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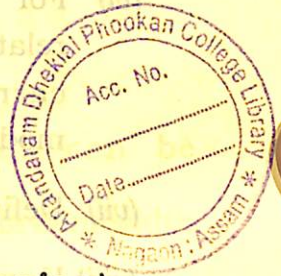
3 (Sem-6/CBCS) PHY HE 1

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 : $1 \times 7 = 7$

(i) Why is modulation needed for communication ?

(ii) Define noise.

(iii) What is baseband signal ?

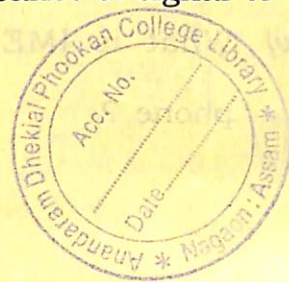
(iv) What is IMEI number of a mobile phone ?

Contd.

- (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 : $2 \times 4 = 8$

- (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.

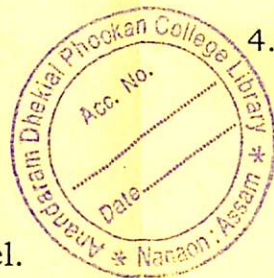
4. Answer **any three** of the following :

$$10 \times 3 = 30$$

(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

