



Bayesian methods in Geotechnical Engineering

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General Information

Geo-structural design requires careful evaluation of soil mechanical profiles and geotechnical parameters while accounting for both aleatory variability and epistemic uncertainty. In practice, ground models and geotechnical parameter values are often inferred using simplified best-case and worst-case scenarios based largely on engineering judgment and experience. Such simplifications may result in inaccurate designs and predictions of geo-structural performance. From a mathematical standpoint, Bayesian methods provide a rigorous framework for combining multidisciplinary information, enabling the systematic updating of prior knowledge as empirical evidence becomes available. This course introduces the principles of Bayesian theory along with its modelling techniques and applications in geotechnical engineering. Both theoretical and practical aspects will be explored supported by illustrative case studies. Each participant will work on a case study designed to reinforce understanding and demonstrate the practical application of the Bayesian method.

Duration: 12 hours (2 credits)

In presence

Materials

Personal Laptop with Matlab/Python installed.

Schedule

Dates	Description
Date 11/05/2026	Introduction to Bayesian analysis for spatial-temporal modelling
Date 14/05/2026	Mechanical ground modelling from sparse multidisciplinary in-situ testing
Date 18/05/2026	Bayesian analysis applied to geo-structure design
Date 26/05/2026	Hierarchical Bayesian Modelling /case study discussion
Total 12 Hours - 2 Credits	

Other information

The course is introductory in nature; no prior experience with Bayesian methods is required.

Examples and exercises will be implemented using Matlab or Python.

For any information www.indicee.unifi.it - dott-dicea@unifi.it