

COURSE : DISASTER MANAGEMENT (MA/MSc PART I)

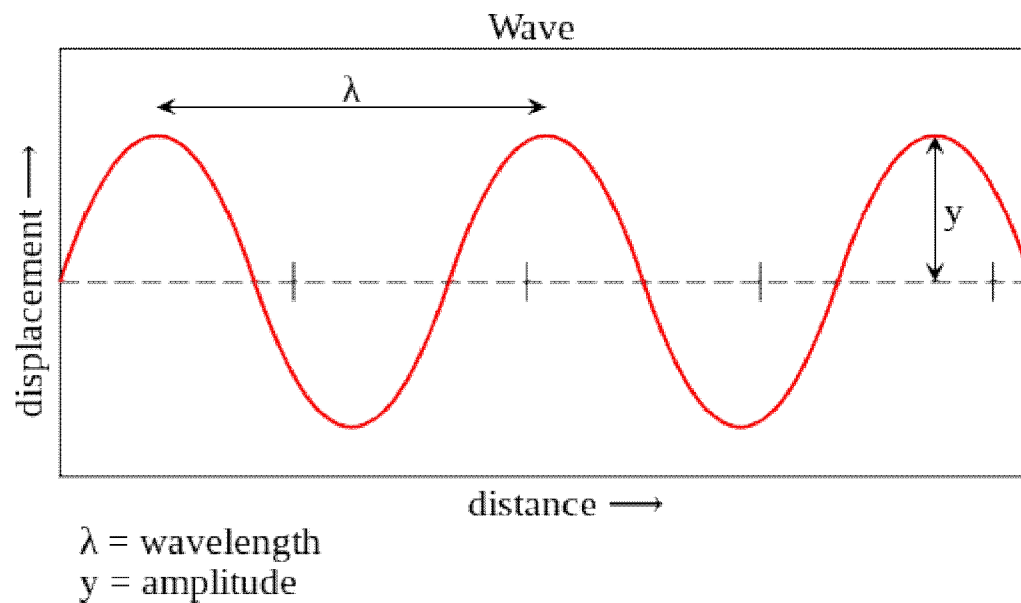
Paper : III

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Topic : Seismic Waves

INTRODUCTION

Energy is transmitted in waves. Every wave has a high point called a crest and a low point called a trough. The height of a wave from the center line to its crest is its amplitude. The distance between waves from crest to crest (or trough to trough) is its wavelength (Figure).



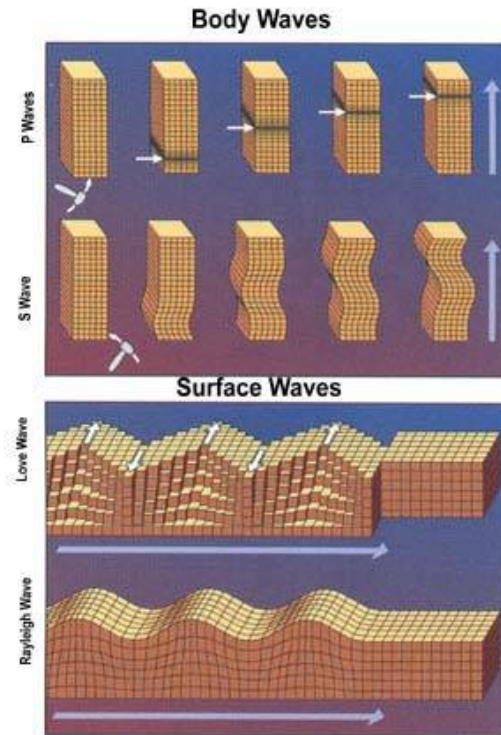
Features of a set of waves.

The energy from earthquakes (and also from explosions) travels in waves called seismic waves. Other types of waves transmit other types of energy; for example, sound waves transmit a child's laughter and other sounds. The study of seismic waves is known as seismology. Seismologists use seismic waves to learn about earthquakes and also about the Earth's interior.

Seismic waves move outward in all directions away from their source. There are two major types of seismic waves. Body waves travel through the solid body of the Earth from the earthquake's focus throughout the Earth's interior and to the surface. Surface waves just travel along the ground surface. The different types of seismic waves travel at different speeds in different materials. All seismic waves travel through rock, but not all travel through liquid or gas. In an earthquake, body waves are responsible for sharp

jolts. Surface waves are responsible for rolling motions. Surface waves do most of the damage in an earthquake.

Body Waves



The top figure shows how body waves, including P-waves and S-waves, move through a grid. The bottom figure shows how surface waves move. The two types of surface waves are Love waves and Rayleigh waves.

There are two types of body waves – primary waves (P-waves) and secondary waves (S-waves). These waves travel through the Earth's interior. P-waves are the fastest at about 6 to 7 kilometers (about 4 miles) per second. They are named primary waves because they are the first waves to reach a seismometer. S-waves are slower and so are the second waves to reach a seismometer. Body waves move at different speeds depending on the type of material they are passing through.

P-waves are longitudinal waves. They move material forward and backward in the same direction that they are traveling. This motion resembles a spring squeezing and unsqueezing. The material returns to its original size and shape after the P-wave goes by. For this reason, P-waves are not the most damaging earthquake waves. P waves can travel through solids, liquids and gases.

S-waves are transverse waves, that move up and down. Their oscillations are perpendicular to the direction the wave is traveling. In a rock, this motion produces

shear stresses. S-waves are about half as fast as P-waves, traveling at about 3.5 km (2 miles) per second. S-waves can only move through solids because liquids and gases have no shear strength.

Surface Waves

Surface waves travel along the ground outward from an earthquake's epicenter. Surface waves are the slowest of all seismic waves, traveling at 2.5 km (1.5 miles) per second. There are two types of surface waves. Love waves move side-to-side much like a snake. Rayleigh waves move in rolls, like ocean swells. These waves cause objects to fall and rise, while swaying back and forth. These motions cause damage to rigid structures during an earthquake.