



NATIONAL UNIVERSITY OF ENGINEERING
COLLEGE OF CIVIL ENGINEERING
CIVIL ENGINEERING PROGRAM

SYLLABUS - CONCRETE TECHNOLOGY I

I. GENERAL INFORMATION

CODE	: EC612 Concrete Technology I
SEMESTER	: 5
CREDITS	: 4
HOURS PER WEEK	: 5 (Theory – Laboratory)
PREREQUISITES	: EC611 Materials Technology, MA611 Statistics and Probabilities
CONDITION	: Compulsory
DEPARTMENT	: Construction

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: Abrasion 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)
Sofisa 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)