Mathematical Modeling Mini-Courses (3MC) presents:

African Mathematical School on Mathematical Modeling in Biology

20-28 March 2023

Sponsored by











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EUROPEAN MATHEMATICAL SOCIETY Mathematical Modeling Mini-Courses (3MC) presents:

African Mathematical School on Mathematical Modeling in Biology

20-28 March 2023

Venues for the lectures: E8-B40 (20-23 March), E8-G37/B36/B39 (24 March), G1-112 (25-28 March)
Wifi: Eduroam is available on campus. Alternatives will be announced during the event.
Website: <u>https://natural-sciences.nwu.ac.za/paa/3MC-School-BM</u>

Monday 20 March 2023 (E8-B40)	
08:00-08:25	Registration
08:25-08:30	Opening
08:30-10:00	Lecture 01 (Portet 1)
10:00-10:30	Tea break
10:30-12:00	Lecture 18 (Santana 1)
12:00-13:00	Group work/Project
13:00-14:00	Lunch
14:00-15:30	Lecture 05 (Li 1)
15:30-16:00	Tea break
16:00-17:00	Tutorial/Computer Lab

Program

Tuesday 21 March 2023 (E8-B40)	
08:30-10:00	Lecture 02 (Portet 2)
10:00-10:30	Tea break
10:30-12:00	Lecture 08 (Watmough 1)
12:00-13:00	Group work/Project
13:00-14:00	Lunch
14:00-15:30	Lecture 19 (Santana 2)
15:30-16:00	Tea break
16:00-17:00	Computer Lab

Wednesday 22 March 2023 (E8-B40)	
08:30-10:00	Lecture 09 (Watmough 2)
10:00-10:30	Tea break
10:30-12:00	Lecture 06 (Li 2)
12:00-13:00	Group work/Project
13:00-14:00	Lunch
14:00-15:30	Lecture 20 (Banasiak 1)
15:30-16:00	Tea break
16:00-17:00	Tutorial/Computer Lab

Thursday 23 March 2023 (E8-B40)	
08:30-10:00	Lecture 07 (Li 3)
10:00-10:30	Tea break
10:30-12:00	Lecture 03 (Portet 3)
12:00-13:00	Group work/Project
13:00-14:00	Lunch
14:00-15:30	Lecture 21 (Banasiak 2)
15:30-16:00	Tea break
16:00-17:00	Tutorial/Discussion

Monday 27 March 2023 (G1-112)	
08:30-10:00	Lecture 13 (Arino 2)
10:00-10:30	Tea break
10:30-12:00	Lecture 11 (Watmough 4)
12:00-13:00	Lecture 04 (Portet 4)
13:00-14:00	Lunch
14:00-15:30	Lecture 16 (Ouifki 2)
15:30-16:00	Tea break
16:00-17:00	Tutorial/Discussion

Friday 24 March 2023 (E8-G37/B36/B39)	
08:30-10:00	Lecture 12 (Arino 1)
10:00-10:30	Tea break
10:30-12:00	Lecture 22 (Banasiak 3)
12:00-13:00	Group work/Project
13:00-14:00	Lunch
14:00-15:30	Lecture 10 (Watmough 3)
15:30-16:00	Tea break
16:00-17:00	Tutorial/Discussion

Saturday 25 March 2023 (G1-112)	
08:30-10:00	Lecture 23 (Banasiak 4)
10:00-10:30	Tea break
10:30-12:00	Lecture 15 (Ouifki 1)
12:00-13:00	Group work/Project
13:00-14:00	Lunch
14:00-15:00	Group work/Project
15:00-15:30	Tea break

Tuesday 28 March 2023 (G1-112)	
08:30-10:00	Lecture 17 (Ouifki 3)
10:00-10:30	Tea break
10:30-12:00	Lecture 14 (Arino 3)
12:00-13:00	Group work/Project
13:00-14:00	Lunch
14:00-15:00	Presentation projects 1
15:00-15:30	Tea break
15:30-16:30	Presentation projects 2

Mini courses

Mini-course 1

Lecturer: Prof Stephanie Portet Lecture 01: Introduction to modelling Lecture 02: Qualitative analysis of ODE and discrete models Lecture 03: Beyond mathematical analysis Lecture 04: Use of collection of models and model selection

Mini-course 2

Lecturer: Prof Michael Li Lecture 05: Epidemic models, epidemiological data, and parameter identification problem Lecture 06: Building Lyapunov functions for complex models Lecture 07: In-host models: modeling HIV-1/SIV-1 infection in brain with clinical data

Mini-course 3

Lecturer: Prof James Watmough

Lecture 08: Simple birth-death processes and their associated deterministic models; an introduction to simple ecological, epidemiological and in-host models

Lecture 09: Thresholds, dynamics and bifurcations; modelling immune system dynamics; intra-guild predation

Lecture 10: Structured models; time-since-infection; multi-scale models

Lecture 11: Spatial Ecology; invasions and spread

Mini-course 4

Lecturer: Prof Julien Arino Lecture 12: The chemostat: an artificial ecosystem Lecture 13: Metapopulation models Lecture 14: Continuous time Markov chains

Mini-course 5

Lecturer: Prof Rachid Ouifki Lecture 15: A brief introduction to the theory of DDEs Lecture 16: Modeling with DDEs Lecture 17: Simulations of delay equations models using Matlab

Mini-course 6

Lecturer: Prof Leonard Santana Lecture 18: Basics of linear regression: Models and estimation Lecture 19: Inference and shrinkage estimators

Mini-course 7

Lecturer: Prof Jacek Banasiak Lecture 20: Discrete models through Leslie matrices Lecture 21: Perron-Frobenius theory and applications Lecture 22: From Leslie matrices to McKendrick-von Foerster models Lecture 23: Epidemiological models with continuous age structure

For more details on the minicourses, go to the website: <u>https://natural-sciences.nwu.ac.za/paa/3MC-School-BM/Mini-Courses</u>

Projects

There are projects available on the following topics

- 1. HIV
- 2. Smallpox
- 3. Influenza
- 4. Yellow Fever in Senegal in 2002
- 5. Cholera in South Africa 2000–2001
- 6. SARS Outbreak
- 7. Paths of an Epidemic
- 8. Models for Extinction
- 9. Growth of Cell Populations
- 10. Cell Competition
- 11. Fairy Rings
- 12. Optimal Spatial Foraging
- 13. Mass March of Termites into the Deadly Trap
- 14. Dashboarding and visualization of disease data
- 15. Data storytelling and presenting infographics of mathematical modeling results

For more details on the projects, see the separate file with the project descriptions.

