***Annex 1***

*Recommended template: “Course Description, Syllabus, Course Requirements”*

# course syllabus and course requirements academic year 2022/2023 semester 1

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| --- | --- |
| Course title | 5G |
| **Course Code** | **SZB083AN** |
| **Hours/Week: le/pr/lab** | **2 practices** |
| **Credits** | **2** |
| **Degree Programme** | **Electric Engineer** |
| **Study Mode** | **Daily** |
| **Requirements** | **Mid-term mark** |
| **Teaching Period** | **14 weeks** |
| **Prerequisites** | **-** |
| **Department(s)**  **Course Director** | **Department of Automation**  **Dora Maros PhD** |
| **Teaching Staff** | **Dora Maros PhD** |
| **Hours/Week: le/pr/lab** | **2** |
|  |  |

# course description

*A short description of the course (max. 10 sentences).*

*Neptun: Instruction/Subjects/Subject Details/Basic data/Subject description*

The use of advanced mobile technologies is now indispensable not only in our daily lives, but also in industrial, commercial and financial applications. Currently, the latest generation, i.e. 5G, networks are rapidly spreading around the world, which changes the application possibilities in several aspects, not only in IT, but also in electrical engineering applications. So, it is very important to acquaint students with the latest mobile technologies and their application, especially with regard to 5th generation mobile networks.

# syllabus

*Neptun: Instruction/Subjects/Subject Details/Syllabus*

## **goals and objectives**

*Goals, student learning outcome.*

*Neptun: Instruction/Subjects/Subject Details/Syllabus/Goal of Instruction*

An overview of the development of mobile technologies, with special regard to the development of QoS (Quality of Service). Description and role of today's broadband technology in M2M (Machine to Machine) and IoT (Internet of Things) communication.

Current and future analysis of the spread of 5G networks, development of 3GPP standardization, 5G concepts. Future visions for 5G application, network design, cellular layout and frequency bands. he role of 5G in the sustainable development of the future: autonomous cars, intelligent transport, e-energy, smart cities and homes, e-health, etc. The development of VR, AR and artificial intelligence in relation to 5G.

## **course content**

*Neptun: Instruction/Subjects/Subject Details/Syllabus/Subject content*

|  |  |
| --- | --- |
|  | TOPICS |
| PRACTICE | 1. *Introduction to mobile technologies* 2. *Development of mobile networks, frequency bands and access technologies* 3. *Structure of 5G networks, standards* 4. *Characteristics of 5G radio transmission* 5. *5G Qos and application classes* 6. *IoT and 5G* 7. *The role of AI in 5G services* 8. *5G applications* |

### **DETAILED SYLLABUS AND COURSE SCHEDULE**

### *academic holidays included*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| PRACTICE, LABORATORY PRACTICE | | | | |
| week | **Topic** | **Compulsory reading; page number**  **(from … to …)** | **Required tasks (assignments, tests, etc.)** | **Completion date, due date** |
| 1. | 09.09 Introduction to mobile technologies (2-5G), characteristics of mobile generations and their application | Presentation for the curriculum delivered in class. | - |  |
| 2. | 09.16 Development of mobile networks, their standards, standardisation organisations, standards, proliferation of networks. | Presentation for the curriculum delivered in class. |  |  |
| 3. | 09.23 Applied frequency bands, access and duplexing technologies, modulations, problems with radio transmission (pathloss, fading, ISI, etc.), error detection and error correction on the radio channel. | Presentation for the curriculum delivered in class. |  |  |
| 4. | 09.30 Introduction to 5G networks, QoS triangle, features and applications of service groups, application of 5G in industrial environments: broadband, MMTC, mission critical KPIs and their comparison. | Presentation for the curriculum delivered in class. |  |  |
| 5. | 10.07 Structure of 5G networks, antenna solutions, cell organization, core network, network slicing | Presentation for the curriculum delivered in class. |  |  |
| 6. | 10.14 Network and mobility management (location update, handover, registration, attach/detach), databases (HSS, EIR, VLR) and their functions | Presentation for the curriculum delivered in class. |  |  |
| 7. | 10.21 MIK professional day mandatory participation |  |  |  |
| 8. | 10.28 5G and IoT networks. Layers of IoT networks (Sensor, Communication, Management, Application), their characteristics and tasks, mesh network structures, examples and applications, IOT Smart Cities, ITS, smart grid, etc. applications | Presentation for the curriculum delivered in class. |  |  |
| 9. | 11.04 Spring break |  |  |  |
| 10. | 11.11 Security of 5G networks, application of AI in services | Presentation for the curriculum delivered in class. |  |  |
| 11. | 11.18 Application of 5G in industry and transport, smart cities, smart energy, self-driving cars, etc. | Presentation for the curriculum delivered in class. |  |  |
| 12. | 11.25 Presentation of project work |  | Project presentations |  |
| 13. | 12.02 Presentation of project work |  | Project presentations |  |
| 14. | 12.09 Online teszt és a félév értékelése |  |  |  |
| 15. | 12.16 Replacement |  | - |  |

## **assessment and evaluation**

*(Neptun: Instruction/Subjects/Subject Details/Syllabus/Examination and Evaluation System)*

##### **Attendance**

*In accordance with the Code of Studies and Examinations of the University of Pécs, Article 45 (2) and Annex 9. (Article 3) a student may be refused a grade or qualification in the given full-time course if the number of class absences exceeds 30% of the contact hours stipulated in the course description.*

***Method for monitoring attendance*** *(e.g.: attendance sheet / online test/ register, etc.)*

Attendance sheet.

##### **assessment**

*Cells of the appropriate type of requirement is to be filled out (course-units resulting in mid-term grade or examination). Cells of the other type can be deleted.*

Course resulting in mid-term grade (PTE TVSz 40§(3))

**Mid-term assessments, performance evaluation and their ratio in the final grade** (The samples in the table to be deleted.)

|  |  |  |
| --- | --- | --- |
| **Type** | **Assessment** | **Ratio in the final grade** |
| *Project presentation* | *max 50 points* | *50%* |
| *Test* | *max 50 points* | *50%* |

**Opportunity and procedure for re-takes** (PTE TVSz 47§(4))

*The specific regulations for improving grades and resitting tests must be read and applied according to the general Code of Studies and Examinations. E.g.: all tests and assessment tasks can be repeated/improved at least once every semester, and the tests and home assignments can be repeated/improved at least once in the first two weeks of the examination period.*

Presentation and test replacement is possible in the last week (week 15.9 of the learning period and in the first week of the exam period.

## **Specified literature**

*In order of relevance. (In Neptun ES: Instruction/Subject/Subject details/Syllabus/Literature)*

##### **compulsory reading and availability**

Current presentation materials uploaded to MS Teams in ppt format.

##### **recommended literature and availability**

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