = f_x \cos\theta + f_y \sin\theta$ and $\frac{1}{r}\frac{\partial w}{\partial \theta} = -f_x \sin\theta + f_y \cos\theta$

3. Find the derivative of the function at P_0 in the direction of **u.**

   1. $f(x,y) = 2xy - 3y^2$, $P_0(5,5)$, $\mathbf{u} = 4\mathbf{i} + 3\mathbf{j}$

4. **F**ind all the local maxima, local minima, and saddle points of the function

   1. $f(x,y)=2x^2+3xy+4y^2-5x+2y$

5. Use the method of Lagrange multipliers to find

   1. **Minimum on a hyperbola** The minimum value of $x + y$, subject to the constraints $xy = 16, x > 0, y > 0$

   2. **Maximum on a line** The maximum value of xy, subject to the constraint $x + y = 16$. Comment on the geometry of each solution.

6. Use Taylor's formula for $f(x, y) = \ln(2x + y + 1)$ at the origin to find quadratic and cubic approximations of f near the origin.

7. Find the area of the circular washer with outer radius 2 and inner radius 1, using **(a)** Fubini's Theorem, **(b)** simple geometry.

8. Find the area enclosed by one leaf of the rose $r = 12\cos 3\theta$.

9. Find the volumes of the regions for the tetrahedron in the first octant bounded by the coordinate planes and the plane passing through $(1, 0, 0)$, $(0, 2, 0)$, and $(0, 0, 3)$