COURSE DESCRIPTION CARD - SYLLABUS

Course name
Design of railway lines [S2Bud1-BDMiK>PLK]

Course

Field of study
Civil Engineering

Year/Semester
1/1

Area of study (specialization)
Road, Bridge and Railway Engineering

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
45

Laboratory classes
10

Other
0

Tutorials
15

Projects/seminars
30

Number of credit points

6,00

Coordinators

dr inż. Michał Pawłowski
michal.pawlowski@put.poznan.pl

Lecturers

Prerequisites

KNOWLEDGE: Student beginning this course should: - have knowledge of mathematics and physics useful in solving tasks connected with railway construction; - know rules governing drawing and reading geodesic maps, including their making using CAD programs; - have knowledge on theoretical mechanics and strength of materials, soil mechanics and constructing foundations; - have basic knowledge on design, construction and maintenance of railroads. SKILLS: Student should be able to: - adjust and use tools appropriate for designing railways; - read construction, geodesic and topographic maps and prepare graphical documentation concerning construction process. SOCIAL COMPETENCIES: Student should: - be able to work individually and in a group on a given task; - take responsibility for the accuracy and reliability of working results and their interpretation; - be responsible for safety of own and group’s work; - realise that it is necessary to improve professional and personal competence.

Course objective

Extending knowledge on design, construction and modernisation of railroads. Acquainting students with methods for optimising geometrical track layout. Acquainting students with classification of traffic and expedition posts. Passing to the students knowledge about designing station’s track layouts and turnout ways. Passing to the students knowledge about management of passengers and cargo.

Course-related learning outcomes

KNOWLEDGE:
1. Has extended knowledge on railroad design and modernisation in plane and profile;
2. Knows rules and methods for optimisation of track geometric layout;
3. Knows rules, codes and standards for designing track layout of stations.
SKILLS:
1. Can design a reconstruction of a geometric track layout in plane and profile in a difficult (complex) terrain;
2. Can design track layout of a simple railway station;
3. Is able to prepare technical documentation of track geometry and station's track layout reconstruction.
SOCIAL COMPETENCES:
1. Takes responsibility for the accuracy and reliability of working results and their interpretation;
2. Can work individually or in a team on a given task;
3. Is conscious about a need to increase professional and personal competences.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

LECTURE: The acquired knowledge from the lectures is verified by a written colloquium done on the last lecture.
The form of the colloquium will be presented by the lecturer during the first class. With a small number of students the form may be changed into an oral colloquium - details should be given at the first lecture. To pass the colloquium, students should acquire at least 50% of points. Activity during the lectures may be taken into account during the colloquium's score evaluation.
LABORATORY: Skills acquired in laboratorium will be used for drawing elements of the project: for the grade from laboratorium the drawings will be checked. Activity and competencies during the classes may improve the evaluation.
TUTORIALS: Skills will be checked by a written colloquium on the last class. Activity and competencies during the classes may improve the evaluation.
PROJECT: Skills and competencies from projects are tested by quality evaluation of the presented project, social competencies presented during consultations, systematic work (notices on consultancy card and presence during classes) and a possible defence of the presented project (written or oral).
Grade scale: 50-60% 3,0; 60-70% 3,5; 70-80% 4,0; 80-90% 4,5; 90-100% 5,0.

Programme content

The module's programme covers:
- enhancement of knowledge and skills concerning design of railway lines and tracks in plane, profile and cross-section;
- enhancement of knowledge on subgrade;
- presentation on railway exploitation points, presentation and design of a station.

Course topics

LECTURE:
1. Introduction; special railway lines: monorail, rack, magnetic;
2. Railroad in plane:
- dependence between speed, curve radius and side acceleration,
- tilt (cant) and tilt ramp, transition curve with linear and curvilinear tilt ramp,
- joining horizontal curves with different radius,
- widening of intertrack distance,
- advantages from using cars with tilt possibility, rules for designing transition curves for such cars,
- design of track geometric layout in harsh conditions,
- optimisation of track geometric layout,
- track geometric layout for high speed lines;
3. Railroad's vertical profile:
- railroad's gradient: maximal, traversable, adverse and advisable, lost, ruling, grade of stable movement resistance,
- optimisation of railroad's track profile,
- design of railroad's profile in harsh terrain and for high speed,
4. Railroad's subgrade:

- usefulness of soil types for embankment construction,
- distribution of soil types in embankment's cross sections,
- embankments and excavations in specific locations, high embankments and deep excavations,
- rules and methods of subgrade construction, evaluation of subgrade's stability,
- methods of constructing embankments and excavations,
- design of earth works, earth works distribution, soil transport calculations, choice of machines for earth works,
- methods of subgrade reconstruction,
- upper subgrade's layer: requirements, geotechnical investigations, reconstruction,
- rules for design, use and construction of protective layers,
- subgrade's drainage,
- use of geosynthetics in subgrade;

5. Operational posts on railway network:
- traffic and expedition posts,
- most important rules of train traffic control,
- classification of stations;

6. Shaping of stations' track layout:
- length of tracks and width of intertrack distance,
- turnouts and shaping of turnout ways,
- passenger service at stations,
- cargo service at stations,
- infrastructure for cargo loading / unloading / storage,
- technology of station's traffic.

TUTORIALS: Optimisation of railroad track's geometrical layout in plane and profile.
LABORATORY: Computer aided optimisation of track's geometrical layout and calculations for station design.
PROJECT: Design of a station's track layout including turnout ways, passenger and cargo service and drainage.

Teaching methods

An informative or problemative lecture including elements of a conversation lecture, utilising a multimedia presentation with an occasional use of a blackboard. A choice of films available on the Internet.
Tutorials utilising tutorial method.
Laboratory - helping with tasks from tutorials and project using computer methods.
Project – design method.

Bibliography

Basic
1. Bałuch. H.: Układy geometryczne toru i ich deformacje. WKiŁ, Warszawa 1989.
2. Cieślakowski S.: Stacje kolejowe. WKiŁ, Warszawa 1992.
3. Chełmecki W.: Stacje kolejowe. Cz. 1. Wydawnictwo Politechniki Krakowskiej, Kraków 1997.
4. Chełmecki W.: Stacje kolejowe. Cz. 2. Wydawnictwo Politechniki Krakowskiej, Kraków 2001.
5. Id-1. Warunki techniczne utrzymania nawierzchni na liniach kolejowych. PKP Polskie Linie Kolejowe S.A., Warszawa 2005.
6. Id-3. Warunki techniczne utrzymania podtorza kolejowego. PKP Polskie Linie Kolejowe S.A., Warszawa 2009.
7. Lewinowski C., Zimnoch S.: Ogólne zasady projektowania robót ziemnych dróg samochodowych i kolejowych. PWN, Warszawa 1987.
8. Massel A.: Projektowanie linii i stacji kolejowych. KOW, Warszawa 2010.
9. Sysak J. (red.): Drogi kolejowe. PWN, Warszawa 1986.
10. Sysak J.: Odwodnienie podtorza. WKiŁ, Warszawa 1980.
11. Szajer R.: Drogi żelazne. WKiŁ, Warszawa 1970
12. Szczegółowe warunki techniczne dla modernizacji lub budowy linii kolejowych do prędkości Vmax ≤ 200 km/h (dla taboru konwencjonalnego) / 250 km/h (dla taboru z wychylnym pudłem). TOM I - DROGA SZYNOWA. PKP Polskie Linie Kolejowe S.A. Warszawa 2019.
13. Węgierski J.: Układy torowe stacji. Funkcja i teoria. WKiŁ, Warszawa 1974.
Additional
1. Batko M.: Budowa i utrzymanie dróg kolejowych. WKiŁ, Warszawa 1985.

2. Bogdaniuk B., Towpik K.: Budowa, modernizacja i naprawy dróg kolejowych. KOW, Warszawa 2010.
3. Cyunel B., Kulczycki B.: Kolejowe budowle ziemne. Tom II. Technologia, organizacja budowy i modernizacji. WKiŁ, Warszawa 1987.
4. Klonowski P., Kluczycki B., Lenkiewicz W., Wasilewski Z., Wyszyński K.: Technologia zmechanizowanych robót kolejowych. Wydawnictwo Politechniki Warszawskiej, Warszawa 1983.
5. Siewczyński Ł., Pawłowski M.: Projektowanie wzmocnień podtorza według jego właściwości. Przegląd Komunikacyjny 10/2014, s. 24-28.
6. Siewczyński Ł., Pawłowski M.: Stabilizacja podtorza dla budowy warstwy ochronnej. Ogólnopolska Konferencja Naukowo-Techniczna „Nowoczesne metody stabilizacji podłoża pod nawierzchnie drogowe i kolejowe", Żmigród-Węglewo 22-23.10.2009 r., s. 111-117.
7. Siewczyński Ł., Pawłowski M.: Stosowanie równoważnych konstrukcji wzmocnień górnej strefy podtorza. Zeszyty Naukowo-Techniczne Stowarzyszenia Inżynierów i Techników Komunikacji w Krakowie. Seria: Materiały Konferencyjne. Rok 2016, nr 2 (109), „Nowoczesne technologie i systemy zarządzania w transporcie szynowym" cz. I. Droga kolejowa, s. 137-146.
8. Siewczyński Ł., Pawłowski M.: Wzmocnienie podtorza warstwą ochronną o ustalonej grubości. Zeszyty Naukowo-Techniczne Stowarzyszenia Inżynierów i Techników Komunikacji w Krakowie. Seria: Materiały Konferencyjne. Rok 2012, nr 3 (99), „Nowoczesne technologie i systemy zarządzania w transporcie szynowym", s. 277-283.
9. Skrzyński E., Sikora R.: Kolejowe budowle ziemne. Tom I. Utrzymanie i naprawy. WKiŁ, Warszawa 1990.
10. Wiłun Z.: Zarys geotechniki. WKiŁ, Warszawa 2005.
11. Wyrzykowski W.: Ruch kolejowy. WKiŁ, Warszawa 1967.

Breakdown of average student's workload

	Hours	ECTS
Total workload	160	6,00
Classes requiring direct contact with the teacher	102	4,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	58	2,00