1. DAC and ADC
   1.1. DAC construction using a current summer, switches, resistors, and a voltage source
   1.2. DAC, Multiplying DAC, PGA
   1.3. ADC constructed from a DAC, a voltage comparator, and a binary number generator.
       (Search scenarios: simple count, binary search or successive approximations)
   1.4. ADC – Dual Slope
   1.5. ADC – Flash
   1.6. DAC, ADC – amplitude resolution – How is it determined?

2. Computer Architecture
   2.1. Number Systems - Binary, Decimal, Hexadecimal
   2.2. Representations/Storage Formats - unsigned integers, signed integers, floating point,
       logical; Character Sets (ASCII, ANSI, UNICODE)
   2.3. Logic operations - AND, OR, XOR, bit, word
   2.4. Gate and Latch and Switch
   2.5. Registers
   2.6. Simple Bus, transfer of information between two devices – 1 bit/4 bit
   2.7. 8 Bit Bus – Master/Slave
   2.8. Bus structures – address, control, data
   2.8. Memory, CPU structure, Disk structure
   2.9. Programmers model of computer, memory structures
   2.10. Simple example of a computer
       • You will not have to create assembly language/machine level programming, but
             you should be able to explain existing code segments.
       • Instruction set, Instruction format
       • Indirect addressing.
       • Register Structure
       • Memory structure
   2.11. Laser Experiment – sequence of events, block diagram, register structure, program,
         memory map

3. Data Acquisition
   3.1. Simple (Programmed)
   3.2. ADC and Real Time Clock
3.3. Programmable Clock
3.4. Direct Coupled Clock
3.5. ADC – Sample and hold
3.6. ADC – Multiplexer
3.7. Local Buffering
3.8. Triggering – Pre-, mid-, post-; hardware, software; trigger signal source; Trigger criteria
3.9. Multiple ADC
3.10. Circular buffers
3.11. Computerized instruments, intelligent instruments, distributed instrument systems
3.12. Arrays of intelligent instruments – Bus connected, daisy chained, star connected
3.13. Timing strategies for data acquisition: equal, varied, exponential

4. National Instruments Hardware
4.1. Be able to identify, reproduce, discuss the block diagram of Computer with NI 6024E and BNC-2120.
4.2. Be able to label and discuss the NI 6024E block diagram,
4.3. Be able to discuss the NI 6024E general specs: ADC, PGA, AO, DIO, (No Timing I/O).
4.4. Be able to label and discuss the BNC-2120 Block Diagram.

5. LabVIEW
   [You will not have to create a VI, but you must be able to discuss existing VI's containing the following aspects.]
5.1. Run, Run Continuously, Highlight Execution, Halt Execution
5.2. Block Diagram, Front Panel
5.3. Tool, Indicator, Control, Function Palettes
5.4. Data/Wire Types: U, I, Dbl, SGL, String, Path, Array
5.5. Controls, Indicators, Variables, Arrays, (no Clusters this time), Labels
5.6. Structures: For, While, Flat Sequence Frames, Stacked Sequence Frames
5.7. *SubVIs, Terminals, Connector Pane, Icon Editing

6. Data Analysis – Signal-to-Noise Enhancement
6.1. Noise sources and types (Systematic, Random)
6.2. Averaging on the fly
6.3. Averaging scans
6.4. Smoothing (smoothing distortions)
6.5. Curve Fitting (Linear Least Squares)
6.6. Curve Fitting (Nonlinear Least Squares), Strategies for finding parameters of the fit.
6.7. FFT (transform of Sine, Square, Triangle, Sawtooth waves),(filtering)

* You will not be held responsible for this.