ONEWORDS

UNIT-1

1) Variable Separable an eqn of the form $f(x)\,dx + f(y)\,dy = 0$.

2) The sol is $\int f(x)\,dx + \int F(y)\,dy = c$.

3) Homogeneous eqn of the form $\frac{dy}{dx} = \frac{f_1(x,y)}{f_2(x,y)}$.

4) f_1 and f_2 are homogeneous functns of the same degree in x and y.

5) A differential equations is a eqn in which differentiable co-efficient occurs.

6) Differential eqns are of two types.
   - ordinary diff. eqn
   - Partial " "

7) one (or) more of the derived functn is called ordinary D.E.

8) Two (or) more independent variable a dependent variable and its partial derivatives is called a partial D.E.

9) The order and degree of the D.E. is a highest order and highest degree derivative occurs.

10) A D.E. of the form is, $f(x,y)\,dx + g(x,y)\,dy = 0$ is called a D.E. of the 1st order and 1st degree.

UNIT-I

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$f(x,y)\,dx + g(x,y)\,dy = 0$ is called a D.E. of the 1st order and 1st degree.

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11) A D.E. is said to be linear when the dependent variable and its derivatives occur only in the first degree. (2)

12) The linear eqn of the form $\frac{dy}{dx} + Py = Q$.

13) P and Q are functns of x on y.

14) The Sol is, I.F. $= e^{\int P dx}$

$$ye^{\int Pdx} = \int Q e^{\int Pdx} + C$$

15) A non homogeneous eqn of the form, $\frac{dy}{dx} = \frac{ax+by+c}{a'x+b'y+c'}$

16) $d(xy) = x\,dy + y\,dx$.

17) $d(x/y) = \frac{y\,dx - x\,dy}{y^2}$.

18) $d(y/x) = \frac{x\,dy - y\,dx}{x^2}$.

19) $d(\tan^{-1}(y/x)) = \frac{x\,dy - y\,dx}{x^2+y^2}$.

20) $d\left[\tan^{-1}\left(x/y\right)\right] = \frac{y\,dx - x\,dy}{x^2+y^2}$.

21) Bernoulli's eqn of the form $\frac{dy}{dx} + Py = Q(y^n)$

22) The Sol is $\frac{dz}{dx} + Pz(1-n) = Q(1-n)$.

23) This eqn is linear in z.

24) An exact D.E. is obtained by equating an exact (or) perfect differential to zero.

25) $\frac{\partial N}{\partial x} - \frac{\partial M}{\partial y} = 0$ hypothesis.

26) $\frac{dy}{dx}$ here after by p.

27) The eqn of the 1^{st} order and of the n^{th} degree be $p^n + P_1 p^{n-1} + P_2 p^{n-2} + \dots + P_n = 0$.

28) The Sol is, $\phi_1(x, y, c_1), \phi_2(x, y, c_2) \dots \phi_n(x, y, c_n) = 0$.

UNIT-2

1) If m_1 and m_2 are real & distinct,

$y = Ae^{m_1 x} + Be^{m_2 x}$

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11) A D.E. is said to be linear when the dependent variable and its derivatives occur only in the first degree. (2)

12) The linear eqn of the form $\frac{dy}{dx} + Py = Q$.

13) P and Q are functns of x on y.

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15) A non homogeneous eqn of the form, $\frac{dy}{dx} = \frac{ax+by+c}{a'x+b'y+c'}$

16) $d(xy) = xdy + ydx$.

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28) The Sol is, $\phi_1(x,y,c_1), \phi_2(x,y,c_2) \dots \phi_n(x,y,c_n) = 0$.

UNIT-2

1) If m_1 and m_2 are real & distinct,

$y = Ae^{m_1 x} + Be^{m_2 x}$

2) If m_1 and m_2 are real & equal $y=(A+Bx)e^{mx}$

3) If the roots are imaginary $y=e^{\alpha x}(A\cos\beta x+B\sin\beta x)$

4) If $f(a)\neq 0$ $\frac{1}{f(D)}\cdot e^{ax}$ replace D by a.

5) If $f(a)=0$, $f(D)=(D-a)^r\phi(D) \Rightarrow \frac{1}{f(D)}\cdot e^{ax}=\frac{1}{\phi(a)}\left(\frac{x^r e^{ax}}{r!}\right)$

6) $(D^2+6D+9)\,y=0 \Rightarrow y=(A+Bx)e^{-3x}$

7) $am^2+bm+c=0$ is called the aux. eqn. 3

8) $(D^2-5D+6)\,y=2e^{4x} \Rightarrow y=Ae^{2x}+Be^{3x}+e^{4x}$

9) $(D^2+6D+8)\,y=e^{-2x}$. C.F $=Ae^{-4x}+Be^{-2x}$

10) $y=\frac{X}{f(D)}$ is called the particular Integral.

UNIT-3

1) An eqn involving more than two variables, only one independent vble, then the eqn is known as a set of ordinary simultaneous eqn.

2) A pair of simultaneous differential eqns of the 1st order and 1st degree may be written as,

$$P_1\frac{dx}{dz}+Q_1\frac{dy}{dz}+R_1=0,\quad P_2\frac{dx}{dz}+Q_2\frac{dy}{dz}+R_2=0.$$

where $P_1, P_2, Q_1, Q_2, R_1, R_2$ are functns of x, y & z.

3) The ratios of the differentials can be obtained as,

$\frac{dx}{P}=\frac{dy}{Q}=\frac{dz}{R}$. where P, Q, R are functns of x, y & z.

4) $P\frac{\partial w}{\partial x}+Q\frac{\partial w}{\partial y}+R\frac{\partial w}{\partial z}=0$ where $w=\phi(u,v)$, ϕ being an arbitrary functn.

5) When two of the ratios in $\frac{dx}{P}=\frac{dy}{Q}=\frac{dz}{R}$ involve only the two corresponding out of the three vbles x, y & z.

6) A part or the whole of the general sol of $\frac{dx}{P}=\frac{dy}{Q}=\frac{dz}{R}$ can also be found by the following method,

$\frac{l\,dx+m\,dy+n\,dz}{lP+mQ+nR}$ where l, m, n are multipliers

We must also have $l\,dx+m\,dy+n\,dz=0$.

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7) If two different sets of such multipliers l, m, n can be obtained then $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$ can be deduced by $u = \int (l dx + m dy + n dz)$.

8) If $u = c_1$ and $v = c_2$ are the general sol of the eqn $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$ then it follows the system of curves

9) D stands for $\partial/\partial t$. d/dx (4)

10) The simplest case of two dependent vbles x & y the eqn can be written in the form,

$$f_1(D)x + \phi_1(D)y = T_1, \; f_2(D)x + \phi_2(D)y = T_2$$

11) If an integral included in the complementary functn of the given eqn be known the complete sol can be found interms of, $\frac{d^2y}{dx^2} + P\frac{dy}{dx} + Qy = R$ where P, Q, R are functns of x.

12) Some cases where in simple functns of x, like x and e^x are integrals of the eqn $P_2\frac{d^2y}{dx^2} + P_1\frac{d^2y}{dx^2} + P_0 y_0 = 0$ should be noted

13) Reduction to the normal form is also known as removing the 1st derivative.

14) z such as the co-eff of $\frac{dy}{dz}$ i.e) $\frac{d^2z}{dx^2} + P\frac{dz}{dx}$ vanishes. $\therefore z = \int e^{-\int P dx} dx$.

15) When $\frac{d^2y}{dz^2}\left(\frac{dz}{dx}\right)^2 + \frac{dy}{dz}\left(\frac{d^2z}{dx^2} + P\frac{dz}{dx}\right) + Qy = R$ becomes immediately integrable is when $Q = \mu\left(\frac{dz}{dx}\right)^2$ where μ is a const.

16) In 2^{nd} case, when $\frac{d^2y}{dz^2}\left(\frac{dz}{dx}\right)^2 + \frac{dy}{dz}\left(\frac{d^2z}{dx^2}\right) + P\frac{dz}{dx} + Qy = R$ becomes integrable when $Qz^2 = \mu\left(\frac{dz}{dx}\right)^2$

Then $\frac{d^2y}{dz^2}\left(\frac{dz}{dx}\right)^2 + \frac{dy}{dz}\left(\frac{d^2z}{dx^2} + P\frac{dz}{dx}\right) + Qy = R$ becomes a homogeneous linear eqn.

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UNIT-4

1) Partial D.E's are those which involves one or more partial derivatives.

2) The partial D.E be $F(x,y,z,p,q)=0$.

3) The sol of $F(x,y,z,p,q)=0$ be $\phi(x,y,z,a,b)=0$.

4) The Sol of $\phi(x,y,z,a,b)=0$ which contains independent vbles is called the Complete integral of $F(x,y,z,p,q)=0$.

5) $\frac{\delta\phi}{\delta a}=0$ and $\frac{\delta\phi}{\delta b}=0$ is called the Singular integral.

6) Lagrange's method of solving the linear eqn of the subsidiary eqns $\frac{dx}{P}=\frac{dy}{Q}=\frac{dz}{R}$.

7) The relation $\phi(u,v)=0$ (or) $\phi(u_1,\dots,u_n)=0$ contains all the integrals of the eqn which are not of the type called singular.

8) Partial D.E. of all spheres whose centres lie on the plane $z=0$ and whose radius is const and equal to r is $z^2(1+p^2+q^2)=r^2$.

9) P.D.E. of all spheres whose centres lie on the z axis is $xq=yp$.

10) P.D.E. of all planes through the origin is $z=px+qy$.

11) P.D.E. of all " having equal x and y intercepts is $p=q$.

12) P.D.E. of all spheres of radius c having their centres on the xy-plane is $z^2(p^2+q^2+r^2)=c^2$.

13) P.D.E. of all planes which are at a constant distance a from the origin is $z=px+qy+a\sqrt{1+p^2+q^2}$.

UNIT-5

1) In std forms, Eqns in which the vbles do not occur explicitly can be written in the form $F(P,q)=0$.

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2) The Sol of $F(P,q)$ is $z=ax+by+c$.

3) The Complete integral is $z=ax+yf(a)+c$.

4) The singular integral is obtained by eliminating a and c between $z=ax+yf(a)+c$ is $0=1$.

5) The singular and general integrals must be indicated in every eqn besides the complete integral.

6) In std form, only one of the vbles x,y,z occurs explicitly such eqn can be written in one of the forms $F(x,P,q)=0$, $F(y,P,q)=0$, $F(z,P,q)=0$.

7) The Sol of $F(x,P,q)=0$ is $z=\int\phi(x,a)dx+ay+b$.

8) " " " $F(y,P,q)=0$ " $z=ax+\int\phi(y,a)dy+b$.

9) The Sol. of $F(z,P,ap)=0$ is $\int\frac{dz}{\phi(z,a)}=x+ay+b$.

10) The Sol of $f_1(x,P)=f_2(y,q)$ is

$z=\int\phi_1(a,x)dx+\int\phi_2(a,y)dy+b$.

11) If $(x^m p)$ & $(y^n q)$ occur in the partial D.E. as in $F(x^m p, y^n q)=0$ or in $F(z, x^m p, y^n q)=0$.

12) $x^m p=(1-m)\frac{\partial z}{\partial x}=(1-m)P$ reduce to $F(P,Q)=0$ or to $F(z,P,Q)=0$.

x ——— x ——— x