M025	FIN,MR-elective-Year 2 IPM-obligatory-Semester 3	**Mathematical Models**	L+P+S 1+0+1	ECTS 3

Course objective. Through lectures and seminar papers students will become familiar with some classical mathematical models used in various fields of human activity (physics, engineering, computing, economy, medicine, biology, agriculture).

Course prerequisites. Undergraduate study programme in mathematics

Syllabus.

1. Models described by first-order linear differential equations. Exponential growth model. Logistic growth model. Gompertz growth model. Von Bertalanffy model. Some diffusion models in economics (Bass model, Easingwood-Mahajan-Muller model). Mechanical oscillations. Planetary motions. Electrical networks. Testing for diabetes. Pursuit curves.
2. Models described by second-order linear differential equations. Predator-pray model. Epidemic models. Some chemical kinetic models. Two-oscillator model. Mathematical theories of war (Richardson's theory of conflict, Lanchester combat models and the battle of Iwo Jima).
3. Models in reliability theory. Basic concepts of reliability theory. Weibull model. Some software reliability models (Jelinski-Moranda model, Littlewood model, etc.).

Expected learning outcomes:

After completing the course, students are expected to:

- become familiar with some classical mathematical models used in various fields of human activity (biology, physics, computing, economy, medicine, agriculture);
- be able to get acquinted with a specific mathematical model and demonstrate they have mastered it by means of a written and verbal report;
- become trained for independent research and work with mathematics literature and presentation.

Teaching methods and student assessment. The course is delivered in form of lectures and seminars. Participation in lectures and seminars is obligatory. Each student must write a seminar paper and present it to other students. The exam consists of a written part and a successfully presented seminar.

Can the course be taught in English: Yes.

Basic literature:

1. D.Mooney, R.Swift, A Course in Mathematical Modelling, Mathematical Association of America, 1999.
2. D. Jukić, Reviewed course materials available on the course website.

Recommended literature:

1. D. Burghes, M. Borrie, Modelling With Differential Equations, Ellis Horwood Ltd, Chichester, 1982.
2. M. Braun, Differential Equations and Their Applications, Springer, New York, 1993.
3. M.S. Klamkin (Editor), Mathematical Modelling: Classroom Notes in Applied Mathematics, SIAM, Philadelphia, 1987.
4. I. Ivanšić, Fourierovi redovi. Diferencijalne jednadžbe, Odjel za matematiku, Osijek, 2000.
5. M. Alić, Obične diferencijalne jednadžbe, PMF-Matematički Odjel, Zagreb, 1994.