



### COURSE SPECIFICATION

|                          |                               |                  |
|--------------------------|-------------------------------|------------------|
| Course code              | full-time:                    | <b>B1-6-602</b>  |
|                          | part-time:                    | <b>BN1-6-602</b> |
| Course title in Polish   | <b>Konstrukcje metalowe 2</b> |                  |
| Course title in English  | <b>Metal Structures 2</b>     |                  |
| Valid from academic year | <b>2023/2024</b>              |                  |

### CURRICULAR ALIGNMENT

|                                          |                                                                    |
|------------------------------------------|--------------------------------------------------------------------|
| Programme                                | <b>CIVIL ENGINEERING</b>                                           |
| Level                                    | <b>first-cycle</b>                                                 |
| Programme profile                        | <b>academic</b>                                                    |
| Mode of attendance                       | <b>full-time; part-time</b>                                        |
| Specialism                               | <b>all</b>                                                         |
| Academic unit responsible for the course | <b>Department of Strength of Materials and Building Structures</b> |
| Course coordinator                       | <b>dr inż. Rafał Piotrowski</b>                                    |
| Approved by                              | <b>prof. dr hab. inż. Grzegorz Świt</b>                            |

### COURSE DESCRIPTION

|                         |           |                                                                                                                                                                                                   |
|-------------------------|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Teaching block          |           | major                                                                                                                                                                                             |
| Course status           |           | required                                                                                                                                                                                          |
| Language of instruction |           | Polish                                                                                                                                                                                            |
| Semester of delivery    | full-time | semester VI                                                                                                                                                                                       |
|                         | part-time | semester VI                                                                                                                                                                                       |
| Prerequisites           |           | Strength of Materials 1 and 2, General Construction, Actions on Building Structures Structural Mechanics 1,2, Foundations, Computational Methods in Structural Engineering, Concrete Structures 1 |
| Exam (YES/NO)           |           | YES                                                                                                                                                                                               |
| ECTS                    |           | 3                                                                                                                                                                                                 |

| Mode of teaching             |            | lecture   | class | lab | project   | other |
|------------------------------|------------|-----------|-------|-----|-----------|-------|
| Number of hours per semester | full-time: | <b>30</b> |       |     | <b>15</b> |       |
|                              | part-time: | <b>24</b> |       |     | <b>12</b> |       |

## LEARNING OUTCOMES

| Category   | Code | Learning outcomes                                                                                                                               | Corresponding programme outcome code |
|------------|------|-------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|
| Knowledge  | W01  | Students demonstrate knowledge of shaping steel halls and designing their selected elements and connections/joints.                             | B1_W07<br>B1_W08<br>B1_W09           |
|            | W02  | Students have knowledge of the preparation of general arrangement assembly drawings of halls and shop drawings of shipping elements/components. | B1_W05                               |
|            | W03  | Students know the criteria for classifying nodes in metal structures and ways to evaluate their structural properties.                          | B1_W08<br>B1_W09                     |
| Skills     | U01  | Students can shape the steel load bearing structure of the hall and select the geometry of the elements of the transverse system.               | B1_U02                               |
|            | U02  | Students are able to design bar elements of the hall transverse system and selected shop and assembly connections.                              | B1_U10<br>B1_U13<br>B1_U14           |
|            | U03  | Students can prepare general arrangement and assembly drawings and shop drawings for shipping components of the hall main transverse system.    | B1_U07                               |
| Competence | K01  | Students are able to work independently.                                                                                                        | B1_K01                               |
|            | K02  | Students are responsible for the reliability of the results obtained.                                                                           | B1_K02                               |
|            | K03  | Students formulate conclusions and describe the results of their work.                                                                          | B1_K04                               |

## COURSE CONTENT

| Teaching mode* | Topics covered                                                                                                                                                                                                                                                     |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| lecture        | Classification of industrial halls, basic dimensions, structural systems, elements of the main supporting system, internal transport, loads and their combinations, cladding of walls and roofs of halls. General assembly and structural drawings of steel halls. |
|                | Classification of bar bracing of steel halls. Principles of bracing arrangement. Imperfections in bracing analysis.                                                                                                                                                |
|                | Design and dimensioning of purlins, types of roof purlins, support of purlins on steel rafters, principles of purlin suspension, cooperation of purlins with roof sheathing.                                                                                       |
|                | Design and dimensioning of lattice trusses, types of trusses, principles of bar and node construction, support nodes, intermediate nodes and assembly joints.                                                                                                      |
|                | Shaping of steel hall columns with single and complex sections loaded in compression and bending, methods of anchoring columns. Design and dimensioning of single and complex columns.                                                                             |
|                | Design and dimensioning of craneway girders, loads on craneway girders, cross-section shaping, brake bracings, buffer stops and support nodes.                                                                                                                     |
|                | Models and classification of nodes in metallic structures. Structural properties of nodes. Construction and dimensioning of welded and bolted nodes.                                                                                                               |
|                | Fatigue of metal structures.                                                                                                                                                                                                                                       |
|                | Fire and corrosion protection of metal structures.                                                                                                                                                                                                                 |

|         |                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| project | <p>Selected elements of a detailed design of a single-bay steel hall with lattice transom. Preparation of a general arrangement-assembly drawing of the hall structure. Load gathering and load combinations, static calculations, checking the load capacity of selected bar elements of the hall structure, checking the load capacity of selected connections. Preparation of shop drawings of a girder beam and column.</p> |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## METHODS OF LEARNING OUTCOMES VERIFICATION

| Learning outcome | Learning outcome verification methods |              |      |         |        |       |
|------------------|---------------------------------------|--------------|------|---------|--------|-------|
|                  | Oral exam                             | Written exam | Test | Project | Report | Other |
| W01              |                                       | X            |      | X       |        |       |
| W02              |                                       | X            |      | X       |        |       |
| W03              |                                       | X            |      | X       |        |       |
| U01              |                                       | X            |      | X       |        |       |
| U02              |                                       | X            |      | X       |        |       |
| U03              |                                       | X            |      | X       |        |       |
| K01              |                                       | X            |      | X       |        |       |
| K02              |                                       | X            |      | X       |        |       |
| K03              |                                       | X            |      | X       |        |       |

## ASSESSMENT

| Teaching mode | Assessment type | Criteria                                                                                                         |
|---------------|-----------------|------------------------------------------------------------------------------------------------------------------|
| lecture       | mark-based      | <i>Scoring at least 50% on the written exam</i>                                                                  |
| project       | mark-based      | <i>Attaining at least a passing grade on each project task and at least a passing grade on its oral defence.</i> |

## STUDENT WORKLOAD

| ECTS weighting |                                                                                |                  |   |   |    |   |           |   |   |    |   |      |
|----------------|--------------------------------------------------------------------------------|------------------|---|---|----|---|-----------|---|---|----|---|------|
|                | Activities                                                                     | Student workload |   |   |    |   |           |   |   |    |   |      |
|                |                                                                                | full-time        |   |   |    |   | part-time |   |   |    |   |      |
| 1.             | Scheduled contact hours                                                        | W                | C | L | P  | S | W         | C | L | P  | S | h    |
|                |                                                                                | 30               |   |   | 15 |   | 24        |   |   | 12 |   |      |
| 2.             | Other (office hours, exams)                                                    | 4                |   |   | 2  |   | 4         |   |   | 2  |   | h    |
| 3.             | Total number of contact hours                                                  | 51               |   |   |    |   | 42        |   |   |    |   | h    |
| 4.             | Number of ECTS credits for contact hours                                       | 2                |   |   |    |   | 1,7       |   |   |    |   | ECTS |
| 5.             | Independent study hours                                                        | 24               |   |   |    |   | 33        |   |   |    |   | h    |
| 6.             | Number of ECTS credits for independent study                                   | 1                |   |   |    |   | 1,3       |   |   |    |   | ECTS |
| 7.             | Practical hours                                                                | 25               |   |   |    |   | 25        |   |   |    |   | h    |
| 8.             | Number of ECTS credits for practical hours                                     | 1                |   |   |    |   | 1         |   |   |    |   | ECTS |
| 9.             | Total workload                                                                 | 75               |   |   |    |   | 75        |   |   |    |   | h    |
| 10.            | ECTS credits for the course<br><i>1 ECTS credit =25 student learning hours</i> | 3                |   |   |    |   |           |   |   |    |   |      |

## READING LIST

1. Biegus A.: Stalowe budynki halowe. Arkady, Warszawa, 2008.
2. Rykaluk K.: Konstrukcje metalowe. Część II. Dolnośląskie Wydawnictwo Edukacyjne, Wrocław 2017
3. Budownictwo ogólne. Tom 5. Stalowe konstrukcje budynków. Projektowanie wg. Eurokodów z przykładami obliczeń. Praca zbiorowa pod kierunkiem M. Giżejowskiego i J. Zółki. Arkady, Warszawa 2010.
4. Konstrukcje stalowe. Przykłady obliczeń według PN-EN 1993-1. Część druga. Stropy i pomosty. Praca zbiorowa pod red. A. Kozłowskiego. Oficyna Wydawnicza Politechniki Rzeszowskiej. Rzeszów 2015.
5. Konstrukcje stalowe. Część trzecia. Hale i wiaty. Praca zbiorowa pod red. A. Kozłowskiego. Oficyna Wydawnicza Politechniki Rzeszowskiej. Rzeszów 2015.
6. Goczek J., Supeł Ł., Gajdzicki M.: Przykłady obliczeń konstrukcji stalowych. Wydawnictwo Politechniki Łódzkiej, Łódź 2011.
7. Trahair N., Bradford M., Nethercot D., Gardner L.: The behaviour and design of steel structures to EC3. Taylor and Francis, London and New York 2008.
8. Łubiński M., Żółtowski W.: Konstrukcje Metalowe. Część II. Arkady, Warszawa 2000.
9. Żmuda J.: Konstrukcje wsporcze dźwignic. PWN, Warszawa, 2013.
10. Kucharczuk W., Labocha S.: Hale o konstrukcji stalowej. Poradnik projektanta. Polskie Wydawnictwo Techniczne, Warszawa 2012.
11. Dz.U. 2002 nr 75 poz. 690: Rozporządzenie Ministra Infrastruktury z dnia 12.04.2002r. w sprawie warunków technicznych, jakim powinny odpowiadać budynki i ich usytuowanie.
12. Aktualne normy przedmiotowe.