I Basics of Bayesian inference [R. Trotta]
Introduction to inference: what is it? Why do we need it?
Frequentist probability vs Bayesian probability
Confidence levels, posterior distributions, priors and the difference between all those
If time allows: classical hypothesis testing vs Bayesian model comparison

II An introduction to random matrix theory [J. Barbier]
The Wigner ensemble and the semi-circular law
Wishart Ensemble and Marcenko–Pastur law
Spiked matrix models and the BBP transition

III Introduction to unsupervised learning and dimensional reduction [A. Laio]
PCA
Multidimensional scaling and kernel methods
Intrinsic dimension estimates

IV Neural networks [S. Goldt]
Neural networks 101: types and applications + some open theoretical problems
Learning dynamics: empirical phenomena and theoretical predictions
The impact of data structure
Unsupervised learning: from Hebbian learning to independent components