

**Thapar Institute of Engineering & Technology, Patiala**

Department of Electronics and Communication Engineering

**UEC639 – Digital Communication**

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

**Tutorial-2**

<b>Q1</b>	If a continuous signal with highest frequency component 15 kHz is sampled and transmitted using PCM system at a transmission rate of 1.5 Mbps (Data Rate = $R_b=1.5$ Mega bit per sec) then determine the values of sampling rate $f_s$ , the quantizing level $L$ , and the binary digits.
<b>Q2</b>	Explain the quantization process with the help of an example. Also do the classification of quantization.
<b>Q3</b>	Derive the expression of mean square quantization error for a sinusoidal input signal. Also, determine this expression in terms of quantization level. Assume uniform distribution for quantization error.
<b>Q4</b>	In a binary PCM system, the output signal to quantization noise ratio is required to be held to a minimum value of 40 dB. Determine the value of quantization level and mean square value of quantization error.
<b>Q5</b>	Explain aperture effect and aliasing error in a sampling process.
<b>Q6</b>	Draw the transfer characteristics of mid-tread and mid-rise type of quantizer.
<b>Q7</b>	<p>For a full-scale sinusoidal modulating signal with amplitude <math>A</math>, show that signal-to-quantizing-noise ratio in a PCM system is given as</p> $(SNR)_o = \left(\frac{S}{N_q}\right)_o = \frac{3}{2} L^2$ $\left(\frac{S}{N_q}\right)_{0\text{ dB}} = 1.76 + 6.02n \text{ dB}$