Course unit title:	Prestressed Concrete		
Course unit code:	CE430		
Type of course unit:	Technical Elective		
Level of course unit:	Bachelor (1st Cycle)		
Year of study:	4		
Semester when the unit is delivered:	7 or 8		
Number of ECTS credits allocated :	6		
Name of lecturer(s):	Dr Antonis Michael		
Learning outcomes of the course unit:	1. Define the principle of prestressed concrete and its applications and list methods of prestressing and appropriate design codes. 2. Analyse the differences and similarities between design codes for prestressed concrete. 3. Associate different systems with the construction of specific prestressed structures 4. Apply appropriate code provisions for the design of prestressed concrete beams and slabs. 5. Create detailed construction drawings of the design structure. 6. Explain how size standardization and mass production influences the economic viability of prestressed concrete. 7. Compare the use of different standard shapes for the construction of a prestressed structure and defend recommended selection.		
Mode of delivery:	Face-to-face		
Prerequisites:	CE110	Co-requisites:	None
Recommended optional program components:	None		
Course contents:	**Introduction:** Define prestress concrete concept. Identify key historical points in the development of modern prestress concrete structures. Identify and list codes and specifications for prestressed concrete. Identify and define the basic principles of prestressed concrete. Identify the material properties of pre-stressing steels such the stress-strain behaviour. Identify the material properties of concrete for prestressed construction (strength, creep, shrinkgage etc). **Prestressing and Post-Tensioning Systems:** List and discuss prestressing and postensioning systems. Discuss and list basic differences. Identify the basic methods for calculating stresses in prestress concrete members (stress superposition, C-line method etc). Calculate stresses at release of prestress and after prestress losses. Identify stress limitations based on code requirements for prestress members. Identify and list losses of prestress in pre-tensioning and post tensioning systems. Identify code provisions relating to prestress losses. Calculate prestress losses due to elastic shortening of concrete, steel relaxation, friction, creep and shrinkage etc. **Analysis of Sections for Flexure:** Present the method of transformed section for determining the exact theoretical solution for both pre-tensioned and post-tensioned concrete members. Calculate stresses for both pre-tensioned and post-tensioned concrete members using the exact theoretical solution and compare with the approximate solution. Identify the development of stresses in steel due to loads in prestress concrete and compare with stresses in steel for reinforced concrete. **Cracking Moment in Prestress Concrete Members:** Identify and list design assumptions. Identify code provisions for calculating the flexural tensile strength of		

	concrete in the extreme fiber. Identify and explain kern points and how they are associated with the location of the center of compression C. Calculate cracking moment for prestressing concrete sections. **<u>Ultimate Moment Capacity:</u>** Present and discuss typical loading history and stress distribution across the depth for typical prestress concrete members. Identify typical load displacement history for typical prestress concrete members. Identify conditions for using the C-line method to determine the ultimate moment capacity of prestressed sections with bonded tendons. Identify and list modes of failure for prestress concrete members. Identify code provision relating to the design of prestressed members (Ultimate moment capacity). Identify code provisions for the termination of prestressing steel and concrete material properties at the ultimate limit state. Calculate ultimate moment capacity of rectangular and tee sections according to code provisions for sections with regular and prestress reinforcement. **<u>Moment Curvature Analysis:</u>** Define the term curvature and how it relates to ductility of structural members. Identify and list the assumptions made for the performance of a moment curvature analysis. Identify stress strain relationship of steel and concrete for the analysis. Identify the analysis procedure and its stages (prior to cracking and after cracking). Calculate and plot the moment curvature response of rectangular sections.
Recommended and/or required reading:	
Textbooks:	Edward G. Nawy (2002), **"Prestressed Concrete: A Fundamental Approach"**, Prentice-Hall International Series in Civil Engineering, 4th edition, Prentice Hall, 984 pp. Eurocode 2: **Design of Concrete Structures – Part 1-1: General rules and rules for buildings**.
References:	Edward G. Nawy (2009), "Prestressed Concrete: A Fundamental Approach", 5th edition, Prentice Hall, 984 pp.
Planned learning activities and teaching methods:	The course is delivered to the students by means of lectures. The lecturer presents to the student the course content and allows for questions. The material is presented using computer presentations incorporating photos / diagrams. Presentation Handouts, homework assignments, and additional material such as relevant magazine articles are made available to students at any time on the e-learning Moodle platform. The learning process is enhanced with the requirement from the student to submit assessments.
Assessment methods and criteria:	• Coursework 50% • Final Exam 50%
Language of instruction:	English
Work placement(s):	No