

UNIT-IV: Multi variable Calculus (Partial Differentiation and Applications)

S.NO	Questions	BT	CO	PO
	Part – A(Short answer questions)			
1	State Euler's theorem for homogeneous function in x and y.	L1	CO5	PO1
2	Determine whether the functions $u = e^x \sin y$, $v = e^x \cos y$ are functionally dependent or not.	L2	CO5	PO2
3	If $x=u(1+v)$, $y=v(1+u)$ then prove that $\frac{\partial(x,y)}{\partial(u,v)} = 1+u+v$.	L2	CO5	PO2
4	Write the working rule to find the maximum and minimum values of $f(x,y)$.	L2	CO5	PO1
5	Verify $\frac{\partial^2 u}{\partial x \partial y} = \frac{\partial^2 u}{\partial y \partial x}$ for the function $u = \tan^{-1} \frac{x}{y}$.	L2	CO5	PO2
6	Find the first and second order partial derivatives of x^3+y^3-3axy and verify $\frac{\partial^2 f}{\partial x \partial y} = \frac{\partial^2 f}{\partial y \partial x}$	L2	CO5	PO2
7	Verify Euler's theorem for the function $xy+yz+zx$.	L1	CO5	PO2
8	If $u=x^2-2y$, $v= x+y+z$, $w=x-2y+3z$ find $\frac{\partial(u,v,w)}{\partial(x,y,z)}$	L1	CO5	PO2
9	Verify if $u= 2x-y+3z$, $v= 2x-y-z$, $w=2x-y+z$ are functionally dependent and if ,so find the relation between them.	L2	CO5	PO2
10	Find the maximum an minimum values of $f(x,y)=x^3+3xy^2-3x^2-3y^2+4$	L2	CO5	PO2

S.NO	Part-B(Long answer questions)	BT	CO	PO
1(a)	If $z = \log(e^x + e^y)$ show that $rt - s^2 = 0$, where $r = \frac{\partial^2 z}{\partial x^2}$, $t = \frac{\partial^2 z}{\partial y^2}$, $s = \frac{\partial^2 z}{\partial x \partial y}$	L3	CO5	PO2
1(b)	If $\sin u = \frac{x^2 y^2}{x^2 + y^2}$, show that $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = \sin 2u$.	L3	CO5	PO2
2(a)	If $u=x+y+z$, $y+z=uv$, $z=uvw$ show that $\frac{\partial(x,y,z)}{\partial(u,v,w)} = u^2 v$.	L3	CO5	PO2
2(b)	If $u = x^2 - y^2$, $v= 2xy$ where $x=r \cos \theta$, $y = r \sin \theta$ show that $\frac{\partial(u,v)}{\partial(r,\theta)} = 4r^3$.	L2	CO5	PO2
3(a)	If $x = \frac{u^2}{v}$, $y = \frac{v^2}{u}$ find $\frac{\partial(u,v)}{\partial(x,y)}$.	L2	CO5	PO2
3(b)	If $x = u\sqrt{(1-v^2)} + v\sqrt{(1-u^2)}$ and $y = \sin^{-1} u + \sin^{-1} v$ then show that x and y are functionally related , also find the relationship.	L3	CO5	PO3

4	Find the maximum and minimum values of the function $f(x, y) = 3x^4 - 2x^3 - 6x^2 + 6x + 1$.	L4	CO5	PO1
5(a)	Find the maximum and minimum values of the function $f(x, y) = x^3y^2(1 - x - y)$.	L4	CO5	PO2
5(b)	Find the maximum and minimum values of $x+y+z$ subject to $\frac{1}{x} + \frac{1}{y} + \frac{1}{z} = 1$ by Lagrange's method of undetermined multipliers.	L3	CO5	PO3
6	Find the dimensions of the rectangular parallelepiped box open at top of max capacity whose surface area is 256 sq. inches.	L4	CO5	PO3