# Syllabus

**Probabilistic inference:** probabilistic modelling for scientific applications, constructing likelihoods, prior specification, properties of posterior estimates and summaries.

**Bayesian computation:** Monte Carlo methods, importance sampling, Markov Chain Monte Carlo (Metropolis-Hastings, Gibbs sampling, slice sampling, Hamiltonian Monte Carlo), nested sampling, convergence diagnostics, Bayesian workflow in practice, approximate inference methods.

**Model comparison:** posterior predictive checks, simulation-based calibration, likelihood ratio, information criteria, Bayes factors, cross-validation.

**Advanced topics:** hierarchical models, shrinkage and partial pooling, non-parametric Bayesian methods (Gaussian processes), probabilistic graphical models, selection effects, topics in time series analysis and spatial statistics.

# Resources

There are many useful textbooks on this subject. However, no single book one covers all the material at the right level and in the way it will be done in this course. Nevertheless, the following book may be useful and were used in preparing these notes:

- D. S. Sivia, "Data Analysis: A Bayesian Tutorial"
- D. J. C. Mackay, "Information Theory, Inference and Learning Algorithms"