Module II:

1. Take an appropriate control volume and derive the mass conservation equation in (a) cylindrical and (b) spherical coordinate system.

2. Write down the Navier-Stokes equations in vector form and use the form of the divergence and gradient operators in vector forms to derive the NS equations in cylindrical and spherical coordinates.

3. Write down the compressible and the incompressible form of the governing equations in Cartesian coordinates for a 2-dimensional flow case.

4. Deduce the governing equation that was solved in Lecture 2 for the case of fully developed flow through a rectangular duct.

5. Write down the corresponding equation if viscosity is not constant but is a function of, say, temperature which varies spatially and temporally (for an unsteady flow case) in a given case.

6. See if you can write down the governing equations for the cases you discussed for Question #2, Module I.

7. Explore the world of non-Newtonian fluids by looking at simple models proposed for the stress vs strain rate relation for these fluids.

8. See if you can write down the governing equation for the problem considered in Lecture 2 if the fluid is a “power-law” fluid.