**UNIT - I**
**CO2 - Partial differentiation**

1.f(x, y) = $x^2$ + xyz + z Find $f_x$ at (1,1,1)
a) 0 b) 1 c) 3 d) -1

2.f(x, y) = sin(xy) + $x^2$ ln(y) Find $f_{yx}$ at (0, $\pi/2$)
a) 33 b) 0 c) 3 d) 1

3.f(x, y) = $x^2 + y^3$ ; X = $t^2 + t^3$; y = $t^3 + t^9$ Find $df/dt$ at t=1.
a) 0 b) 1 c)-1 d) 164

4.f(x, y) = sin(x) + cos(y) + $xy^2$; x = cos(t); y = sin(t) Find $df/dt$ at t = $\pi/2$
a) 2 b)-2 c) 1 d) 0

5.f(x, y, z, t) = xy + zt + $x^2$ yzt; x = $k^3$ ; y = $k^2$; z = k; t = √k
Find $df/dt$ at k = 1
a) 34 b) 16 c) 32 d) 61

6.f(x, y) = sin(y + $yx^2$) / 1 + $x^2$ Value of $f_{xy}$ at (0,1) is
a) 0 b) 1 c) 67 d) 90

7.Necessary condition of euler's theorem is _____
a) z should be homogeneous and of order n
b) z should not be homogeneous but of order n
c) z should be implicit
d) z should be the function of x and y only

8.If $u = x^2 tan^{-1}(y/x) - y^2 tan^{-1}(x/y)$then $\frac{\partial^2 u}{\partial x \partial y}$is
a) $\frac{x^2+y^2}{x^2-y^2}$ b) $\frac{x^2-y^2}{x^2+y^2}$ c)$\frac{x^2}{x^2+y^2}$ d)$\frac{y^2}{x^2+y^2}$

9.If f(x,y)is a function satisfying euler' s theorem then?
a) $x^2\frac{\partial^2 f}{\partial x^2} + 2xy\frac{\partial^2 f}{\partial x \partial y} + y^2\frac{\partial^2 f}{\partial y^2} = n(n-1)f$
b) $\frac{1}{x^2}\frac{\partial^2 f}{\partial x^2} + \frac{2}{xy}\frac{\partial^2 f}{\partial x \partial y} + \frac{1}{y^2}\frac{\partial^2 f}{\partial y^2} = n(n-1)f$
c) $x^2\frac{\partial^2 f}{\partial x^2} + 2xy\frac{\partial^2 f}{\partial x \partial y} + y^2\frac{\partial^2 f}{\partial y^2} = nf$
d)$y^2\frac{\partial^2 f}{\partial x^2} + 2xy\frac{\partial^2 f}{\partial x \partial y} + x^2\frac{\partial^2 f}{\partial y^2} = n(n-1)f$

10.In euler theorem x $\partial z/\partial x$ + y $\partial z/\partial y$ = nz, here 'n' indicates?
a) order of z b) degree of z c) neither order nor degree d) constant of z

11.For homogeneous function with no saddle points we must have the minimum value as _____
a) 90 b) 1 c) equal to degree d) 0

12.f(x, y) = sin(y/x)$x^3$ + $x^2$y find the value of $f_x + f_y$ at (x,y)=(4,4).

a) 0 b) 78 c) $4^2$ . 3(sin(1) + 1) d) -12

13.f(x, y) = $x^3$ + $xy^2$ + 901 satisfies the Euler's theorem.

a) True b) False

14.If z = $x^n$ f($y/x$) then?

a) $y\frac{\partial z}{\partial x} + x\frac{\partial z}{\partial y} = nz$ b) $\frac{1}{y}\frac{\partial z}{\partial x} + \frac{1}{x}\frac{\partial z}{\partial y} = nz$

c) $x\frac{\partial z}{\partial x} + y\frac{\partial z}{\partial y} = nz$ d) $\frac{1}{x}\frac{\partial z}{\partial x} + \frac{1}{y}\frac{\partial z}{\partial y} = nz$

15.If $z = e^{\frac{x2+y2}{x+y}}$ then, $x\frac{\partial z}{\partial x} + y\frac{\partial z}{\partial y}$is?

a) 0 b) zln(z) c) $z^2$ ln (z) d) z

16.Relative error in x is?

a) δx b) $\delta x/x$ c) $\delta x/x$ * 100 d) 0

19.The Jacobian of $p, q, r$ w.r.t $x, y, z$ given $p = x + y + z, q = y + z, r = z$ is _____

a) 0 b) 1 c) 2 d) -1

20.Given $u = \frac{yz}{x}, v = \frac{zx}{y}, w = \frac{xy}{z}$ then the value of $\frac{\partial(u,v,w)}{\partial(x,y,z)}$ is _____

a) 4 b) -4 c) 0 d) 1

21.If u=x+$3y^2$-$z^3$, v=$4x^2$ yz, w=$2z^2$-xy then $\frac{\partial(u,v,w)}{\partial(x,y,z)}$ at (1,1,1).

a) -184 b) -90 c) 20 d) 40

22.If x=rcosθ, y=rsinθ then the value of $\frac{\partial(x,y)}{\partial(r,\theta)}$ is _____

a) 1 b) 0 c) r d) $\frac{1}{r}$

23.If $u + v = e^x$ cos y and $u - v = e^x$ sin y the value of $J\left(\frac{u,v}{x,y}\right)$ is _____

a) $e^{2x}$ b) $\frac{e^2x}{2}$ c) $\frac{-e^2x}{2}$ d) 0

24.Which among the following is the definition of Jacobian of u and v w.r.t x and y?

a) $J\left(\frac{x,y}{u,v}\right)$ b)$J\left(\frac{u,v}{x,y}\right)$ c)$\frac{\partial(x,y)}{\partial(u,v)}$ d)$\frac{\partial(u,v)}{\partial(x,y)}$

25.Given f (x,y)=$e^x$ cosy, what is the value of the fifth term in Taylor's series near $(1, \frac{\pi}{4})$ where it is expanded in increasing order of degree & by following algebraic identity rule?

a) $\frac{-e(x-1)\left(y-\frac{\pi}{4}\right)}{\sqrt{2}}$ b) $-\sqrt{2}e(x-1)\left(y-\frac{\pi}{4}\right)$

c) $\frac{e(x-1)^2}{\sqrt{2}}$ d) $\frac{e\left(y-\frac{\pi}{4}\right)^2}{\sqrt{2}}$

26.Consider the f(x, y) = $x^2 + y^2$ – a. For what values of a do we have critical points for the function.

a) independent of a b) for any real number except zero

c) a ∈ (0, +∞) d) a ∈ (-1, 1)

27.f(x, y) = sin(x).cos(y) Which of the following is a critical point?

a) $\left(\frac{\pi}{4}, \frac{\pi}{4}\right)$ b) $\left(\frac{-\pi}{4}, \frac{\pi}{4}\right)$ c) $\left(0, \frac{\pi}{4}\right)$ d) (0, 0)

28.The point (0,0) in the domain of f(x, y) = sin(xy) is a point of _____

a) Saddle b) Minima c) Maxima d) Constant

29.Maximize the function x + y – z = 1 with respect to the constraint xy=36.

a) 0 b) -8 c) 8 d) No Maxima exists

30.A partial differential equation requires

a) exactly one independent variable b) more than one dependent variable

c) two or more independent variables d) equal number of dependent and independent variables

31.If $u = e^x(xcosy - ysiny)$,then $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial x^2} = \ldots$

a)0 b)u c)eu d)none

32.If $x = uv, y = u/v$then $\frac{\partial(x,y)}{\partial(u,v)}$is,

a) $-2\,u/v$ b) $-2\,v/u$ c)0 d)1

33.If $J_1 = \frac{\partial(u,v)}{\partial(x,y)}$, $J_2 = \frac{\partial(x,y)}{\partial(u,v)}$then $J_1 J_2$is

a) 2 b)0 c)1 d)none

34.If $u = x^y$, then $\frac{\partial u}{\partial x}$is

a)0 b)$yx^{y-1}$ c)$x^y logx$ d)none

35.If $u = x^y$, then $\frac{\partial u}{\partial y}$is

a)0 b)$yx^{y-1}$ c)$x^y logx$ d)none

36.If $u = x^3 + y^3$, then $\frac{\partial^2 u}{\partial x \partial y}$is equal to

a)-3 b)3 c)0 d)3x+3y

37.If $u = x^2 + 2xy + y^2 + x + y$then $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$is equal to

a)2u b)u c)0 d)none

38.If $u = log\frac{x^2}{y}$then $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$is equal to

a)2u b)3u c)u d)1

39.If $A = f_{xx}(a,b), B = f_{xy}(a,b), C = f_{yy}(a,b)$ then $f(x,y)$ will have a maximum at (a,b) if

a)$f_x = 0, f_y = 0, AC < B^2$and $A < 0$ b)$f_x = 0, f_y = 0, AC = B^2$and $A > 0$

c)$f_x = 0, f_y = 0, AC > B^2$and $A > 0$ d)$f_x = 0, f_y = 0, AC > B^2$and $A < 0$

40.If $z = sin^{-1}\frac{\sqrt{x^2+y^2}}{x+y}$then $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$is equal to

a)0 b)1/2 c)1 d)2

41.If $u = sin^{-1}(x/y) + tan^{-1}(y/x)$, then $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$is equal to

a)u b)2u c)3u d)0

42.If an error of 1% is made in measuring its length and breadth, the percentage error in the area of a rectangle is

a)0.2% b)0.02% c)2% d)1%

43. $\frac{\sqrt{x}-\sqrt{y}}{\sqrt{x}+\sqrt{y}}$is a homogeneous function of degree.....

a)1 b)2 c)0 d)1/2

44.If u and v are functions of r, s where r, s are functions of x, y then $\frac{\partial(u,v)}{\partial(r,s)}.\frac{\partial(r,s)}{\partial(x,y)}$=.....

a) $\frac{\partial(u,v)}{\partial(x,y)}$ b)$\frac{\partial(u,v)}{\partial(r,s)}$ c)$\frac{\partial(r,s)}{\partial(x,y)}$ d)none

45.The necessary conditions for a function $f(x,y)$to have an extreme at (a,b) are.....

a)$f_x > 0, f_y > 0$ b)$f_x < 0, f_y > 0$ c)$f_x = 0, f_y = 0$ d)$f_x < 0, f_y < 0$

46.If $u = (x-y)^4 + (y-z)^4 + (z-x)^4$, then $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z}$is

a)1 b)u c)4u d)0

47.If $u = cos^{-1}(x/y) + tan^{-1}(y/x)$then $x^2u_{xx} + 2xyu_{xy} + y^2u_{yy}$is

a)u b)2u c)0 d)1

48.If $u = f(x+ay) + g(x-ay)$then $\frac{\partial^2 u}{\partial y^2}$equals

a)$\frac{\partial^2 u}{\partial x^2}$ b)$a\frac{\partial^2 u}{\partial x^2}$c)$a^2\frac{\partial^2 u}{\partial x^2}$ d)$\frac{\partial^2 u}{\partial x \partial y}$

49.If $u = x^4 + y^4 + 3x^2y^2$, then $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$is

a)u b)3u c)4u d)2u

50.If $u = f(y/x)$then

a)$x\frac{\partial u}{\partial x} - y\frac{\partial u}{\partial y} = 0$ b)$x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 0$

c)$x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 2u$ d)$x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 1$

**Answers: 1)c 2)d 3.)d 4)b 5)b 6)a 7)a 8.)b 9)a 10)a 11)d 12)c 13)b 14)c 15)b 16)b 17)a 18)a 19)b 20)a 21)a 22)c 23)c 24)b 25)a 26)a 27)c 28)d 29)d 30) 31)a 32)b 33)c 34)b 35)c 36)c 37)d 38) 39)d 40)a 41)a 42)d 43)c 44)a 45)c 46)d 47)c 48)c 49.)c 50)b**