

1. COURSE

AR2D1. Design Studio IV (Mandatory)

2. GENERAL INFORMATION

2.1 Course	:	AR2D1. Design Studio IV
2.2 Semester	:	4 th Semester.
2.3 Credits	:	4
2.4 Hours	:	4 HT; 4 HP;
2.5 Duration of the period	:	16 weeks
2.6 Type of course	:	Mandatory
2.7 Learning modality	:	Face to face
2.8 Prerequisites	:	AR1D3. Design Studio III. (3 rd Sem)

3. PROFESSORS

Meetings after coordination with the professor

4. INTRODUCTION TO THE COURSE

Design Studio IV: Neighborhood Facilities is the student's first public-building project, following Design Studio III (AR1D3, prerequisite). Working at the scale of a neighborhood library or a community health post, students design a medium-scale public facility and, for the first time in the sequence, develop its structural system explicitly as part of the architectural proposal – selecting and sizing the vertical and lateral load-resisting elements, and coordinating them with construction assemblies, natural ventilation strategies, and the applicable building codes. This course is the foundation for Design Studio V (AR2D2).

5. GOALS

- Apply the fundamental principles of structural mechanics (loads, equilibrium, internal forces) to the design of a medium-scale public building.
- Select and size the vertical and lateral load-resisting systems (columns, walls, frames, diaphragms) of a neighborhood facility.
- Coordinate structural, envelope, and interior systems into a constructible building assembly.
- Verify a design proposal's compliance with applicable building codes, accessibility standards, and zoning regulations.
- Design naturally ventilated spaces using cross-ventilation and stack-effect strategies appropriate to the building's program and climate.

6. COMPETENCES

- AG-A08)** Understands the structural and environmental design problems associated with construction and the engineering of building design. (Usage)
- AG-A12)** Possesses the design skills needed to satisfy building users' requirements within cost constraints and building regulations. (Usage)
- AG-A14)** Possesses creative capacity in construction techniques, grounded in a comprehensive understanding of the disciplines and construction methods related to architecture. (Usage)

7. TOPICS

Unit 1: Structural Principles and Mechanics (10 hours)	
Competences Expected: AG-A08	
Topics	Learning Outcomes
- Types of loads: dead, live, snow, wind, seismic, and thermal; load combinations per ASCE 7; internal force diagrams (axial, shear, moment) in statically determinate beams - Stress-strain relationships for common structural materials: elastic and plastic behavior, yield strength, ultimate strength, modulus of elasticity, and ductility - Static equilibrium equations ($\sum F_x = 0$, $\sum F_y = 0$, $\sum M = 0$) and calculation of support reactions in beams, trusses, and simple frames - Truss analysis: method of joints, method of sections, zero-force members, and truss configurations (howe, pratt, warren, vierendeel) for different span conditions - Beam deflection: moment-area method, superposition, and the role of deflection limits ($L/360$, $L/240$) in serviceability design	- Describe the primary types of structural loads and internal forces, and explain how they influence the sizing and configuration of structural elements [Familiarity] - Calculate support reactions, shear and moment diagrams, and deflection in simple statically determinate beams and trusses [Usage] - Evaluate the structural adequacy of a simple beam or truss configuration against given load and deflection criteria, proposing cross-section or material changes where needed [Assessment]
Readings : [Schierle2012], [Onouye2017]	

Unit 2: Vertical Load Path and Foundations (10 hours)	
Competences Expected: AG-A08	
Topics	Learning Outcomes
- Vertical load-bearing systems: short vs. slender columns, buckling (Euler), effective length factor; load-bearing walls (masonry, concrete, timber, steel studs) - Foundation systems and load transfer: spread footings, continuous footings, pile caps, grade beams, and the role of connections in ensuring load path continuity - Structural grid design: bay sizes, column spacing implications for floor framing (one-way vs. two-way slabs, beam-and-girder, flat plate, flat slab),	- Identify the primary vertical load-bearing elements and foundation systems in a building, and describe how loads are transferred from the structural grid to the foundation [Familiarity] - Select and configure an appropriate column/wall system, foundation type, and structural grid for a medium-rise building, considering program and material availability [Usage] - Evaluate a building's vertical load path for continuity and foundation adequacy, identifying potential load-transfer discontinuities [Assessment]
Readings : [Schierle2012], [Onouye2017]	

Unit 3: Natural Ventilation and Indoor Air Quality (8 hours)	
Competences Expected: AG-A08	
Topics	Learning Outcomes
• Drivers for natural ventilation: wind pressure coefficients (C_p), stack effect (buoyancy), and combined wind and stack; ventilation rate calculation using the orifice equation • Cross-ventilation and stack ventilation design: opening placement (inlet vs. outlet heights), room depth limits for effective cross-flow ($2\text{-}2.5\times$ floor-to-ceiling height) • Indoor air quality standards and contaminants: ASHRAE 62.1 ventilation rate procedure, indoor pollutant sources (VOCs, CO₂, particulates), • Mixed-mode (hybrid) ventilation: sequencing strategies (changeover, zoned, concurrent), control logic for switching between natural and mechanical modes, • Airflow simulation for natural ventilation: computational fluid dynamics (CFD) for detailed analysis, zonal models for early design, and wind tunnel testing for complex geometries	• Describe the physical drivers of natural ventilation - wind and stack effect - and explain how opening size, placement, and building depth influence airflow rates [Familiarity] • Design a natural ventilation strategy for a building in a moderate climate, specifying opening sizes, heights, [Usage] • Evaluate a naturally ventilated building design using airflow simulation or simplified calculations, identifying zones with insufficient ventilation [Assessment]
Readings : [BrownDeKay2001]	

Unit 4: Building Systems and Assemblies (12 hours)	
Competences Expected: AG-A14	
Topics	Learning Outcomes
• Integration of building systems: coordinating structural frame, mechanical/electrical/plumbing (MEP), envelope, and interior fit-out within constrained floor-to-floor heights • Construction documentation for assemblies: details at 1:5, 1:10, and 1:20; section-through-wall details, sill and head conditions, and coordination between architectural • Construction tolerances and coordination: dimensional tolerances in concrete, steel, and masonry; clearances for MEP rough-in • Waterproofing and moisture management: below-grade waterproofing systems, drainage planes, vapor barriers, and flashing at penetrations • Fire-rated assemblies: UL-listed wall, floor, and ceiling assemblies; fire-stopping at penetrations, intumescent seals, and the architectural detailing required by fire codes • Prefabricated and modular assemblies: volumetric modular construction, panelized wall systems, and the design implications of off-site manufacturing tolerances	• Identify the principal building systems and describe how they are integrated and coordinated within a multi-story building assembly [Familiarity] • Develop construction-level details for a building assembly that correctly coordinate structural, envelope, and MEP systems within realistic tolerances and code requirements [Usage] • Evaluate a set of construction documents for assembly coordination quality, identifying conflicts, missing details, and buildability risks [Assessment]
Readings : [AllenIano2019]	

Unit 5: Building Codes, Accessibility, and Zoning (10 hours)	
Competences Expected: AG-A12	
Topics	Learning Outcomes
• Building codes and standards: IBC (International Building Code), IRC (International Residential Code), IFC (International Fire Code) • Means-of-egress and fire-evacuation route design: maximum travel distance to an exit, number and width of exits required by occupant load, exit discharge and assembly points, and diagramming evacuation routes on a life-safety plan • Accessibility codes: ADA Standards for Accessible Design, ICC A117.1, and local accessible building codes • Energy codes: IECC (International Energy Conservation Code), ASHRAE 90.1; prescriptive vs. performance paths • Zoning and land use regulations: zoning districts (residential, commercial, industrial, mixed-use), floor area ratio (FAR), lot coverage, setbacks, height limits • Permitting process: building permit, variance, special exception; code interpretation appeals; the architect's role in preparing permit sets, responding to plan review comments	• Describe the key provisions of building codes that affect architectural design - occupancy classification, means of egress, fire-resistance, accessibility, and energy performance [Familiarity] • Apply IBC occupancy and construction type tables to determine allowable building area and height for a given use and sprinkler status, [Usage] • Evaluate a building design's code compliance for accessibility (ADA) and life safety (IBC), identifying violations and recommending code-conforming modifications [Assessment]
Readings : [ChingCodes2017]	

8. WORKPLAN

8.1 Methodology

Individual and team participation is encouraged to present their ideas, motivating them with additional points in the different stages of the course evaluation.

8.2 Theory Sessions

The theory sessions are held in master classes with activities including active learning and roleplay to allow students to internalize the concepts.

8.3 Practical Sessions

The practical sessions are held in class where a series of exercises and/or practical concepts are developed through problem solving, problem solving, specific exercises and/or in application contexts.

9. EVALUATION SYSTEM

***** EVALUATION MISSING *****

10. BASIC BIBLIOGRAPHY