Question 1

In a Delta Modulation system, a sinusoidal signal is sampled at a rate of 64 KHz. The maximum signal amplitude is 1.
1) Determine the minimum value of the step size to avoid slope overload
2) Determine the granular noise power

Question 2

A DPCM system with first order predictor is used with a mid-rise uniform quantizer with a step $\Delta = 1$.
1) Draw the block diagram of the DPCM transmitter.
2) If the input signal samples are $[0.3 \ \ 1.6 \ \ 1.9 \ \ 3.4]$, what will be the output of the encoder? Assume the predictor has zero initial state.
3) Draw the block diagram of the DPCM receiver.
4) What will be the output of the receiver?
5) What is the end-to-end quantization noise, i.e. $m[k] - m_q[k]$?

Question 3

Repeat the solution of the previous question for each of the following cases:
1) Mid-tread uniform quantizer with a step $\Delta = 1$
2) Mid-rise uniform quantizer with a step $\Delta = 0.5$
3) DPCM system with second order averaging predictor

Question 4

A Delta Modulator system is used with a mid-rise uniform quantizer with a step $\Delta = 1$.
1) Draw the block diagram of the DM encoder.
2) If the input signal is half a cycle of $\sin(2\pi t)$ sampled at four times the Nyquist rate, what will be the output of the encoder? Assume the predictor has zero initial state.
3) Draw the block diagram of the DM decoder.
4) What will be the output of the decoder?
5) Is the slope overhead condition satisfied? Justify your answer.