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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 : $1 \times 7 = 7$

(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

