NATIONAL UNIVERSITY OF ENGINEERING
COLLEGE OF CIVIL ENGINEERING

CIVIL ENGINEERING PROGRAM

SYLLABUS - CONCRETE TECHNOLOGY I

I. GENERAL INFORMATION

CODE	:	EC612
SEMESTER	:	5
CREDITS	:	4
HOURS PER WEEK	:	5 (Theory – Laboratory)
PREREQUISITES	:	EC611 Materials Technology
CONDITION	:	Compulsory
DEPARTMENT	:	Construction
INSTRUCTOR	:	Ana Torre
INSTRUCTOR E-MAIL	:	anatorre@uni.edu.pe

II. COURSE DESCRIPTION

This course is theoretical and practical and provides students with the knowledge to assess the quality of materials used in a design of mortars, as well as aspects regarding the concrete which will be the base for the development of courses of the area. The course deals with: Concrete. Concrete resistance. Physical characteristics of aggregates. Concrete admixture. Properties of green and hardened concretes. Admixture design of normal and high-performance concrete. Quality control. Statistic assessment of resistance results. Ready mixed concrete batching and mixing plant. Concrete mixing, pumping and compaction equipment.

III. COURSE OUTCOMES

1. Identify characteristics of materials making up the base for admixture designs.
2. Put forward cause – effect relationships in green and hardened concrete properties.
3. Interpret and apply methods of admixture dosage for normal weight and medium compress resistance concrete.
4. Assess criteria for handling concrete in works.
5. Analyze concrete quality.

IV. LEARNING UNITS

1. MATERIALS / 15 HOURS

Concrete as structural material / History of concrete components / Types of concrete. Properties of green concrete and hardened concrete / importance of the technical training / Cement / Definition / Classification / Composition / Structure / Gel / Capillary pore / Water for its preparation and curing / Aggregates / Physical characteristics / Classification / General specifications. Specific gravity / Volumetric gravity / Humidity condition / Granulometric design / Absolute and apparent volume of aggregates / Method of aggregate combination for a required granulometry / Specific surface area / Concrete admixtures / Classification / Reducer admixture of water retarding as modifiers of green concrete properties / Air incorporating admixtures / Waterproofing admixtures / Cutting-edge admixtures.

2. PROPERTIES OF CONCRETE / 25 HOURS

Concrete permeability / Concrete temperature problems / Freezing and thaw processes in the concrete, weathering influences and causes / Concrete resistance / Compression resistance / Tensile strength due to diametrical compression / Flexural strength / Concrete resistance nature /

Water-cement relation / Design water / Design water / Effective water / Factors modifying resistance.

3. DESIGN OF CONCRETE MORTARS / 15 HOURS
Basic considerations in mortar design / Description. Factors having influence / Essential requirements and ratio expressions. Types of concrete mortars. Steps for designing a mortar. Criteria in the selection of design values / Design of concrete mortars: ACI methods, aggregate fineness modulus, Fuller's curve / Procedures and applications.

4. CONCRETE QUALITY CONTROL / 15 HOURS
Average resistance / general criteria / Statistic fundamentals / Results interpretations / Characteristic resistance / Destructive and nondestructive testing in the hardener concrete / Acceptance and rejection green and hardened concrete / Elasticity and plastic flow / Strain and crazing / Cracking interpretation.

5. EQUIPMENT / 15 HOURS
Equipment / Concrete mixer / types / Mixing time / Transport / Concrete placing and finishing / Concrete compaction equipment / Concrete pumping equipment.

V. LABORATORY EXPERIENCES

Lab. 1: Granulometry / Unitary weight / Mesh 200
Lab. 2: Specific gravity / Humidity content / Percentage of absorption
Lab 3: Abrassion resistance / Durability / Organic impurities
Lab. 4: Mix design
Lab. 5: Fresh concrete testing: settling, exudation, unitary weight, air content
Lab. 6: Hardened concrete testing: compression tension, flexion, elasticity

VI. METHODOLOGY

This course applies an active method in the learning-teaching process in which students participate every class. The instructor exposes using the available audiovisual aids. An analysis is carried out in order to find out the interaction of the different materials within the mortar design. In class, there will be cases, debates, examples, demonstrations that allow students to understand performing and practicing in the training and handling of lab equipment and tools, as well as the achievement of feedback.

VII. EVALUATION FORMULA

The average grade PF is calculated as follows:

$$PF = 0.25\ EP + 0.25\ EF + 0.25\ PP + 0.25\ PL$$

EP: Mid-Term Exam EF: Final Exam
PP: Quizzes average PL: Labs average

VIII. BIBLIOGRAPHY

1. **RIVVA LÓPEZ, ENRIQUE**
   Recommendation for the process of planting concrete structures (Spanish)
   Sosfisa Editorial, lima - Peru (1988)

2. **NEVILLE A.M. AND BROOKS J.J.**
   Concrete Technology (Spanish)
   Trillas Editorial, Mexico (1998)

3. **KUMAR MEHTA, P. AND MONTEIRO, PAULO**
   Concrete, structure, materials and properties (Spanish)
   Mexican Institute of Cement and Concrete (1998)

IX. COURSE CONTRIBUTIONS TO STUDENT OUTCOMES ATTAINMENT

Course contributions to Student Outcomes are shown in the following table:

K = Key **R** = Related **Empty box** = Does not apply

	Outcome	Contribution
Engineering Design	Design civil works satisfying requirements and needs as well as given constraints and limitations.	**K**
Problem solving	Identify, formulate and solve engineering problems properly using the methods, techniques and tools of civil engineering.	**K**
Sciences Application	Apply the knowledge and skills of mathematics, sciences and engineering to solve civil engineering problems.	**K**
Experimentation	Conceive and conduct experiments, analyze data and interpret results	
Modern Engineering	Use and apply techniques, methods and tools of modern engineering necessary for the practice of civil engineering.	
Engineering Impact	Understand the impact of engineering solutions on people and society in local and global contexts.	**R**
Project Management	Plan and manage civil engineering projects taking into account efficiency and productivity criteria.	
Environmental Appraisal	Takes into account the importance of preserving and improving the environment in the development of their personal and professional activities.	**K**
Lifelong Learning	Recognize the need to keep their knowledge and skills up to date according to advances of civil engineering and engage in lifelong learning.	**R**
Contemporary Issues	Know and analyze relevant contemporary issues in local, national and global contexts.	**R**
Ethics and Professional Responsibility	Evaluate their decisions and actions from a moral perspective and assume responsibility for the executed projects.	
Communication	Communicate clearly and effectively in oral, written and graphical formats, interacting with different types of audiences.	
Teamworking	Appraise the importance of teamworking and participate actively and effectively in multidisciplinary teams.	