Syllabus

Descrizione corso

Titolo insegnamento	Flexible Electronics: From Materials to Systems and Applications
Codice insegnamento	46060
Titolo aggiuntivo	
Settore Scientifico-Disciplinare	IINF-01/A
Lingua	Inglese
Corso di Studio	Corso di Dottorato di ricerca in Advanced-Systems Engineering
Altri Corsi di Studio (mutuati)	
Docenti	dr. Zina Fredj Ep Tej, Zina.FredjEpTej@unibz.it https://www.unibz.it/en/faculties/engineering/academic-staff/person/52392
Assistente	
Semestre	Secondo semestre
Anno/i di corso	1
CFU	3
Ore didattica frontale	30
Ore di laboratorio	0
Ore di studio individuale	15
Ore di ricevimento previste	
Sintesi contenuti	The course is a specialized course in the interdisciplinary area of physics, material science, chemistry, biology, biotechnology, and electronics, addressing the implementation of flexible electronics technologies. It is designed to acquire knowledge in flexible electronics device technology, from materials and fabrication processes, to devices, systems, and applications, including state of the art and the status of commercialization.
Argomenti dell'insegnamento	1. Flexible electronics: general introduction - Historical background

	- Materials, devices, systems, applications - Fabrication techniques - Unique aspects, status in the field and trends 2. Thin-film microfabrication techniques - Basics and fundamentals - Deposition and structuring methods 3. Printing techniques - Basics and fundamentals - Fluid formation and rheology for printing - Inks and printing techniques - Additional coating and structuring methods 4. Thin-film transistors and circuits - Thin film transistors (TFTs) - Device operation, materials, and structures - Device characterization and performance - UNIBZ's case study: sub-micrometer Indium-Gallium-Zinc-Oxide TFTs and spray-coated carbon nanotube TFT - Thin film circuits - From transistors to circuits - Digital and analog circuits 5. From thin-film transistors to biosensors - Transistors-based sensors - Principles and fundamentals - Examples - Unibz's case study: electrolyte-gated field effect transistors and organic electrochemical transistors 6. Applications - Examples applications from academia and industry
Parole chiave	Flexible electronics; printed electronics; stretchable electronics; organic electronics; functional materials; flexible substrates; conductive polymers; nanomaterials; thin films; fabrication techniques; additive manufacturing; device integration; flexible sensors; wearable devices; electronic skin; energy harvesting; biomedical applications; commercialization.

Prerequisiti	
Insegnamenti propedeutici	
Modalità di insegnamento	Digital format (provided on teams) divided in: - Theoretical lectures using: - Slides - Videos - Practical exercises: - Use of softwares (e.g., Origin, Corel) for data analysis and plotting. - Projects & assignments: - Informal discussions on presentations and scientific papers - Preparation of short papers based on literature review
Obbligo di frequenza	Preferred
Obiettivi formativi specifici e risultati di apprendimento attesi	The specific educational objectives are to: - Acquire basic understanding and knowledge of printing and microfabrication technologies. - Acquire basic understanding and knowledge of device operation mechanisms (especially for what concerns thin-film transistors and transistor-based sensors).
Obiettivi formativi specifici e risultati di apprendimento attesi (ulteriori info.)	
Modalità di esame	A project work developed by the student will be assessed: presentation and discussion of a topic related to the contents of the course agreed between lecturer and students.
Criteri di valutazione	Quality of the presentation and engagement in the practical project.
Bibliografia obbligatoria	assigned in class
Bibliografia facoltativa	Bibliography: • “Organic Flexible Electronics: Fundamentals, Devices, and Applications”, P. Coseddu and M. Caironi, Elsevier, 2020. • “Organic and Amorphous-Metal-Oxide Flexible Analogue Electronics”, V. Pecunia, M. Fattori, S. Abdinia, H. Sirringhaus, and E. Cantatore, Cambridge Elements, 2018. • “Organic and Printed Electronics: Fundamentals and Applications”, G. Nisato, D. Lupo, S. Ganz, CRC Press,

	2016. • “Large Area and Flexible Electronics”, M. Caironi and Y.Y. Noh, WILEY-VCH, 2015. • “Flexible Electronics: Materials and Applications”, W. S. Wong, A. Salleo, Springer, 2009.
Altre informazioni	
Obiettivi di Sviluppo Sostenibile (SDGs)	Istruzione di qualità