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

1. COURSE

AR3B2. Sustainability and Circular Economy (Mandatory)

2. GENERAL INFORMATION

2.1 Course	:	AR3B2. Sustainability and Circular Economy
2.2 Semester	:	7^{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 Prerrequisites	:	AR3B1. Structural and MEP Coordination. (6^{th} Sem)

3. PROFESSORS

Meetings after coordination with the professor

4. INTRODUCTION TO THE COURSE

Sustainability and Circular Economy is the seventh course of the ten-course BIM I-X sequence (AR1B1 to AR4B1) that runs obligatorily alongside the Design Studio and Representation lines across the whole program. Building on Structural and MEP Coordination (AR3B1, prerequisite), where students consolidated model-based coordination and delivery practice, this course turns the BIM model into the data source for a building's environmental performance: exporting model geometry and materials to energy and daylight analysis tools, tagging model elements for circular-economy strategies such as design-for-disassembly and material passports, and tracking a project's compliance with green-building certification systems (LEED, EDGE, BREEAM) directly from model data and generating the corresponding documentation. The course's transversal Practicum unit – a hands-on software-lab component that recurs, unchanged in structure, across all ten courses of the sequence – shifts its guided exercises and certification-aligned practice to the sustainability-analysis and certification-tracking tools relevant to this course's theme.

5. GOALS

- Export a BIM model's geometry and material data to run energy and daylight analyses, and use the results to inform design iterations.
- Tag a BIM model's elements with material-passport and design-for-disassembly data to support a future deconstruction or reuse scenario.
- Track a chosen set of green-building certification credits (LEED, EDGE, or BREEAM) against a BIM model's quantities and analysis results, and generate the supporting compliance documentation.
- Build hands-on proficiency in the course's BIM sustainability-analysis and certification-tracking tools through a sequence of guided, graded practicum exercises culminating in a cumulative deliverable.

6. COMPETENCES

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. (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: BIM for Sustainability Analysis (24 hours)	
Competences Expected: AG-A13	
Topics	**Learning Outcomes**
• BIM-integrated energy analysis: gbXML export from BIM authoring tools to energy-simulation engines, and iterative design-stage energy performance feedback • BIM-integrated daylight and solar analysis: linking BIM massing and material data to daylight simulation (Insight, IES-VE) and solar-access studies • Embedding sustainability data in BIM objects: embodied-carbon data (EPDs) and material-passport information attached to BIM elements for lifecycle assessment	• Describe how BIM models can be exported or linked to energy, daylight, and sustainability-analysis tools, and explain the data requirements for each [Familiarity] • Export a BIM model's geometry and material data to run an energy or daylight analysis, and use the results to inform a design iteration [Usage] • Evaluate a BIM-based sustainability analysis for data accuracy and the appropriateness of its design recommendations [Assessment]
Readings : [Wil18]	

Unit 2: BIM for Circular Economy and Material Reuse (24 hours)	
Competences Expected: AG-A13	
Topics	**Learning Outcomes**
• Design-for-disassembly principles embedded in BIM: reversible connections, material separation, and modeling components for future deconstruction • Material passports and material banks: tagging BIM elements with reuse potential, provenance, and end-of-life data for future material recovery • Deconstruction sequencing and planning using a BIM model, mirroring 4D construction scheduling in reverse	• Describe how BIM data (material passports, reversible-connection tagging) can support circular-economy design decisions [Familiarity] • Tag a BIM model's elements with material-passport and design-for-disassembly data to support a future deconstruction or reuse scenario [Usage] • Evaluate a BIM-based circular-economy strategy for a project, judging the completeness of its material-passport data and the feasibility of its deconstruction plan [Assessment]
Readings : [Add06]	

Unit 3: BIM-Supported Green Building Certification (24 hours)	
Competences Expected: AG-A12	
Topics	**Learning Outcomes**
• Certification credit tracking from model data: linking BIM quantities and performance analysis results to LEED, EDGE, or BREEAM credit requirements • Generating certification documentation (narratives, calculations, drawings) directly from BIM model data and schedules	• Describe how BIM model data can be linked to green-building certification credit requirements and documentation [Familiarity] • Track a chosen set of green-building certification credits against a BIM model's quantities and analysis results [Usage] • Evaluate a BIM-based certification compliance package for completeness and consistency with the model it was generated from [Assessment]
Readings : [US 13]	

Unit 4: BIM Software Practicum (24 hours)	
Competences Expected: AG-A06	
Topics	**Learning Outcomes**
• Guided, graded software exercises in the BIM tool(s) specific to the course's theme (authoring, coordination, scheduling, analysis, or FM platforms), building toward a cumulative course deliverable • Practice aligned with vendor or industry certification exams (Autodesk Certified Professional, buildingSMART openBIM) relevant to the course's software focus	• Describe the practicum structure for the course's BIM software focus and the deliverable it builds toward [Familiarity] • Complete a sequence of guided exercises in the course's BIM software focus, building toward a cumulative practicum deliverable [Usage] • Evaluate the student's own practicum deliverable against the software proficiency expected for the course's BIM theme [Assessment]
Readings : [KN08]	

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

[Add06] Bill Addis. *Building with Reclaimed Components and Materials: A Design Handbook for Reuse and Recycling*. 1st. Earthscan, 2006.

[KN08] Eddy Krygiel and Bradley Nies. *Green BIM: Successful Sustainable Design with Building Information Modeling*. 1st. Sybex, 2008.

[US 13] U.S. Green Building Council. *LEED v4 Reference Guide for Building Design and Construction*. 1st. USGBC, 2013.

[Wil18] Pieter de Wilde. *Building Performance Analysis*. 1st. Wiley, 2018.