

| <b>Course code</b>                                |   |           |            |           |            |         |   |       |   |               |   |   |   |   |   |   |   |            |    |    |    |    |    |    |    |                                 |   |   |   |      |   |   |      |
|---|---|-----------|------------|-----------|------------|---------|---|-------|---|---------------|---|---|---|---|---|---|---|------------|----|----|----|----|----|----|----|---------------------------------|---|---|---|------|---|---|------|
| <b>Type and description</b>                       | EC– Elective Course in Discipline: Civil engineering and transport  |           |            |           |            |         |   |       |   |               |   |   |   |   |   |   |   |            |    |    |    |    |    |    |    |                                 |   |   |   |      |   |   |      |
| <b>ECTS credit</b>                                | 1   |           |            |           |            |         |   |       |   |               |   |   |   |   |   |   |   |            |    |    |    |    |    |    |    |                                 |   |   |   |      |   |   |      |
| <b>Course name</b>                                | Concrete Durability   |           |            |           |            |         |   |       |   |               |   |   |   |   |   |   |   |            |    |    |    |    |    |    |    |                                 |   |   |   |      |   |   |      |
| <b>Course name in Polish</b>                      | Trwałość betonu   |           |            |           |            |         |   |       |   |               |   |   |   |   |   |   |   |            |    |    |    |    |    |    |    |                                 |   |   |   |      |   |   |      |
| <b>Language of instruction</b>                    | English   |           |            |           |            |         |   |       |   |               |   |   |   |   |   |   |   |            |    |    |    |    |    |    |    |                                 |   |   |   |      |   |   |      |
| <b>Course level</b>                               | 8 PRK   |           |            |           |            |         |   |       |   |               |   |   |   |   |   |   |   |            |    |    |    |    |    |    |    |                                 |   |   |   |      |   |   |      |
| <b>Course coordinator</b>                         | dr hab. inż. Marcin Koniorczyk  |           |            |           |            |         |   |       |   |               |   |   |   |   |   |   |   |            |    |    |    |    |    |    |    |                                 |   |   |   |      |   |   |      |
| <b>Course instructors</b>                         | dr hab. inż. Marcin Koniorczyk  |           |            |           |            |         |   |       |   |               |   |   |   |   |   |   |   |            |    |    |    |    |    |    |    |                                 |   |   |   |      |   |   |      |
| <b>Delivery methods and course duration</b>       | <table border="1"> <thead> <tr> <th></th> <th>Lecture</th> <th>Tutorials</th> <th>Laboratory</th> <th>Project</th> <th>Seminar</th> <th>Other</th> <th>Total of teaching hours during semester</th> </tr> </thead> <tbody> <tr> <td>Contact hours</td> <td>0</td> <td>0</td> <td>0</td> <td>5</td> <td>0</td> <td>0</td> <td>5</td> </tr> <tr> <td>E-learning</td> <td>no</td> <td>no</td> <td>no</td> <td>no</td> <td>no</td> <td>no</td> <td>no</td> </tr> <tr> <td>Assessment criteria (weightage)</td> <td>0</td> <td>0</td> <td>0</td> <td>100%</td> <td>0</td> <td>0</td> <td>100%</td> </tr> </tbody> </table> |           | Lecture    | Tutorials | Laboratory | Project | Seminar                                 | Other | Total of teaching hours during semester | Contact hours | 0 | 0 | 0 | 5 | 0 | 0 | 5 | E-learning | no | no | no | no | no | no | no | Assessment criteria (weightage) | 0 | 0 | 0 | 100% | 0 | 0 | 100% |
|   | Lecture   | Tutorials | Laboratory | Project   | Seminar    | Other   | Total of teaching hours during semester |       |   |               |   |   |   |   |   |   |   |            |    |    |    |    |    |    |    |                                 |   |   |   |      |   |   |      |
| Contact hours                                     | 0   | 0         | 0          | 5         | 0          | 0       | 5                                       |       |   |               |   |   |   |   |   |   |   |            |    |    |    |    |    |    |    |                                 |   |   |   |      |   |   |      |
| E-learning  | no  | no        | no         | no        | no         | no      | no                                      |       |   |               |   |   |   |   |   |   |   |            |    |    |    |    |    |    |    |                                 |   |   |   |      |   |   |      |
| Assessment criteria (weightage)                   | 0   | 0         | 0          | 100%      | 0          | 0       | 100%                                    |       |   |               |   |   |   |   |   |   |   |            |    |    |    |    |    |    |    |                                 |   |   |   |      |   |   |      |
| <b>Course objective</b>                           | <p>Aims of the course is:</p> <ol style="list-style-type: none"> <li>1. to make the student familiar with the material durability related problems,</li> <li>2. to present the methods of concrete protections against the aggressive environment,</li> </ol>   |           |            |           |            |         |   |       |   |               |   |   |   |   |   |   |   |            |    |    |    |    |    |    |    |                                 |   |   |   |      |   |   |      |
| <b>Learning outcomes</b>                          | <p>After the course student:</p> <ol style="list-style-type: none"> <li>1. knows the basics of thermodynamics of processes in porous building materials (W1),</li> <li>2. knows how to recognize the basic degradation mechanisms in concrete (U1),</li> <li>3. knows how to determine the basic durability-related properties of concrete (U1),</li> <li>4. knows how to effectively protect concrete (W1).</li> </ol>   |           |            |           |            |         |   |       |   |               |   |   |   |   |   |   |   |            |    |    |    |    |    |    |    |                                 |   |   |   |      |   |   |      |
| <b>Assessment methods</b>                         | The assessment based on project (100%)  |           |            |           |            |         |   |       |   |               |   |   |   |   |   |   |   |            |    |    |    |    |    |    |    |                                 |   |   |   |      |   |   |      |
| <b>Prerequisites</b>                              |   |           |            |           |            |         |   |       |   |               |   |   |   |   |   |   |   |            |    |    |    |    |    |    |    |                                 |   |   |   |      |   |   |      |
| <b>Course content with delivery methods</b>       | <p>Thermodynamics of heat and mass transport in concrete<br/> Durability related properties of concrete, associated mechanisms, experimental tests<br/> Types of reinforced concrete corrosion (chloride, sulphate, freeze-thaw, etc)<br/> The methods of concrete protection against the aggressive environment</p>  |           |            |           |            |         |   |       |   |               |   |   |   |   |   |   |   |            |    |    |    |    |    |    |    |                                 |   |   |   |      |   |   |      |
| <b>Basic reference materials</b>                  | <ol style="list-style-type: none"> <li>1. A. Neville, Properties of Concrete, 2012.</li> <li>2. J. Plank, E. Sakai, C.W. Miao, C. Yud, J.X. Hong, Chemical admixtures — Chemistry, applications and their impact on concrete microstructure and durability, Cement and Concrete Research 78 (2015) 81–99.</li> <li>3. S.W. Tang, Y. Yao, C. Andrade, Z.J. Li, Recent durability studies on concrete structure, Cement and Concrete Research 78 (2015) 143–154.</li> </ol>   |           |            |           |            |         |   |       |   |               |   |   |   |   |   |   |   |            |    |    |    |    |    |    |    |                                 |   |   |   |      |   |   |      |
| <b>Other reference materials</b>                  |   |           |            |           |            |         |   |       |   |               |   |   |   |   |   |   |   |            |    |    |    |    |    |    |    |                                 |   |   |   |      |   |   |      |
| <b>Average student workload outside classroom</b> | 15h   |           |            |           |            |         |   |       |   |               |   |   |   |   |   |   |   |            |    |    |    |    |    |    |    |                                 |   |   |   |      |   |   |      |
| <b>Comments</b>                                   |   |           |            |           |            |         |   |       |   |               |   |   |   |   |   |   |   |            |    |    |    |    |    |    |    |                                 |   |   |   |      |   |   |      |
| <b>Last update</b>                                | July 2020   |           |            |           |            |         |   |       |   |               |   |   |   |   |   |   |   |            |    |    |    |    |    |    |    |                                 |   |   |   |      |   |   |      |