Topics – Scaling and Estimation in Physics

(Each unit ~ 1 hr.)
Note: In all cases, the style of presentation will be that of "back-of-envelope".

A.)   *Scaling* – An Introduction

i.)   *A Second Look at Pi*: assumptions in, restrictions on, and *non-trivial* applications of Buckingham's Theorem

ii.)-iii.) *Self-Similarity*: concept, examples/space: Blast Waves, Ground Water Flow; examples/scales: turbulent cascade, fractals, generalized dimension

iv.)   *Self-Similarity II*: Intermittency corrections to cascade spectra, incomplete similarity

B.)   *Fluids* – A *Very* Short Introduction for Physicists

v.)-vi.) *Steady Flow*: Potential, Stokes, Boundary Layers, Wakes (Laminar, Turbulent)

vii.)   *Waves*: Surface, Capillary, Shallow Water, Beach Phenomena, Bores

viii.)   *Instability*: Rayleigh-Taylor, shear, convection

ix.)   *Turbulent Boundary Layers*: Pipe Flow, Heat Transfer, Convection Re-visited

x.)   *More Turbulence*: 2D, dual cascade, formation of flow structure