



## STUDIJŲ DALYKO (MODULIO) APRAŠAS

| Dalyko (modulio) pavadinimas  | Kodas |
|-------------------------------|-------|
| Daiktų interneto technologija |       |

| Dėstytojas / a (-ai)                                           | Padalinys (-iai)                           |
|----------------------------------------------------------------|--------------------------------------------|
| Koordinuojantis (-i): dr. Saulius Niauronis<br>Kitas / a (-i): | Vilniaus universiteto<br>Šiaulių akademija |

| Studijų pakopa | Dalyko (modulio) tipas |
|----------------|------------------------|
| Pirmoji        | Pasirenkamasis         |

| Igyvendinimo forma | Vykdymo laikotarpis | Vykdymo kalba (-os) |
|--------------------|---------------------|---------------------|
| Auditorinė         | Ruduo/pavasaris     | Lietuvių            |

| Reikalavimai studijuojančiajam |                                     |
|--------------------------------|-------------------------------------|
| Išankstiniai reikalavimai:     | Gretutiniai reikalavimai (jei yra): |

| Dalyko (modulio) apimtis kreditais | Visas studento darbo krūvis | Kontaktinio darbo valandos | Savarankiško darbo valandos |
|------------------------------------|-----------------------------|----------------------------|-----------------------------|
| 5                                  | 133                         | 56                         | 77                          |

| Dalyko (modulio) tikslas                                                                                                                                                                                                                                                                                                                               |                                                                                                                               |                                                                                    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| Supažindinti su daiktų interneto principais, tipine įranga bei įrankiais, komunikacijomis bei jų sauga, suteikti praktinių įgūdžių naudotis populiariausiomis daiktų interneto atviro programinio kodo platformomis ir vykdyti nesudėtingus inovatyvių produktų kūrimo projektus, apimančius techninę ir programinę, o taip pat ir komunikacijų dalis. |                                                                                                                               |                                                                                    |
| Dalyko (modulio) studijų rezultatai                                                                                                                                                                                                                                                                                                                    | Studijų metodai                                                                                                               | Vertinimo metodai                                                                  |
| Žinoti daiktų interneto sistemų sandarą bei populiariausių priemonių įvairovę, galimybes, apribojimus.                                                                                                                                                                                                                                                 | Interaktyvi paskaita                                                                                                          | Egzaminas                                                                          |
| Suprasti ir gebėti taikyti daiktų interneto komunikacijas ir žinoti pagrindinius jų saugos aspektus.                                                                                                                                                                                                                                                   | Paskaita, pavyzdžių analizė, demonstravimas, probleminis mokymasis, pratybos, laboratoriniai darbai                           | Laboratorinių darbų ataskaita                                                      |
| Gebėti taikyti daiktų interneto technologiją praktiniuose projektuose.                                                                                                                                                                                                                                                                                 | Pratybos, laboratoriniai darbai, individualus arba komandinis projektas, realių gyvenimiškų situacijų (projektų) modeliavimas | Laboratorinių darbų ataskaita, Projekto ataskaita, Žodinis iliustruotas pranešimas |

| Temos                                                  | Kontaktinio darbo valandos |               |           |          |                       |          |                          | Savarankiškų studijų laikas ir užduotys |                                   |
|--------------------------------------------------------|----------------------------|---------------|-----------|----------|-----------------------|----------|--------------------------|-----------------------------------------|-----------------------------------|
|                                                        | Paskaitos                  | Konsultacijos | Seminarai | Pratybos | Laboratoriniai darbai | Praktika | Visas kontaktinis darbas | Savarankiškas darbas                    | Savarankiškai atliekamos užduotys |
| 1. Daiktų interneto paradigma ir atsiradimo priežastys | 2                          | 0             | 0         | 0        | 0                     | 0        | 2                        | 2                                       | Literatūros paieška               |

|                                                                            |           |          |          |           |           |          |           |           |                                                                                                |
|----------------------------------------------------------------------------|-----------|----------|----------|-----------|-----------|----------|-----------|-----------|------------------------------------------------------------------------------------------------|
| 2. Daiktų interneto sąvokos, savybės ir specifi-<br>ka                     | 4         | 0        | 0        | 0         | 0         | 0        | 2         | 5         | Literatūros skaitymas                                                                          |
| 3. Daiktų interneto sistemų struktūra,<br>komponentai ir veikimo principai | 4         | 0        | 0        | 2         | 4         | 0        | 8         | 20        | Sistemų pavyzdžių<br>analizė, komponentų<br>dokumentacijos<br>skaitymas,<br>programavimas      |
| 4. Daiktų interneto sistemų projektavimo<br>principai                      | 6         | 0        | 0        | 4         | 2         | 0        | 10        | 18        | Sistemos struktūros ir<br>algoritmų projektavimas                                              |
| 5. Daiktų interneto sistemų kūrimo<br>platformos                           | 8         | 0        | 0        | 6         | 4         | 0        | 10        | 16        | Dokumentacijos<br>skaitymas,<br>programavimas<br>naudojant specifines<br>programavimo aplinkas |
| 6. Daiktų interneto sistemų saugumo<br>užtikrinimo būdai ir priemonės      | 4         | 0        | 0        | 2         | 4         | 0        | 8         | 16        | Literatūros skaitymas,<br>praktinis metodų<br>taikymas programuojant                           |
| <b>Iš viso</b>                                                             | <b>28</b> | <b>0</b> | <b>0</b> | <b>14</b> | <b>14</b> | <b>0</b> | <b>56</b> | <b>77</b> |                                                                                                |

| Vertinimo strategija                    | Svoris<br>proc. | Atsiskaitymo<br>laikas                                    | Vertinimo kriterijai                                                                                                                                                                     |
|-----------------------------------------|-----------------|-----------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Laboratorinio darbo<br>ataskaita        | 40              | Semestro metu<br>(per savaitę po<br>l. darbo<br>atlikimo) | Vertinama laboratorinių darbų ataskaitų kokybė,<br>Apskaičiuojamas visų l. darbų įvertinimų vidurkis                                                                                     |
| Individualus arba grupinis<br>projektas | 20              | Iki semestro<br>pabaigos                                  | Vertinama darbo rašto ir įforminimo kokybė (20 proc.),<br>darbo išsamumas ir naujumas (60 proc.), gynimo metu<br>studento pateikti atsakymai į klausimus (20 proc.).                     |
| Egzaminas                               | 40              | Egzaminų<br>sesija                                        | Egzamino metu studentas atsako į 5 uždarus klausimus.<br>Vertinimas atsakymų tikslumas ir išbaigtumas.<br>Kiekvienas klausimas vertinamas 10 balų sistemoje,<br>apskaičiuojamas vidurkis |

| Autorius (-iai)                               | Leidimo metai                                                                                                                                                                                                                                                                                                                   | Pavadinimas                                                                                            | Periodinio leidinio Nr. ar leidinio tomas | Leidykla ar internetinė nuoroda  |
|-----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|-------------------------------------------|----------------------------------|
| Privaloma literatūra                          |                                                                                                                                                                                                                                                                                                                                 |                                                                                                        |                                           |                                  |
| IOT-OPEN.EU Consortium                        | 2025                                                                                                                                                                                                                                                                                                                            | IOT-OPEN.EU Reloaded: A Coursebook Introduction to the IoT, 2nd Edition                                |                                           | IOT-OPEN.EU Consortium           |
|                                               | <a href="https://iot-open.eu/download/iot-open-eu-introduction-to-the-iot-coursebook-in-english-2/">https://iot-open.eu/download/iot-open-eu-introduction-to-the-iot-coursebook-in-english-2/</a>                                                                                                                               |                                                                                                        |                                           |                                  |
| Cirani, Ferrari, G., Picone, M., & Veltri, L. | 2018                                                                                                                                                                                                                                                                                                                            | Internet of Things: Architectures, Protocols and Standards                                             |                                           | John Wiley & Sons, Incorporated. |
|                                               | <a href="https://virtualbiblioteka.vu.lt/permalink/370LABT_VU/1f3lf0l/alma9912907331608452">https://virtualbiblioteka.vu.lt/permalink/370LABT_VU/1f3lf0l/alma9912907331608452</a>                                                                                                                                               |                                                                                                        |                                           |                                  |
| Kumar, Wheeler, D., Cheruvu, S., & Smith, N.  | 2020                                                                                                                                                                                                                                                                                                                            | Demystifying Internet of Things Security: Successful IoT Device/Edge and Platform Security Deployment. |                                           | Apress                           |
|                                               | <a href="https://virtualbiblioteka.vu.lt/permalink/370LABT_VU/cb7j5i/cdi_biblioboard_openresearchlibrary_oai_biblioboard_com_adda9611_81f4_41ac_bfb1_9b3190afe7eb">https://virtualbiblioteka.vu.lt/permalink/370LABT_VU/cb7j5i/cdi_biblioboard_openresearchlibrary_oai_biblioboard_com_adda9611_81f4_41ac_bfb1_9b3190afe7eb</a> |                                                                                                        |                                           |                                  |
| Papildoma literatūra                          |                                                                                                                                                                                                                                                                                                                                 |                                                                                                        |                                           |                                  |
| Schwartz M.                                   | 2016                                                                                                                                                                                                                                                                                                                            | Internet of Things with ESP: Build amazing Internet of Things projects using the Espressif Wi-Fi chip  |                                           | Packt Publishing Ltd.            |
| Vermesan O., Friess P.                        | 2013                                                                                                                                                                                                                                                                                                                            | Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems           |                                           | River Publishers                 |
|                                               | <a href="http://www.internet-of-things-research.eu/pdf/Converging_Technologies_for_Smart_Environments_and_Integrated_Ecosystems_IERC_Book_Open_Access_2013.pdf">http://www.internet-of-things-research.eu/pdf/Converging_Technologies_for_Smart_Environments_and_Integrated_Ecosystems_IERC_Book_Open_Access_2013.pdf</a>       |                                                                                                        |                                           |                                  |

|                              |                                                                                                                                                                                                                     |                                                                                                 |  |                                  |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|--|----------------------------------|
| Buyya, & Vahid Dastjerdi, A. | 2016                                                                                                                                                                                                                | Internet of Things: Principles and Paradigms                                                    |  | Elsevier Science & Technology    |
|                              | <a href="https://virtualbiblioteka.vu.lt/permalink/370LABT_VU/cb7j5i/cdi_askewsholts_vlebooks_9780128093474">https://virtualbiblioteka.vu.lt/permalink/370LABT_VU/cb7j5i/cdi_askewsholts_vlebooks_9780128093474</a> |                                                                                                 |  |                                  |
| TechTarget tinklapis         |                                                                                                                                                                                                                     | Internet of Things (IoT).                                                                       |  |                                  |
|                              | <a href="https://www.techtarget.com/iotagenda/definition/Internet-of-Things-IoT">https://www.techtarget.com/iotagenda/definition/Internet-of-Things-IoT</a>                                                         |                                                                                                 |  |                                  |
| Madiseti V., & Bahga A.      | 2014                                                                                                                                                                                                                | “Internet of Things (A Hands-on-Approach)”, 1st Edition,                                        |  | Arshdeep Bahga & Vijay Madiseti, |
| McEwe A.                     | 2014                                                                                                                                                                                                                | Designing the Internet of things.                                                               |  | John Wiley & Sons                |
| da Costa F.                  | 2013                                                                                                                                                                                                                | “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1st Edition, |  | Apress Publications              |
| Vermesan O., Fries P.        | 2016                                                                                                                                                                                                                | Digitising the Industry Internet of Things Connecting the Physical Digital and Virtual Worlds   |  | River Publishers                 |
| Halvorsen H. P.              | 2019                                                                                                                                                                                                                | Programming with Arduino                                                                        |  | Hans-Petter Halvorsen            |



## COURSE UNIT (MODULE) DESCRIPTION

| Course unit (module) title    | Code |
|-------------------------------|------|
| Internet of Things Technology |      |

| Academic staff                      | Core academic unit(s)                  |
|-------------------------------------|----------------------------------------|
| Coordinating: dr. Saulius Niauronis | Vilnius University<br>Šiauliai Academy |
| Other:                              |                                        |

| Study cycle | Type of the course unit |
|-------------|-------------------------|
| First       | Optional                |

| Mode of delivery | Semester or period when it is delivered | Language of instruction |
|------------------|-----------------------------------------|-------------------------|
| Face-to-face     | Autumn/Spring                           | English                 |

| Requisites     |                              |
|----------------|------------------------------|
| Prerequisites: | Co-requisites (if relevant): |

| Number of ECTS credits allocated | Student's workload (total) | Contact hours | Individual work |
|----------------------------------|----------------------------|---------------|-----------------|
| 5                                | 133                        | 56            | 77              |

| Purpose of the course unit                                                                                                                                                                                                                                                                                                                              |                                                                                                              |                                                                       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|
| To introduce the principles, typical equipment and tools, communications and their security in a field of Internet of Things (IoT). To provide practical skills in using the most popular open-source IoT platforms and conducting simple innovative product development projects which incorporate hardware and software and also communication parts. |                                                                                                              |                                                                       |
| Learning outcomes of the course unit                                                                                                                                                                                                                                                                                                                    | Teaching and learning methods                                                                                | Assessment methods                                                    |
| To know the structure of IoT systems and the variety, capabilities, and limitations of the most popular tools.                                                                                                                                                                                                                                          | Interactive lecture                                                                                          | Exam                                                                  |
| To understand and be able to apply IoT communications and to know their main security aspects.                                                                                                                                                                                                                                                          | Lecture, analysis of examples, demonstrations, problem-based learning, workshops, laboratory works           | Laboratory work report                                                |
| To be able to apply IoT technology in practical projects.                                                                                                                                                                                                                                                                                               | Workshops, Laboratory works, Individual or group (team) project, modeling of real-life situations (projects) | Laboratory work report, Project report, Oral illustrated presentation |

| Content                                           | Contact hours |           |          |           |                 |            |                      | Individual work: time and assignments |                           |
|---------------------------------------------------|---------------|-----------|----------|-----------|-----------------|------------|----------------------|---------------------------------------|---------------------------|
|                                                   | Lectures      | Tutorials | Seminars | Workshops | Laboratory work | Internship | Contact hours, total | Individual work                       | Tasks for individual work |
| 1. The IoT paradigm and reasons for its emergence | 2             | 0         | 0        | 0         | 0               | 0          | 2                    | 2                                     | Literature search         |

|                                                                   |           |          |          |           |           |          |           |           |                                                                            |
|-------------------------------------------------------------------|-----------|----------|----------|-----------|-----------|----------|-----------|-----------|----------------------------------------------------------------------------|
| 2. IoT concepts, characteristics, and specifics                   | 4         | 0        | 0        | 0         | 0         | 0        | 2         | 5         | Literature reading                                                         |
| 3. Structure, components, and operating principles of IoT systems | 4         | 0        | 0        | 2         | 4         | 0        | 8         | 20        | Analysis of system examples, reading component documentation, programming  |
| 4. Principles of IoT system design                                | 6         | 0        | 0        | 4         | 2         | 0        | 10        | 18        | System structure and algorithm design                                      |
| 5. IoT system development platforms                               | 8         | 0        | 0        | 6         | 4         | 0        | 10        | 16        | Reading documentation, programming using specific development environments |
| 6. Methods and tools for ensuring the security of IoT systems     | 4         | 0        | 0        | 2         | 4         | 0        | 8         | 16        | Literature reading, practical application of methods by programming        |
| <b>Total</b>                                                      | <b>28</b> | <b>0</b> | <b>0</b> | <b>14</b> | <b>14</b> | <b>0</b> | <b>56</b> | <b>77</b> |                                                                            |

| Assessment strategy           | Weight % | Deadline                                                | Assessment criteria                                                                                                                                                                                               |
|-------------------------------|----------|---------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Laboratory work report        | 40       | During semester (during one week after laboratory work) | The quality of laboratory work reports is assessed. The average of all laboratory work grades is calculated.                                                                                                      |
| Individual or teamwork report | 20       | Until end of semester                                   | The quality of the written work and its formatting is evaluated (20%), the thoroughness and originality of the work (60%), as well as student answers to questions provided during the defence of the work (20%). |
| Exam                          | 40       | During exam session                                     | During the exam, the student answers 5 closed questions. The accuracy and completeness of the answers are assessed. Each question is graded on a 10-point scale, and the average is calculated.                   |

| Author (-s)                                   | Publishing year                                                                                                                                                                                                                                                                                                                 | Title                                                                                                  | Issue of a periodical or volume of a publication | Publishing house or web link     |
|-----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|--------------------------------------------------|----------------------------------|
| Required reading                              |                                                                                                                                                                                                                                                                                                                                 |                                                                                                        |                                                  |                                  |
| IOT-OPEN.EU Consortium                        | 2025                                                                                                                                                                                                                                                                                                                            | IOT-OPEN.EU Reloaded: A Coursebook Introduction to the IoT, 2nd Edition                                |                                                  | IOT-OPEN.EU Reloaded Consortium  |
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| Recommended reading                           |                                                                                                                                                                                                                                                                                                                                 |                                                                                                        |                                                  |                                  |
| Schwartz M.                                   | 2016                                                                                                                                                                                                                                                                                                                            | Internet of Things with ESP: Build amazing Internet of Things projects using the Espressif Wi-Fi chip  |                                                  | Packt Publishing Ltd.            |
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| Vermesan O.,<br>Friess P. | 2013                                                                                                                                                                                                                                                                                                                      | Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems    |  | River Publishers                 |
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| TechTarget website        |                                                                                                                                                                                                                                                                                                                           | Internet of Things (IoT).                                                                       |  |                                  |
|                           | <a href="https://www.techtarget.com/iotagenda/definition/Internet-of-Things-IoT">https://www.techtarget.com/iotagenda/definition/Internet-of-Things-IoT</a>                                                                                                                                                               |                                                                                                 |  |                                  |
| Madiseti V., & Bahga A.,  | 2014                                                                                                                                                                                                                                                                                                                      | “Internet of Things (A Hands-on-Approach)”, 1st Edition,                                        |  | Arshdeep Bahga & Vijay Madiseti, |
| McEwe A.                  | 2014                                                                                                                                                                                                                                                                                                                      | Designing the Internet of things.                                                               |  | John Wiley & Sons                |
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| Halvorsen H.P.            | 2019                                                                                                                                                                                                                                                                                                                      | Programming with Arduino                                                                        |  | Hans-Petter Halvorsen            |