NOTE: This is an open books/notes exam. Each question is worth 20 points. Use of any electronic devices including mobile phone is strictly forbidden.

1. A comparator may be thought of as a one-bit analog-to-digital converter. Explain why this description of a comparator is appropriate. What exactly is meant by the term analog-to-digital converter,” or ADC?

2. Flash analog-to-digital converters are easy to understand, but are not practical for many applications. Identify some of the drawbacks.

3. The following diagram shows the frequency spectrum of a signal that we want to digitize. How can you comment on the maximum sampling period of this signal to avoid information loss?

4. For the following circuit, derive the transfer function relating the capacitor voltage, $V_c(t)$, to the input voltage, $e(t)$ (i.e. derive the transfer function $V_c(s)/E(s)$).