Private University of Tacna (UPT)
School of Architecture
Syllabus 2027-I

1. COURSE

AR3R1. 3D Modeling and Virtual Animation (Mandatory)

2. GENERAL INFORMATION

2.1 Course	:	AR3R1. 3D Modeling and Virtual Animation
2.2 Semester	:	3rd Semester.
2.3 Credits	:	4
2.4 Hours	:	2 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 Prerrequisites	:	AR2R1. Digital Drafting. (2nd Sem)

3. PROFESSORS

Meetings after coordination with the professor

4. INTRODUCTION TO THE COURSE

3D Modeling and Virtual Animation closes the Representation sequence, building on the CAD/BIM production pipeline from Digital Drafting (ARC2R1) and extending it into real-time 3D, simulation, and immersive media (SketchUp/V-Ray/Blender, Unreal Engine/Twinmotion). It is the course that equips students to actually communicate the territorial and urban proposals developed in the Taller de Urbanismo sequence to authorities, investors, and affected communities – the course's own emphasis on storytelling and citizen participation makes this an explicit communication, not just a visualization, skill.

5. GOALS

- Build geo-referenced, hyperrealistic 3D models of existing or proposed urban environments, integrating multi-sector data (buildings, vegetation, infrastructure).
- Run performance/impact simulations on 3D urban models (daylight, traffic, flood scenarios) to support planning decisions.
- Produce immersive, interactive experiences (VR/AR walkthroughs) with basic navigation and information layers for community engagement.
- Communicate urban proposals persuasively to non-technical audiences through narrative, real-time animation, and storytelling techniques.

6. COMPETENCES

AG-A04) Communicates effectively and inclusively with the architecture community and society through reports, design documentation, and presentations tailored to different audiences. (Assessment)

AG-A06) Recognizes the need to learn independently and continuously, adapt to new and emerging technologies, and apply critical thinking in the face of technological change. (Assessment)

7. TOPICS

Unit 1: Three-Dimensional Modeling (24 hours)	
Competences Expected: AG-A06	
Topics	**Learning Outcomes**
• Geometric modeling types: solid modeling (extrude, loft, revolve, boolean operations), surface modeling (NURBS, patches), mesh modeling (subdivision) • Modeling workflows: massing model (initial concept), schematic model (rooms, openings), detailed model (materials, joinery, fixtures), • 3D rendering for presentation: material assignment (diffuse, roughness, metallic, transparency), lighting setup (directional, point, ambient, HDRI), camera settings (focal length • UV mapping and texturing: UV coordinates for applying 2D images to 3D surfaces, texture mapping (diffuse, bump, normal, displacement), and avoiding texture stretching and seams • Interoperability between modeling tools: file formats (OBJ, FBX, STEP, STL, 3MF) and common translation issues (lost geometry, material mapping	• Describe the differences between solid, surface, and mesh modeling and identify the appropriate modeling technique for a given architectural task (massing, detailed component [Familiarity] • Create a detailed 3D model of a building component (window, stair, facade panel) using solid modeling operations, then generate a rendered view with materials and lighting [Usage] • Evaluate the quality of a 3D model for a specific use (rendering, 3D printing, BIM integration), assessing geometric accuracy, topology cleanliness, and resolution appropriateness [Assessment]
Readings : [Bri20]	

Unit 2: Simulation and Performance Analysis (24 hours)	
Competences Expected: AG-A06	
Topics	**Learning Outcomes**
• Daylight simulation workflows: importing geometry into Radiance-based tools (DIVA, ClimateStudio), setting materials (reflectance, transmittance), defining sky models (overcast • Energy modeling workflows: setting up geometry in OpenStudio/EnergyPlus or IES VE, defining construction assemblies (U-value, SHGC), schedules, internal loads, HVAC systems, • Solar radiation analysis: calculating incident solar radiation on building surfaces (facade, roof, ground) using Ladybug or ClimateStudio • Thermal comfort simulation: PMV (predicted mean vote) and adaptive comfort models in EnergyPlus; natural ventilation modeling • Computational fluid dynamics (CFD) for architecture: simplified (zonal) vs. detailed (RANS, LES) airflow simulation	• Describe the main simulation types - daylight, energy, solar radiation, thermal comfort, and airflow - [Familiarity] • Perform a daylight simulation for a building facade using a climate-based model, interpreting sDA and ASE results to adjust aperture size, WWR, or shading [Usage] • Evaluate a simulation report for a building design, identifying unrealistic inputs (e.g., overly optimistic plug loads, missing shading) [Assessment]
Readings : [AHH18]	

Unit 3: Augmented, Virtual, and Mixed Reality (XR) (24 hours)	
Competences Expected: AG-A06	
Topics	**Learning Outcomes**
• Virtual reality for architectural design: immersive walkthroughs, scale verification, lighting and material perception, and the use of VR for client presentations • Augmented reality for construction and on-site coordination: overlaying BIM models onto physical construction via tablets or AR glasses (HoloLens) • Mixed reality for collaborative design: multi-user shared virtual environments, real-time sketching and model manipulation across remote locations, • XR workflow integration: exporting models from Revit, Rhino, or SketchUp to VR platforms (Enscape, Twinmotion, Unreal Engine), optimization for real-time performance (LOD • Usability and ethical considerations in XR for architecture: cybersickness, accessibility for users with disabilities, data privacy in shared virtual spaces,	• Describe the differences between virtual reality (VR), augmented reality (AR), and mixed reality (MR), [Familiarity] • Set up a VR walkthrough of an architectural model using a real-time rendering engine, optimizing the model for performance and evaluating the design at 1:1 scale in immersive mode [Usage] • Evaluate the usability of an AR or VR application for a specific architectural task (client presentation, design review, construction QA), identifying technical limitations [Assessment]
Readings : [Mil23]	

Unit 4: Architectural Communication and Presentation (24 hours)	
Competences Expected: AG-A04	
Topics	**Learning Outcomes**
• Design boards and panels: composition principles (grid, hierarchy, contrast, white space), integrating drawings (plan, section, elevation, axonometric, perspective), renderings • Architectural portfolio design: project selection (range of scales, stages, typologies), portfolio structure, narrative, captioning, • Physical model presentation: material choices (cardboard, foam, acrylic, 3D-printed, laser-cut), scale selection, level of detail, lighting • Verbal presentation of design: structuring a 5-10 minute design pitch (problem, concept, proposal, testing, conclusion), visual aids, responding to critique, • Architectural diagramming: circulation, program, structure, environmental performance, form generation, process	• Describe the key elements of effective architectural communication: narrative structure, visual hierarchy, appropriate level of detail, [Familiarity] • Produce a design presentation board (single panel) for an architectural project that integrates orthographic drawings, rendered views, diagrams, [Usage] • Evaluate a design portfolio or presentation for its communicative effectiveness, identifying strengths in narrative and visual clarity [Assessment]
Readings : [Dua08]	

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

[Dua08] Nancy Duarte. *Slide:ology – The Art and Science of Creating Great Presentations*. 1st. O'Reilly Media, 2008.

[AHH18] Tomas Akenine-Möller, Eric Haines, and Naty Hoffman. *Real-Time Rendering*. 4th. CRC Press, 2018.

[Bri20] Michael Brightman. *The SketchUp Workflow for Architecture*. 2nd. Wiley, 2020.

[Mil23] Jovan Milovanovic. *Unreal Engine for Architectural Visualization*. 1st. Packt Publishing, 2023.