Baccalaureate Degree

Baccalaureate Degree Program in Industrial Automation

The Bachelor of Science Degree in Industrial Automation focuses on the application of electronics and computer technology to industrial automation systems, including instrumentation and control, industrial robotics, and process control systems. The program prepares students for careers in the design, operation, and management of industrial automation systems focusing on the local industries that utilize these technologies, such as petroleum production, food production, fabrication, and logistics. Significant emphasis is placed on project-based learning facilitated by significant laboratory work.

Mission

The Baccalaureate Program in Industrial Automation is designed to prepare individuals for technical management careers in industries that utilize automation, including the petroleum, manufacturing, logistics and agriculture industry sectors, in order to improve the regional economy.

Prerequisite Requirements

All prerequisite coursework must be completed with a “C” grade or higher:

- ENGL B1A (Expository Composition); 3 units at Bakersfield College or equivalent course at another accredited college.
- MATH B1A (Precalculus I), MATH B2 (Basic Functions and Calculus for Business), OR MATH B6A (Analytic Geometry/Calculus I); 4 units at Bakersfield College or equivalent course at another accredited college.
- PHYSICS B2A (General Physics-Mechanics and Heat) OR PHYSICS B4A (Mechanics and Wave Motion); 4 units at Bakersfield College or equivalent course at another accredited college.
- Critical Thinking (CSU GE Area A3) - PHIL B7, or B9, or ENGL B1B, or B2, or B3, or COMM B5; 3 units at Bakersfield College or equivalent course at another accredited college.
- Communication (CSU GE Area A1) - COMM B1, or B4 or B8; 3 units at Bakersfield College or equivalent course at another accredited college.
- Any five of the following six courses must be completed for admittance to the Baccalaureate Degree Program. However, all six lower division technical core courses must be completed prior to graduation. Demonstrated competency in lower division core courses may satisfy this requirement subject to evaluation by program faculty.
  1. ELET B1 (Basic Electronics) 4 units
  2. ELET B4 (Computer Integrated Manufacturing) 3 units
  3. ELET B5 (Programmable Logic Controllers) 3 units
  4. ELET B55A (Electric Motors - Controls) 3 units
  5. ELET B56 (Instrumentation and Process Control) 3 units
  6. ELET B70 (Mechanical Systems) 3 units

General Education

General Education courses meeting the CSU General Education Pattern are required to graduate with the BS in Industrial Automation from Bakersfield College. Thirty five of the 41 CSU GE units must be completed for admittance to the Baccalaureate Degree Program. However, all 41 lower division GE units must be completed prior to graduation.

- A. English Language Communication and Critical Thinking (9 units)
  A.1 Oral Communication (3 units)
    COMM B1, OR B4 OR B8

Program Learning Outcomes

Upon successful completion, the student will:

- Apply critical and analytical thinking skills to industry related problems, related to safety, quality assurance and design of systems.
- Display effective communication skills, including presentation and technical writing skills.
- Demonstrate a broad understanding of the mathematical and scientific principles utilized in industrial automation and manufacturing.
- Demonstrate competency in industrial automation and instrumentation, including relevant hardware and software utilized in industry.
- Manage automation and manufacturing projects applying knowledge of budgetary and scheduling principles in an ethical environment.

Curriculum Overview

The first two years of the Baccalaureate Degree Program, students will be expected to satisfy the general education requirements outlined in the California State University General Education Breadth course list in addition to the existing electronics courses that comprise the technical core to prepare for upper division coursework.

Lower Division Curriculum:

CSU GE Breadth (41 units)

<table>
<thead>
<tr>
<th>CSU GE Breadth Designation</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.1 Oral Communication</td>
<td>3.0</td>
</tr>
</tbody>
</table>
A.2 Written Communication 3.0
A.3 Critical Thinking 3.0
B.1 Physical Universe (Physics B2A or higher required - satisfies B.3 Lab requirement)*
  *Or Physics B4A or higher 4.0
B.2 Life Science 3.0
B.3 Laboratory Activity
B.2 Mathematics/Quantitative Reasoning (Math B1a required)*
  *Or Math B2, Math B6A or higher 4.0
C. Arts and Humanities 9.0
D. Social Sciences 9.0
E. Lifelong Learning and Self-Development 3.0

**Lower Division Curriculum:**

**Lower Division Technical Core (19 units)**

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELET B1</td>
<td>Basic Electronics</td>
<td>4.0</td>
</tr>
<tr>
<td>ELET B4</td>
<td>Computer Integrated Manufacturing</td>
<td>3.0</td>
</tr>
<tr>
<td>ELET B5</td>
<td>Programmable Logic Controllers</td>
<td>3.0</td>
</tr>
<tr>
<td>ELET B55A</td>
<td>Electric Motors - Controls</td>
<td>3.0</td>
</tr>
<tr>
<td>ELET B56</td>
<td>Instrumentation and Process Control</td>
<td>3.0</td>
</tr>
<tr>
<td>ELET B70</td>
<td>Mechanical Systems</td>
<td>3.0</td>
</tr>
</tbody>
</table>

**Upper Division Curriculum:**

**Upper Division Technical Core (51 units)**

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>INDA B100</td>
<td>Industrial Design Graphics I</td>
<td>3.0</td>
</tr>
<tr>
<td>INDA B101</td>
<td>Industrial Design Graphics II</td>
<td>3.0</td>
</tr>
<tr>
<td>INDA B105</td>
<td>Materials Science for the Technician</td>
<td>3.0</td>
</tr>
<tr>
<td>INDA B110</td>
<td>IA Networks</td>
<td>3.0</td>
</tr>
<tr>
<td>INDA B112</td>
<td>IA Measurement</td>
<td>3.0</td>
</tr>
<tr>
<td>INDA B114</td>
<td>Industrial Safety Principles and Management</td>
<td>3.0</td>
</tr>
<tr>
<td>INDA B120</td>
<td>IA Systems</td>
<td>3.0</td>
</tr>
<tr>
<td>INDA B122</td>
<td>Industrial Motion Control</td>
<td>3.0</td>
</tr>
<tr>
<td>INDA B124</td>
<td>Industry Sector Seminar: Applied Automation</td>
<td>3.0</td>
</tr>
<tr>
<td>INDA B130</td>
<td>Industrial Manufacturing Processes</td>
<td>3.0</td>
</tr>
<tr>
<td>INDA B132</td>
<td>Project Management and Budgeting</td>
<td>3.0</td>
</tr>
<tr>
<td>INDA B140</td>
<td>Industry Sector Seminar: Manufacturing and Production</td>
<td>3.0</td>
</tr>
<tr>
<td>INDA B140</td>
<td>Quality Management</td>
<td>3.0</td>
</tr>
<tr>
<td>INDA B142</td>
<td>Facilities Planning and Operations</td>
<td>3.0</td>
</tr>
<tr>
<td>INDA B144</td>
<td>Leadership and Entrepreneurship</td>
<td>3.0</td>
</tr>
<tr>
<td>INDA B150</td>
<td>Systems Design and Integration</td>
<td>3.0</td>
</tr>
<tr>
<td>INDA B151</td>
<td>Systems Implementation</td>
<td>3.0</td>
</tr>
</tbody>
</table>

**Upper Division Curriculum:**

**Upper Division General Education (9 units)**

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGL B100</td>
<td>Technical Writing</td>
<td>3.0</td>
</tr>
<tr>
<td>PSYC B100</td>
<td>Industrial and Organizational Psychology</td>
<td>3.0</td>
</tr>
<tr>
<td>PHIL B100</td>
<td>Industry Ethics</td>
<td>3.0</td>
</tr>
</tbody>
</table>
Courses
Upper Division Courses

**English Courses**

**ENGL B100 Technical Writing**

*3 units*

**Description:** Study of the process of technical writing and written communication. Students review various formats and writing purposes and produce technical and business-related documents.

**Prerequisites:** Admissions to the Bachelor of Science, Industrial Automation Program

**Hours:** 54 lecture

**CCS:** Credit Course

**Transferable:** Bachelor’s Degree Applicable

**Industrial Automation Courses**

**INDA B100 Industrial Design**

*3 units*

**Description:** The application of two-dimensional industrial design techniques (sketching, drafting, and Computer Aided Drafting) taught within the context of automation and process design. Students will gain design and management skills while generating process flow diagrams (PFD’s), piping & instrumentation diagrams (P&ID’s), and control panel layouts.

**Prerequisites:** Admissions to the Bachelor of Science, Industrial Automation Program

**Hours:** 36 lecture, 54 laboratory

**CCS:** Credit Course

**Transferable:** Bachelor’s Degree Applicable; Career and Technical Education (CTE)

**INDA B101 Industrial Design Graphics II**

*3 units*

**Description:** The application of three-dimensional industrial design techniques taught within the context of automation and process design. Students will utilize mechanical Computer Aided Drafting software (SolidWorks/Inventor) to design weldments, piping/conduit systems, and sheet metal assemblies. Design projects will emphasize technical and project management skills.

**Prerequisites:** IND A B100 AND Admission to Industrial Automation Bachelor’s Degree program

**Hours:** 36 lecture, 54 laboratory

**CCS:** Credit Course

**Transferable:** Bachelor’s Degree Applicable; Career and Technical Education (CTE)

**INDA B105 Materials Science for the Technician**

*3 units*

**Description:** An introduction to materials science for technicians and technologists. Topics to be presented include atomic structure of materials, electrical and mechanical properties, properties testing, basic metallurgy, corrosion and wear, and materials selection. Materials covered include ceramics, polymers and composites, steels, and nonferrous metal alloys. Students will also be introduced to processes including heat treatment, surface treatments, polymer manufacturing, and composite fabrication.

**Prerequisites:** (PHYS B2A OR PHYS B4A) AND (MATH B1A OR MATH B2 OR MATH B6A) AND Admission to Industrial Automation Bachelor’s Degree program

**Hours:** 36 lecture, 54 laboratory

**CCS:** Credit Course

**Transferable:** Bachelor’s Degree Applicable; Career and Technical Education (CTE)

**INDA B110 Industrial Automation Networks**

*3 units*

**Description:** The basic theory and implementation of industrial automation networks, including digital data, industrial control networks, instrumentation and process control bus and network standards, SCADA (Supervisory Control and Data Acquisition) and DCS (Distributed Control Systems), and essentials of human-machine interface (HMI) panels connection, programming, and modification of programs and features.

**Prerequisites:** ELET B1 AND ELET B5 AND Admission to Industrial Automation Bachelor’s Degree program

**Hours:** 36 lecture, 54 laboratory

**CCS:** Credit Course

**Transferable:** Bachelor’s Degree Applicable; Career and Technical Education (CTE)

**INDA B112 Industrial Automation Measurement**

*3 units*

**Description:** Advanced applications of industrial measurement and instrumentation, including instrumented process control based on a PLC. Topics include: instrumentation and process control review, instrumentation documents (process flow diagrams, P&ID’s, loop diagrams, instrument and process equipment symbols, and instrument tags), instrument connections, instrument calibration and calibration programs, diagnostic strategies, continuous analytical measurement, machine vibration measurement, control valves (ranging, sizing, characterization, and problems), process dynamics and PID controller tuning, basic process control strategies, and process safety and instrumentation. This course continues the study of instrumentation from the ELET B56a course, and covers the approximately 40% of the remaining content of the International Society for Automation (ISA) Certified Control Systems Technician (CCST) certification, level 1.

**Prerequisites:** ELET B56 AND Admissions to the Bachelor of Science, Industrial Automation Program

**Hours:** 36 lecture, 54 laboratory

**CCS:** Credit Course

**Transferable:** Bachelor’s Degree Applicable; Career and Technical Education (CTE)

**INDA B114 Industrial Safety Principles and Management**

*3 units*

**Description:** An overview of components of successful safety and industry hygiene programs, best practices, OSHA reporting requirements, legal and ethical obligations of both employer and employee, principles of safety management, assessment of hazards associated with various industrial processes and facilities, and protective measures used to minimize hazards such as personal protective equipment, hazard management, education and training options, and incentive programs.

**Prerequisites:** Admission to Industrial Automation Bachelor’s Degree program

**Hours:** 54 lecture

**CCS:** Credit Course

**Transferable:** Bachelor’s Degree Applicable; Career and Technical Education (CTE)
INDA B120 Industrial Automation Systems
3 units
Description: This course provides additional study and hands-on lab activities beyond the Computer Integrated Manufacturing course, and will cover industrial automation systems, including: principles of robotics, power supplies and movement systems, sensing and end-of-arm tooling, and control systems and maintenance.
Prerequisites: ELET B4 AND Admission to Industrial Automation Bachelor's Degree program
Hours: 36 lecture, 54 laboratory
CCS: Credit Course
Transferable: Bachelor's Degree Applicable; Career and Technical Education (CTE)

INDA B122 Industrial Motion Control
3 units
Description: Methods of implementing motion control utilizing VFD's (Variable Frequency Drives) including general purpose drives and vector drives, servo controllers and drives, stepper controllers and drives, and other motion control devices. Utilization of test equipment for testing and troubleshooting will be covered, as well as an overview in maintenance program development and management. Lab activities will be provided with actual equipment and software used in industry.
Prerequisites: ELECT B55 OR ELET B55A AND Admission to Industrial Automation Bachelor's Degree program
Hours: 36 lecture, 54 laboratory
CCS: Credit Course
Transferable: Bachelor's Degree Applicable; Career and Technical Education (CTE)

INDA B124 Industry Sector Seminar: Applied Automation
3 units
Description: A study of the specific automation processes related to the following industry sectors: Petroleum (the application of automation and process control in oilfield operations and processes, and commodities transport processes), logistics and distribution (the application of automation in distribution centers and warehousing), cogeneration and renewable energy, as well as automation support professions.
Prerequisites: Admission to Industrial Automation Bachelor's Degree program
Hours: 54 lecture
CCS: Credit Course
Transferable: Bachelor's Degree Applicable; Career and Technical Education (CTE)

INDA B130 Industrial Manufacturing Processes
3 units
Description: An overview of the specific processes used in manufacturing, including but not limited to: forming, casting, extrusion, blow-molding, material addition and removal, welding and joining, folding, pressing, and shearing operations, measurement and insertion of products into packaging, coating and sealing, and other processes used in manufacturing industries.
Prerequisites: Admission to Industrial Automation Bachelor's Degree program
Hours: 54 lecture
CCS: Credit Course
Transferable: Bachelor's Degree Applicable; Career and Technical Education (CTE)

INDA B132 Project Management and Budgeting
3 units
Description: This course provides hard information and skills to work successfully in a project environment and to accomplish project objectives. It will equip students by explaining concepts and techniques and by using numerous examples to show how they can be skillfully applied. Topics covered in this course include project management life cycle and process; identifying and selecting projects; developing a project proposal; techniques for planning, scheduling, resource assignment, budgeting, and controlling project performance; project risks; project manager responsibilities and skills; project team development and effectiveness; project communication and documentation; and project management organizational structures. The concepts in the course support the project management knowledge areas of the Project Management Institute’s A Guide to the Project Management Body of Knowledge (PMBOK® Guide).
Prerequisites: Admission to Industrial Automation Bachelor's Degree program
Hours: 54 lecture
CCS: Credit Course
Transferable: Bachelor’s Degree Applicable; Career and Technical Education (CTE)

INDA B134 Industry Sector Seminar: Manufacturing and Production
3 units
Description: A study of the specific automation processes related to the following industry sectors: petroleum (refining and materials processing of petroleum-related products including gasses, plastics and polystyrene foam), food and value-added agriculture processing (including processing, packaging, food safety, good manufacturing processes, quality assurance processes, and other topics of importance to the food processing industry), materials processing (including building materials, minerals, and other non-food products created from natural resources), as well as equipment, industrial manufacturing, and aerospace industries.
Prerequisites: Admission to Industrial Automation Bachelor's Degree program
Hours: 54 lecture
CCS: Credit Course
Transferable: Bachelor’s Degree Applicable; Career and Technical Education (CTE)

INDA B140 Quality Management
3 units
Description: An overview of the various methods of quality assurance (the systematic process of determining whether products meet customers' expectations), quality control (the systematic process of determining the quality and consistency of products), and efficient manufacturing processes (using techniques that determine the most efficient method of manufacturing and logistics). Strategies such as Six-Sigma, Lean Manufacturing, Failure Mode Analysis, ISO 9001, and various continuous improvement programs will be examined.
Prerequisites: Admission to Industrial Automation Bachelor's Degree program
Hours: 54 lecture
Transferable: Bachelor’s Degree Applicable; Career and Technical Education (CTE)
**INDA B142 Facilities Planning and Operations**  
*3 units*

**Description:** An overview of the processes used in planning and operating an industrial facility, including but not limited to: efficient design of workflow, quality assurance, material handling, time and motion study, scheduling, inventory control, examining the application of automation through a cost-benefit analysis, organizing production and facilities operation, and structuring management operations efficiently.

**Prerequisites:** Admission to Industrial Automation Bachelor’s Degree program

**Hours:** 54 lecture

**CCS:** Credit Course

**Transferable:** Bachelor’s Degree Applicable; Career and Technical Education (CTE)

**INDA B144 Leadership and Entrepreneurship**  
*3 units*

**Description:** Students strengthen personal and organizational leadership skills. The course increases understanding of and experience with decision making, problem solving, and communication. An investigation of the factors that determine leadership with special emphasis on the leader’s vision. The study and analysis of the issues and options which must be faced in developing a successful technological venture and on the creation of a winning business plan. Particular attention is directed to the identification of technology-based venture opportunities, evaluation of technical feasibility and commercial potential, and planning for successful commercialization.

**Prerequisites:** Admission to Industrial Automation Bachelor’s Degree program

**Hours:** 54 lecture

**CCS:** Credit Course

**Transferable:** Bachelor’s Degree Applicable; Career and Technical Education (CTE)

**INDA B150 Senior Problem I (Systems Design and Integration)**  
*3 units*

**Description:** Students will work in teams to design, plan for production, and integrate various automation technologies into the production of a simple product. A working product prototype, a business plan, a facilities plan, and a production plan will also be developed.

**Prerequisites:** INDA B132 (Project Management and Budgeting) AND INDA B140 (Quality Management) AND INDA B142 with a grade of “C” or better. (Facilities Planning and Operations) AND Admission to Industrial Automation Bachelor’s Degree program

**Hours:** 9 lecture, 135 laboratory

**CCS:** Credit Course

**Transferable:** Bachelor’s Degree Applicable; Career and Technical Education (CTE)

**INDA B151 Senior Problem II (Systems Implementation)**  
*3 units*

**Description:** The product and processes designed in by the student teams in INDA B150 will be further refined to create a demonstration production run or simulated production process. The production plan will be refined according to the production run or simulation, and a final plan will be presented. Additionally a simple marketing plan will be included.

**Prerequisites:** INDA B150 AND Admission to Industrial Automation Bachelor’s Degree program

**Hours:** 9 lecture, 135 laboratory

**CCS:** Credit Course

**Transferable:** Bachelor’s Degree Applicable; Career and Technical Education (CTE)

**Philosophy Courses**

**PHIL B100 Industry Ethics**  
*3 units*

**Description:** The main objective of this course is to stress analytical reasoning and emphasize clear thinking regarding the application of major ethical theories to specific workplace, organizational, and global business and technological issues that students are most likely to encounter once in the workforce. An examination of the responsibilities of the employee, manager, and organization within an industry context will take place, highlighting such issues such as whistleblowing, environment (e.g., asset disposal program), discrimination and harassment, risk, and safety. A key component of the class will also discuss the ethical importance of emerging technologies and their impact on society.

**Prerequisites:** Admission to Industrial Automation Bachelor’s Degree program

**Hours:** 54 lecture

**CCS:** Credit Course

**Transferable:** Bachelor’s Degree Applicable

**Psychology Courses**

**PSYC B100 Industrial and Organizational Psychology**  
*3 units*

**Description:** The application of psychological principles and theories to the workplace: This includes an introduction to the methods, practices, research, and theories necessary to the scientific study of the attitudes and behaviors of employees and employers; interpersonal relationships in the workplace; the structure of organizations and organizational policies; the complex processes of motivation and leadership; individual and organizational performance; and the match between people and jobs.

**Prerequisites:** Admission to Industrial Automation Bachelor’s Degree program

**Hours:** 54 lecture

**CCS:** Credit Course

**Transferable:** Bachelor’s Degree Applicable