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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 : 1×7=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