Review Questions (SDOF and Response Spectrum)

What do we use (what do we start with as our "input") to develop a response spectrum (please be very specific)? With this input, how is a response spectrum developed?

What is the parameter we obtain from a displacement response spectrum D, and why is this particular parameter of importance?

For a SDOF of T = 2 sec and 2% viscous damping, D = 8 inches (in a particular spectrum), find V and A for this SDOF (include units, and change A to g units please).

Why is it that D, V, and A can all be shown on a single plot (the usual spectrum figure)?

Why is the response spectrum useful for analysis of most SDOF structures?

Why is the response spectrum useful for analysis of many MDOF structures?

Why is a single response spectrum inadequate for design of a particular structure under consideration, and what do we do instead (following the logic of use of spectra)?

How do we develop a design spectrum?

What is the difference between a design spectrum and a response spectrum?

Sketch D, V, and A each on a graph showing the main difference in the shape of these curves.

What structural response parameter (for SDOF) do we obtain from a given displacement response spectrum (please be very specific)?

Why are V and A known as "Pseudo" spectra?

Derive a relation showing that A is also the spectrum of actual total (absolute) acceleration for zero damping (actually, A is also a close approximation of a total acceleration spectrum for low damping and low T values as shown in Figure in class).

A SDOF can be described by m, k, and c and also by frequency and damping ratio. What is the relationship between these parameters? Write the SDOF in terms of frequency and damping.

How do we get frequency in Hz using k and m?

Define Hz (draw a small sketch if needed).

A viscous damping c is added in the SDOF equation, although we know that viscosity is not necessarily the dominant damping mechanism in structures. Mention some common damping mechanisms in structures. Why do we resort to c in our analyses?

Define critical damping.

Define damping ratio and name a typical value for structures and a range.

What T corresponds to a rigid structure?

Why does D always start at zero for T =0 seconds?

How do we find the peak ground displacement from a response spectrum D, and why?

How do we estimate the peak ground acceleration from A?

Design Spectrum Question (draw sketches as much as possible)
a) If a fairly rigid structure is to be designed, the engineer decided to pay close attention to a smaller nearby active fault. Why?

b) The same engineer thought that this fault is not as relevant for a tall high rise building in the same area. Why?

c) If it is decided that this nearby fault is the main concern, how would we go about developing a design spectrum for the site of interest?

d) If there is also a distant active very large fault, how would we develop a design spectrum for the area near the smaller fault?