

Directions: Answer any 6 questions in the space provided or on separate sheets, with at most one question per side. One 8.5 x 11 inch note sheet is permitted. No talking. Closed book. Show your work.

1. a) What is a layered system?
 - b) What is the difference between chained layers and end-to-end layers?
 - c) Why are layered systems desirable? Is there a cost?

2. a) What are Nyquist's Theorem and the Sampling Theorem? How are they related?
 - b) What is their relevance to digital encoding?

 - c) Derive an expression for the minimum signal-to-noise ratio (in dB) required for transmission of V distinct signal elements sent at the Nyquist rate.

3. a) Describe PAM - what is it, why is it used?
 - b) What is PCM and why is it used? How does it differ from PAM?

 - c) What is Delta Modulation - what are its strengths and weaknesses?

 - d) What is companding - why is it used and how does it work?

4. a) What are four important considerations when evaluating digital encoding of digital information? Why are these important?
 - b) What is a differential encoding and what benefits does this type of coding offer?

 - c) How does a DPLL work and why are they important?

 - d) Compare Manchester coding, Bipolar AMI, and NRZ coding.

5. a) Draw the signal constellation for a 4-ary ASK modulation scheme.
 - b) Draw the signal constellation for a 4-ary PSK modulation scheme.

 - c) What is AM-PSK and what does a signal constellation for it look like?

 - d) What is PPM and why is it used? What is its efficiency relative to binary ASK?