SYLLABUS
COURSE DESCRIPTION YEAR 2024/2025

COURSE TITLE	**Mobile and Physical Systems**
COURSE CODE	76254
SCIENTIFIC SECTOR	INF/01
DEGREE	Bachelor in Computer Science
SEMESTER	1st
YEAR	3rd
CREDITS	12
MODULAR	Yes

TOTAL LECTURING HOURS	80
TOTAL LAB HOURS	40
ATTENDANCE	Attendance is not compulsory, but highly recommended as many labs require an adequate software and hardware infrastructure; non-attending students may contact the lecturer at the start of the course to get support on the modalities of the independent study
PREREQUISITES	Students should have done the following courses: Software Engineering
COURSE PAGE	Teams

SPECIFIC EDUCATIONAL OBJECTIVES	• Type of course: "attività formativa caratterizzante" • Scientific area: "informatica" **MODULE 1 Engineering of Mobile Systems**: Students will learn the key concepts of mobile application development and the internet of things. Practical experience will be gained by using state of the art technologies for the development of mobile applications. Upon completion of the course, students shall have acquired expertise in writing mobile applications that leverage advanced mobile APIs and connect to outside web services, and shall be aware of the various trade-offs in the development of mobile applications. **MODULE 2 Physical Computing Project**: By building an idea, designers are challenged to "build to think" and thus gain deeper insights. This course will go beyond early physical prototyping and show how to implement smart sensing devices that can be used to control an interactive environment (e.g., game). Participants will learn basic electronics, microcontroller programming, and physical prototyping using the Arduino/ESP32 platform, then use digital

	and analog sensors which results in a next-generation controller, e.g., in combination with Unity. Therefore, students will gain a profound understanding of sensor technologies as well as a broad overview of how to design and implement a 3d environment

MODULE 1	**Engineering of Mobile Systems**
MODULE CODE	76254A
MODULE SCIENTIFIC SECTOR	INF/01
CREDITS	6
LECTURER	Pretto Niccolò
SCIENTIFIC SECTOR OF THE LECTURER	INF/01
TEACHING LANGUAGE	English
OFFICE HOURS	By previous email appointment: niccolo.pretto@unibz.it - Office POS 1.16, first floor, Faculty of Engineering or - Office A1.4.29e, fourth floor, NOI Techpark Thursday from 10.00 to 12.00
TEACHING ASSISTANT	Same as lecturer
OFFICE HOURS	-
LIST OF TOPICS COVERED	• Functional and declarative programming • Design of mobile applications • Frameworks and platforms for mobile development • Data and resource management in a mobile context • Mobile device sensors • Internet of Thing
TEACHING FORMAT	Frontal lectures, labs, projects.

MODULE 2	**Physical Computing Project**
MODULE CODE	76254B
MODULE SCIENTIFIC SECTOR	INF/01
CREDITS	6
LECTURER	Haller Michael

SCIENTIFIC SECTOR OF THE LECTURER	INF/01
TEACHING LANGUAGE	**German**
OFFICE HOURS	By previous email appointment: michael.haller@unibz.it Office POS 1.16, first floor, Faculty of Engineering Friday from 12.00 to 14.00
TEACHING ASSISTANT	Same as lecturer
OFFICE HOURS	-
LIST OF TOPICS COVERED	• Introduction to interaction design for physical computing • Physical computing hardware for interactive solutions • Physical computing software for interactive solutions • Ideation and conceptualisation of physical computing solutions • Development of physical computing solutions • Evaluation of physical computing solutions
TEACHING FORMAT	Frontal lectures, labs, projects.

LEARNING OUTCOMES	**Knowledge and understanding:** • To have a knowledge and methodologies of software design and development in the mobile environment. **Applying knowledge and understanding:** • Be able to develop small and medium size programs using different programming languages and paradigms. • Be able to solve problems using programming methodologies. • Be able to develop Mobile applications. • Be able to select and apply innovative technologies and methods that are appropriate for a given context and problem. **Ability to make judgments:** • Be able to collect and interpret useful data and to judge information systems and their applicability. • Be able to work autonomously according to the own level of knowledge and understanding. • Be able to take the responsibility for development of projects or IT consulting. **Communication skills:** • Be able to use one of the three languages English, Italian and German, and be able to use technical terms and communication appropriately. • Be able to use modern communication systems, even at a distance. • Be able to work in teams for the realization of IT systems.

	Ability to learn: • Have developed learning capabilities to pursue further studies with a high degree of autonomy. • Be able to follow the fast technological evolution and to learn cutting edge IT technologies and innovative aspects of last generation information systems.

ASSESSMENT	Final exam: the exam covers the topics addressed in MODULE 1 and MODULE 2 and consists of two parts: • MODULE 1 (50% of the final exam): The assessment is based on two components: - An oral exam. - A project work in which students will design and develop a mobile application for addressing a practical problem. The project will be submitted in a git repository provided by the lecturer, described in a report, and presented during the oral exam. In case of a positive mark, the project will count for all 3 regular exam sessions. Projects must be submitted at least a week BEFORE the exam, otherwise the student cannot access to the oral exam. • MODULE 2 (50% of the final exam): The major activity of the class is centered around a group project (in pairs of two), but there will be individual assignments early in the semester. The goal of these assignments is to ensure everyone in the class gains experience and understanding of the design and implementation of a novel input controller, without which creating an interesting and sophisticated project (next-generation controller) will be difficult.
ASSESSMENT LANGUAGE	English (Module 1) German (Module 2)
EVALUATION CRITERIA AND CRITERIA FOR AWARDING MARKS	The exam is evaluated based on correctness of projects, answers, clarity of answers, ability to summarize, evaluate, and establish relationships between topics, skills in critical thinking, quality of argumentation, problem solving ability. In order pass the exam, the students should get at least 18/30 in each module. The mark related to each part contributes to the final grade as follows: • MODULE 1: 50% 70% project work and 30% oral exam. Need to pass project work to access to oral exam. Project work assessment: provide working solutions; adhere to good programming practices and styles. Oral exam: clarity of answers and project presentation; being able to master the terminology of the course; being able to solve problems related to mobile applications or summarize theoretical concepts.

	• MODULE 2: 50% Each student group is provided with a physical computing kit including an Arduino/ESP32 compatible board as well as everything needed to learn how to use sensors and actuators and how to combine it with 3rd party tools (e.g. Unity). Through hands-on experiences during class periods, students acquire basic skills and learn to build a range of typical circuits that will communicate to Unity. Along with basic skill acquisition, students are involved in a semester-long group assignment in which they develop a complex project from start to finish. Students are encouraged to quickly arrive at a working prototype at which point they can fine-tune their project through testing. At the end of the semester, the projects are presented to the rest of the class

REQUIRED READINGS	• Lecture slides and notes • Lab exercise slides and notes
SUPPLEMENTARY READINGS	MODULE 1: • David Griffiths, Dawn Griffiths; Head First Android Development, 3rd Edition. O'Reilly Media, Inc, 2021. ISBN: 9781492076520 • Bryan Sills, Brian Gardner, Kristin Marsicano, and Chris Steward; Android Programming: The Big Nerd Ranch Guide, 5th Edition. Big Nerd Ranch LLC, 2021. ISBN-13: 9780137645732 MODULE 2: • Peter Marwedel; Embedded System Design. Embedded Systems Foundations of Cyber-Physical Systems, and the Internet of Things, 2021. ISBN: 9783030609108
SOFTWARE USED	MODULE 1 Different platforms and development tools will be used. The students mainly use Android Studio developing in Kotlin, Java and C++. Visual Studio Code, React Native and Expo will be also presented as multi-platform alternative. MODULE 2: Different microcontrollers and microelectronics kits are used. Only participant students, who attend classes, can use them during class time. Moreover, we will mainly use ProtoPie, Visual Studio Code, Unity and the Arduino IDE, all of which are available for the students. Further information is provided on the course page