

Óbuda University Bánki Donát Faculty of Mechanical and Safety Engineering		Institute of Mechanical Engineering and Technology Department of Materials Technology	
Lecture name and Neptun code: BAXHME2MNF, Thermal processes and their modeling Credits: 4			
Course type: Online			
Period: 2024/25 2nd semester			
Master course: Mechanical Engineering			
Lecturer: András Dr. Mucsi, associate professor		Practice: Name	
Number of sessions/week/term: Weekly		Lecture:	Practise:
Exam/ course assignment: Midterm mark		Language: English	
Course objective			
Goal of the course: The goal is to gain the basic principles of modeling of heat transfer processes. Students will learn from the basics through the 1 and 2D modeling of stationary heat processes to the solving of time-dependent heat transfer problems. Learning the possibilities of modeling of transformation processes.			
Thematics: Basics, heat transfer coefficient, thermal conductivity, differential equation of heat conduction, solving it for 1D Descartes and cylindrical coordinate systems in stationary cases. Time dependent heating of an electric wire with and without insulation. Heat loss trogh walls and tubes with and without multi-layer insulation. Contact heat transfer resistance. Mathematical basics of numerical differentiation and integration. Finite difference method for solving transient 1D heat conduction problem in case of semi-infinite wall and tube. Modeling of transformation processes in metallic materials. Modeling of isothermal irreversible transformations using the Johnson-Mehl-Avrami-Kolmogorov theory. Modeling of non-isothermal transformation processes using recursive algorithm. Basics of cellural automation methods.			

Subjects		
Weeks	Lectures	Practices
1	Introduction, heat transfer, heat radiation, heat conduction	
2	Heat conduction differential equation. Solving for 1D cases.	
3	Steady-state and transient heating of electrical wires with and without insulation	
4	Heat loss through multi-layer walls in Descartes and cylindrical coordinate system	
5	Numerical differentiating and integrating, finite differences	
6	1D transient heat transfer equation solving via finite difference method in Descartes coordinate system	Microscopy test
7	Boundary conditions, application with finite difference method	Etching materials
8	1D transient heat transfer equation solving via finite difference method in cylindrical coordinate system	Microscopy test
9	Transformation processes. Classification, modelling possibilities	Non-destructive test of the welded joint 1
10	Modeling of isothermal transformation processes using the JMAK equation.	Non-destructive test of the welded joint 2
11	Determination of JMAK constants using measurements. Fitting of JMAK equation.	Non-destructive test of the welded joint 3
12	Modeling of nonisothermal transformations using recursive method	Hardness tests

13	Cellular automation methods. Effect of parameters on growth characteristics.	Second Test
14	Summary	Replacement of the missed practice

Semester week	Test
13.	First
14.	Repeated test (over time)
Course assessments:	
<p>Evaluation of tests happens by scoring. The tasks are theoretical and practical. Participation in the test is mandatory.</p> <p><u>The midterm mark is determined from the test result.</u></p> <p><u>Intervals of the grade:</u></p> <p>under 50%: 1 (unsatisfying)</p> <p>50-62,5 %: 2 (pass mark)</p> <p>62,5-75 %: 3 (satisfactory mark)</p> <p>75-87,5 % 4 (class)</p> <p>87,5-100% 5 (Excellence)</p> <p><u>In the case of an unsatisfying midterm mark, you can take a midterm grade replacement exam.</u></p>	
<p>The method of the supplement: You can take a midterm grade replacement exam only one time set out by the tutor in the first 10 days of the exam period with the payment of the examination fee. This is the writing exam with the whole curriculum. The examination method is writing.</p>	
Compulsory literature	
<p>- M. Necati Özişik: Heat transfer – a basic approach. McGraw – Hill Book Company, New York, 1985.</p>	
Quality assurance methods of the subject:	
<p>The standard of theoretical and practical education is annually overviewed at an institution's conference based on the feedback of the teachers and students. They assess the success of the subject and make suggestions for necessary changes in order to maintain the interaction between theory and practical training.</p>	

Budapest, 2025.01.15.

András Dr. Mucsi
Subject Leader
Lecturer