# Syllabus for "Computer-Aided Design"

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| Course Title (Chinese) | 计算机辅助设计 | | |
| Course Title (English) | Computer Aided Design | | |
| Course Number | 020578 | Language of instruction | English |
| Credit | 1 | Class time (teaching week) / Number of weeks (practical week) | Total class hours: 18 , including 0 practical hours . |
| Course Types | professional elective courses | Exam/Assessment | Assignment |
| Prerequisites | none | | |
| Are there courses taught entirely in English? | yes | Course coordinator | Pang Lei |
| Teaching team members | Pang Lei, Gan Wei | | |

## 1. Course positioning and basic requirements

### 1) Course Positioning

This course, set against the backdrop of the transformation of architectural and urban planning design practices and the development of digital technologies, uses typical planning and design tasks as its main thread to construct a teaching system encompassing "planning types—spatial cognition—digital expression—scheme support." Moving beyond traditional computer-aided drafting skills training, the course uses AutoCAD as its foundational platform, combined with related software such as ArcGIS and Ecotect. Through several typical planning and design examples, students will master fundamental methods from basic drafting and spatial analysis to scheme expression, and understand the roles and boundaries of different digital tools in the planning and design process.

The course content uses the main design types of urban and rural planning as case studies, including: (1) residential planning and design; (2) urban and rural master planning and land space planning; (3) rural planning and design; (4) overall urban design and local urban renewal design; and (5) regulatory detailed planning. In view of the current industry change where traditional planning and design business, which is mainly based on incremental development, is shifting to urban renewal, stock space optimization and refined design, the course appropriately strengthens the content of local urban renewal, detailed planning and urban design, so that students can understand that CAD drawing is not only a tool for drawing results, but also an important medium

for spatial analysis, scheme deduction and design communication.

Building upon traditional two-dimensional digital cartography instruction, this course further introduces new technologies such as low-altitude panoramic drone video and digital twins to expand students' spatial perception and digital design capabilities. Through low-altitude drone video, students move beyond static satellite imagery and two-dimensional maps to dynamically observe real-world spatial scales, pedestrian and vehicular traffic, and spatial usage. They also attempt to "reduce the dimensionality" of dynamic images through frame captures, plan views, cross-sections, and structural analysis diagrams. Building on this foundation, the course introduces data mapping, dynamic updates, and visualization between real and digital spaces using digital twin technology, providing a new technological framework for subsequent urban design and urban renewal. For students with a further interest in low-altitude spatial perception, digital twins, and smart planning technologies, visits, hands-on experiences, and extended learning opportunities are available at relevant national-level research and experimental platforms to understand the applications of drones, digital twins, and spatial intelligence technologies in practical research and planning.

Through the above teaching content, the course ultimately forms a progressive teaching structure of "2D drafting basics - multi-source spatial perception - digital spatial analysis - assisted design expression", enabling students to not only master basic digital drafting tools such as AutoCAD, but also understand the relationship between new technologies such as drones, GIS, digital twins and artificial intelligence and traditional planning and design methods, laying a digital design foundation for subsequent business work such as residential planning, urban design, and urban renewal.

2) Course Teaching Objectives

Course Objective 1: Spatial Dimension Reduction Representation and Vocational Skills

By combining land and space planning and design work, mastering computer-aided design technology, understanding the logic of dimensional reduction in the transformation of three-dimensional space into two-dimensional drawings, and comprehensively utilizing CAD and GIS technologies, one can achieve multi-scale drawing expression from macro planning to micro design, thus becoming competent in urban and rural planning professions.

Course Objective 2: Cross-scale cognition and digital innovation capabilities

Establish a spatial cognition system from the human perception scale to the overall urban scale, combine the concepts of smart communities and low-carbon development, and use computer-aided design technology to complete the dimensionality reduction analysis and graphic representation of different spatial levels, so as to help cities drive innovation-driven development.

Course Objective 3: Multi-scale Graphical Methods and Their Application in Rural Planning

In response to the national rural revitalization strategy, the system of dimension reduction expression methods is systematically integrated into the rural planning and design module. This cultivates students' ability to flexibly switch expression tools between different planning scales, such as individual buildings, residential areas, and blocks, and provides operable technical

methodological support for rural planning and design.

3） GenAI uses standards

GenAI is an auxiliary tool, not a replacement for planning decisions. The core competency of urban and rural planning lies in understanding space, interpreting scale, and making trade-offs; this ability can only be acquired through repeated practice by students themselves. This course encourages students to use generative artificial intelligence tools appropriately to assist learning, but the following basic principles must be followed:

GenAI can be used to assist in conceptualization, graphic generation, and scheme comparison. However, the core judgment of spatial dimensionality reduction expression—that is, the scale selection and expression logic for converting from three-dimensional space to two-dimensional drawings—must be completed independently by students and cannot be directly replaced by AI output. For any content generated using GenAI in the submitted results, the tools used, the process used, and manual modification instructions must be indicated in the drawings or reports; use without attribution will be considered academic misconduct.

## 2. Course content, teaching requirements, time allocation, and teaching methods

| Serial No. | Knowledge Unit | Lecture No. | Knowledge points /skills points | Require |
|---|---|---|---|---|
| 1 | Overview , Overall Planning and Design (CAD ) | 1 | Background and basic knowledge; Operation of planning and design base map under the "One Map for Planning" framework; CAD for overall planning and design. | A brief introduction to commonly used software such as AutoCAD, Ecotect, SketchUp, and ArcGIS; standardization of coordinates in planning thematic maps; and the application of satellite imagery. |
| 2 | Detailed planning and design (CAD ) | 2 | planning design ( CAD ) | Computer-aided detailed planning and design of residential areas (including urban micro-renewal and environmental design) |
| | | 3 | Rural planning and design | Applications of AutoCAD and ArcGIS in Urban Master Planning and Rural Planning |
| | | 4 | Regulations Design CAD | Computer-aided planning and local urban design |

| Serial No. | Knowledge Unit | Lecture No. | Knowledge points /skills points | Require |
|---|---|---|---|---|
| 3 | Programming, data processing, and design presentation | 5 | Energy-saving design | Computer-aided solar radiation and ventilation simulation |
| | | 6 | Low-altitude panoramic imaging and spatial perception | UAV low-altitude panoramic video and spatial information acquisition; video frame extraction, scale anchor point and spatial relationship recognition; dimensionality reduction representation of "3D spatial video-planar-section". |
| | | 7 | Interface with GIS software and data conversion | Conversion between AutoCAD DXF and ArcGIS SHP files, etc. |
| | | 8 | Digital twins combined with computer-aided design AI | SketchUp and Rhyno, including analytical diagrams and hand-drawn renderings. |
| 4 | comprehensive | 9 | test | |

## 3. Textbooks and main reference books

| Textbook Title | Author | Publisher /Link | Edition | Textbook situation |
|---|---|---|---|---|
| ArcGIS Pro help | Esri | https://pro.arcgis.com/en/pro-app/latest/help/main/welcome-to-the-arcgis-pro-app-help.htm (Accessed May 1, 2024) | ArcGIS Pro 3.2 | ArcGIS Pro latest version |
| AutoCAD 2025 help | AutoCAD | https://help.autodesk.com/view/ACD/2025/ENU/ (Accessed May 1, 2024) | AutoCAD 2025 | AutoCAD latest version |
| DJI Terra Official Tutorial Videos | DJI Terra | https://enterprise.dji.com/cn/dji-terra/video (Accessed Aug 24, 2026) | 2026 | Instructional Videos |