INTRODUCTION

Physics is concerned with the basic principle of the universe. There are five areas of physics:

1. Mechanics, which deals with the motion of materials objects.
2. Thermodynamics, which involves in heat, temperature and behaviour of large number of particles.
3. Electromagnetism, which involves in electricity, magnetism and electromagnetic field.
4. Theory of relativity, which is the theory describing particles moving at speeds less than the speed of light.
5. Quantum theory which is the theory dealing with the behaviour of particles at the submicroscopic level.

Limits of applicability of classical theory

In the theory of relativity the velocity of light $c = 3.10^8$ m/s plays a fundamental role. *c* is the upper limit on the velocity of any material particles. If the velocity of particle is much less than the velocity of the light then the nonrelativistic treatment is adequate.

The laws of classical physics are good fhenomonological laws, but they not tell us everything about microscopic bodies. If we can describe, for example, the behaviour of mechanismus consisting of springs, we must have given some material constant such a density, modulus of elasticity, etc. of the materials of which a body is built.

However, if we ask why the density is what it is, why the elastic constant has the value what it has, then the classical physics is silent. Classical physics does not tell us why copper melts at 1083°C, why sodium vapor emits yellow light or why silver conduct electricity, in opposite, why sulphur is an insulator. These quantities could not be discussed within classical theory they should be studied with the principle of quantum physics. We may ask whether an analogous criterion does exist which tell us when the theory of classical physics is adequate. Is there a constant of nature “analogous” to the constant of *c*?

Such constant exists and it is known as Planck`s constant and its value is $h = 6.62 \times 10^{-34} Js$. Physical dimension of this constant is

$$(\text{energy})\times(\text{time})=(\text{length})\times(\text{momentum})=\text{angular momentum}$$

The criterium is following. If for physical system any dynamical variable which has the dimension of action assumes a numerical value comparable with Planck`s constant then the behaviour of the system must be described within the principle of quantum physics. On the other hand, every variable having dimension of action very large against *h*, then the laws of classical physics are valid to sufficient accuracy.

In first part of our course we shall study the laws of nature of classical physics.

Note

a) the laws of classical physics follow from the laws of quantum physics. They are approximate laws of nature

b) we shall use the International system of units (SI) in which the unit of mass is kilogram, length is meter and time is 1 sec

c) we shall use the rectangular coordinate system x, y, z