

Preface

The thesis is aimed at studying the motion of the waves in incompressible fluids of varying densities and viscosities, under the influence of gravity and different natural forces.

The wave motion is the most common oscillatory motion which happens in the nature. Though the study of the subject has long been initiated, still it's necessity has not ceased. Because of the fact, the wave generates and maintains due to multi various agencies of forces, varieties of shapes of the beds and banks.

Moreover, density, viscosity and surface tension have also played the important role.

The necessity of the wave study is still inevitable. In the present context we are mostly concerned with the water waves, which is classified mainly into

i) stationary waves - if two simple harmonic progressive waves of the same amplitude, wave length and period travels in opposite directions, the resulting disturbances of the medium is represented mathematically.

$$y = a \sin(mx - nt) + a \sin(mx + nt) = 2a \sin mx \cos nt,$$

Where a is the amplitude, period of the wave is $\frac{2\pi}{n}$ or $\frac{\lambda}{c}$, λ denoted by the wave length, the distance between two consecutive crests of the curve is $\frac{2\pi}{n}$.

ii) Long waves - Occur in shallow water, where the depth of the water is small compared to the wave length and the disturbance affects the motion of the whole of the fluid.

The mathematical expression is, $\frac{\partial^2 \xi}{\partial t^2} = -g \frac{\partial \eta}{\partial x}$, ξ is the time integral of the displace-

ment past the plane, $x = \text{constant}$, in time t , η the elevation of the free surface above the undisturbed level.

iii) Surface waves - Where the wave length may be small compared to the depth so that the effects of the disturbance ceases to be appreciable below a certain depth. The mathematical expression is $\frac{\partial^2 \phi}{\partial x^2} + \frac{\partial^2 \phi}{\partial y^2} = 0$; where ϕ is the velocity potential. The waves of

the sea are sometimes called surface waves. They disturb only a relatively shallow surface layer of water. At a depth of one wave length, the wave motion is only a few percent of what it is at the surface.

That is why submarines that have submerged a hundred feet or more have not been affected by wave motion even during a heavy storm.

It has been observed that

- i) High waves of short period are produced by strong winds near by.
- ii) High waves of long period are produced by very strong winds far away.
- iii) Low waves of short period are produced by weak winds nearby.
- iv) Low waves of long period are produced by moderate winds far away.

The more one studies waves, the more one realises how irregular they are.

High waves are followed by low waves and the changes involved are often considerable.

The complexity of the sea surface is due to the fact that wave trains from many different sources pass over it.

Circular waves spreading in all directions. Two circular waves will pass through each other. Each train will spread as if the other one was not there. Wave trains from two storms or three or four can pass through one another even the different parts of the same storm.

It is clear that winds - Present and past, local and distant, pretty well determine local wave conditions.

If we know about the winds, it should be possible to predict the nature of the waves.

In the deep sea, wave velocity is independent of depth. In shallow water, however, velocity decreases as the depth decreases.

Tidal waves - which are caused by earth quakes : Certain violent ocean waves are caused by earth quakes. The waves may be caused by sudden dislocations of the sea bottom or by submarine land slides; both dislocations and land slides are known to occur during earth quakes. The waves that result are popularly known as tidal waves, also known, earth quake waves or tsunamis.

Tidal waves can travel for great distances at great velocities. In the open sea they are perhaps a foot high and several hundred feet long, but coming towards shore they are greatly amplified.

The present context is mainly dealt with the generation and maintaining of waves of different classes, e.g.. Surface waves, long waves, occurring in seas, rivers, canals with sides of various slopes and of various beds.

They have occurred under the action of gravity and many different natural forces of mathematical and geophysical functions.

In order to represent the pictorial view, the graphical representations have been made, for variation of time as well as spatial co - ordinates.