**Lab / Exercise / Reading Sequence**

**ENGG 107**

1. Why use Bayesian methods?
   1. Review of probability
   2. The Bayesian approach
      1. Links to decision-making
      2. The likelihood function
      3. The prior
      4. The posterior
2. “Simple” approaches (when things seems or may even be easy)
   1. Analytical solutions / Kalman filter
   2. Precalibration
   3. Bayes Monte Carlo
   4. Markov Chain Monte Carlo
3. How to plan, document, and communicate Bayesian analyses?
   1. How to define the question?
   2. How to pick a (n initial) method?
   3. How to pitch a research idea?
   4. How to write a method section for a paper / a proposal?
   5. How to document and share your analyses?
4. What to do when simple approaches do not work?
   1. Detecting problems
      1. Lack of convergence
      2. Misconvergence
      3. Deep uncertainty
      4. Poor priors
   2. Tackling the problems
      1. Slow models
         1. Particle Filter
         2. Emulation
         3. Hybrid methods
         4. Global sensitivity analysis and factor prioritization
      2. Poor priors
         1. Expert elicitation
         2. Probabilistic inversion
      3. Deep uncertainty
         1. Communication and analysis
         2. Bayes factors
         3. Bayesian model averaging
         4. Links to robust decision-making
5. Student presentations