Advanced Engineering Mathematics

Session I
(or the warm up)
Contents (What?)

• Linear Analysis, Hilbert Space => Functional Analysis
  – Why?
    • System-based point of view: signals and systems,
    • Physics-based point of view:
Contents

• Sturm-Liouville Operator Theory
  – Why?
    • Usually encountered in electromagnetic problems,
    • Gives us new sets of functions useful in spectral, pseudo-spectral methods
Contents

• Green’s Function Method
  – Why?
    • Gives us closed form analytic expressions
    • Spectral behavior of SL operators
Contents

• The Spectral Representation
  – Why?
    • Great physical importance
    • Mathematical importance in Green’s function representation
Contents

• Mathematical Modeling of Electromagnetic Sources,
• Spectra of Open/Closed Waveguides,
Approach (How?)

• Reasoning:
  – Plausible,
    • Why? => train of thought
  – Strong,
    • Why? => no Baconian idols, no Ockham’s razor
  – Aristotle vs. Euclid
  – How do we learn?
Approach

• Organism + Environment =>
  Consciousness/Cognition

Object => Sensation =>
  Perception
  +Recollection
  +Imagination
  => Concept, Idea
Approach

• Concept, Idea =>
  Cognition/Consciousness
  – Emotional (organism’s reaction)
    Inside
  – Scientific
    Outside

Music vs. Mathematics/Subjective or Objective?
Approach

• Math: the free creation of mind?
• Realism vs. Antirealism
• Einstein: "Physical concepts are the free creations of the human mind and are not, however it may seem, uniquely determined by the external world."
• Realism vs. Antirealism