|  |  |
| --- | --- |
| **Course code** | CC2 |
| **Type and description** |  |
| **ECTS credit** | 1 |
| **Course name** | **Physics of Building Materials 2** |
| **Course name in Polish** | **Fizyka porowatych materiałów budowlanych 2** |
| **Language of instruction** | English |
| **Course level** | 8 PRK |
| **Course coordinator** | **Dariusz Gawin** |
| **Course instructors** | **Dariusz Gawin, Marcin Koniorczyk, Witold Grymin** |
| **Delivery methods and course duration** | |  | **Lecture** | **Tutorials** | **Laboratory** | **Project** | **Seminar** | **Other** | **Total of teaching hours during semester** | | --- | --- | --- | --- | --- | --- | --- | --- | | Contact hours | 8 | 0 | 7 | 0 | 0 | 0 | 15 | | E-learning | No | No | No | No | No | No |  | | Assessment criteria (weightage) |  |  | 1,00 |  |  |  |  | |
| **Course objective** | Aims of the course is:   1. to extend knowledge in the field of durability of porous building materials, 2. to learn formulating coupled mathematical models of chemo-hygro-thermo-mechanical phenomena in porous building materials, 3. to learn numerical methods for simulation of coupled chemo-hygro-thermo-mechanical phenomena in porous materials. |
| **Learning outcomes** | After the course student:   1. knows and understands main degradation processes influencing building materials durability (W1), 2. knows and understands physical and chemical fundamentals of porous building materials durability (W1), 3. knows and understands basics of chemical thermodynamics and physico-chemistry for analysis of porous building materials durability (W1), 4. knows and is able to formulate initial-boundary problems for analysis of coupled chemo-hygro-thermo-mechanical phenomena in porous materials (U1), 5. knows the chemical and physical origins of mutual couplings between chemical processes and hygro-thermo-mechanical processes in porous materials (W1), 6. can derive a weak form of the mathematical model of coupled chemo-hygro-thermo-mechanical phenomena in porous materials (U1), 7. knows and can apply numerical methods and/or softwares to analysis of coupled chemo-hygro-thermo-mechanical phenomena in porous building materials (U1). 8. can present the obtained results (U2). |
| **Assessment methods** | Verification methods of learning outcomes:  effects no. 1-8: by worksheet project.  The final grade is composed of:  75% - project  25% - oral presentation of achieved solutions in project |
| **Prerequisites** |  |
| **Course content with delivery methods** | Basics of durability of porous building materials.  Basics of Thermodynamics of degradation processes in porous materials.  Mathematical models of coupled chemo-hygro-thermo-mechanical phenomena in porous materials.  Application of Finite Element and Finite Difference Methods for simulation of coupled chemo-hygro-thermo-mechanical phenomena in porous materials.  Numerical analysis of coupled chemo-hygro-thermo-mechanical phenomena in porous materials  Examples of practical application. |
| **Basic reference materials** | 1. Aitkins, P., de Paula, J., 2002. Aitkins’ Physical Chemistry, Seventh Edition. Oxford University Press Inc., New York. 2. Lewis, R.W., Schrefler, B.A., 1998. The Finite Element Method in the Static and Dynamic Deformation and Consolidation of Porous Media, 2nd edition. John Wiley & Sons, Chichester. 3. Gawin, D., 2000. Modelling of coupled hygro-thermal phenomena in building materials and building components (in Polish), Scientific Bulletin of Łódź Technical University No 853. Editions of Łódź Technical University, Łódź. 4. Gawin, D., 2010, Procesy degradacji mikrostruktury kompozytów cementowych w wysokiej temperaturze, Seria Studia z Zakresu Inżynierii Nr. 69, stron 232, ISBN 978-83-89687-54-8, Wydawnictwo Komitetu Inżynierii Lądowej i Wodnej PAN, Warszawa. 5. Koniorczyk, M., 2013, Transport i krystalizacja soli w materiałach budowlanych, Zesz. Nauk. Politech. Łódz. Rozpr. Nauk. 2013, z.443, stron 166, Łódź |
| **Other reference materials** |  |
| **Average student workload outside classroom** | 10h |
| **Comments** |  |
| **Last update** |  |