# SYLLABUS

## 1. Program Information

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|---|---|
| 1.1 Higher education institution | Technical University of Cluj-Napoca |
| 1.2 Faculty | Faculty of Automation and Computer Science |
| 1.3 Department | Department of Automation |
| 1.4 Field of study | Automation, Applied Informatics and Intelligent Systems |
| 1.5 Cycle of studies | Bachelor |
| 1.6 Study Programme/Qualification | Intelligent Automation Systems (dual, in English language) |
| 1.7 Form of education | IF – full-time education |
| 1.8 Course code | |

## 2. Course information

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|---|---|---|---|---|---|---|
| 2.1 Course title | | | | | **Functional Safety for Industrial Automation** | |
| 2.2 Course lecturer | | | | | *Conf.Dr.Ing. Adrian.Colesa@cs.utcluj.ro* | |
| 2.3 Seminar / Laboratory / Project Lecturer | | | | | *Dr.Ing. Marius.Ticala (Emerson)*<br>*Dr.Ing. Ciprian Harlisca (Emerson)*<br>*Ing. Lucian Vescan (Emerson)* | |
| 2.4 Year of study | 4 | 2.5 Semester | 2 | 2.6 Type of assessment | | E |
| 2.7 Course status | Formative category *(DF, DS, DC)* | | | | | DS |
| | Optionality *(DOB, DOP, DFac)* | | | | | DOB |

## 3.Total estimated time

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 3.1 Number of hours per week | 4 | of which: | HEI | Lecture | 2 | Seminar | 0 | Laboratory | 0 | Project | 0 |
| | | | CO | | 0 | | 0 | | 2 | | 0 |
| 3.2 Number of hours per semester | 56 | of which: | HEI | Lecture | 28 | Seminar | 0 | Laboratory | 0 | Project | 0 |
| | | | CO | | 0 | | 0 | | 28 | | 0 |

| 3.3 Distribution of time allocation (hours per semester) for: | HEI | CO |
|---|---|---|
| (a) Study based on textbook, course support, bibliography, and notes | 28 | |
| (b) Additional documentation in library, specialized electronic platforms, and fieldwork | 7 | 7 |
| (c) Preparation of seminars/laboratories, assignments, papers, portfolios and essays | | 7 |
| (d) Tutoring | 7 | |
| (e) Examinations | 3 | 7 |
| (f) Other activities: | 2 | 1 |
| 3.4 Total individual study hours (sum (3.3(a)... 3.3(f))) | 47 | 22 |
| 3.5 Total hours per semester (3.2+3.4) | 75 | 50 |
| 3.6 Number of credits per semester | 3 | 2 |

*(HEI = Higher Education Institution, CO = Company)*

## 4. Prerequisites (where applicable)

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| 4.1 Curriculum Prerequisites | • Industrial Automation Platforms (Company project - sem1)<br>• Computer Architecture, Operating Systems and Fundamentals of Computer Networking<br>• Measurement and transducers<br>• Process Modelling<br>• Software Engineering and Databases<br>• Electric and Electronic Control Equipment<br>• Introduction to System Theory and Control Systems<br>• Automatic monitoring and Control systems<br>• Computer Networks<br>• Control Engineering II<br>• System Engineering I |

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| | • Hydro-pneumatic Control Equipment<br>• Cybersecurity for Industrial Automation |
| 4.2 Competency Prerequisites | • Excellent understanding of industrial control systems, knowledge of programming, fundamentals of automation system design, excellent understanding of the electrical hardware equipments, knowledge of elaborating technical documentation |

**5. Conditions** (where applicable)

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| 5.1. Course Organization Conditions | • Lecture room equipped with video projector and internet access. |
| 5.2. Seminar / Laboratory / Project organization conditions | • Laboratory equipped with DeltaV demo setup system, simulation environment.<br>• Attendance at the laboratory is mandatory. |

**6. Specific Competencies Acquired**

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| Professional Competencies | • PC01 Adjust engineering designs<br>• PC03 Approve engineering design<br>• PC06 Define technical requirements<br>• PC07 Demonstrate disciplinary expertise<br>• PC09 Design prototypes<br>• PC26 Use information technology tools<br>• PC29 Come up with solutions to problems<br>• PC32 Perform data analysis |
| Transversal Competencies | • TC01 Apply knowledge of science, technology and engineering<br>• TC02 Think analytically<br>• TC03 Demonstrate responsibility |

**7. Learning outcomes**

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| Knowledge: | Upon completion of the course, the student will be able to:<br>• **Describe and summarize** the structure of industrial safety automation systems, including the IEC safety standards, emergency shut down systems (ESD), burner management system (BMS), fire&gas system (FGS, F&G) with emphasis on DeltaV and Ovation platforms.<br>• **Explain** the application of safety systems and how these are implemented in DeltaV and Ovation environments.<br>• **Identify and categorize** the architectural components of safety control systems and their roles in industrial applications. |
| Skills: | The student will be able to:<br>• **Apply** safety concepts to the design and analysis of procedural and physical models.<br>• **Design** a safety system.<br>• **Configure and test** DeltaV demo stand.<br>• **Utilize** standard protocols.<br>• **Utilize** safety dedicated tools.<br>• **Integrate** safety systems with other systems. |
| Responsibility and autonomy: | At the end of the course, the student will:<br>• **Demonstrate responsibility** in designing safety systems that comply with safety standards and ensure traceability and validation. |

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| | • **Collaborate effectively** in multidisciplinary teams to complete project-based integration tasks involving safety procedure.<br>• **Document and justify** technical decisions in project reports and presentations, using industry-standard terminology and structure.<br>• **Adapt and innovate** solutions in response to integration challenges and operational constraints found in regulated industrial environments. |

**8. Course Objectives**

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| 8.1 General objective of the course | • To introduce students into state of the art safety instrumented systems with advanced knowledge and practical skills, focusing on functional safety IEC 61508 and IEC 61511 standards. |
| 8.2 Specific objectives | • Explain safety architecture and standards.<br>• Explain safety concepts<br>• Explain SIL concept<br>• Understand SIS application<br>• Discuss about DeltaV solutions<br>• Discuss DeltaV safety in industrial environment, applications and components |

**9. Contents**

| 9.1 Lectures | No. of hours | Teaching methods | Obs. |
|---|---|---|---|
| 1. Industrial Environment Overview | 2 | Comprehensive slides<br><br>Blackboard annotations<br><br>Oriented discussions on the subject | |
| 2. Safety Instrumented systems - introduction | 2 | | |
| 3. SIS Architecture and Design, ICSS | 2 | | |
| 4. Safety Components | 2 | | |
| 5. Safety Network | 2 | | |
| 6. DeltaV Solution | 2 | | |
| 7. SIS Applications | 2 | | |
| 8. Emergency shut down system - ESD | 2 | | |
| 9. Fire and Gas system – F&G, FGS | 2 | | |
| 10. Burner management system - BMS | 2 | | |
| 11. Other safety systems – HIPPS, AOPS | 2 | | |
| 12. SIS Operation and Practice | 2 | | |
| 13. SIS integration | 2 | | |
| 14. System Consultancy and Certification | 2 | | |

Bibliography


1. PAS002 – PCSD EQM
2. 7009 – DeltaV System Implementation 1
3. 7018 – DeltaV Hardware and Troubleshooting
4. 7304 – DeltaV Safety Instrumented Systems with electronic Marshalling maintenance
5. 7305 – DeltaV SIS Implementation
6. IEC 61508 standard
7. IEC 61511 standard


| 9.2 Seminar / laboratory / project | Hours HEI | Hours CO | Teaching methods | Obs. |
|---|---|---|---|---|
| 1. SIS Basic setup | | 4 | Guided practical, Demo Hands-on, | |
| 2. Safety programming introduction | | 4 | | |
| 3. Documentation methodology | | 4 | | |
| 4. DeltaV SIS system | | 4 | | |

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| 5. Ovation SIS system | | 4 | Task based exercise, Live analysis, Guided navigation, Integration setup | |
| 6. Integration with other system | | 4 | | |
| 7. Safety system design | | 4 | | |

Bibliography


1. PAS002 – PCSD EQM
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4. 7304 – DeltaV Safety Instrumented Systems with electronic Marshalling maintenance
5. 7305 – DeltaV SIS Implementation
6. IEC 61508 standard
7. IEC 61511 standard


**10. Correlation of course content with the expectations of the epistemic community representatives, professional associations, and major employers in the field related to the program**

This course aligns with current demands in regulated industries such as chemical, oil&gas, mining and manufacturing. The curriculum incorporates Emerson technologies and IEC standards, ensuring high relevance to employers such as Emerson, HIMA, Honeywell, and safety services. The course supports job roles such as safety engineer.

**11. Evaluation**

| Activity Type | Evaluation criteria | Evaluation methods | Weight in final grade |
|---|---|---|---|
| 11.1 Lecture | Understanding key concepts, terminology, and standards | Written final exam | 50% |
| 11.2 Seminar/ Laboratory/Project | Practical skill in using DeltaV SIS safety system | In-class evaluation | 50% |

11.3 Minimum Performance Standard

Understand and apply basic safety concepts, demonstrate understanding concept of DeltaV safety system

- Final exam >=5
- Lab grade>=5 mandatory to be able to take the final exam
- **50% Final exam + 50% Lab Grade > 5**

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| Date of completion: | Lecturers | | Signature |
| | Course | Conf.dr.ing. Adrian COLESA | |
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| Date of approval by the Department of Automation Council<br>24.11.2025 | Director of the Department of Automation<br>Prof.dr.ing. Honoriu VĂLEAN |
| Date of approval by the Faculty of Automation and Computer Science Council<br>28.11.2025 | Dean<br>Prof.dr.ing. Vlad MUREȘAN |