

1. COURSE

AR3D4. Design Studio X (Mandatory)

2. GENERAL INFORMATION

2.1 Course	:	AR3D4. Design Studio X
2.2 Semester	:	10 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	:	AR3D3. Design Studio IX. (9 th Sem)

3. PROFESSORS

Meetings after coordination with the professor

4. INTRODUCTION TO THE COURSE

Design Studio X: Comprehensive Architectural Project closes the Design Studio sequence that began in Design Studio I (AR1D1) and continued through Design Studio IX (AR3D3, prerequisite). Students develop a high-complexity anteproyecto (preliminary design) that integrates, for the first time within a single project, every major dimension practiced across the sequence: a complex building program, a fully coordinated structural and systems assembly, net-zero-oriented sustainability strategies, and Building Information Modeling as the representational and coordination platform, all verified against applicable building codes. Unlike the Tesis sequence (AR401-AR403), this course does not involve thesis research or an individual defense: it is the Design Studio sequence's comprehensive, integrative capstone project.

5. GOALS

- Develop a comprehensive architectural anteproyecto that integrates complex programming, structural logic, and building systems into a single coherent design proposal.
- Coordinate the structural, envelope, and building-system assemblies of the comprehensive project into a constructible whole.
- Apply net-zero and high-performance sustainability strategies (energy modeling, efficiency-first design, on-site renewables) to the comprehensive project.
- Develop and coordinate the comprehensive project using Building Information Modeling, from conceptual massing to a construction-ready level of development.
- Verify the comprehensive project's compliance with applicable building codes and regulations.

6. COMPETENCES

AG-A09) Creates architectural designs that satisfy aesthetic and technical requirements. (Usage)

AG-A12) Possesses the design skills needed to satisfy building users' requirements within cost constraints and building regulations. (Usage)

AG-A13) Demonstrates knowledge of the means to achieve ecologically responsible design and environmental conservation and rehabilitation. (Usage)

7. TOPICS

Unit 1: Large-Scale and Complex Buildings (16 hours)	
Competences Expected: AG-A09	
Topics	Learning Outcomes
• Programming and spatial organization at large scale: stacking diagrams, core-to-perimeter ratios, vertical circulation strategies, • Life safety and means of egress in large buildings: occupancy-based egress design, pressurized stairwells, refuge floors, fire compartmentalization, and NFPA/IBC requirements • Vertical transportation systems: elevator group design, sky lobbies, express/local zone strategies, escalators, and integration of vertical transport into building form • Hybrid and mixed-use building design: separating and linking residential, commercial, hotel, and civic programs; transfer floors, podium strategies, and shared amenity programming • Phased construction and building complexity: designing for construction staging, operational continuity, future expansion, and changeable use within long-lifespan complex buildings • Campus and master plan design at large scale: site organization, wayfinding, public realm, phasing, infrastructure coordination, and identity across a multi-building ensemble	• Identify the key design challenges - program complexity, life safety, vertical transport, and phasing - that distinguish large-scale buildings from smaller architectural projects [Familiarity] • Apply large-scale building design strategies to develop a spatial and programmatic organization for a complex multi-story or mixed-use building typology [Usage] • Evaluate a large-scale building design for programmatic coherence, life safety compliance, and operational efficiency [Assessment]
Readings : [Schierle2012]	

Unit 2: Building Systems and Assemblies (12 hours)	
Competences Expected: AG-A09	
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 3: BIM Fundamentals and Authoring (5 hours)	
Competences Expected: AG-A09	
Topics	Learning Outcomes
• Core BIM concepts: object-oriented modeling (walls, doors, windows with embedded data), parametric relationships (hosting, constraints), and the difference between BIM and conventional 2D/3D modeling • BIM authoring tools: Revit (project-based, family editor), ArchiCAD (virtual building model), Vectorworks, and their respective modeling philosophies and interoperability • Level of development (LOD) specification: LOD 100 (conceptual), 200 (schematic), 300 (detailed), 350 (construction-ready), 400 (fabrication), 500 (as-built) • Data exchange standards: Industry Foundation Classes (IFC) as openBIM exchange format, IFC schema (IfcWall, IfcDoor, IfcWindow, IfcSpace), and vendor-neutral model interoperability	• Describe the core concepts of BIM: object-based modeling, parametric relationships, LOD, and data exchange via IFC, and explain how BIM differs from traditional 2D CAD [Familiarity] • Develop a BIM model of a small building at LOD 200-300, producing plans, sections, elevations, and a simple schedule directly from the model, and export the model to IFC format [Usage] • Evaluate a BIM model for appropriate LOD, correct parametric relationships, and clean IFC export, identifying modeling errors that would impede downstream coordination or data exchange [Assessment]
Readings : [Eastman2011]	

Unit 4: BIM Execution Planning and Standards (3 hours)	
Competences Expected: AG-A09	
Topics	Learning Outcomes
• BIM Execution Plan (BEP): project goals for BIM use (clash detection, 4D/5D, facility management), LOD matrix by discipline, model sharing protocols • ISO 19650 framework: information management using BIM across the delivery and operational phases of assets, information requirements (EIR, OIR, AIR), and the information-delivery cycle	• Describe the purpose of a BIM Execution Plan and the ISO 19650 information-management framework, and explain how they structure a project's BIM deliverables [Familiarity] • Draft a BIM Execution Plan for a project, specifying BIM goals, LOD matrix, and information-delivery milestones aligned with ISO 19650 [Usage] • Evaluate a BIM Execution Plan for a design project, assessing its LOD specifications, exchange protocols, and BIM use cases for adequacy and clarity [Assessment]
Readings : [Eastman2011]	

Unit 5: Energy Efficiency and Net-Zero Design (10 hours)	
Competences Expected: AG-A13	
Topics	Learning Outcomes
• Building energy modeling (BEM): physics-based simulation (EnergyPlus, eQUEST, IES VE), input parameters (envelope, lighting, HVAC, schedules, plug loads), • Efficiency-first approach: envelope optimization (high R-value, low air leakage), high-performance glazing, efficient lighting (LED with controls), • On-site renewable energy: photovoltaic (PV) array sizing (roof, facade, parking canopy), inverter selection, and estimating annual production (PVWatts, SAM) • Zero energy certification frameworks: NZEB (zero net energy building) definitions by DOE, Living Building Challenge Energy Petal, and Passive House Plus • Deep energy retrofit for existing buildings: envelope upgrades (window replacement, exterior insulation), HVAC replacement with heat pumps, and lighting retrofit	• Describe the components of a net-zero energy building design - load reduction, efficiency, and on-site renewables - [Familiarity] • Perform a preliminary energy balance for a building design, calculating estimated EUI from a simple model and sizing a PV array to offset annual energy consumption [Usage] • Evaluate a proposed net-zero building design by reviewing its energy model inputs and assumptions, identifying unrealistic plug load estimates or insufficient PV area, [Assessment]
Readings : [Kibert2016]	

Unit 6: Building Codes, Accessibility, and Zoning (8 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