**ROAD AND RAILWAY DESIGN 1.**

**(DESIGN, CONSTRUCTION & MAINTENANCE OF ROADS)**

**Course Code:** PMTKGNB035CA-EA-00; PMTKGNB035CA-GY-01

**Term/Semester:** Spring

**ETCS Credits:** 4

**Lectures per Week:** 2

**Evaluation:** Examination (with score)

**Prerequisites:** English language, Basics of Physics, Mathematics and Soil Mechanics

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**Course Aim and Learning Objectives:**

**Highway and Railway Design 1** is dealing mainly with road engineering, being a discipline branching from Civil Engineering that involves the planning, design, construction and maintenance of roads, aiming to ensure safe and effective transport of people and goods. Its objective is to provide appropriate knowledge of: (i) basic principles of planning and design of roads; (ii) locate the alignment of a road and its adaptation to the environment and safety requirements; (iii) technologies of road building process.

**Course Content**

Students will be prepared to design the horizontal and vertical alignment of roads and intersections/interchanges, taking into account future traffic flows. It will be explained, how to select appropriate building materials and apply quality control measures related to flexible (asphalt concrete) and rigid (cement concrete) pavements. Development of methods used for structural design of pavement is demonstrated. Road geometric design primarily refers to the visible elements of the highways, but road engineers must also consider environmental and social impacts of their design on the surrounding infrastructure and pavement maintenance in the future. Considerations will be properly addressed, how to fit a road successfully to a site's topography, including efficient drainage system. A broad overview of traffic signs and markings, road accident analysis and safety concerns will be carried out. Technologies for building and maintaining roads have evolved over time and become increasingly sophisticated, therefore they are to be considered today as part of road design and maintenance know-how. Finally the objectives and pre-conditions of successful implementation of a Pavement Management Systems (PMS) will be discussed.

**Methodology:**

- **Lectures**: will give detailed insight and explanation of the basic knowledge of road geometric design as well as of construction and maintenance issues related to the current road- and traffic engineering practice.

- **Exercise/Training**: Numerical examples with solutions (related to some lectures), will be made accessible on the intranet for study at home. A half-day demonstration of a 3D Computer Aided Design (CAD) software developed and used for road design will be held during the Spring Term (attendance is mandatory for all students registered)

- **Examinations:** Knowledge acquired will be tested by a written (quiz-type) mid-term examination (scheduled on the 7th week) and a similar written final examination scheduled at the end of the Term. The examination has two separate parts as follows: (i) a questionnaire containing 22 questions is to be answered by choosing the right answer among 3 variants;

(ii) 3 numerical examples are to be solved individually.

Those, who failed the mid-term examination will have only one more opportunity for re-sit examination; repeated failure involves automatic refusal of acknowledgement of the course/study and denial to register for the final written examination.

**Detailed Schedule of Lectures:**

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| **Week/Day** | **Topic** |
| 1st  05.February | 1. HISTORY OF ROADS AND ROAD TRANSPORT |
| 2nd  12. February | 2. VEHICLE’S MOTION ON THE ROAD - RESISTANCES - SIGHT DISTANCES & GEOMETRIC ELEMENTS |
| 3rd  19. February | 3. ELEMENTS AND COORDINATION OF HORIZONTAL & VERTICAL ALIGNMENT |
| 4th  26. February | 4. JUNCTIONS, INTERSECTIONS & INTERCHANGES |
| 5th  05. March | 5. ROAD SIGNS, SIGNALS & PAVEMENT MARKINGS |
| 6th  12. March | 6. TRAFFIC FLOW ANALYSIS, CAPACITY & LEVEL OF SERVICE |
| 7th  19. March | **MID-TERM WRITTEN EXAMINATION** (SCOPE: CONTENT OF LECTURES 1-6) |
| 8th  26. March | 7. ROAD TRAFFIC ACCIDENTS |
| 9th  02. April | **EASTER MONDAY** |
| 10th  09. April | 8. MATERIALS OF ASPHALT MIXTURES & QUALITY CONTROL |
| 11th  16. April | 9. FLEXIBLE & RIGID PAVEMENTS – ROAD DRAINAGE |
| 12th  23. April | 10. PAVEMENT DESIGN |
| 13th  30. April | **HOLIDAY** |
| 14th  07. May | 11. ROAD CONSTRUCTION TECHNOLOGIES |
| 15th  14. May | 12. ROAD MAINTENANCE & PAVEMENT MANAGEMENT |

**Attendance:**

It is required to attend all lectures (it will be controlled), while attendance impacts the final score (max. 20%). Unexcused absences will adversely affect the score and in case of absence from more than 30% of the total number of lectures will be grounds for failing the sourse/study. To be in class at the starting time and stay there until the scheduled end of the lecture is required, delayed arrival or early departure of more than 20 minutes will be considered as an absence. In the case of an illness or family emergency, the student must present a valid excuse, such as a doctor's note.

**Grading/Scoring:**

20% - Attendance

15% - Participation at the demonstration of a 3D Computer Aided Design software (mandatory)

25% - Mid-term written examination (repeated failure involves denial to attend final examination)

40% - Final written examination

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| --- | --- | --- | --- | --- | --- |
| **Grade/Score** | **5** | **4** | **3** | **2** | **1** |
| **Percentage** | **100%-85%** | **84%-74%** | **73%-63%** | **62%-51%** | **50%-0%** |

**Students with Special Needs:**

Students with a disability and needs to request special accommodations, please, notify the Deans Office. Proper documentation of disability will be required. All attempts to provide an equal learning

environment for all will be made.

**Recommended Readings and Reference Materials:**

**Daniel J Findley, Bastian Schroeder, Christopher Cunningham, Tom Brown:**

Highway Engineering: Planning, Design and Operations. Elsevier Inc. (2016)

<https://www.amazon.com/Highway-Engineering-Planning-Design-Operations/dp/012801248X>

**Design Manual for Roads and Bridges (UK)**

<http://www.standardsforhighways.co.uk/ha/standards/dmrb/index.htm>

**Highways England**: Guidance - Standards for Highways online resources <https://www.gov.uk/guidance/standards-for-highways-online-resources>

**New York State Department of Transportation (USA)**: Highway Design Manual <https://www.dot.ny.gov/divisions/engineering/design/dqab/hdm>

**Transportation Research Board (TRB):** Highway Capacity Manual

(Online Edition – HCM 2010)

<http://hcm.trb.org/?qr=1>