PART-I

PHYSICS

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		Instruments
1.	Hydrometer	Measuring the density or relative density of liquids. Based on floatation principle.
2.	Magnetron	Produces microwave. Used in ovens.
3.	Actinometer	Used to measure intensity of electromagnetic radiation
4.	Altimeter	Aneroid barometer for measuring altitude.
5.	Bolometer	For measuring heat radiation
6.	Dasymeter	Measuring density of gas
7.	Galvanometer	Used for detecting small electric currents.
8.	Gyroscope	Determine orientation in aircraft, ships etc.
9.	Katharometer	Measuring thermal conductivity
10.	Manometer	Measuring the pressure of a gas.
11.	Nethoscope	Determining the speed of celestial bodies.
12.	Rectifier	Converts AC into DC.
13.	Tonometer	Measures pitch of sound
14.	Venturimeter	Measures rate of flow of fluids
15.	Udometer	Rain guage.

Standard Units

1.	Viscocity	Pascal Second
2.	Power	Dioptre
3.	Luminous intensity	Candela
4.	Inductance	Henry
5.	Loudness	Phon
6.	Magnetic Inductance	Tesla
7.	Magnetic Flux	Weber
8.	Electric Charge	Farad, Coulomb

1: THE UNIVERSE

WHAT IS UNIVERSE

The Universe is commonly defined as the totality of existence, including planets, stars, and galaxies, the contents of intergalactic space, and all matter and energy. Definitions and usage vary and similar terms include the cosmos, the world and nature.

The most widely accepted cosmological model is that of the Big Bang. This was proven since the discovery of the cosmic microwave background radiation or CMBR. The Universe was infinitely hot at birth, cooling down as it expanded Today's Universe is found to have an average temperature of only 2.725 Kelvin.

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Observations made especially on galaxies farthest from us show that the Universe is expanding at an accelerated rate. The data that show that the Universe is cooling allows us to believe that the most probable ending for our universe is that of a Big Freeze.

The Universe is 13.7 billion years old. The information is based on measurements made on the CMBR.

The matter is spread uniformly (homogeneously) throughout the universe, when averaged over distances longer than 300 million light-years. However, on smaller length-scales, matter is observed to form clumps, i.e., to cluster hierarchically; many atoms are condensed into stars, most stars into galaxies, most galaxies into clusters, super clusters and, finally, the largest-scale structures such as the Great Wall of galaxies. The observable matter of the Universe is also spread isotropically, meaning that no direction of observation seems different from any other; each region of the sky has roughly the same content.

The Universe mainly consists of Galaxies, Stars, Solar System, Comets, Meteors and Asteroids. A galaxy is a collection of stars, dust and gas. All these materials bound together gravitationally to form a galaxy. Gas and dust found in galaxy in between the stars. It is called interstellar gas, which is mainly hydrogen in its atomic form (H) and to some extent, in molecular form (H2).

Gas forms an important constituent of Galaxy. Gas in Galaxy is both in neutral and iconic form. In neutral atomic form, interstellar gas is mainly hydrogen. In ionic form, some other elements like oxygen, carbon, helium, iron, neon, sulphur and some other elements are present along with ionic hydrogen.

Another constituent of galaxy is dust. Dust can be in small or large particle sizes.

Stars are the third and final constituents of galaxies. Number of stars in a galaxy ranges from 10 million to more than a trillion.

STAR

A star is a huge, shining ball that produces a large amount of energy in form of light and other forms Stars are very far from us, that's why they look like twinkling points of light Our sun is also a star. A lot of stars are like our sun. Some differ in mass, size, brightness and temperature.

The nearest star to the Earth is Sun. It is nearly 150000000 kilometers away from the Earth. The next nearest star is Alpha Centauri. It is at a distance of about 40000000000000 km from the Earth.

The stars forming a group that has a recognizable shape is called a Constellation. For example, one can see Ursa Major during summer time in the early part of the night. It is also known as the Big Dipper, the Great Bear or the Saptarshi. Another well known constellation, Orion can be seen during winter in the late evenings. It is also called the Hunter. Cassiopeia is another prominent constellation in the northern sky. It is visible during winter in the early part of the night. It looks like a distorted letter W or M.

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Stars come in many sizes. Some of the stars have a radius of about 1,000 times that of the sun. The smallest stars are the neutron stars, some of which have a radius of only about 6 miles (10 kilometers). About 75 percent of all stars are members of a binary system, a pair of closely spaced stars that orbit each other. The sun is not a member of a binary system. However, its nearest known stellar neighbor, Proxima Centauri, is part of a multiple-star system that also includes Alpha Centauri A and Alpha Centauri B. Proxima Centauri is 4.2 light years far form sun.

Stars are grouped in huge structures called galaxies. Telescopes have revealed galaxies throughout the universe at distances of 12 billion to 16 billion light-years. Our sun is in a galaxy called the Milky Way that contains more than 100 billion stars. There are more than 100 billion galaxies in the universe, and the average number of stars per galaxy may be 100 billion.

Stars have life cycles. They born, pass through several phases, and finally die. The sun was born about 4.6 billion years ago and will remain much as it is for another 5 billion years. Then it will grow to become a red giant. Late in the sun's lifetime, it will cast off its outer layers. The remaining core, called a white dwarf, will slowly fade to become a black dwarf.

Other stars will end their lives in different ways. Some will not go through a red giant stage. Instead, they will merely cool to become white dwarfs, then black dwarfs. A small percentage of stars will die in spectacular explosions called supernovae.

Brightness of star seen from Earth depends on two factors:

- The amount of light energy the star emits.
- The distance from Earth to the star.

These characteristics are related to one another in a complex way. Color depends on surface temperature, and brightness depends on surface temperature and size. Mass affects the rate at which a star of a given size produces energy and so affects surface temperature.

SURFA CE TEMPER A TURE

The surface temperature of a star is determined by the rate of energy production at the core and the radius of the star and is often estimated from the star's color index. It is normally given as the effective temperature, which is the temperature of an idealized black body that radiates its energy at the same luminosity per surface area as the star. The temperature in the core region of a star is several million kelvins. The stellar temperature determines the rate of energization or ionization of different elements, resulting in characteristic absorption lines in the spectrum. The surface temperature of a star, along with its visual absolute magnitude and absorption features, is used to classify a star.

Massive main sequence stars can have surface temperatures of 50,000 K. Smaller stars such as the Sun have surface temperatures of a few thousand K. Red giants have relatively low surface temperatures of about 3,600 K, but they also have a high luminosity due to their large exterior surface area.

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WHY STAR S A RE OF DIF FER E NT COLO RS

Color of star is the color of light the star is emitting. A star can appear red, if it emits light more towards red part of visible band of electromagnetic spectrum, and can appear blue if it emits light more towards blue part of visible spectrum. Our sun emits light equally among all wavelengths of visible spectrum. That is why our sun appears white to us.

Color of the star depends on its surface temperature.

ASTEROIDS

Asteroids are small rocky bodies that orbit the sun in a belt (Kuiper belt) between orbits of Mars and Jupiter. Not all the asteroids orbit in Kuiper belt. Some are between orbit of Jupiter and some are beyond the orbit of Saturn. More than 100000 asteroids have been found with well charted orbits, out of which 2000 follow the orbits that lead them into inner and outer solar system. Earth has been struck many times by an asteroid.

WHAT ARE M ETEO RS

A meteor is a bright streak of light that appears briefly in the sky. Meteors are often called shooting stars or falling stars because they look like stars falling from the sky. Brightest meteors are sometimes called fireballs. A meteor appears when a particle or chunk of metallic or stony matter called a meteoroid enters the earth's atmosphere from outer space. Air friction heats the meteoroid so that it glows and creates a shining trail of gases and melted meteoroid

particles. The gases include vaporized meteoroid material and atmospheric gases that heat up when the meteoroid passes through the atmosphere. Most meteors glow for about a second.

Most meteoroids disintegrate before reaching the earth. But some leave a trail that lasts several minutes. Meteoroids that reach the earth are called meteorites.

COMETS

Comets revolve around the Sun in highly elliptical orbits. However, their period of revolution round the Sun is usually very long. A Comet appears generally as a bright head with a long tail. The length of the tail grows in size as it approaches the Sun. The tail of a comet is always directed away from the Sun.

Many comets are known to appear periodically. One such comet is Halley’s Comet, which appears after nearly every 86 years.

THE SOLAR SYSTEM

The Sun and the celestial bodies which revolve around it form the solar system. It consists of large number of bodies such as planets, comets, asteroids and meteors. The gravitational attraction between the Sun and these objects keeps them revolving around it. The earth is planet and a member of the solar system. There are seven other planets that revolve around

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