

Thapar Institute of Engineering & Technology, Patiala

Department of Electronics and Communication Engineering

UEC639 – Digital Communication

B. E. (Third Year): Semester-V (ENC)

Tutorial-3

Q1	Consider a signal $x(t) = 40 \sin(200 \pi t)$ is given as input to a PCM system. If 256 quantization levels are employed, then (a) Determine the voltage between levels when there is no compression? (b) Determine the smallest and largest effective separation between levels when non-linear quantization is used with $\mu = 255$
Q2	Consider an audio signal with spectral components from 300 to 3300 Hz. A PCM signal is generated with a sampling rate of 8000 samples per sec. The required output signal-to-quantizing-noise ratio is 30 dB. (a) What is the minimum number of uniform quantizing levels needed? (b) What is the minimum number of bits per sample needed? (c) Determine the minimum system bandwidth required. (d) Repeats parts (a) to (c) when a $\mu - law$ compander is used with $\mu = 255$.
Q3	What is Companding? What is the need of Companding? Explain A-law and mu-law compression.
Q4	What is slope overload distortion and granular noise? How these problems can be overcome
Q5.	Derive the expression of mean square value of quantization noise and post filtered output signal-to-quantizing-noise ratio for a delta modulation system.
Q6	A DM system is designed to operate at 4 times the Nyquist rate for a signal with a 6 kHz bandwidth. The quantizing step size is 250 mV. (a) Determine the maximum amplitude of a 3-kHz input sinusoidal signal for which delta modulator does not show slope overload. (b) Determine the post filtered output signal-to-quantizing-noise ratio in dB.