M.SC. INSTRUMENTATION SCIENCE FIRST YEAR SECOND SEMESTER- 2023

Subject: **COMMUNICATION SYSTEMS**   Time: Four Hours   Full Marks: 80

Instructions: Answer any eight questions (all questions carry equal marks $10 \times 8 = 80$)

1) Define deterministic & random signal,analog & digital signal,energy & power signal and causal & non-causal signal and unit impulse & unit step function.

2) Explain instantaneous frequency of a signal. Obtain an expression for an FM wave.

3) A modulating signal $10 \sin(2\pi \times 10^3 t)$ is used to amplitude modulate a carrier signal $20 \sin(2\pi \times 10^4 t)$. Determine the modulation index, percentage modulation, frequencies of the sideband components

and their amplitudes .What will be the bandwidth of the modulated signal ?

4) Explain why Telemetry is required. Describe a Wireless Telemetry system with block diagram?

5) State & prove sampling theorem considering a band limited signal g(t) of B Hz and a impulse pulse train $\delta TS(t)$ with frequency fs .Draw the time and frequency domain waveforms.

6) Define Pulse communication and its application? Explain PAM modulation and demodulation process with proper diagrams and mathematical expression.

7) Encode the bit stream 1100110 into polar RZ, polar NRZ, unipolar RZ, AMI & Manchester.

8) State Shannon's channel capacity theorem. Calculate the capacity of the channel where channel bandwidth is 4Khz, noise power is 0.0001 mW and the signal power required at the receiver is 0.1mW.

9) For a 12-bit data string of 101100010010; determine the number of Hamming bits required, arbitrarily place the Hamming bits into the data string, determine the condition of each Hamming bit, assuming an arbitrary single-bit transmission error, and prove that the Hamming code will detect the error.

10) Describe BPSK modulation with wave form diagram. What is the band width of BPSK signal?

11) Describe a Multi-Channel PCM Telemetry system with diagram.