Name: Ahmed Musa.

ID # 7944

Section "B"

sub: DE

Instructer: Mam shomaila
Mazhar

fourth Semester.

Department of civil
Engineering

INU PESHAWER

FORMATION OF PARTIAL DIFFERENTIAL EQUATIONS

→ it is defined as an equation involving two OR more independent variable like x, y, z — a dependant variable like u and its partial derivatives.

→ Partial differential Equation can be formed either by elimination of the arbitrary constants OR by the elimination of arbitrary functions from a relation involving three OR more variables.

GENRAL FORM

→ The Genral form of a first order partial differential equation is

$$F\left(x, y, z, \frac{\partial z}{\partial x}, \frac{\partial z}{\partial y}\right) = F(x, y, z, P, q) = 0$$

Wher x, y are two independent variables z is the dependant variable and $P = z_x$ and $q = z_y$

INVENTION OF DIFFERENTIAL EQUATION

→ In Mathematics the history of D.E traces the development of "Differential Equation" From, calculas, which itself was independantly invented by English Physicist Newton and German mathemitician Gottfried Leibniz.

→ The history of the subject of D.E in consice From a Synopsis of the Recent article "The History of D.E 1670-1950":

→ "D.E began with Leibniz, the Bernoulli brothers and other from the 1680 s. not long after Newton 'fluxional equation in the 1670s"

Application of partial differential Equations.

PDES are used to model many system in many different fields of science and Engineering.

Important Examples :→

→ Laplace Equation

→ Heat Equation

→ Wave Equation.

LAPLACE EQUATION :→

→ Laplace Equation is used to describe of head in a body

→ Also used to describe the steady state distribution of Electrical charge in a body.

$$\frac{\partial^2 U(x,y,z)}{\partial x^2} + \frac{\partial^2 U(x,y,z)}{\partial y^2} + \frac{\partial^2 U(x,y,z)}{\partial z^2} = 0$$

HEAT EQUATION :->

→ The Function $U(x,y,z,t)$ is used to represent the tampareture at time t in a physical body at a point with coordinate (x,y,z)

→ α is the thermal diffusivity. it is sufficient to consider the case α

$= 1$

$$\frac{\partial U(x,y,z,t)}{\partial t} = \alpha \left[\frac{\partial^2 U}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 U}{\partial z^2} \right]$$

WAVE EQUATION:-

→ The function $U(x,y,z,t)$ is used to represent the displacement at time t of a particle whose position at Rest is (x,y,z)

→ The constant c Represent the propagation speed of the wave.

$$\frac{\partial^2 U(x,y,z,t)}{\partial t^2} = c^2 \left[\frac{\partial^2 U}{\partial x^2} + \frac{\partial^2 U}{\partial y^2} + \frac{\partial^2 U}{\partial z^2} \right]$$

*Application in daily life:

→ Partial derivatives are used in the basic Laws of physics for example Newton Laws of Linear motion, Maxwell's equation of Electromagnetism and Einstien equation in Genral Relativity

* In Economics field :→

→ In the field of economics we use partial differential equation to check what happen to other variable keeping one variable Constant.

* Application in the field of Civil Engineering :→

→ Differential equation are the true essence of the physical world. They are used to describe the physical phenomenan which is encountered at microscopic as well as macroscopic level.

→ Differential Equation are extensivly involved in Civil Engineering

→ Civil Engineering Mostly concerened with building structure and Geometrical shapes. So any work revolved around modling structure, fluids, pollutants and more can be modled using differential equations. If you have any Complicated geomatries, which most. Realastic problems have you'll likely to use the said differential equations in an approximation framework like that of finit (Difference volume, element) to approximately figure out a solution to a problem you care about-

→ In the field of Mechanical Engineering

* There are different Orders of the partial differential Equation discribing the rate of change of a function. that Represinting the Real life qualities.

* The use of the Separation of variables technique to solve partial differential Equation Relating to heat conduction in solids and the vibration of Solid in multidimensional system.

End of the Assignment