

# Design & Engineering Technology

## | American River College

Our program offers a wide variety of courses that cover our full multidisciplinary approach. Each course is based on real world, practical applications.

### Note to Transfer Students

This program is intended to provide skills and experiences that will help students transition directly into the workforce after obtaining a certificate or a degree. Students who may later wish to transfer to a four-year college often find that the portfolio developed in this program, and experiences gained in the workplace, can be used to aid in the transfer process. However, the courses specific to this degree are generally not designed to meet a specific college transfer pathway. Should a student wish to pursue a plan to transfer, it is critical that they meet with an ARC counselor to select and plan the additional courses required for transfer to the specific four-year college or university in order to pursue a bachelor's degree. Colleges vary widely in terms of the required coursework. The courses that ARC requires for an associate's degree in this major are often different from the requirements needed for a bachelor's degree at a specific college. It is recommended that students keep a portfolio of all design/engineering technology coursework completed at ARC to present for evaluation by four-year college program advisors.

### Foundational Courses

- No experience is required (no prerequisite courses).
- In general, these classes are taken first as each provides required skills and knowledge for various later courses
- Intro - Computer Aided Design & Drafting - DESGN 100
- Intro to Material Resources - DESGN 300
- 3D Graphics and Design - DESGN 320


### Technical Courses

- These courses provide specific skill and proficiency training which are required for successful entry into the workplace.
- All courses include work with 3D models, BIM, and 2D documentation.
- Technical Documentation - DESGN 302
- Graphical Analysis & Documentation- DESGN 310
- Architectural Modeling - DESGN 325
- Engineering Modeling - DESGN 328


### Advanced Project Courses

- These courses require full application and integration of all aspects of the previous courses. Work includes research, analysis, design, technical documentation and the use of collaborative technology
- Machine / System Design - DESGN 330
- Residential Architectural Design - DESGN 340
- Surveying and Land Planning - DESGN 350
- Commercial Engineering and Design - DESGN 360


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## Associate Degrees

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### A.A. in Design Technology

This degree emphasizes the knowledge and skills required for entry-level success in the architectural, civil, and mechanical engineering professions. These include graphic standards and practices, technical analysis and communication, material sciences, and the design and critique processes. In addition, projects include environmental (sustainable) design, product economics, and legal considerations. Current computer technologies and various design software for three dimensional modeling and two dimensional drafting are used throughout the program. Graphic documentation and a portfolio of work are created for each course.

#### NOTE TO TRANSFER STUDENTS:

It is critical that students meet with an ARC counselor to select and plan the courses required for transfer to a four-year college or university in order to pursue a bachelor's degree in Architecture and/or Engineering Technology. Colleges vary widely in terms of the required preparation. The courses that ARC requires for an associate's degree in this major may be different from the requirements needed for the bachelor's degree.

Admission to accredited Schools of Architecture/ Engineering technologies is highly competitive. It is recommended that students keep a portfolio of all design/engineering technology coursework completed at ARC to present for evaluation by college program advisors. Some colleges require portfolios prior to granting transfer credit or gaining admission.

### Degree Requirements

| COURSE CODE  | COURSE TITLE                               | UNITS   |
|--------------|--|---------|
| DESGN 300    | Introduction to Design Resources           | 3       |
| DESGN 302    | Technical Documentation with CADD          | 3       |
| DESGN 310    | Graphic Analysis and Documentation         | 3       |
| DESGN 320    | Three Dimensional Graphics and Design      | 3       |
| DESGN 325    | Architectural Modeling and Design          | 3       |
| DESGN 328    | Engineering Modeling and Design            | 3       |
| DESGN 330    | Engineering Systems and Design             | 5       |
| DESGN 340    | Architecture and Construction              | 5       |
| DESGN 350    | Surveying and Land Planning (5)            | 4 - 5   |
| or ENGR 310  | Engineering Survey Measurements (4)        |         |
| DESGN 360    | Commercial Engineering Design and Drafting | 5       |
| Total Units: |  | 37 - 38 |

*The Design Technology Associate in Arts (A.A.) degree may be obtained by completion of the required program, plus general education requirements, plus sufficient electives to meet a 60-unit total. See ARC graduation requirements.*

### Student Learning Outcomes

Upon completion of this program, the student will be able to:

- solve architectural and engineering technical problems by applying design and engineering process methodologies; critique and analyze the success or failure of the process and the solutions.
- apply the appropriate use of representational media, including study and presentation models (electronic and physical), freehand and conceptual drawing, technical documentation, and diagramming, to convey envisioned ideas at each stage of the design process.
- organize a set of documents for land planning and site development, commercial and residential buildings, and product assemblies that include material selections, cross-referencing, code review, checklists, and coordination.
- create design solutions that demonstrate knowledge and understanding of historical, cultural, human, aesthetic, environmental (sustainable) and social issues.
- communicate architectural and engineering design solutions effectively through individual and cooperative group efforts including speaking, writing, presentation, and the use of various design graphics and technical software.

## Career Information

A student who has earned a degree in design technology is well prepared to enter the architecture or engineering field as a design technician. Design technicians are involved in all phases of the design process and duties may include the preparation of technical and presentation drawings, specifications, reports and cost estimates. Design technicians primarily work with architects, mechanical engineers, structural engineers and civil engineers.

## A.S. in Engineering Technology

This degree emphasizes the knowledge and skills required for entry-level success in the engineering professions. These include a basic preparation within mathematics and the scientific fields including physics, chemistry, and material sciences. These sciences are applied to technical analysis and graphic communication standards and practices. In addition, projects include environmental and sustainable design issues, product economics, and legal considerations. Current computer technologies and various analytical design and documentation software are emphasized throughout the program.

### NOTE TO TRANSFER STUDENTS:

It is critical that students meet with an ARC counselor to select and plan the courses required for transfer to a four-year college or university in order to pursue a bachelor's degree in Engineering Technology. Colleges vary widely in terms of the required preparation. The courses that ARC requires for an associate's degree in this major may be different from the requirements needed for the bachelor's degree.

Admission to accredited Schools of Engineering Technologies is highly competitive. It is recommended that students keep a portfolio of all design/engineering technology coursework completed at ARC to present for evaluation by college program advisors. Some colleges require portfolios prior to granting transfer credit or gaining admission.

## Degree Requirements

| COURSE CODE | COURSE TITLE                            | UNITS |
|-------------|---|-------|
| CHEM 305    | Introduction to Chemistry (5)           | 4 - 5 |
| or CHEM 310 | Chemical Calculations (4)               |       |
| CISA 315    | Introduction to Electronic Spreadsheets | 2     |
| CISA 316    | Intermediate Electronic Spreadsheets    | 2     |
| DESGN 300   | Introduction to Design Resources        | 3     |
| DESGN 302   | Technical Documentation with CADD       | 3     |
| DESGN 310   | Graphic Analysis and Documentation (3)  | 3     |
| or ENGR 312 | Engineering Graphics (3)                |       |
| DESGN 328   | Engineering Modeling and Design         | 3     |
| DESGN 330   | Engineering Systems and Design          | 5     |

| COURSE CODE  | COURSE TITLE                                   | UNITS   |
|--------------|--|---------|
| DESGN 340    | Architecture and Construction (5)              | 5       |
| or DESGN 360 | Commercial Engineering Design and Drafting (5) |         |
| DESGN 350    | Surveying and Land Planning (5)                | 4 - 5   |
| or ENGR 310  | Engineering Survey Measurements (4)            |         |
| MATH 330     | Trigonometry                                   | 3       |
| PHYS 310     | Conceptual Physics (3)                         | 3 - 4   |
| or PHYS 350  | General Physics (4)                            |         |
| Total Units: |  | 40 - 43 |

*The Engineering Technology Associate in Science (A.S.) degree may be obtained by completion of the required program, plus general education requirements, plus sufficient electives to meet a 60-unit total. See ARC graduation requirements.*

## Student Learning Outcomes

Upon completion of this program, the student will be able to:

- solve technical engineering problems by applying design and engineering process methodologies; critique and analyze the success or failure of the process and the solutions.
- apply the appropriate use of representational media, including study and presentation models (electronic and physical), freehand and conceptual drawing, technical documentation, and diagramming.
- organize a set of engineering product development documents and technical reports per industry standards.
- research and design for engineering products that demonstrate knowledge and understanding of historical, cultural, human, aesthetic, environmental (sustainable) and social issues.
- communicate engineering design solutions effectively through individual and cooperative group efforts including speaking, writing, presentation, and the use of various design graphics and technical software.

## Career Information

Upon completion of the degree program the engineering technician will be prepared to go directly into the employment market as a technical assistant to engineers, or other technical employment. For every engineer, several support technicians are required. Engineering technicians are needed in the fields of manufacturing, architecture, construction, materials testing, public utilities, and many other fields.

## A.S. in Mechatronics

This degree provides training in a multi-disciplinary field focusing on industrial automation. Topics include electricity, electronics, industrial motor controls, programmable logic controllers, robotics, AC/DC drives, mechanical design, and manufacturing technologies.

## Degree Requirements

| COURSE CODE | COURSE TITLE  | UNITS |
|-------------|---|-------|
| DESGN 100   | Introduction to Computer Aided Drafting and Design (CADD) | 3     |
| DESGN 302   | Technical Documentation with CADD                         | 3     |
| DESGN 310   | Graphic Analysis and Documentation                        | 3     |
| DESGN 328   | Engineering Modeling and Design                           | 3     |
| ET 193      | Introduction to Robotics and Sensors (4)                  | 4     |

| COURSE CODE  | COURSE TITLE                              | UNITS |
|--------------|---|-------|
| or ET 199    | Advanced Mechatronics (4)                 |       |
| ET 197       | Introduction to Mechatronics              | 4     |
| ET 302       | Principles of Electricity and Electronics | 4     |
| WELD 300     | Introduction to Welding                   | 3     |
| Total Units: |   | 27    |

*The Mechatronics Associate in Science (A.S.) degree may be obtained by completion of the required program, plus general education requirements, plus sufficient electives to meet a 60-unit total. See ARC graduation requirements.*

## Student Learning Outcomes

Upon completion of this program, the student will be able to:

- integrate the principles of mechanical, electronic, and electrical technologies into the design of mechatronic systems.
- evaluate mechanical and electrical solutions to technological problems.
- apply industry-appropriate design techniques to develop technical design documents from a conceptual design.
- design robotic and machine automation systems using mechatronic principles.
- evaluate welding projects in accordance with welding procedures and specifications.
- contrast DC, AC, brushless, servo, and stepper motor operation.
- create technical documentation/presentations of models from the mechanical engineering discipline in both technically correct and visually pleasing solid, orthographic, and section view formats.
- design programmable logic controller (PLC) programs demonstrating input/output capabilities.
- design programs for an operator interface terminal (OIT) demonstrating input/output capabilities.

## Career Information

This degree prepares students for the following technical and supervisory career opportunities: industrial mechanical/electrical systems technician, food processing machine service technician, facilities systems technician, waste water systems technician, manufacturing coordinator, field service technician, and mechanical electrical machine systems installer.

# Certificates of Achievement

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## Design Technology Certificate

This certificate emphasizes the knowledge and skills required for entry level success in the architectural, civil, and mechanical engineering professions. These include graphic standards and practices, technical analysis and communication, material sciences, and the design and critique processes. In addition, projects include environmental (sustainable) design, product economics, and legal considerations. Current computer technologies and various design software for three dimensional modeling and two dimensional drafting are used throughout the program. Graphic documentation and a portfolio of work are created for each course.

## Certificate Requirements

| COURSE CODE | COURSE TITLE                      | UNITS |
|-------------|-----------------------------------|-------|
| DESGN 300   | Introduction to Design Resources  | 3     |
| DESGN 302   | Technical Documentation with CADD | 3     |

| COURSE CODE  | COURSE TITLE                               | UNITS   |
|--------------|--|---------|
| DESGN 310    | Graphic Analysis and Documentation         | 3       |
| DESGN 320    | Three Dimensional Graphics and Design      | 3       |
| DESGN 325    | Architectural Modeling and Design          | 3       |
| DESGN 328    | Engineering Modeling and Design            | 3       |
| DESGN 330    | Engineering Systems and Design             | 5       |
| DESGN 340    | Architecture and Construction              | 5       |
| DESGN 350    | Surveying and Land Planning (5)            | 4 - 5   |
| or ENGR 310  | Engineering Survey Measurements (4)        |         |
| DESGN 360    | Commercial Engineering Design and Drafting | 5       |
| Total Units: |  | 37 - 38 |

## Student Learning Outcomes

Upon completion of this program, the student will be able to:

- solve architectural and engineering technical problems by applying design and engineering process methodologies. Critique and analyze the success or failure of the process and the solutions.
- apply the appropriate use of representational media, including study and presentation models (electronic and physical), freehand and conceptual drawing, technical documentation, and diagramming, to convey envisioned ideas at each stage of the design process.
- organize a set of documents for land planning and site development, commercial and residential buildings, and product assemblies that include material selections, cross-referencing, code review, checklists, and coordination.
- create design solutions that demonstrate knowledge and understanding of historical, cultural, human, aesthetic, environmental (sustainable) and social issues.
- communicate architectural and engineering design solutions effectively through individual and cooperative group efforts including speaking, writing, presentation, and the use of various design graphics and technical software.

## Gainful Employment

The US Department of Education requires colleges to disclose a variety of information for any program that is eligible for financial aid that "prepares students for gainful employment in a recognized occupation." The following link provides Gainful Employment Disclosure information for this certificate program:

[Gainful Employment Information for Design Technology Certificate of Achievement \(https://web.losrios.edu/gainful-emp-info/arc/30411/30411.htm\)](https://web.losrios.edu/gainful-emp-info/arc/30411/30411.htm)

## Career Information

A student who has earned a certificate in design technology is well prepared to enter the architecture or engineering field as a design technician. Design technicians are involved in all phases of the design process and duties may include the preparation of technical and presentation drawings, specifications, reports and cost estimates. Design technicians primarily work with architects, mechanical engineers, structural engineers and civil engineers.

## Engineering Technology Certificate

This certificate emphasizes the knowledge and skills required for entry level success in the engineering professions. These include a basic preparation within the scientific fields including physics, mathematics, chemistry, and material sciences. These sciences are applied to technical analysis and graphic communication standards and practices. In addition, projects include environmental and sustainable design issues, product economics, and legal considerations. Current computer technologies and various analytical design and documentation software are emphasized throughout the program.

## Certificate Requirements

| COURSE CODE  | COURSE TITLE                                   | UNITS   |
|--------------|--|---------|
| CHEM 305     | Introduction to Chemistry (5)                  | 4 - 5   |
| or CHEM 310  | Chemical Calculations (4)                      |         |
| CISA 315     | Introduction to Electronic Spreadsheets        | 2       |
| CISA 316     | Intermediate Electronic Spreadsheets           | 2       |
| DESGN 300    | Introduction to Design Resources               | 3       |
| DESGN 302    | Technical Documentation with CADD              | 3       |
| DESGN 310    | Graphic Analysis and Documentation (3)         | 3       |
| or ENGR 312  | Engineering Graphics (3)                       |         |
| DESGN 328    | Engineering Modeling and Design                | 3       |
| DESGN 330    | Engineering Systems and Design                 | 5       |
| DESGN 340    | Architecture and Construction (5)              | 5       |
| or DESGN 360 | Commercial Engineering Design and Drafting (5) |         |
| DESGN 350    | Surveying and Land Planning (5)                | 4 - 5   |
| or ENGR 310  | Engineering Survey Measurements (4)            |         |
| MATH 330     | Trigonometry                                   | 3       |
| PHYS 310     | Conceptual Physics (3)                         | 3 - 4   |
| or PHYS 350  | General Physics (4)                            |         |
| Total Units: |  | 40 - 43 |

## Student Learning Outcomes

Upon completion of this program, the student will be able to:

- solve technical engineering problems by applying design and engineering process methodologies. Critique and analyze the success or failure of the process and the solutions.
- apply the appropriate use of representational media, including study and presentation models (electronic and physical), freehand and conceptual drawing, technical documentation, and diagramming.
- organize a set of engineering product development documents and technical reports per industry standards.
- research and design for engineering products that demonstrate knowledge and understanding of historical, cultural, human, aesthetic, environmental (sustainable) and social issues.
- communicate engineering design solutions effectively through individual and cooperative group efforts including speaking, writing, presentation, and the use of various design graphics and technical software.

## Gainful Employment

The US Department of Education requires colleges to disclose a variety of information for any program that is eligible for financial aid that "prepares students for gainful employment in a recognized occupation." The following link provides Gainful Employment Disclosure information for this certificate program:

[Gainful Employment Information for Engineering Technology Certificate of Achievement \(https://web.losrios.edu/gainful-emp-info/arc/30417/30417.htm\)](https://web.losrios.edu/gainful-emp-info/arc/30417/30417.htm)

## Career Information

Upon completion of this certificate program the engineering technician will be prepared to go directly into the employment market as a technical assistant to engineers, or other technical employment. For every engineer, several support technicians are required. Engineering technicians are needed in the fields of manufacturing, architecture, construction, materials testing, public utilities, and many other fields.

# Mechatronics Certificate

This certificate provides training in a multi-disciplinary field focusing on industrial automation. Topics include electricity, electronics, industrial motor controls, programmable logic controllers, robotics, AC/DC drives, mechanical design, and manufacturing technologies.

## Certificate Requirements

| COURSE CODE  | COURSE TITLE  | UNITS |
|--------------|---|-------|
| DESGN 100    | Introduction to Computer Aided Drafting and Design (CADD) | 3     |
| DESGN 302    | Technical Documentation with CADD                         | 3     |
| DESGN 310    | Graphic Analysis and Documentation                        | 3     |
| DESGN 328    | Engineering Modeling and Design                           | 3     |
| ET 193       | Introduction to Robotics and Sensors (4)                  | 4     |
| or ET 199    | Advanced Mechatronics (4)                                 |       |
| ET 197       | Introduction to Mechatronics                              | 4     |
| ET 302       | Principles of Electricity and Electronics                 | 4     |
| WELD 300     | Introduction to Welding                                   | 3     |
| Total Units: |   | 27    |

## Student Learning Outcomes

Upon completion of this program, the student will be able to:

- integrate the principles of mechanical, electronic, and electrical technologies into the design of mechatronic systems.
- evaluate mechanical and electrical solutions to technological problems.
- apply industry-appropriate design techniques to develop technical design documents from a conceptual design.
- design robotic and machine automation systems using mechatronic principles.
- evaluate welding projects in accordance with welding procedures and specifications.
- contrast DC, AC, brushless, servo, and stepper motor operation.
- create technical documentation/presentations of models from the mechanical engineering discipline in both technically correct and visually pleasing solid, orthographic, and section view formats.
- design programmable logic controller (PLC) programs demonstrating input/output capabilities.
- design programs for an operator interface terminal (OIT) demonstrating input/output capabilities.

## Gainful Employment

The US Department of Education requires colleges to disclose a variety of information for any program that is eligible for financial aid that "prepares students for gainful employment in a recognized occupation." The following link provides Gainful Employment Disclosure information for this certificate program:

[Gainful Employment Information for Mechatronics Certificate of Achievement \(https://web.losrios.edu/gainful-emp-info/arc/30645/30645.htm\)](https://web.losrios.edu/gainful-emp-info/arc/30645/30645.htm)

## Career Information

This certificate prepares students for the following career opportunities: industrial mechanical/electrical systems technician, food processing machine service technician, facilities systems technician, waste water systems technician, manufacturing coordinator, field service technician, and mechanical



# Certificate

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## Basic Mechatronics Certificate

This certificate provides introductory training in the multidisciplinary field of mechatronics which combines mechanical and electronic technologies. Topics include introductory courses in electronics, programmable logic controllers, basic CAD design, and welding.

### Certificate Requirements

| COURSE CODE  | COURSE TITLE  | UNITS |
|--------------|---|-------|
| DESGN 100    | Introduction to Computer Aided Drafting and Design (CADD) | 3     |
| ET 302       | Principles of Electricity and Electronics                 | 4     |
| DESGN 302    | Technical Documentation with CADD                         | 3     |
| ET 197       | Introduction to Mechatronics                              | 4     |
| WELD 300     | Introduction to Welding                                   | 3     |
| Total Units: |   | 17    |

### Student Learning Outcomes

Upon completion of this program, the student will be able to:

- integrate the basic principles of mechanical, electronic, and electrical technologies into the design of mechatronic systems.
- evaluate mechanical and electrical solutions to technological problems.
- apply basic design techniques to develop technical design documents.
- design basic robotic and machine automation systems using mechatronic principles.
- create and evaluate welding projects in accordance with welding procedures and specifications.

### Gainful Employment

The US Department of Education requires colleges to disclose a variety of information for any program that is eligible for financial aid that "prepares students for gainful employment in a recognized occupation." The following link provides Gainful Employment Disclosure information for this certificate program:

[Gainful Employment Information for Basic Mechatronics Certificate \(https://web.losrios.edu/gainful-emp-info/arc/47097/47097.htm\)](https://web.losrios.edu/gainful-emp-info/arc/47097/47097.htm)

### Career Information

This certificate prepares students for internships and entry-level employment with local industries using mechatronic and design principles.

## Design Technology (DESGN)

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### DESGN 100 Introduction to Computer Aided Drafting and Design (CADD)

|               |                            |
|---------------|----------------------------|
| Units:        | 3                          |
| Hours:        | 36 hours LEC; 72 hours LAB |
| Prerequisite: | None.                      |

This course is an introduction to computer-assisted drafting and design (CADD) and basic technical drawing. It covers orthographic and isometric

projection concepts, utilizing CADD to produce basic technical drawings. It introduces basic drawings from architecture, mechanical design, electronics and space planning.

## Student Learning Outcomes

Upon completion of this course, the student will be able to:

- demonstrate basic CADD skills for producing technical drawings
- apply basic technical drawing concepts of orthographic and isometric projection, sections and dimensioning
- apply basic CADD commands for developing orthographic and isometric projections
- determine whether technical drawings meet industry standards

## DESGN 295 Independent Studies in Design Technology

|               |       |
|---------------|-------|
| Units:        | 1 - 3 |
| Prerequisite: | None. |

## DESGN 298 Work Experience in Design Technology

|                        |  |
|------------------------|--|
| Units:                 | 1 - 4  |
| Hours:                 | 60 - 300 hours LAB   |
| Prerequisite:          | None.  |
| Enrollment Limitation: | Students must be in a paid or unpaid internship, volunteer position, or job related to the architectural and engineering field with a cooperating site supervisor. Students are advised to consult with the Design Technology Department faculty to review specific certificate and degree work experience requirements. |
| Advisory:              | Eligible for ENGRD 310 or ENGRD 312 AND ENGWR 300; OR ESLR 340 AND ESLW 340.   |
| General Education:     | AA/AS Area III(b)  |

This course provides students with opportunities to develop marketable skills in preparation for employment or advancement within the architectural and engineering field. It is designed for students interested in work experience and/or internships in associate degree level or certificate occupational programs. Course content includes understanding the application of education to the workforce, completion of Title 5 required forms which document the student's progress and hours spent at the work site, and developing workplace skills and competencies.

During the semester, the student is required to complete 75 hours of related paid work experience, or 60 hours of related unpaid work experience for one unit. An additional 75 or 60 hours of related work experience is required for each additional unit. All students are required to attend the first class meeting, a mid-semester meeting, and a final meeting. Additionally, students who have not already successfully completed a Work Experience course will be required to attend weekly orientations while returning participants may meet individually with the instructor as needed. Students may take up to 16 units total across all Work Experience course offerings. This course may be taken up to four times when there are new or expanded learning objectives. Only one Work Experience course may be taken per semester.

## Student Learning Outcomes

Upon completion of this course, the student will be able to:

- demonstrate mastery of specific job skills in the architectural and engineering field related to an associate degree or certificate occupational program level career as written in the minimum three (3) learning objectives created by the student and his/her employer or work site supervisor at the start of the course.
- make effective decisions, use workforce information, and manage his/her personal career plans.
- behave professionally, ethically, and legally at work, consistent with applicable laws, regulations, and organizational norms.
- behave responsibly at work, exhibiting initiative and self-management in situations where it is needed.

- apply effective leadership styles at work, with consideration to group dynamics, team and individual decision making, and workforce diversity.
- communicate in oral, written, and other formats, as needed, in a variety of contexts at work.
- locate, organize, evaluate, and reference information at work.
- demonstrate originality and inventiveness at work by combining ideas or information in new ways, making connections between seemingly unrelated ideas, and reshaping goals in ways that reveal new possibilities using critical and creative thinking skills such as logical reasoning, analytical thinking, and problem-solving.

## DESGN 300 Introduction to Design Resources

|               |  |
|---------------|--|
| Units:        | 3  |
| Hours:        | 54 hours LEC   |
| Prerequisite: | None.  |
| Advisory:     | ENGWR 102 or 103, and ENGRD 116 with a grade of "C" or better; OR ESLR 320 and ESLW 320 with a grade of "C" or better. |
| Transferable: | CSU  |

This course is a survey of the resources that are used in the architectural and engineering professions. It introduces construction materials and their properties and characteristics that affect construction processes. Environmental and sustainable materials, sustainable building certification, and rating systems are also covered.

### Student Learning Outcomes

Upon completion of this course, the student will be able to:

- describe basic materials of construction
- prepare a material specification utilizing MasterFormat project breakdown structure
- assemble a project estimate for human and material resources
- research industry materials
- assess the human resources necessary for design and construction

## DESGN 302 Technical Documentation with CADD

|               |  |
|---------------|--|
| Units:        | 3  |
| Hours:        | 36 hours LEC; 72 hours LAB   |
| Prerequisite: | DESGN 100 with a grade of "C" or better  |
| Advisory:     | ENGWR 102 or 103, and ENGRD 116 with a grade of "C" or better; OR ESLR 320 and ESLW 320 with a grade of "C" or better. |
| Transferable: | CSU  |

This course emphasizes using various electronic graphical media software to create standardized technical documentation for architectural, civil, and mechanical applications. A wide range of methods are used to create, print and save 2D, 3D, orthographic, and isometric presentations in a wide variety of output formats using AutoCAD as the primary tool. Section views for mechanical and architectural applications are covered, as well as a variety of drawing and file management topics. This course was formerly DESGN 102.

### Student Learning Outcomes

Upon completion of this course, the student will be able to:

- set up a wide variety of file management and software customization tools to prepare, develop, coordinate, and output drawings in accord with best practices for architectural, civil, and mechanical applications
- apply orthographic and isometric projection and sectioning principles to architectural, civil, and mechanical engineering drawings
- produce industry standard technical documentation
- choose and use industry appropriate design graphic techniques to develop technical design documents from a conceptual design

## DESGN 310 Graphic Analysis and Documentation

|               |   |
|---------------|---|
| Units:        | 3   |
| Hours:        | 36 hours LEC; 72 hours LAB  |
| Prerequisite: | DESGN 100 with a grade of "C" or better   |
| Advisory:     | DESGN 302 (Technical Documentation with CADD), AND ENGWR 102 or 103, and ENGRD 116 with a grade of "C" or better; OR ESLR 320 and ESLW 320 with a grade of "C" or better. |
| Transferable: | CSU   |

This course covers the application of orthographic projection and geometric construction principles as they are used to solve technical problems. Additionally, graphical analysis is used to determine strength, deflection, cost, volume, and green technology ratings. These analyses may utilize design characteristics such as forces, moments, ratios, and areas as well as distance, bearing, and grade. These characteristics are then used in the solution of engineering and architectural problems.

### Student Learning Outcomes

Upon completion of this course, the student will be able to:

- solve for (graphically determine) the design characteristics of shapes used in architectural, engineering, and green technology disciplines
- analyze and present data in a meaningful graphical manner that allows for the solution of design problems
- solve technical problems from architectural, engineering, and green technology disciplines

## DESGN 320 Three Dimensional Graphics and Design

|               |  |
|---------------|--|
| Units:        | 3  |
| Hours:        | 36 hours LEC; 72 hours LAB   |
| Prerequisite: | None.  |
| Advisory:     | ENGWR 102 or 103, and ENGRD 116 with a grade of "C" or better; OR ESLR 320 and ESLW 320 with a grade of "C" or better. |
| Transferable: | CSU; UC  |

This course is an introduction to the fundamentals of the design process for architecture and engineering. It includes the application of programming, environmental analysis, sustainable (green) considerations, code guidelines and restrictions, market analysis, and economic considerations on design projects. Technical design solutions with freehand perspective graphics, physical mass modeling prototyping, and virtual concept computer modeling are also covered. The course also includes individual and team studio situations, oral presentations, and formal critiques.

### Student Learning Outcomes

Upon completion of this course, the student will be able to:

- conceptualize and sketch design ideas in three dimensions by drawing in one-point perspective
- conceptualize and sketch design ideas in three dimensions by drawing in two-point perspective
- sketch and conceptualize design ideas in three dimensions by quick sketching for concept design solutions

- justify design solutions through multiple academic disciplines including, research documentation, 3D graphics, and 2D technical documentation
- apply mass modeling computer software applications to conceptual architectural and engineering design projects
- render presentation graphics by using composition techniques for formal presentation and critique
- render presentation documents by developing an individual drawing and graphic style
- develop virtual computer mass model prototypes based on program requirements for various architectural and engineering assignments, projects, and design problems
- create physical mass models based on defined design programming guidelines
- utilize problem solving and design process methodologies to identify problems, analyze criteria and apply learned principles to synthesize solutions to specific design projects
- apply basic organizational and spatial concepts in the development of architectural and engineering environments
- apply basic sustainable design considerations to prototype models

## DESGN 325 Architectural Modeling and Design

|               |  |
|---------------|--|
| Units:        | 3  |
| Hours:        | 36 hours LEC; 72 hours LAB   |
| Prerequisite: | DESGN 100 (Introduction to Computer Aided Drafting and Design (CADD)) and DESGN 320 (Three Dimensional Graphics and Design) with a grade of "C" or better; AND DESGN 300 (Introduction to Design Resources) or ENGR 307 (Industrial Materials Testing) with a grade of "C" or better |
| Advisory:     | ENGWR 102 or 103, and ENGRD 116 with a grade of "C" or better; OR ESLR 320 and ESLW 320 with a grade of "C" or better.   |
| Transferable: | CSU  |

This course covers the concepts and applications of three dimensional graphic design using various visualization, modeling, and Building Information Modeling (BIM) programs, such as AutoCAD, SketchUp and Revit Architectural. Topics include the procedures and techniques for producing architectural models and associated technical documentation and presentation. Course projects emphasize sustainable design concepts and include all phases of design.

### Student Learning Outcomes

Upon completion of this course, the student will be able to:

- create technically correct architectural surface and solid models that are useful for visualization and problem solving using various design software programs such as AutoCAD, SketchUp, and Revit Architectural
- create documentation from architectural models that are technically correct and include plans, elevations, sections, and details
- create varied presentations of architectural models that include conceptual design sketches, solar studies, and photo realistic renderings
- produce project design documentation that shows the ability to utilize modeling skills in project based assignments

## DESGN 328 Engineering Modeling and Design

|               |  |
|---------------|--|
| Units:        | 3  |
| Hours:        | 36 hours LEC; 72 hours LAB   |
| Prerequisite: | DESGN 100 with a grade of "C" or better  |
| Advisory:     | DESGN 320; ENGWR 102 or 103, and ENGRD 116 with a grade of "C" or better; OR ESLR 320 and ESLW 320 with a grade of "C" |

|               |
|---------------|
|               |
| Transferable: |

or better.

CSU; UC

This course covers the concepts and applications of three dimensional graphic design using various visualization, modeling, and Building Information Modeling (BIM) programs, such as AutoCAD, SketchUp, and Revit MEP. Topics include the procedures and techniques for producing surface models, solid models, and their associated technical documentation/presentation components as well as their application to civil engineering, mechanical engineering and green technology. This course was formerly DESGN 308.

### Student Learning Outcomes

Upon completion of this course, the student will be able to:

- create technically correct surface and solid models that are common to and useful for visualization and problem solving in civil and mechanical engineering disciplines using various design software programs such as AutoCAD, SketchUp, and RevitMEP
- create technical documentation/presentations of models from civil and mechanical engineering disciplines in both technically correct and visually pleasing solid, orthographic, and section view formats
- produce project design documentation using modeling skills in project-based assignments
- coordinate civil and mechanical engineering models into the design development process

## DESGN 330 Engineering Systems and Design

|               |
|---------------|
| Units:        |
| Hours:        |
| Prerequisite: |
| Advisory:     |
| Transferable: |

5

54 hours LEC; 108 hours LAB

DESGN 302; AND either DESGN 300 or DESGN 320; AND either DESGN 325 or DESGN 328 with grades of "C" or better.

Eligible for ENGRD 310 or ENGRD 312 AND ENGWR 300; OR ESLR 340 AND ESLW 340.

CSU

This course covers machine and mechanical system design and analysis through the study of Mechanical Electrical Plumbing (MEP) system applications. The topics include the application of Basic Building Information Modeling (BIM) techniques and technical documentation to a variety of industrial and commercial products utilizing orthographics, sections, auxiliaries, tolerance reviews, Geometric Dimension and Tolerancing (GDT), as well as the creation of facility and production plans. It emphasizes the current American National Standards Institute (ANSI) standard for geometric dimension and tolerancing and its application to working drawings. It also emphasizes green technology concerns, such as water and energy conservation in industrial, commercial, or municipal settings.

### Student Learning Outcomes

Upon completion of this course, the student will be able to:

- apply the principles of proper dimensioning and tolerancing, application of notes and documentation of specifications in order to present designs according to industry standards.
- produce finished drawings for use in manufacturing a product.
- produce finished documentation specifying the use and applicability of given mechanical products in commercial applications.
- analyze the application of machine system components in accord with professional workplace practices.

## DESGN 340 Architecture and Construction

|        |
|--------|
| Units: |
| Hours: |

5

54 hours LEC; 108 hours LAB

|               |   |
|---------------|---|
| Prerequisite: | DESGN 302; AND either DESGN 300 or DESGN 320; AND either DESGN 325 or DESGN 328 with grades of "C" or better. |
| Advisory:     | Eligible for ENGRD 310 or ENGRD 312 AND ENGWR 300; OR ESLR 340 AND ESLW 340.                                  |
| Transferable: | CSU   |

This course is an introduction to the residential architectural design process. It covers the fundamentals of construction materials and methodology, basic code requirements, and the introduction of applied engineering concepts for light construction. It also includes the application of a predefined program, environmental analysis, sustainable design, building mass prototyping, and graphical technical documentation.

## Student Learning Outcomes

Upon completion of this course, the student will be able to:

- integrate basic organizational and spatial principles for the conception and development of a residential design project.
- solve residential design problems using design process methodologies and to synthesize possible solutions.
- illustrate the skills associated with representing envisioned ideas, objects, and environments for residential architecture.
- employ appropriate representational media including study and presentation models (electronic and physical); freehand and conceptual drawing; technical documentation and diagramming to convey visual ideas and convey essential formal elements at the programming stage, design stage, and construction documents stage.
- assess residential construction methodologies and techniques including materials and systems.
- evaluate primary building systems including structure, structural engineering concepts, and environmental systems that are integrated into a residential building.
- assemble a set of documents including cross-referencing, code review, checklists, coordination, and other planning methods.
- identify diverse roles that utilize individual talents when working as members of a team to maximize accomplishment.
- assess historical, cultural, human, aesthetic, environmental (sustainable), and social issues to be able to create change in the development of a built environment.
- communicate through group discussion and formal oral presentation.
- justify design solutions through research documentation, three-dimensional graphics, and two-dimensional technical documentation.

## DESGN 350 Surveying and Land Planning

|               |   |
|---------------|---|
| Units:        | 5   |
| Hours:        | 54 hours LEC; 108 hours LAB   |
| Prerequisite: | DESGN 302; AND either DESGN 300 or DESGN 320; AND either DESGN 325 or DESGN 328 or HORT 329 with grades of "C" or better. |
| Advisory:     | Eligible for ENGRD 310 or ENGRD 312 AND ENGWR 300; OR ESLR 340 AND ESLW 340.  |
| Transferable: | CSU   |

This course examines elementary surveying principles and basic civil design and drafting techniques. It covers the instruments, methods, and theories necessary for the measurement of distance, direction, angles, and elevations. Surveyed data is applied to create site layouts, site models, profiles, cut and fill volumes, and traverse computations. Additionally, environmental and sustainable design practices are applied to a variety of projects.

## Student Learning Outcomes

Upon completion of this course, the student will be able to:

- analyze, design, and create civil engineering drawings such as site plans, topographical maps, and land profiles.
- develop design conclusions based on sound architecture and engineering principles.

- design, draw, and present design solutions through graphic and oral presentations.
- evaluate design solutions based on peer group and instructor critiques.
- use surveying equipment including a total station, level, rod, and tape to gather the data needed to develop topographical maps, traverses, and profiles.
- identify and evaluate environmental and sustainable land planning concepts.

## DESGN 360 Commercial Engineering Design and Drafting

|               |   |
|---------------|---|
| Units:        | 5   |
| Hours:        | 54 hours LEC; 108 hours LAB   |
| Prerequisite: | DESGN 302; AND either DESGN 300 or DESGN 320; AND either DESGN 325 or DESGN 328 with grades of "C" or better. |
| Transferable: | CSU   |

This course employs individual and group exercises simulating typical design and engineering problems in commercial structures, commercial building systems, and environmental systems in buildings. Topics include the fundamentals of construction materials and methodology, and basic code requirements. Also included is an introduction of applied engineering concepts for heavy construction. Activities include review and application of program definitions, environmental analysis, sustainable design applications, and mass prototyping. Design solutions are presented by various freehand concept drawings, physical modeling, and electronic media applications.

### Student Learning Outcomes

Upon completion of this course, the student will be able to:

- apply basic organizational and spatial principles to the conception and development of a commercial design project.
- solve and use design process methodologies to identify problems, analyze criteria, and apply learned principles to synthesize solutions to a specific commercial design project.
- illustrate the skills associated with representing envisioned ideas, objects, and environments.
- employ appropriate representational media including study and presentation models (electronic and physical); freehand and conceptual drawing; technical documentation and diagramming to convey visualize ideas and convey essential formal elements at each stage of the programming, design process, and construction documents.
- recognize commercial construction methodologies and techniques including, materials, systems, and recognize how they are applied to documents that control the construction of a building.
- describe the primary building systems including structure, structural engineering concepts, and environmental systems that are integrated into a building and apply learned principles to create the drawings that control building development.
- organize a set of documents including cross-referencing, code review, checklists, coordination, and other planning methods to create the documents that control building development.
- identify diverse roles that utilize individual talents when working as members of a team to maximize accomplishment.
- demonstrate ability at active participation and contribution to a team effort as well as individual effort.
- identify historical, cultural, human, aesthetic, environmental (sustainable), and social issues to be able to create change in the development of built environment.
- exhibit a communication skillset in group discussions and formal oral presentation in regards to design thinking.
- justify design solutions through multiple academic disciplines including research documentation, three-dimensional (3D) graphics, and two-dimensional (2D) technical documentation.



## DESGN 495 Independent Studies in Design Technology

|               |                    |
|---------------|--------------------|
| Units:        | 1 - 3              |
| Hours:        | 54 - 162 hours LAB |
| Prerequisite: | None.              |
| Transferable: | CSU                |

Independent Study is an opportunity for the student to extend classroom experience in this subject, while working independently of a formal classroom situation. Independent study is an extension of work offered in a specific class in the college catalog. To be eligible for independent study, students must have completed the basic regular catalog course at American River College. They must also discuss the study with a professor in this subject and secure approval. Only one independent study for each catalog course will be allowed.

## DESGN 498 Work Experience in Design Technology

|                        |  |
|------------------------|--|
| Units:                 | 1 - 4  |
| Hours:                 | 60 - 300 hours LAB   |
| Prerequisite:          | None.  |
| Enrollment Limitation: | Students must be in a paid or unpaid internship, volunteer position, or job related to the advanced manufacturing field or the architectural and engineering field with a cooperating site supervisor. Students are advised to consult with the Design Technology Department faculty to review specific certificate and degree work experience requirements. |
| Advisory:              | Eligible for ENGRD 310 or ENGRD 312 AND ENGWR 300; OR ESLR 340 AND ESLW 340.   |
| Transferable:          | CSU  |
| General Education:     | AA/AS Area III(b)  |

This course provides students with opportunities to develop marketable skills in preparation for employment or advancement within the advanced manufacturing field or the architectural and engineering field. It is designed for students interested in work experience and/or internships in transfer-level occupational programs. Course content includes understanding the application of education to the workforce, completion of Title 5 required forms which document the student's progress and hours spent at the work site, and developing workplace skills and competencies.

During the semester, the student is required to complete 75 hours of related paid work experience, or 60 hours of related unpaid work experience for one unit. An additional 75 or 60 hours of related work experience is required for each additional unit. All students are required to attend the first class meeting, a mid-semester meeting, and a final meeting. Additionally, students who have not already successfully completed a Work Experience course will be required to attend weekly orientations while returning participants may meet individually with the instructor as needed. Students may take up to 16 units total across all Work Experience course offerings. This course may be taken up to four times when there are new or expanded learning objectives. Only one Work Experience course may be taken per semester.

### Student Learning Outcomes

Upon completion of this course, the student will be able to:

- demonstrate mastery of specific job skills in the advanced manufacturing field or the architectural and engineering field related to a transfer degree level career as written in the minimum three (3) learning objectives created by the student and his/her employer or work site supervisor at the start of the course.
- make effective decisions, use workforce information, and manage his/her personal career plans.
- behave professionally, ethically, and legally at work, consistent with applicable laws, regulations, and organizational norms.
- behave responsibly at work, exhibiting initiative and self-management in situations where it is needed.
- develop effective leadership styles at work, with consideration to group dynamics, team and individual decision making, and workforce diversity.
- communicate in oral, written, and other formats, as needed, in a variety of contexts at work.

- locate, organize, evaluate, and reference information at work.
- demonstrate originality and inventiveness at work by combining ideas or information in new ways, making connections between seemingly unrelated ideas, and reshaping goals in ways that reveal new possibilities using critical and creative thinking skills such as logical reasoning, analytical thinking, and problem-solving.

## Faculty

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