

### MODULE 3: PARTIAL DIFFERENTIATION

1. State Euler's theorem for homogeneous function of two variables.
2. If  $u = f(x, y)$  where  $x = x(t)$  and  $y = y(t)$  then write the total derivative of  $u$  with respect to  $t$ .
3. If  $u = 3x^2y + 6xy^2 + 7$ , find  $\frac{\partial u}{\partial x}$  and  $\frac{\partial u}{\partial y}$ .
4. If  $u = \sin(xy)$ , find  $\frac{\partial u}{\partial x}$  and  $\frac{\partial u}{\partial y}$ .
5. If  $u = e^{4x+3y}$ , find  $\frac{\partial u}{\partial x}$  and  $\frac{\partial u}{\partial y}$ .
6. If  $f(x, y) = x^2y - 3y^2$ , find  $\frac{\partial f}{\partial x}$  and  $\frac{\partial f}{\partial y}$ .
7. If  $u = x^y$  then find  $\frac{\partial^2 y}{\partial x \partial y}$ .
8. If  $f(x, y) = x^2y + 3xy^2$ , find  $\frac{\partial f}{\partial x}, \frac{\partial f}{\partial y}$ .
9. If  $f(x, y) = \cos(xy)$ , find  $\frac{\partial f}{\partial x}, \frac{\partial f}{\partial y}$ .
10. If  $u = e^{4x+3y}$  then find  $\frac{\partial u}{\partial x}$  and  $\frac{\partial u}{\partial y}$ .
11. If  $u = e^x \cos y + 1$ , show that  $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ .
12. If  $u = x^2 + y^2$ , find  $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2}$ .
13. Define symmetric functions with examples.
14. If  $z = u^2 + v^2$  and  $v = at^2$ . Find  $\frac{dz}{dt}$ .
15. If  $z = x^2y + y^2x$ ,  $x = at^2$ ,  $y = 2at$ , find  $\frac{dz}{dt}$ .
16. If  $u = \frac{x}{y}$ , then show that  $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = 0$ .
17. Write the formula for
18. Write the formula for Jacobian  $J \left[ \frac{x, y, z}{u, v, w} \right]$ .
19. If  $u = x + y$ ,  $v = x - y$ , find  $J \left[ \frac{u, v}{x, y} \right]$ .
20. If  $u = x + y$ ,  $v = x^2 + y^2$ , find  $\frac{\partial(u, v)}{\partial(x, y)}$ .
21. If  $x = u + v$  and  $y = u - v$ , find  $J \left( \frac{x, y}{u, v} \right)$ .
22. If  $x = u^2 + v^2$  &  $y = uv$ , find  $J \left( \frac{x, y}{u, v} \right)$ .

### MODULE 4: INTEGRAL CALCULUS

1. Find  $\iint (x + y) dx dy$ .
2. Evaluate  $\iint (x - y) dx dy$ .

3. Find  $\int_1^2 \int_1^3 xy^2 \, dx dy$  .
4. Evaluate  $\int_{y=0}^2 \int_{x=0}^1 xy \, dx \, dy$ .
5. Evaluate  $\int_1^3 \int_2^4 9x^3y^2 \, dy dx$ .
6. Evaluate  $\int_0^1 \int_0^2 (x + y) \, dx \, dy$ .
7. Compute  $\int_0^1 \int_x^{x^2} (x + y) \, dy \, dx$ .
8. Evaluate  $\int_0^1 \int_1^2 (x + 3) \, dx \, dy$ .