3 (Sem–6/CBCS) PHY HE 1

2022

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 *any seven* questions :   1×7=7

   (i) Why is modulation needed for communication ?

   (ii) Define noise.

   (iii) What is baseband signal ?

   (iv) What is IMEI number of a mobile phone ?

(v) Write the frequency range for 4G network.

(vi) For amplitude modulation, write the relation between powers of side and carrier frequency if the depth of modulation is 1.

(vii) Define pre-emphasis.

(viii) How many side bands exist in frequency modulation ?

(ix) What are the frequencies the modulated wave has in case of amplitude modulation ?

(x) Write one difference between FM and PM.

2. Answer any four of the following : 2×4=8

(i) Draw a block diagram for communication system.

(ii) Write the significance of signal-to-noise ratio.

(iii) Explain briefly the importance of modulation index.

(iv) Define ASK and FSK.

(v) How many AM stations can be accommodated in a 100 kHz bandwidth if the highest frequency of the message signal is 5 kHz ?

(vi) A 500 W carrier is to be modulated to 90% level. Determine the total transmitted power.

(vii) Write two differences between GSM and CDMA.

(viii) Define path loss in satellite communication and express it mathematically.

3. Answer **any three** of the following :

$$5 \times 3 = 15$$

(i) What are the advantages of geostationary satellite ? Draw a simplified block diagram of earth station. $2+3=5$

(ii) Discuss briefly about cell splitting and cell sectoring.

(iii) If a 1000 kHz carrier wave is modulated by an audio signal varying between 10 and 500 Hz, Calculate the —

(a) frequency span of sideband;

(b) maximum upper side frequency;

(c) the frequency range of the channel.

(iv) Draw a simplified block diagram of mobile phone handset.

(v) Consider an audio signal $15 \sin 2\pi$ $(1500\ t)$ that amplitude modulates a carrier $60 \sin 2\pi (100000\ t)$.

(a) Construct all the signals.

(b) Determine the modulation index and percentage modulation.

(c) What are the frequencies of audio signal and the carrier ?

(vi) Discuss the generation of frequency modulation using VCO.

(vii) Write a short note on mobile communication network.

(viii) Explain briefly about the process of uplink in satellite communication.

4. Answer **any three** of the following :

$$10 \times 3 = 30$$

(i) Derive an expression for amplitude modulated wave. The output signal from an AM modulator is
$s(t) = 5\ cos\ (1800\,\pi\,t) + 20\ cos\ (2000\,\pi\,t) + 5\ cos\ (2200\,\pi\,t)$. Calculate —

(a) the modulation index; and

(b) the ratio of the power in the sidebands to the power in the carrier. $5+5=10$

(ii) Derive the expression of modulated wave in case of frequency modulation. A 100 *MHz* carrier is frequency modulated by 10 *kHz* wave. For a frequency deviation of 50 *kHz*, calculate the modulation index of the FM signal.

6+4=10

(iii) Explain the emitter modulation method to generate AM wave.

(iv) Draw a block diagram of super heterodyne receiver and explain the function of each section.

(v) Define PAM, PWM and PPM. Consider a sinusoidal signal and draw the corresponding modulated wave for each modulation method. (3+2+2)+3=10

(vi) Explain with diagram the working of ASK, FSK and PSK.

3+3+4=10

(vii) Explain the diode detector method to detect amplitude modulated wave.

(h) Write short notes on :   5+5=10

(a) Global positioning system

(b) Electromagnetic communication spectrum

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