

Total number of printed pages-4

3 (Sem-6/CBCS) PHY HE 1

2023

PHYSICS

(Honours Elective)

Paper : PHY-HE-6016

(Communication Electronics)

Full Marks : 60

Time : Three hours

The figures in the margin indicate full marks for the questions.

1. Answer the following : $1 \times 7 = 7$
- (i) Write the frequency range used for FM broadcast.
 - (ii) What are radio waves ?
 - (iii) Geosynchronous satellites are located at a height of _____ km.
 - (iv) Write the significance of modulating index.

Contd.

(v) Write the full form of IMEI.

(vi) How many satellites are there in Indian GPS ?

(vii) What is the frequency band used in GSM system ?

2. Answer the following : $2 \times 4 = 8$

(i) What is the need for data encryption ?

(ii) Why is the amplitude of the modulating signal kept less than the amplitude of the carrier wave ?

(iii) Write *two* advantages of geostationary satellite.

(iv) Define noise. Write the names of *any two* external noise. $1 + 1 = 2$

3. Answer *any three* from the following :

$$5 \times 3 = 15$$

(i) Define Johnson noise. Write down the expression for maximum noise power output of a resistor and derive the expression for rms noise voltage associated with a resistor. $1 + 1 + 3 = 5$

(ii) Calculate the percentage power saving when the carrier and one of the sidebands are suppressed in an AM wave modulated to a depth of (a) 100 per cent and (b) 50 per cent. $2^{1/2} + 2^{1/2} = 5$

(iii) What is frequency division multiplexing ? Draw a block diagram of FDM. Define guard band. $1 + 3 + 1 = 5$

(iv) Illustrate briefly the need of satellite communication ? Write the *six* orbital elements. Mention *two* uses of geosynchronous satellite. $2 + 2 + 1 = 5$

(v) What is mobile communication ? Mention the *three* types of mobile communication techniques and give *one* example for each of the type. $1 + 2 + 2 = 5$

4. Answer *any three* from the following :

$$10 \times 3 = 30$$

(i) Define the uplink and downlink for satellite communication. Draw proper block diagram to show the uplink and downlink processes. Name the frequency bands used for satellite link.

$$2 + 6 + 2 = 10$$

(ii) For an input binary sequence 010101101 draw the ASK and FSK modulated wave. Explain the working of a synchronous ASK demodulator with proper block diagram. $2+2+6=10$

(iii) Write the basic principles of PAM, PWM and PPM. Explain with circuit diagram the generation of PAM signal. $6+4=10$

(iv) Draw a block diagram of mobile communication network. What are the major subsystems of GSM network architecture? Outline the difference between 2G and 4G network.

$5+3+2=10$

(v) Derive an expression for frequency modulated wave. The output signal of an FM wave is given by $s(t) = 20 \cos((8\pi \times 10^6 t + 9 \sin(2\pi \times 10^3 t)))$. Calculate the frequency deviation, bandwidth, and power of FM wave.

$5+1\frac{1}{2}+1\frac{1}{2}+2=10$

(vi) Write short notes on : $5+5=10$

(a) Radio communication system in India (TRAI)

(b) GSM technology

Total number of printed pages-7

3 (Sem-6/CBCS) PHY HE 4

2023

PHYSICS

(Honours Elective)

Paper : PHY-HE-6046

(Astronomy and Astrophysics)

Full Marks : 80

Time : Three hours

The figures in the margin indicate full marks for the questions.

1. Answer the following questions : $1 \times 10 = 10$
 - (a) What is Stellar Parallax?
 - (b) Write the sequence of classification of stars.
 - (c) What is the most basic property of a star that determines its location on the main sequence?

Contd.

- (d) Define an asteroid.
- (e) Will solar time and sidereal time differ if the difference in the longitudes of two places is equal to the difference in time ?
- (f) Where does the star formation take place in our galaxy ?
- (g) What is cosmic microwave background radiation ?
- (h) What is the shape of Kuiper belt ?
- (i) What does f -number represent in a telescope ?
- (j) What is Zenith point ?

2. Answer the following questions : $2 \times 5 = 10$

- (a) Solar corona is observed only during total solar eclipse. Why ?

- (b) Express 1 January, 2023 in Julian Date.

- (c) Write declination δ of

- (i) Celestial North pole

- (ii) Celestial South pole

- (iii) Zenith

- (d) State the cosmological principle.

- (e) The apparent magnitude of full Moon is -12.5 and that of Venus is -4 . Which one is brighter and how much ?

3. Answer **any four** questions from the following : $5 \times 4 = 20$

- (a) Parallax of Barnard's star is 0.522 . Calculate its distance in parsec, light year, astronomical unit, mile and kilometre. $1+1+1+1+1=5$

(b) Sketch the Sun, and identify the corona, chromosphere, photosphere, convection zone, radiation zone and core. Explain why the temperature of the chromosphere increases with height. $3+2=5$

(c) The mass of Sirius B is thrice that of the Sun. Find the ratio of luminosity and difference in their absolute magnitude. Taking the absolute magnitude of the Sun as 5, find the absolute magnitude of Sirius B. $1+2+2=5$

(d) Explain *one* method used for determination of distance of nearby celestial bodies.

(e) Define luminosity and radiant flux. Using Stefan-Boltzmann law of radiation, obtain the ratio of radii R_1 and R_2 of two stars with surface temperatures T_1 and T_2 and absolute magnitudes M_1 and M_2 respectively. $2+3=5$

(f) Explain the concept of distance ladder.

4. Answer **any four** questions from the following : $10 \times 4 = 40$

(a) Sketch the H-R diagram showing all groups of stars. Show the location of the Sun on the diagram. What information does the H-R diagram provide about stars? $6+1+3=10$

(b) What are galaxies? Explain the origin and evolution of galaxies. How are they classified? Draw a schematic view of the Hubble galaxy classification. What are the main differences between lenticulars and spirals? $1+2+1+3+3=10$

(c) Explain the terms ecliptic, North and South celestial pole, horizon, celestial equator, latitude, longitude, declination, right ascension and hour angle. Draw a celestial sphere and show the positions of above mentioned terms in the celestial sphere. $5+5=10$

(d) Derive Virial theorem and find the internal energy of a Star. $6+4=10$

(e) (i) Discuss various parts of Milky Way, Stellar populations and motions of Stars in the Milky Way.

5

(ii) Define active galaxies. Mention the characteristics of active galaxies.

$2+3=5$

(f) Discuss different stages of the evolution of a star.

(g) What is meant by resolving power of a telescope? Explain the Rayleigh criterion for resolution. Calculate the diffraction limit of resolution of a 3m telescope for wavelength 600nm.

$2+5+3=10$

(h) Write short notes on **any two** of the following : $5 \times 2 = 10$

(i) Carbon-nitrogen cycle

(ii) White dwarf

(iii) Oort's cloud

(iv) Neutron star

(v) Oscillating universe
