AKGEC/IAP/FM/02

Ajay Kumar Garg Engineering College, Ghaziabad

Department of Applied Sciences and Humanities

MODEL SOLUTION ST-2

Course:	B.Tech	Semester:	III
Section:	CS-3,IT-1,2,EN-1, EI	Session:	2017-18
Subject:	SPACE SCIENCES	Sub. Code:	ROE-034
Max Marks: 50		Time:	2hour

Section-A

Q.1. Define distance modulus.

Ans. Distance Modulus

If we know the apparent magnitude m and the absolute magnitude then we can find the distance in parsec to the star.

$$m = 5 \log_{10}(d) + 5$$

rearranging for d

$$\boxed{d = [10(m-M)+5]/5}$$

Q2. What do you mean by asteroid belt?

Ans: Asteroids are minor planets of inner solar system. There are millions of asteroids, many thought to be the shattered remnants of planetesimals bodies within the young Sun's solar nebula that never grew large enough to become planets. The large majority of known asteroids ~~obr~~ orbit in the asteroid belt between the orbits of Mars and Jupiter.

Q.3 Write names of few natural satellites?

Ans:

S.No.	Satellite	Related Planet
1	Moon	Earth
2	Mimas	Saturn
3	Enceladus	Saturn
4	Io	Jupiter
5	Miranda	Uranus
6	Tethys	Saturn

Q.4: What is nebula?

Ans: A nebula is a truly wondrous thing to behold. It is a cloud of dust, hydrogen and helium gas and plasma. They are also known as Stellar nurseries, i.e. the place where stars are born. Nebula are of different types. Giant molecular clouds are the most common but least noticed because they don't look very exciting, being big, dark and cold clouds of dust and gas.

Q.5: What are Comets?

Ans: A Coment is an icy small solar system body that, when passing close to the sun warms and begins to release gases, a process called out gassing. This process is visible as a tail. Comet nuclei range from a few hundred meters to tens of kilometers across.

Que 6 What are the problems related to eye & their remedies?

Ans → There is a spectrum of symptoms occuring due to air pollution. It may range from simple irritation & burning to severe allergy cataract & even cancer. The most common problems are –

(i) Redness of eyes
(ii) Burning sensation
(iii) watering
(iv) Ropy discharge
(v) Itching sensation
(vi) Dry, gritty sensation
(vii) Difficulty in vision due to watering & itching.

Allergic Reaction: Severe itching, redness, discharge, eyelid swelling, unable to open eyes, vision problem & risk of infection.

Some of the remedies are:

→ Cool compress to closed eyes.
→ Frequent use of lubricants eye drops given by eye specialists.
→ Sunglasses
→ Avoid direct splashing of water to open eyes.
→ Avoid contact lens and eye makeup if eyes are feeling sore.

Q. 7 what is Bode's law? Which planet do not fit in Bode's law and why?

Bode's law also called Titius- Bode law, empirical rule giving the approximate distance of planets from the Sun It was first announced by Titius in 1766 ~~by~~ a German astronomer but popularized only from 1772 by Elert Bode.

It begins with the sequence 0, 3, 6, 12, 24 .... in which each no. after 3 is twice the previous One. To each no. is added 4, after each result is divided by 10. Of the 7 answers 0.4, 0.7, 1.0, 1.6, 2.8, 5.2, 10.0 - six of them (2.8 being the exception) closely approx. the distances from Sun, expressed in astronomical units. Mercury, Venus, Earth, Mars, Jupiter & Saturn follows the rule approx.. At about 2.8 AU from the sun, b/w MARS & Jupiter, the asteroids were later Discovered begining with Ceres in 1801. Uranus (in 1781) found to hold the rule at 19 AU. But it failed to be hold for planet Neptune & that of Pluto.

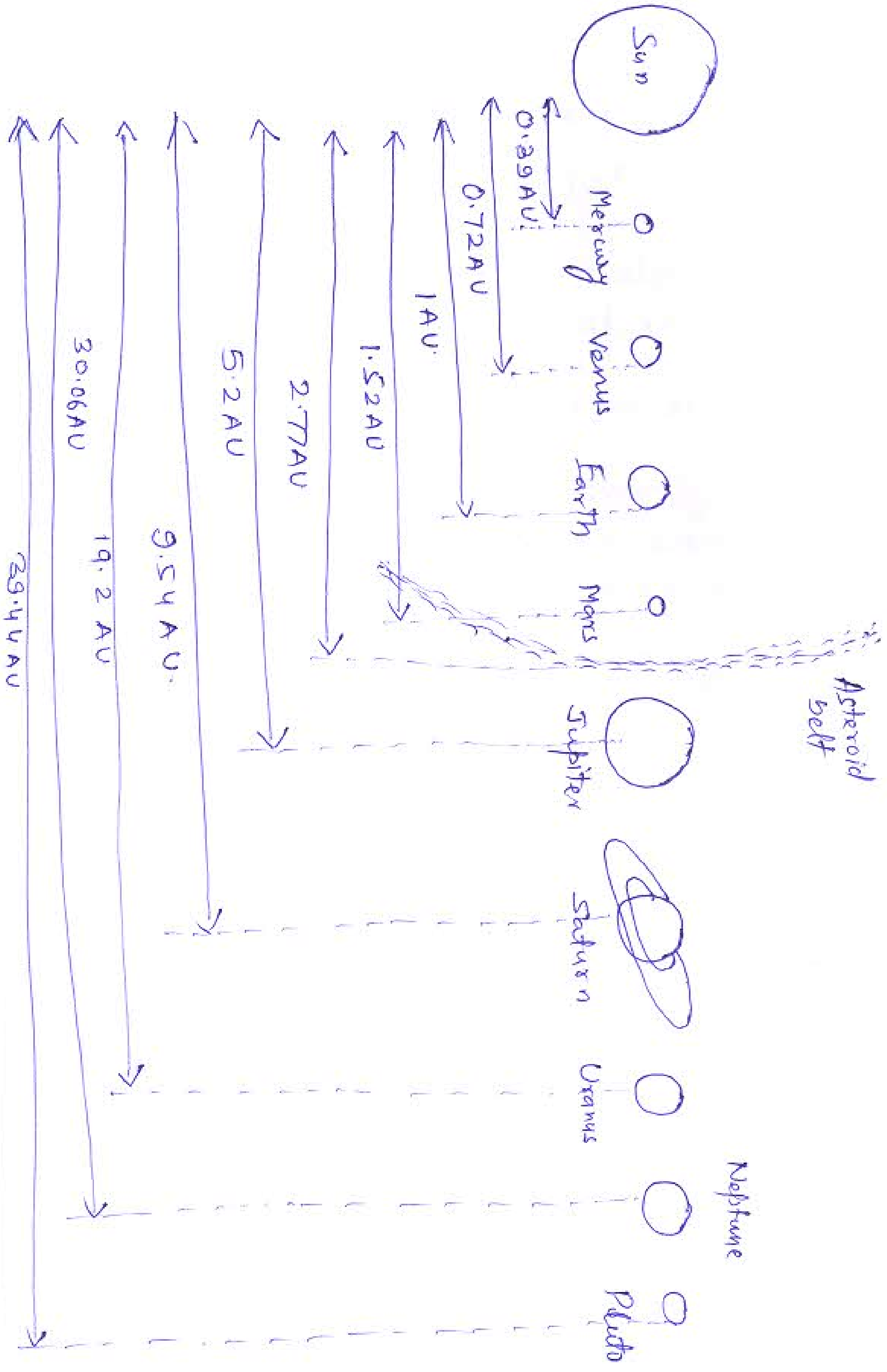
let A is semimajor axis distance

$$\boxed{A = 0.4 + 0.3\,(2^k)}\ AU.$$

	Planet	2^k	Bode (AU)	Actual (AU)	Correctness (%)
1.	Mercury	0	0.4	0.39	97.5 %
2.	Venus	1	0.7	0.72	97.2 %
3.	earth	2	1.	1.	100 %
4.	Mars	4	1.6	1.52	95 %
5.	Asteroids	8	2.8	2.77	98.92 %
6	Jupiter	16	5.2	5.2	100.0 %
7.	Saturn	32	10.	9.54	95.4 %
8.	Uranus	64	19.6	19.2	97.95 %
9	Neptune	128	38.8	30.06	77%
10.	Pluto	256	77.2	39.44	51.08 %

Q.8: Draw a neat and clean sketch of our Solar system and show the relative position of Planets?

Sol:



Que 9 How non-optical telescopic techniques are used in space observation

Measuring distance in space and magnitude

The distances involved in the universe are so vast that meters or Kms are not sufficient to it. We must introduce new length scales with which we can span the heavens.

Astronomical unit (A.U)

$$1\ A.U = 1.49 \times 10^{8}\ Km.$$

Light Year :- It is the distance travelled by light in one year at the rate of speed of light.

$$1\ L.y = 63230.6717\ AU$$

Parsec :- The other commonly used unit in astronomy at which star would have a parallax angle P equal to one second of arc.

$$1\ Parsec = 3.26\ light\ year.$$

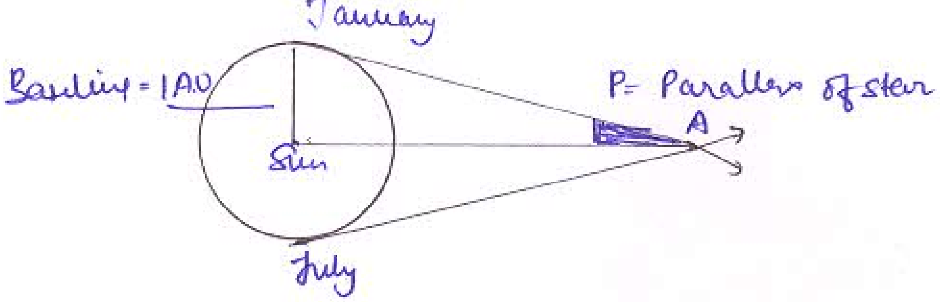
Magnitude of Stars

Apparent magnitude

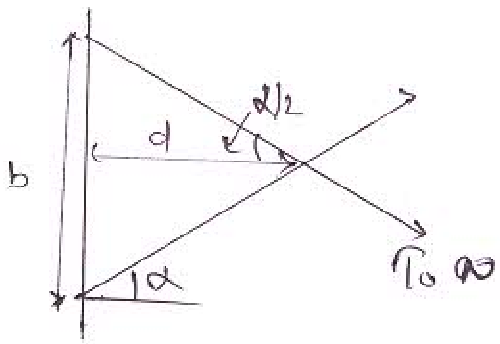
Name	Apparent magnitude	distance from Earth
Sun	-26.74	1 AU
Full moon	-12	2×10^{5} Km
Venus	-4.71	38 million Km
Sirius	-1.46	26 pc
Vega	0.03	13 pc
Canopus	7	96 pc ± 5pc

Fainted stars   30 as seen with the european extremely large telescope (E.E.L.T)

Parallax → Consider that the earth moves in its orbit around the sun, allowing us to look nearly stars from slightly different



By knowing the size of earth's orbit & measuring the angles of sun light from the star at two points in the orbit the distance to the star can be derived.



b = baseline
d = distance to object
α = measure parallax angle

$$d = \frac{(1/2)b}{\tan(\alpha/2)}$$

Absolute Magnitude :- The absolute magnitude is the brightness of a star at a distance of 10 parsecs.

Q.10 How do scientists measure space weather? Mention Technique.

Sol: Even though the sun is very far away, it has a big effect on earth. It gives us warmth & light. Storms on the sun can also bring about what scientist call space weather on earth on near earth (just outside our atmosphere so space weather starts at the sun, so, scientists watch the sun with special telescopes. Some of the telescopes are on earth & some are out in space. Scientist use other special instruments to look at the different layers of the sun or to find out what make up the sun.

The sun gives off light, but it also shoots out radiation. When radiation from the sun hits earths atmosphere, the radiation can make the atmosphere 'glow' may be you have seen this glow.

Although weather of space is base on observation hence there are two types of observations are

(1) Ground base observation

(2) Satellite observation

Sending of spacecraft ~~obs~~ signals due to temperature of space.

(2) Solar winds

(3) by rendering temperature devices on space crafts.

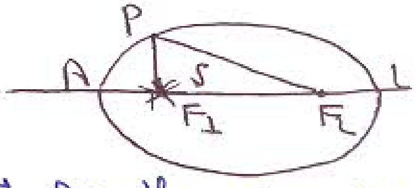
Shubham Pandey
(S-3)

Q(1) State Kepler's law of Planetary motion and show that how they can be deduced from Newton's law of gravitation.

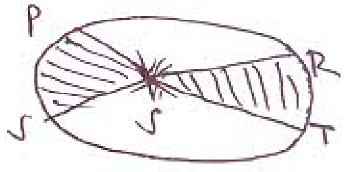
Ans → In the early 1600s, Johannes Kepler proposed three laws of Planetary motion as follows:

* Kepler's First law (law of orbits):- Each planet moves around the sun in an elliptical orbit with sun at one of its foci.

$$\boxed{PF_1 + PF_2 = \text{constant}}$$



* Kepler's Second law (Law of areas) → As the planet moves in its orbit, a line drawn from sun to the planet sweeps out equal areas in equal intervals of time. Let PQS and RST be the areas swept by the line joining the planet and sun in equal intervals of time. Kepler found that these areas are equal. Hence the speed of the planet around the sun must be maximum at the perihelion position and minimum at the aphelion position



* Kepler's third law (Law of periods) →
The squares of the periods of revolution of the planet are proportional to the cubes of their mean distance from the sun.
If R is the mean distance of the planet from the sun and T is the period of its revolution the third law states that

$$\boxed{T^2 \propto R^3}$$

deduction of Kepler's law from Newton's law of gravitation

According to Newton's law of gravitation, Gravitational force between two bodies of mass M and m is given by

$$F = \frac{GMm}{r^2} \quad -(1)$$

where 'r' is the distance between two bodies
G → universal gravitational constant
In this case we consider 'r' is the radius of a Planet's circular orbit about the sun.

When an object moves in a circle, even at constant speed, it experience an acceleration. This is because velocity is changing as direction of velocity vector is changing.

Acc. to Newton's 2nd law,

$$F = ma$$

for circular motion, this force is known as centripetal force. It is given by

$$F = \frac{mv^2}{r} \quad -(2)$$

where 'm' is mass of moving body,
'v' is its speed
'r' is radius of the circular orbit.

This centripetal force is given by gravity. So we can say that

$$\frac{GMm}{r^2} = \frac{mv^2}{r}$$

$$\frac{GM}{r} = v^2 \quad -(3)$$

for one full circle

$$v = \frac{2\pi r}{T}$$

$2\pi r$ → circumference of circle
'T' is the time it take to complete one full orbit

$$v^2 = \frac{4\pi^2 r^2}{T^2} \quad -(4)$$

Using (4) in (3)

$$\frac{GM}{r} = \frac{4\pi^2 r^2}{T^2}$$

$$GM\,T^2 = 4\pi^2 r^3$$

$$T^2 = \left(\frac{4\pi^2}{GM}\right) r^3$$

$K = \frac{4\pi^2}{GM}$ known as Proportionality constant

$$\Rightarrow T^2 = Kr^3 \Rightarrow \boxed{T^2 \propto r^3}$$

Proved

(12)

Achievents of Hubble Space telescope.

⇒ First of all Hubble space telescope ~~is~~ helps us to guess the age of universe.

Now we know that universe is 13.7 bilion years old.

⇒ Hubble space telescope after announcing discovery of three blank hole in three normal galaxies, astromers suggest that nearly all galaxies may harbor super massive blank holes that once powered quasars (extremely luminous objects in the center of galaxies), but are not quiescent. So we can just state that massive black hole Dwell in most galaxies.

⇒ By the Hubble telescope we can observe the nature ~~of~~ and conclude how planets are formed.

⇒ Nasa's hubble telescope has made the first detection ever of an organic molecule in the atmosphere of a jupiter-size planet orbiting another star. This breakthrough is an important step in eventualy identifying sign of life on a planet outside our solar System

⇒ The hubble space telescope detected a distanct supernova that suggest the universe only recently began speeding

why radio telescopes are better than optical ones

Light and radio waves are both forms of electromagnetic radiation, which means they both are the result of interaction of energy and matter in ~~a~~ specific ways. optical radiation and radio wave are of ~~a~~ significantly different wavelengths. another way of saying that light and radio wave are different energy. There interection with matter are therefore much different so measuring radio waves and light from the same source provides information about different things going on with the source. so radio telescope are better because they provide insight insight into different things than optical telescope can provide.

The important factor is the ratio between the wavelength of the ~~wave~~ electromagnetic radiation to the diameter of the telescope. The small that ratio, the more detailed the image can be.

So radio telescope are better.