MODULE SPECIFICATION

Module code	
Module title in Polish	**Konstrukcje betonowe 1**
Module title in English	**Concrete Structures 1**
Module running from the academic year	**2016/2017**

A. MODULE IN THE CONTEXT OF THE PROGRAMME OF STUDY

Field of study	**Civil Engineering**
Level of qualification	**First cycle** *(first cycle, second cycle)*
Studies profile	**Academic** (*academic/practical)*
Mode of study	**Full-time** *(full-time / part-time)*
Specialism	
Organisational unit responsible for module delivery	**The Department of Strength of Materials of Concrete Structures**
Module co-ordinator	**Paweł Tworzewski, PhD, Eng.**
Approved by	**Marek Iwański, Professor**

B. MODULE OVERVIEW

Module type	**Core module** (*core/programme-specific/elective HES*)*
Module status	**Compulsory module** *(compulsory / non-compulsory)*
Language of module delivery	**English**
Semester in the programme of study in which the module is taught	**Semester 5**
Semester in the academic year in which the module is taught	**Winter semester** *(winter / summer)*
Pre-requisites	**None** (*module code/module title, where appropriate)*
Examination required	**Yes** *(yes / no)*
ECTS credits	**5**

Mode of instruction	**lectures**	**classes**	**laboratories**	**project**	**others**
Total hours per semester	**30**	**15**		**30**	

* elective HES − elective modules in the Humanities and Economic and Social Sciences

C. LEARNING OUTCOMES AND ASSESSMENT METHODS

Module aims	The aim of the module is to learn and master basic principles of work concerning concrete structures (taking their nonlinearity into consideration). Other aims are to design and determine load bearing capability of concrete elements and structures. This knowledge is a fundamental of designing concrete structures.

Module outcome code	Module learning outcomes	Mode of instruction *(l/c/lab/p/ others)*	Corresponding programme outcome code	Corresponding discipline-specific outcome code
W_01	A student knows theoretical fundamentals of the essence of concrete structures.	l	B_W09	T1A_W03 T1A_W07
W_02	A student knows nonlinear characteristics of concrete structures.	l/c/p	B_W09	T1A_W03 T1A_W07
W_03	A student knows the fundamentals of designing typical elements of concrete structures. Moreover, a student is knowledgeable about static analysis of the designed structure.	l/c/p	B_W08 B_W09 B_W10	T1A_W03 T1A_W04 T1A_W05 T1A_W07 T1A_W08
W_04	A student knows the principles of reinforcing typical elements of concrete structures.	l/c/p	B_W09 B_W08 B_W10	T1A_W03 T1A_W04 T1A_W05 T1A_W07 T1A_W08
U_01	A student can apply the material meeting appropriate properties (concrete and steel) for the designed structure. Moreover, a student can describe a calculation situation. Finally, a student can describe the work of a reinforced concrete section.	l/c/p	B_U24	T1A_U03 T1A_U05 T1A_U08 T1A_U09 T1A_U13 T1A_U14 T1A_U15 T1A_U16
U_02	A student is able to apply an appropriate calculation model for designing a concrete structure. In addition, a student can apply an appropriate static scheme for the designed element of concrete structure.	l/c/p	B_U02	T1A_U11 T1A_U13
U_03	A student can design a typical element of concrete structure (a beam and a column).	l/c/p	B_U14	T1A_U03 T1A_U04 T1A_U05 T1A_U14 T1A_U16
U_04	A student can correctly design reinforcement for a basic concrete structure element (a beam and a column).	l/c/p	B_U14	T1A_U03 T1A_U04 T1A_U05 T1A_U14 T1A_U16
K_01	A student can work individually and in a team. Moreover, a student can organise the work of a team which will analyse a given task. In addition, a student can divide work among team members into tasks according to their competences.	p	B_K01 B_K05 B_K07	T1A_K01 T1A_K03 T1A_K04 T1A_K05 T1A_k07
K_02	A student is responsible for the reliability of the obtained results.	p	B_K02 B_K03 B_K07	T1A_K01 T1A_K02 T1A_K03 T1A_K05 T1A_K06 T1A_K07

K_03	A student can formulate conclusions and describe the results of the obtained work.	p	B_K04 B_K07	T1A_K01 T1A_K03 T1A_K07

Module content:

1. Topics to be covered in the lectures

No.	Topics	Module outcome code
1.	Discussing the syllabus of the lectures. Introductory information: historical conditions, the types of concrete structures, determining basic notions, calculation situations, the types of limit states	W_01 U_01
2.	The properties of materials: - concrete: mechanical properties of concrete (σ-ε relationship, strength according to work conditions, the coefficient of elasticity; concrete deformability; reological properties, i.e. shrinking, bulking, creep, and relaxation; calculation models; calculation and characteristic strength values; Poisson's ratio) - steel: characteristic and calculation plasticity boundary; steel elasticity module; steel deformability; the coefficient of thermal expandability; guidelines concerning the selection of types of steel	W_01 W_02 U_01 U_02
3.	The interaction between concrete and steel (the factors influencing the interaction between concrete and steel). Anchorage length.	W_01
4.	The phases of work concerning reinforced concrete beam. The methods of reinforced concrete design: the method of linear stresses, the method of plastic deformations, the limit states method. Structure safety.	W_01 W_02 U_02
5.	Ultimate Limit States (ULS): designing of reinforced concrete beam with the general method.	W_02, W_03 U_02 U_03
6.	Ultimate Limit States (ULS): designing of reinforced concrete beam with the simplified stress block method.	W_02 W_03 U_01
7.	Ultimate Limit States (ULS): design of reinforcement in support zones; placing of shear reinforcement.	W_02 W_03 U_01
8.	Ultimate Limit States (ULS): designing of element subjected to axial load (stretching and compression) and bending moment.	W_02 W_03 U_01
9.	Ultimate Limit States (ULS): designing of element subjected to torsion. Serviceability limit states (SLS): assumptions	W_02 W_03 U_01
10.	Serviceability limit states (SLS) - deflection.	W_02 W_03 U_01
11.	Serviceability limit states (SLS) - cracks.	W_02 W_03 U_01
12.	Static analysis of reinforced concrete structures.	W_03 U_02
13.	The fundamentals of designing: general principles of designing according to PN-EN 1992-1-1:2008; structural requirements while designing reinforced concrete structures.	W_03 W_04 U_03 U_04
14.	Designing of basic elements (a beam and a column).	W_01 W_02

		W_03 W_04 U_02 U_03 U_04

2. Topics to be covered in the classes

No.	Topics	Module outcome code
1.	Designing of reinforced concrete beams based on limit states method (rectangular shape cross-sections).	W_02 W_03 U_01 U_02 U_03 U_04 K_01 K_02
2.	Designing of reinforced concrete beams based on limit states method (T-shape cross-sections).	W_02 W_03 U_01 U_02 U_03 U_04 K_01 K_02
3.	Determining of load bearing capacity of reinforced concrete element subjected to bending (rectangular shape cross-sections).	W_02 W_03 U_01 U_02 U_03 U_04 K_01 K_02
4.	Determining load bearing capacity of reinforced concrete element subjected to bending (T-shape cross-sections).	W_02 W_03 U_01 U_02 U_03 U_04 K_01 K_02
5.	Designing of shear reinforcement in support zones.	W_02 W_03 U_01 U_02 U_03 U_04 K_01 K_02
6.	Designing of the column subjected to axial load and bending moments acting on the section (compressive force).	W_02 W_03 U_01 U_02 U_03 U_04 K_01

		K_02
7.	Determining load bearing capacity of the column subjected to axial load and bending moments (compressive force).	W_02 W_03 U_01 U_02 U_03 U_04 K_01 K_02

3. Topics to be covered in the projects

Project number	Topics	Module outcome code
1	Determining and verification of normal and shear stresses in beam.	W_01 K_01 K_02 K_03
2	Statistical analysis of examination results of concrete strength: - mean value, - standard deviation, - the coefficient of variability, - characteristic compressive strength of concrete, - design value of concrete compressive strength, - secant modulus of elasticity of concrete.	W_02 U_01 K_01 K_02 K_03
3	Design of reinforced concrete beam (according to limit state method); - designing of longitudinal reinforcement, - designing of shear reinforcement; - determining of load bearing capacity, - verification of serviceability limit states, - preparation of executive drawing.	W_02 W_03 W_04 U_01 U_02 U_03 U_04 K_01 K_02 K_03
4	Designing of the column subjected to axial load and bending moments. - designing of reinforcement, - determining of load bearing capacity, - preparation of executive drawing.	W_02 W_03 W_04 U_01 U_02 U_03 U_04 K_01 K_02 K_03

Assessment methods

Module outcome code	Assessment methods *(Method of assessment; for module skills − reference to specific project, laboratory and similar tasks)*
W_01	A test and a project
W_02	A test and a project
W_03	A test and a project
W_04	A test and a project
U_01	A test and a project

U_02	A test and a project
U_03	A test and a project
U_04	A test and a project
K_01	A project
K_02	A project
K_03	A project

C. STUDENT LEARNING ACTIVITIES

ECTS summary		
	Type of learning activity	**Study time/ credits**
1	Contact hours: participation in lectures	**30**
2	Contact hours: participation in classes	**15**
3	Contact hours: participation in laboratories	
4	Contact hours: attendance at office hours (2-3 appointments per semester)	**3**
5	Contact hours: participation in project-based classes	**15**
6	Contact hours: meetings with a project module leader	**2**
7	Contact hours: attendance at an examination	**2**
8		
9	**Number of contact hours**	**67** *(total)*
10	**Number of ECTS credits for contact hours** *(1 ECTS credit =25-30 hours of study time)*	**2.7**
11	Private study hours: background reading for lectures	**15**
12	Private study hours: preparation for classes	**5**
13	Private study hours: preparation for tests	**8**
14	Private study hours: preparation for laboratories	
15	Private study hours: writing reports	
16	Private study hours: preparation for a final test in laboratories	
17	Private study hours: preparation of a project/a design specification	**20**
18	Private study hours: preparation for an examination	**10**
19		
20	**Number of private study hours**	**58** *(total))*
21	**Number of ECTS credits for private study hours** *(1 ECTS credit =25-30 hours of study time)*	**2.3**
22	**Total study time**	**125**
23	**Total ECTS credits for the module** *(1 ECTS credit =25-30 hours of study time)*	**5**
24	**Number of practice-based hours** *Total practice-based hours*	**40**
25	**Number of ECTS credits for practice-based hours** *(1 ECTS credit =25-30 hours of study time)*	**1.6**