STUDY MODULE DESCRIPTION FORM

Name of the module/subject **Railway line design**		Code **1010102111010128626**
Field of study **Civil Engineering second-cycle studies**	Profile of study (general academic, practical) **(brak)**	Year /Semester **1 / 1**
Elective path/specialty **Road, bridge and railway engineering**	Subject offered in: **Polish**	Course (compulsory, elective) **obligatory**
Cycle of study: **Second-cycle studies**	Form of study (full-time,part-time) **full-time**	
No. of hours Lecture: **45** Classes: **15** Laboratory: **-** Project/seminars: **30**		No. of credits **6**
Status of the course in the study program (Basic, major, other) **(brak)**	(university-wide, from another field) **(brak)**	
Education areas and fields of science and art **technical sciences** **Technical sciences**		ECTS distribution (number and %) **6 100%** **6 100%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Knowledge from mathematics and physics required to solve tasks dealing with railroad construction. Knowledge and skills for drawing and reading geodesic maps, including drawing using CAD software. Knowledge of fundamentals of mechanics and strength of materials. Knowledge of fundamentals of soil mechanics. Knowledge of properties, scope of utilisation and investigations of construction materials. Basic knowledge of design, construction and maintenance.
2	**Skills**	Ability to evaluate and make a statement of loads acting on railway track; Ability to choose and use appropriate tools for the design of the railway line; Ability to read construction drawings and geodesic maps; Ability to prepare graphical documentation.
3	**Social competencies**	Can work individually and in a group on a given task; Takes responsibility for solidity of own work?s results and interpretation, Takes responsibility for own and team?s safety; Consciousness about a need to improve professional skills and personal competence.

Assumptions and objectives of the course:

Getting to know elements and construction of superstructure, their design parameters and assessment of their technical conditions. Improve knowledge of design, construction and reconstruction of railroads. To get acquainted with methods of optimization of railroad track geometry.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. Has extended knowledge of design and reconstruction of railway lines in plane - [K_W09]
2. Has extended knowledge of design and reconstruction of railway lines in profile - [K_W09]
3. Knows rules and methods of optimization of railway track geometry - [K_W09]

Skills:

1. Can design a reconstruction of railway track geometry in plane in complex terrain conditions - [K_U06]
2. Can design a reconstruction of railway track geometry in profile in complex terrain conditions - [K_U06]
3. Is able to prepare technical documentation of reconstruction of railway track geometry in plane and in profile - [K_U16]

Social competencies:

1. Can work individually and in a group on a given task - [K_K01]
2. Is responsible for solidity of own work?s results and interpretation - [K_K02]
3. Formulate conclusions and describes the results of own work?s - [K_K09]

Assessment methods of study outcomes

Outcome of the lectures - written exam - checking master the knowledge presented in the lectures. Graduation from 51%.

Outcome of the classes - written colloquium in the 15. week of the semester. Graduation from 51%.

Outcome of the projects on the basis of: substantive assessment of designed documentation, systematic work (entries in the consultation card and attendance at exercises), the projects? defense (written or oral).

Course description

Lectures: learning method - lecture / problem lecture / lecture with multimedia presentation

Introduction. Special railway lines: monorail, toothed, magnetic. Railway track: Classical and ballastlest track; Construction standards of the railway track; Track classification; Pressures from rolling stock in railway track elements; Force and bending moments in track elements; Types, destiny and characteristics of the components of the classical railway track: ballast, sleepers, rails, fastenings; Indirect and direct fastenings (type K, SB and SKL); Fish plate jointes supported and hanging. Rails: types, permissible tolerances, tests, damage and defects. Sleepers: types, permissible tolerances, tests, damage and defects. Ballast: material, parameters, tests, source of pollution. Track fish plate joints, their use, the track frame at the joining point. Fastenings: types, tests, defects. Railroad switches: types, overview of the design of blade, crossings, adjustment locks. Rules for shaping switching roads at stations. Station work technology. Ballastlest track: division and characterization and rules of application. Installations in the rail road. Tracks on bridges. Kinematic gauge, infrastructure gauge: gauge according to PN-69 K-02057 and PN-EN15273. Track geometry in plan: Relationship between radius, velocity and acceleration; Cantilever and cant ramp; Transition curves with straight and curvilinear elevation runoff; Linking arcs with different radii; Widening of the intertrack space; Benefits of use tilting train; Rules for shaping transition curves for tilting train; Design of the geometric layout of the track in the plan in difficult terrain conditions; Optimization of the geometric layout of the track in the plan; Geometric layout in high speed rail plan. Railway line in profile: Assertive gradient; Harmful and harmless gradient; lost gradient; Line with constant resistance; Substitute gradient; Optimizing the geometry of the track in the profile; Design of grade line in difficult terrain conditions; Gradient of high-speed rail lines. Subgrade: The usefulness of soil to build embankments; Layout of different types of soil in cross-sections of embankments; Embankments and cuttings in special locations; High embankments, deep cuttings; Principles of subgrade construction; Subgrade stability rating; Methods of subgrade construction; Methods of construction of cuttings; Methods of construction of embankments; Design of earth works; Distribution of earth masses and transport tables; Selection of machines for earth works; Methods of reconstruction of the subgrade; Requirements for the upper sub-zone of subgrade; Geotechnical investigation of the upper zone of subgrade; Principles of design, application and construction of protective layers (subballast); Drainage subgrade; Geosynthetics in the subgrade; Reconstruction of the upper zone of subgrade.

Classes: learning method - exercise method

Optimization of a track geometry layout in plan and profile.

Projects: learning method - project method (practical project)

Project of rebuilding of section of a railway line, with a detailed analysis of the earthworks.

Basic bibliography:

1. Bałuch. H., Bałuch M.: Układy geometryczne toru i ich deformacje. KOW, Warszawa 2010.

2. Batko M.: Budowa i utrzymanie dróg kolejowych, WKiŁ, Warszawa 1985.

3. Bogdaniuk B., Towpik K.: Budowa, modernizacja i naprawy dróg kolejowych. KOW, Warszawa 2010.

4. Cieślakowski S.: Stacje kolejowe, WKiŁ, Warszawa 1992.

5. Cyunel B., Kulczycki B.: Kolejowe budowle ziemne. Tom II. Technologia, organizacja budowy i modernizacji. WKiŁ, Warszawa 1987.

6. Id-1. Warunki techniczne utrzymania nawierzchni na liniach kolejowych. PKP Polskie Linie Kolejowe S.A., Warszawa 2005.

7. Id-3. Warunki techniczne utrzymania podtorza kolejowego. PKP Polskie Linie Kolejowe S.A., Warszawa 2009.

8. Kiewlicz S., Łączyński J., Pelc S.:Nawierzchnia kolejowa typu S60, S49, S42. WKiŁ, Warszawa 1974.

9. Klonowski P., Kluczycki B., Lenkiewicz W., Wasilewski Z., Wyszyński K.: Technologia zmechanizowanych robót kolejowych. Wydawnictwo Politechniki Warszawskiej, Warszawa 1983.

10. Lewinowski C., Zimnoch S.: Ogólne zasady projektowania robót ziemnych dróg samochodowych i kolejowych. PWN, Warszawa 1987.

11. Matylla S.: Technologia zmechanizowanych robót kolejowych. Wydawnictwo Politechniki Poznańskiej, Poznań 1981.

12. Skrzyński E., Sikora R.: Kolejowe budowle ziemne. Tom I. Utrzymanie i naprawy. WKiŁ, Warszawa 1990.

13. Sancewicz S.: Nawierzchnia kolejowa. KOW, Warszawa 2010.

14. Semrau A., Zamięcki H.: Budowa i utrzymanie dróg kolejowych, tom II, WKiŁ, Warszawa 1975.

15. Sysak J. (red.): Drogi kolejowe. PWN, Warszawa 1986.

16. Sysak J.: Odwodnienie podtorza. WKiŁ, Warszawa 1980.

17. Szajer R.: Drogi żelazne, WKiŁ, Warszawa 1970

18. Towpik K.: Utrzymanie nawierzchni kolejowej. WKiŁ, Warszawa 1990.

Additional bibliography:

1. Wiłun Z.: Zarys geotechniki, WKiŁ, Warszawa 2005.
2. Transport Miejski i Regionalny, Stowarzyszenie Inżynierów i Techników Komunikacji Rzeczpospolitej Polskiej, Warszawa
3. Infrastruktura Transportu, ELAMED, Katowice
4. Przegląd Komunikacyjny, Stowarzyszenie Inżynierów i Techników Komunikacji Rzeczpospolitej Polskiej, Warszawa.
5. Technika Transportu Szynowego, EMI-PRESS, Łódź

Result of average student's workload

Activity	Time (working hours)
1. Student?s attendance to lectures	45
2. Student?s attendance to classes	15
3. Student	30
4. Current preparation to classes	10
5. Own study using the indicated literature and online resources	10
6. Preparation to exam	15
7. Preparation to colloquium	5
8. Designing project	15
9. Consulting	5

Student’s workload

Source of workload	hours	ECTS
Total workload	150	6
Contact hours	95	4
Practical activities	65	2