PARUL UNIVERSITY
Faculty of Engineering & Technology
Department of Applied Sciences and Humanities
1ST SEMESTER B.Tech PROGRAMME (CSE, IT)
CALCULUS(03019101BS01)
ACADEMIC YEAR – 2025-26

Tutorial 2B: Multivariate Calculus

Q. 1 Find the Jacobian $\frac{\partial(u,v)}{\partial(x,y)}$ for the following functions:

(i) $u = x^2 - y^2, v = 2xy$

(ii) $u = \frac{x^2+y^2}{1-xy}, v = tan^{-1}x + tan^{-1}y$

Q. 2 If $x = u + 3v, \ y = v - u$, show that $J \cdot J' = 1$.

Q. 3 Find the equation of the tangent plane and normal line to the surface $2xz^2 - 3xy - 4x = 7$

at (1, -1, 2).

Q. 4 Find the equation of the normal line of the sphere $x^2 + y^2 + z^2 = 6$ at the point (a, b, c).
Show that the normal line passes through the origin.

Q. 5 Examine the function $f(x, y) = x^3 y^2 (12 - 3x - 4y)$ for extreme values.

Q. 6 Find maxima/minima for $f(x, y) = xy (a - x - y), a > 0$.

Q. 7 Find the minimum values of xyz, subject to the condition $2x + 2y + 2z = 36$.

Q. 8 Find the numbers x, y, z such that $xyz = 8$. Find the maximum value of $xy + yz + xz$ using
method of Langrange's multipliers.

Q. 9 The pressure P at any point (x, y, z) in space is $P = 400xyz^2$. Find highest pressure on the
surface of unit sphere $x^2 + y^2 + z^2 = 1$.

Q. 10 Expand $e^y cosx$ in powers of x and y upto third degree.