

FACULTY OF CIVIL ENGINEERING

SUBJECT CARD

Name in English: Bridges
Name in Polish: Mosty
Main field of study (if applicable): *Civil Engineering*
Specialization (if applicable): Civil Engineering
Level and form of studies: ~~1st~~ / 2nd level*, full-time / ~~part-time~~*
Kind of subject: obligatory / ~~optional~~ / ~~university-wide~~*
Subject code: CEB008062
Group of courses: ~~YES~~ / NO*

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30			30	
Number of hours of total student workload (CNPS)	60			60	
Form of crediting	Examination / crediting with grade *	Examination / crediting with grade *	Examination=/crediting with grade *	Examination / crediting with grade *	Examination=/crediting with grade *
For group of courses mark (X) final course					
Number of ECTS points	2			2	
including number of ECTS points for practical (P) classes				2.0	
including number of ECTS points for direct teacher-student contact (BK) classes	1.3			1.3	

* delete as appropriate

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Identifies structural elements
2. Identifies parameters of a structure
3. Identifies physical values used in mechanics

SUBJECT OBJECTIVES

- C1. Introduction to basic terms of bridge engineering
- C2. Introduction to modern construction methods
- C3. Introduction to structural analysis methods
- C4. Strengthening of work in group

SUBJECT EDUCATIONAL EFFECTS

Relating to knowledge:

PEK_W01	Knows and understands basic ideas of bridge engineering
PEK_W02	Knows the layout of structural elements as well as non-structural elements
PEK_W03	Knows analysis methods and modelling of bridge structures
PEK_W04	Knows modern construction methods
PEK_W05	Knows selected methods of bridge testing

Relating to skills:

PEK_U01	Properly distinguishes bridge elements
PEK_U02	Is able to describe selected construction methods
PEK_U03	Properly describes selected methods of bridge testing and structural modelling
PEK_U04	Is able to do basic structural analysis
PEK_U05	Makes the drawings of bridge structures according to the rules
PEK_U06	Is able to design the superstructure of girder span in the field of main girders and slab

Relating to social competences:

PEK_K01	Is able to work alone or in group
PEK_K02	Is aware of a need of updating the knowledge related to bridge testing

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Lec1	Introduction, bridge infrastructure, basic terminology	2
Lec2	Bridge classification, static systems of bridges, bridge components	2
Lec3	Bridge supports, bridge accessories, bridge bearings	2
Lec4	Structural analysis of bridge structures	2
Lec5	Numerical modelling and computer tools for structural analysis	2
Lec6	Concrete bridges – classification and structural details	2
Lec7	Concrete bridges – structural analysis	2
Lec8	Steel & composite bridges – classification and structural details	2
Lec9	Steel & composite bridges – structural analysis	2
Lec10	Masonry bridges – classification, structural details & analysis	2
Lec11	Construction methods	2
Lec12	Testing methods	2
Lec13	Bridges defects	2
Lec14	Exploitation and maintenance problems	2
Lec15	Test	2
Total hours		30

Form of classes - class		Number of hours
C11		
...		
Total hours		

Form of classes - laboratory		Number of hours
Lab1		
...		
Total hours		

Form of classes - project		Number of hours
Proj1	Introduction, formal information, distribution of project subjects, description of the project's scope.	2
Proj2	Basic design rules for bridge substructure, shaping the bridge surroundings (typical sizes of piers and abutments according to formal requirements).	2
Proj3	Design rules for bridge superstructure, determination of bridge span lengths, selection of bridge girder's height, dimensions of main structural elements of a bridge (slab, transverse beams), bridge accessories (pavements, barriers, railings, drainage, expansion joints), examples.	2
Proj4	Description of conceptual drawings – rules for drawing, descriptions, scales, thickness of lines, variants of the conceptual design.	2
Proj5	Initial calculations – scope, basic assumptions, methods of analysis, collecting of loads.	2
Proj6	Initial calculations – finding internal forces with application of influence lines.	2
Proj7	Initial calculations – dimensioning of girders at bending. Basic rules for designing of reinforcement (thickness of bars and cover, distances between bars).	2
Proj8	Detailed calculations – bridge superstructure modelling by means of FEM, presentation of exemplary models.	2
Proj9	Detailed calculations – analysis of bridge main girders by means of FEM method: collection and application of loads, finding the internal forces.	2
Proj10	Detailed calculations – creation of envelopes of internal forces, loading scenarios and combinations.	2
Proj11	Detailed calculations – ultimate limit state of bridge girder at bending and shearing, envelopes of resistance.	2
Proj12	Technical drawings of a bridge girder – scope and rules for drawing; details of reinforcement design (anchorage length, bending radius, hook, overlapping, joining of bars).	2
Proj13	Technical description of the designed bridges.	2
Proj14	Individual consultations of student projects.	2
Proj15	Passing the projects.	2
Total hours		30

Form of classes - seminar		Number of hours
Sem1		
...		
Total hours		

TEACHING TOOLS USED
N1. Lecture: presentations, slides, making the drawings on the blackboard
N2. Project: presentations, slides, making the drawings and schemes on the blackboard, examples of calculations
N3. Individual meetings

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT		
Evaluation (F – forming (during semester), P – concluding (at semester end))	Educational effect number	Way of evaluating educational effect achievement
F1 (proj)	PEK_U04	Individual task – conceptual drawings
F2 (proj)	PEK_U05	Individual task – first stage of calculations
F3 (proj)	PEK_U06 PEK_K01	Individual task – detailed design
$P=0.2 \times F1 + 0.1 \times F2 + 0.7 \times F3$		
P (lect)	PEK_W01 PEK_W02 PEK_W03 PEK_W04 PEK_W05 PEK_K02	Test

PRIMARY AND SECONDARY LITERATURE
<u>PRIMARY LITERATURE:</u>
[1] I Parke G., Hewson N., <i>ICE manual of bridge engineering</i> , Thomas Telford Limited, 2008.
[2] Tonia D. E., Zhao J. J., <i>Bridge Engineering: Rehabilitation, and Maintenance of Modern Highway Bridges</i> . McGraw-Hill Professional. 2006.
[3] <i>Bridge engineering handbook</i> / ed. by Wai-Fah Chen and Lian Duan. 2000.
[4] Mondorf P., <i>Concrete Bridges</i> , Routledge, 2006.
[5] Ghosh U.K., <i>Design and Construction of Steel Bridges</i> , Taylor & Francis; 2006.
[6] Collings D., <i>Steel-Concrete Composite Bridges</i> , Thomas Telford, 2005.
[7] Hirt M., Lebet J.P. <i>Steel Bridges: Conceptual and Structural Design of Steel and Steel-Concrete Composite Bridges</i> , CRC Press, 2013.
[8] Hendy C.R., Smith D.A., <i>Designers' Guide to EN 1992 Eurocode 2: Design of Concrete Structures: Concrete bridges</i> , Thomas Telford, 2007.
[9] Hendy C. R., Murphy C. J., <i>Designers' Guide to EN 1993-2 Eurocode 3: Design of Steel Structures: Steel Bridges</i> , Thomas Telford, 2007.
[10] Hendy C.R., Johnson R.P., <i>Designers' Guide to EN 1994-2 Eurocode 4 : Design of Steel and Composite Structures: General Rules and Rules for Bridges</i> . Taylor & Francis; 2006.
<u>SECONDARY LITERATURE:</u>
[1] David J., Brown, <i>Bridges – Three thousand Years of Defying Nature</i> , Mitchell Beazley, Octopus Publishing Group, London 1993-2005

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Bridges
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY *Civil Engineering*
AND SPECIALIZATION **Civil Engineering**

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)**	Subject objectives ***	Programme content ***	Teaching tool number ***
Knowledge				
PEK_W01	K2_W07, K2S_CEB_W19	C1	Lec1 ÷ Lec14	N1, N3
PEK_W02	K2_W04, K2_W06, K2_W07, K2S_CEB_W19	C1, C2, C3	Lec1 ÷ Lec14	N1, N3
PEK_W03	K2_W03, K2_W05, K2S_CEB_W19	C1, C3	Lec1 ÷ Lec14	N1, N3
PEK_W04	K2_W10, K2S_CEB_W21	C1, C2	Lec1 ÷ Lec14	N1, N3
PEK_W05	K2S_CEB_W19	C1, C2	Lec1 ÷ Lec14	N1, N3
Skills				
PEK_U01	K2_U02, K2_U04, K2S_CEB_U22	C1	Lec1 ÷ Lec14	N1, N2, N3
PEK_U02	K2S_CEB_U22	C1, C2	Lec11	N1, N2, N3
PEK_U03	K2_U11, K2S_CEB_U22	C2, C3	Lec5, Lec12	N1, N2, N3
PEK_U04	K2_U05, K2_U07, K2_U08, K2S_CEB_U22	C3	Proj2 ÷ Proj7	N2, N3
PEK_U05	K2_U12, K2S_CEB_U22	C1, C3	Proj4, Proj13	N2, N3
PEK_U06	K2_U11, K2S_CEB_U19, K2S_CEB_U22	C1, C2, C3	Proj2 ÷ Proj14	N2, N3
Social competences				
PEK_K01	K2_K01, K2_K03	C4	Lec1 ÷ Lec15	N2, N3
PEK_K02	K2_K02	C1, C2, C3	Proj2 ÷ Proj15	N2, N3

** - enter symbols for main-field-of-study/specialization educational effects

*** - from table above