

Automotive and Robotics Engineering

Introduction

The Automotive Robotics Engineering (ARE) Program provides comprehensive approaches to developing students' excellent abilities within the Digital Era, which are implemented in a wide spectrum of Automotive Industries and Robotics Industries. ARE program is a front runner in prioritizing both industries implementations through Artificial Intelligence of Things (AIoT).

Those abilities above allow students to analyze, design, and build smart mechanical and automated electronic systems for smart automotive systems, smart manufacturing processes, and smart home/building/city applications, using design tools used in global industries today. Subsequently, these abilities are indispensable for students to be excellent in professional and entrepreneurship, posterior their graduation from BINUS ASO School of Engineering (BASE). Ultimately, the aforementioned abilities are aligned with current and incoming challenges in the Digital Era of Industry 4.0, which include the design and development of mechanical systems within 3D tools, computerized electronic systems, intelligent automotive systems, and intelligent robotic systems for global industries.

Vision

A world class computer engineering study program that focuses on the development of smart systems and continuously contribute to fostering and empowering society for the benefit of mankind

Mission

To contribute to the global community through the provision of world-class education by:

1. Educating BINUSIAN to meet global standards.
2. Conducting high-impact research to solve nation's problems.
3. Providing a vibrant environment for teaching and research.
4. Fostering BINUSIAN as a lifelong learner in order to adapt to rapid changes.
5. Empowering BINUSIAN to use their knowledge to serve and build the nation.

Program Objective

The objectives of the program are:

1. Our graduates will excel in methodological and computational skills to solve problems creatively within their professional and communities.
2. Our graduates will lead the team and professionally responsible to benefit the organizations, society, and nation.
3. Our graduates will sustainably update their knowledge by engaging in life-long learning to adapt rapidly changing work environments and to meet evolving global requirements.

Student Outcomes

After completing the study, graduates are:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze, and interpret data, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Prospective Career of the Graduates

- Advanced Driver Assistance-Systems Engineer
- Autonomous Driving Engineer
- Intelligent Robotics-Systems Engineer
- Artificial Intelligence of Things Engineer
- Data Science Engineer
- Quality Control Engineer
- Electric Vehicle Engineer
- Technopreneur

Curriculum

The Curriculum Core of the Automotive Robotics Engineering (ARE) Program complies with Internationally acknowledged guidelines from the Institute of Electrical and Electronics Engineers (IEEE) and the Association for Computing Machinery (ACM). These compliances constitute the competitive advantages of ARE Students toward International Recognition within Students' International Exposure in Professional and Entrepreneurship. Furthermore, students conduct their international study exposures in Fukuoka, Japan. During that international study exposure within the summer course, students are exposed to comprehensive courses and internships in Japanese companies through coordination with ASO College of Automotive Engineering and Technology. Ultimately, the curriculum above is orchestrated to ensure the balance between knowledge and industrial implementations through hands-on projects.

This 4-year program covers, but is not limited to, basic courses and engineering fundamentals in the field of mechanical systems, intelligent software systems, and connected electronic systems. Eventually, the technical and special courses, including the internship and final project, will support the development of intelligent automotive and robotics systems.

Course Structure

| Sem | Code | Course Name | SCU | Total | |
|------------------------------|--|--|-----|-------|--|
| 1 | CHAR6016010 | Character Building: Pancasila | 2 | 20 | |
| | SCIE6058010 | Physics I | 4/1 | | |
| | MATH6170010 | Calculus I | 4 | | |
| | MATH6205010 | Linear Algebra | 3 | | |
| | MATH6172010 | Chemistry | 2 | | |
| | COMP6920010 | Physical Computing & Algorithm | 4 | | |
| 2 | SCIE6059010 | Physics II | 4/1 | 20 | |
| | MATH6173010 | Calculus II | 4 | | |
| | STAT6182010 | Probability and Statistics | 4 | | |
| | CPEN6237010 | Circuit & Electronics | 4/1 | | |
| | AREN6062010 | Mechanical Strength of Material | 2 | | |
| 3 | MATH6174010 | Discrete Mathematics | 4 | 20 | |
| | CPEN6118010 | Digital Signal Processing | 2/1 | | |
| | CPEN6267010 | Microcontroller (AIE) | 2/1 | | |
| | CPEN6269010 | IoT Application | 2 | | |
| | AREN6061010 | Machine Learning | 4 | | |
| | LANG6120010 | Indonesian | 2 | | |
| | COSC6013010 | Foundations of Artificial Intelligence | 2 | | |
| 4 | CHAR6017010 | Character Building: Kewarganegaraan | 2 | 22 | |
| | CPEN6238010 | Computer Networks & Information Security | 4/1 | | |
| | CPEN6266010 | Digital System | 4/1 | | |
| | AREN6032010 | Control Systems | 3/1 | | |
| | AREN6029010 | Machine Element Design | 4 | | |
| | ENPR6296010 | Entrepreneurship: Prototyping | 2 | | |
| 5 | CHAR6018010 | Character Building: Agama | 2 | 18 | |
| | CPEN6268010 | Computer Organization and Architecture | 2 | | |
| | CPEN6240010 | Mobile Application Development for Engineer (AIE) | 2 | | |
| | AREN6063010 | Manufacturing Processes | 2 | | |
| | ENTR6590010 | Entrepreneurship: Market Validation | 2 | | |
| | Streaming: Intelligent Robotics | | | | |
| | AREN6030010 | Robot Kinematics and Dynamics | 2/1 | | |
| | AREN6064010 | Data Science and Applications | 2/1 | | |
| | AREN6065010 | Advanced Robotics | 2 | | |
| | Streaming: Intelligent Automotive | | | | |
| | AREN6066010 | Vehicle Powertrain Station | 2/1 | | |
| | AREN6068010 | Vehicle Dynamics | 2/1 | | |
| | AREN6067010 | Autonomous Driving Systems | 2 | | |
| 6 | Enrichment Program I | | 20 | 20 | |
| 7 | Enrichment Program II | | 20 | 20 | |
| 8 | AREN6014010 | Final Project | 6 | 6 | |
| Total Credits 146 SCU | | | | | |

-) (AIE) - Artificial Intelligence Embedded

Enrichment Program I (6th Semester) & Enrichment Program II (7th Semester):

-) *Enrichment Program is a compulsory off-campus enrichment program for all students. Students will take one of the enrichment of choice program tracks (off-campus). See the enrichment appendix for the tracks detail.*

Enrichment Track Scheme

| Track | Semester 6 | | | | | | | Semester 7 | | | | | | |
|-------|------------|----|----|----|----|----|-----|------------|----|----|----|----|----|-----|
| | IN | RS | EN | CD | SA | IS | etc | IN | RS | EN | CD | SA | IS | etc |
| 1 | v | | | | | | | v | | | | | | |
| 2 | v | | | | | | | | v | | | | | |
| 3 | v | | | | | | | | | v | | | | |
| 4 | v | | | | | | | | | | v | | | |
| 5 | v | | | | | | | | | | | v | | |
| 6 | | v | | | | | | v | | | | | | |
| 7 | | | | v | | | | v | | | | | | |
| 8 | | | | | v | | | v | | | | | | |
| 9 | | | | | | v | | v | | | | | | |
| 10 | v | | | | | | | | | | | | v | |

Notes:

| | | | |
|----|-----------------------------------|-----|--|
| IN | : Certified Internship | SA | : Study Abroad |
| RS | : Certified Research | IS | : Certified Specific Independent Study |
| EN | : Certified Entrepreneurship | etc | : Study Program Special Purposes |
| CD | : Certified Community Development | | |

Description:

Student will take one of enrichment program tracks

Certified Internship Track

| Code | Course Name | SCU | Total |
|------------------------------|--|-----|-------|
| Enrichment Program I | | | |
| AREN6040010 | Industrial Practice | 8 | 20 |
| AREN6050010 | Technical Analysis in Practical Circumstance | 6 | |
| AREN6051010 | Leadership Practice | 6 | |
| Enrichment Program II | | | |
| AREN6042010 | Knowledge and Skills Implementation | 8 | 20 |
| AREN6044010 | New Knowledge Acquisition and Application | 6 | |
| AREN6043010 | Communication and Teamwork | 6 | |

Certified Entrepreneurship Track

| Code | Course Name | SCU | Total |
|------------------------------|---|-----|-------|
| Enrichment Program II | | | |
| AREN6045010 | Idea Generation and Prototyping | 8 | 20 |
| AREN6047010 | New Knowledge Acquisition and Application | 6 | |
| AREN6046010 | Business Plan Development | 6 | |

Certified Research Track

| Code | Course Name | SCU | Total |
|---|---|-----|-------|
| For students who take Research Track in either odd or even semester, they should take these courses: | | | |
| AREN6055010 | Recent Trend in Automotive and Robotic Engineering Research | 8 | 20 |
| AREN6056010 | Scientific Communication of Automotive and Robotic Engineering Research | 6 | |
| AREN6057010 | Critical Thinking Skills in Automotive and Robotic Engineering Research | 6 | |

Certified Community Development Track

| Code | Course Name | SCU | Total |
|--|--|-----|-------|
| For students who take Community Development Track in either odd or even semester, they should take these courses: | | | |
| AREN6058010 | Implementation of Automotive and Robotic Engineering Technology in Community | 8 | 20 |
| AREN6059010 | Design of Automotive and Robotic Engineering Technology in Community | 6 | |
| AREN6060010 | Adaptability and Collaboration in Society | 6 | |

Certified Study Abroad Track

| Code | Course Name | SCU | Total |
|--|-------------------------------------|-----|-------|
| Elective courses list for study abroad* | | | |
| For students who take Study Abroad Track in either odd or even semester, they should take these courses | | | |
| GLOB6272010 | Elective Course for Study Abroad 1 | 4 | 20 |
| GLOB6273010 | Elective Course for Study Abroad 2 | 4 | |
| GLOB6274010 | Elective Course for Study Abroad 3 | 4 | |
| GLOB6275010 | Elective Course for Study Abroad 4 | 4 | |
| GLOB6276010 | Elective Course for Study Abroad 5 | 4 | |
| GLOB6277010 | Elective Course for Study Abroad 6 | 2 | |
| GLOB6278010 | Elective Course for Study Abroad 7 | 2 | |
| GLOB6279010 | Elective Course for Study Abroad 8 | 2 | |
| GLOB6280010 | Elective Course for Study Abroad 9 | 2 | |
| GLOB6281010 | Elective Course for Study Abroad 10 | 2 | |
| GLOB6282010 | Elective Course for Study Abroad 11 | 3 | |
| GLOB6283010 | Elective Course for Study Abroad 12 | 3 | |
| GLOB6284010 | Elective Course for Study Abroad 13 | 3 | |
| GLOB6285010 | Elective Course for Study Abroad 14 | 5 | |

Certified Specific Independent Study Track

| Code | Course Name | SCU | Total |
|---|----------------------------|-----|-------|
| Elective courses list for study abroad* | | | |
| For students who take Specific Independent Study Track in either odd or even semester, they should take these courses: | | | |
| CSIS6157010 | Course Certification | 3 | 20 |
| CSIS6158010 | Technical Skill Enrichment | 4 | |
| CSIS6159010 | Industrial Project | 9 | |
| CSIS6160010 | Soft Skill Enrichment | 4 | |

| Code | Course Name | SCU | Total |
|-------------|---|-----|-------|
| CSIS6123010 | Elective Course for Specific Independent Study 1 | 4 | |
| CSIS6124010 | Elective Course for Specific Independent Study 2 | 4 | |
| CSIS6125010 | Elective Course for Specific Independent Study 3 | 4 | |
| CSIS6126010 | Elective Course for Specific Independent Study 4 | 4 | |
| CSIS6127010 | Elective Course for Specific Independent Study 5 | 4 | |
| CSIS6128010 | Elective Course for Specific Independent Study 6 | 2 | |
| CSIS6129010 | Elective Course for Specific Independent Study 7 | 2 | |
| CSIS6130010 | Elective Course for Specific Independent Study 8 | 2 | |
| CSIS6131010 | Elective Course for Specific Independent Study 9 | 2 | |
| CSIS6132010 | Elective Course for Specific Independent Study 10 | 2 | |
| CSIS6138010 | Elective Course for Specific Independent Study 16 | 3 | |
| CSIS6139010 | Elective Course for Specific Independent Study 17 | 3 | |
| CSIS6155010 | Elective Course for Specific Independent Study 33 | 3 | |
| CSIS6161010 | Elective Course for Specific Independent Study 35 | 5 | |

*) For students who take BINUS certified specific independent study courses, they should take the first 4 courses on the list above (20 credits). Meanwhile, electives courses 1 to 35 are transferred courses for students who take certified specific independent study outside BINUS University. Transferred courses will be transferred based on credit transfer policies on study program with total of 20 credits.

The Table of Prerequisite for Automotive Robotics Engineering Program

| Course | SCU | Sem. | Prerequisite Course | SCU | Sem. | |
|-------------|------------------------|------|---------------------|--|------|---|
| AREN6014010 | 6 | 8 | SCIE6058010 | Physics I | 4/1 | 1 |
| | | | MATH6170010 | Calculus I | 4 | 1 |
| | | | MATH6205010 | Linear Algebra | 3 | 1 |
| | | | MATH6172010 | Chemistry | 2 | 1 |
| | | | COMP6920010 | Physical Computing & Algorithm | 4 | 1 |
| | | | SCIE6059010 | Physics II | 4/1 | 2 |
| | | | MATH6173010 | Calculus II | 4 | 2 |
| | | | STAT6182010 | Probability and Statistics | 4 | 2 |
| | | | CPEN6237010 | Circuit & Electronics | 4/1 | 2 |
| | | | AREN6062010 | Mechanical Strength of Material | 2 | 2 |
| | | | MATH6174010 | Discrete Mathematics | 4 | 3 |
| | | | CPEN6118010 | Digital Signal Processing | 2/1 | 3 |
| | | | CPEN6267010 | Microcontroller | 2/1 | 3 |
| | | | CPEN6269010 | IoT Application | 2 | 3 |
| | | | AREN6061010 | Machine Learning | 4 | 3 |
| | | | CPEN6238010 | Computer Networks & Information Security | 4/1 | 4 |
| | | | CPEN6266010 | Digital System | 4/1 | 4 |
| | | | AREN6032010 | Control Systems | 3/1 | 4 |
| AREN6029010 | Machine Element Design | 4 | 4 | | | |

| | | | | | | | |
|--|--|--|--|-------------|---|-----|---|
| | | | | CPEN6268010 | Computer Organization and Architecture | 2 | 5 |
| | | | | CPEN6240010 | Mobile Application Development for Engineer | 2 | 5 |
| | | | | AREN6063010 | Manufacturing Processes | 2 | 5 |
| | | | | AREN6030010 | Robot Kinematics and Dynamics | 2/1 | 5 |
| | | | | AREN6064010 | Data Science and Applications | 2/1 | 5 |
| | | | | AREN6065010 | Advanced Robotics | 2 | 5 |
| | | | | AREN6066010 | Vehicle Powertrain Station | 2/1 | 5 |
| | | | | AREN6068010 | Vehicle Dynamics | 2/1 | 5 |
| | | | | AREN6067010 | Autonomous Driving Systems | 2 | 5 |

Student should pass all of these quality controlled courses as listed below:

| No. | Course Code | Course Name | Minimal Grade |
|-----|-------------|--------------------------------------|---------------|
| 1. | CHAR6016010 | Character Building: <i>Pancasila</i> | B |

