



NATIONAL UNIVERSITY OF ENGINEERING
COLLEGE OF CIVIL ENGINEERING
CIVIL ENGINEERING PROGRAM

SYLLABUS - STRUCTURAL ANALYSIS II

I. GENERAL INFORMATION

CODE	: ES934 Structural Analysis II
SEMESTER	: 8-10
CREDITS	: 4
HOURS PER WEEK	: 5 (Theory – Practice)
PREREQUISITES	: EC211 Structural Analysis I
CONDITION	: Elective
INSTRUCTOR	: Hugo Scaletti
INSTRUCTOR E-MAIL	: scaletti@alum.mit.edu

II. COURSE DESCRIPTION

This course provides students with fundamental principles of the Matrix Analysis of structures and its application to bar structures. Its general objective is the understanding of the concepts on which computational techniques used in structural analysis are based and their application through manual procedures using calculators and student versions of commercial programs as well as the analysis of the results obtained.

III. COURSE OUTCOMES

1. Apply methods and techniques common in Civil Engineering for formulating and solving problems of the specialty.
2. Use specialized software to perform his/her work.
3. Interpret results of the structures behavior from the laws which determine them.
4. Mathematically represent the structural analysis of civil engineering problems, and carry out the respective modeling and analysis.
5. Analyze and design reticulated structures.
6. Analyze and design portico-type structures.

IV. LEARNING UNITS

1. ANALYSIS OF RETICULATED STRUCTURES

Plane and spatial reticulated structures / Assumptions and simplifying assumptions / Rigidity of 2D and 3D bi-articulated bars / Analysis of reticulated structures with concentrated loads / Temperature increments / Initial deformations / Algorithms and programs for analyzing reticulated

2. ANÁLISIS DE PORTICO-TYPE STRUCTURES

Rigidity and flexibility of 2D beam-column elements / Shear deformation / Translation and rotation of reference system / Consideration for distributed forces / General 3D case / Simplifying hypothesis.

3. ADDITIONAL TOPICS IN THE ANALYSIS OF PORTICO-TYPE STRUCTURES

Portico-type structures with plates / Rigidity of elements with rigid arms / Embedded forces / Comparison of results with different hypothesis / Static and dynamic considerations / Elements with articulated borders / Substructures / Elements with varying section and/or curve axis.

4. SEISMIC ANALYSIS WITH EQUIVALENT STATIC FORCES

Lateral rigidity of a leveled portico / Approximations for modeling / Close coupling modeling / Wall lateral rigidity / Seismic analysis with tridimensional models / Rigid diaphragms / Comparison of results with different hypothesis.

5. INTRODUCTION TO FINITE ELEMENTS

Principle of virtual work / Potential energy / Rigidity and statically equivalent forces / Simple finite elements / Consistency, continuity and convergence / Iso-parametric elements / Practical considerations / Analysis of slabs with transversal loads.

6. INTRODUCTION TO NONLINEAR ANALYSIS

Nonlinear behavior, analysis and design / Geometric nonlinearities / Tensed structures / Moments magnification / Hypothesis of plastic patella / Seismic isolators and viscous dampers.

VI. METHODOLOGY

The course is carried out in theory and practice sessions, using active methods in the learning and teaching process, encouraging students' participation. The instructor exposes and gives examples to complement students' activities, using the available audiovisual aids. Students complete design projects.

VII. EVALUATION FORMULA

The average grade PF is calculated as follows:

$$PF = 0.33 EP + 0.33 EF + 0.16 PP + 0.17 TE$$

EP: Mid-Term Exam

EF: Final Exam

PP: Average of three quizzes

TE: Average of four design project reports

VIII. BIBLIOGRAPHY

- 1. MC GUIRE, William, GALLAGHER, Richard y ZIEMIAN, Ronald**
Matrix Structural Analysis
John Wiley and Sons, N.Y., 2000
- 2. TENA, Arturo**
Structures Analysis Using Matrix Methods
Limusa Editorial, México, 2004
- 3. JAVIER PIQUÉ AND HUGO CALETTI**
Building Seismic Analysis
CIP – Chapter of Civil Engineering. Lima, 1991