

1249

Roll No.

Name of the Department : Department of Physics and Astrophysics
Name of the Course : B.Sc. Hons. (Physics)_NEP: UGCF-2022
Name of the Paper : Communication Systems (DSE paper)
Semester : V- Semester
Unique Paper Code : 2223010015
Question paper Set number : Set I
Duration : 2 hours
Maximum Marks : 60 Marks

Instructions for Candidates:

- (a) Write your Roll No. on the top immediately on receipt of this question paper.
- (b) Attempt **FOUR** questions in all. Question number **one** is compulsory.
- (c) Non-programmable scientific calculator is allowed.

Q1 Attempt any five parts from this question. All questions carry same marks (3x5=15)

- (a) State the difference between analog and digital modulation. Give one example of each.
- (b) Determine the percent power saving when the carrier wave and one of the sidebands is suppressed in an AM wave modulated to a depth of 50%.
- (c) Explain the need for modulation in communication?
- (d) Draw PPM and PWM wave forms for a sinusoidal modulating signal.
- (e) Why is the uplink frequency kept higher than the downlink frequency in satellite communication?
- (f) What information is contained in the SIM number?

Q2

- (a) Define Amplitude Modulation (AM) and write mathematical expressions for AM. The output signal from an AM modulator is.

$$V_{AM}(t) = 5 \cos(1800\pi t) + 20 \sin(2000\pi t) - 5 \cos(2200\pi t)$$

Determine the following.

- (i) Frequency and amplitude of modulating signal
- (ii) Frequency and amplitude of carrier signal
- (iii) Modulation index

- (iv) Ratio of the power in the sidebands to the power in the carrier. (7)
- (b) Define the two types of angle modulation. (2)
- (c) A single tone modulating signal $\cos(15\pi \cdot 10^3 t)$ frequency modulates a carrier of 10 MHz and produces a frequency deviation of 75 KHz. Find the modulation index and phase deviation produced in FM wave. If another modulating signal produces a modulation index of 100 while maintaining the same deviation, find the frequency and amplitude of the modulating signal. Assume $k_f = 15 \text{ KHz/volt}$. (6)

Q3

- (a) State and prove sampling theorem. Calculate the Nyquist rate and sampling frequency for analog signal is expressed by the equation (7)

$$x(t) = 5 \cos(100\pi t) + 10 \sin(500\pi t) - 8 \cos(300\pi t)$$
- (b) What is Pulse Amplitude Modulation (PAM)? Draw the circuit of a Pulse Amplitude modulator and explain its working. List the disadvantages of PAM. (8)

Q4

- (a) Sketch ASK, FSK and BPSK waveforms for the sequence: 1011011010. (3)
- (b) Describe in detail the three basic operations involved in Pulse Code Modulation. (6)
- (c) Distinguish between Time Division Multiplexing (TDM) and Frequency Division Multiplexing (FDM). (6)

Q5

- (a) Draw and explain the block diagram of transponder in a communication satellite. What are the advantages of a geostationary satellite? (8)
- (b) Why is mobile phone called a cellphone? Explain the concept of cell sectoring and cell splitting in mobile communication? (7)