ΤΜΗΜΑ ΜΗΧΑΝΙΚΩΝ ΣΧΕΔΙΑΣΗΣ ΠΡΟΪΟΝΤΩΝ ΚΑΙ ΣΥΣΤΗΜΑΤΩΝ
DEPARTMENT OF PRODUCT AND SYSTEMS DESIGN ENGINEERING

ΟΔΗΓΟΣ ΣΠΟΥΔΩΝ

COURSE GUIDE

2023-2024

ΠΑΝΕΠΙΣΤΗΜΙΟ ΔΥΤΙΚΗΣ ΜΑΚΕΔΟΝΙΑΣ
ΠΟΛΥΤΕΧΝΙΚΗ ΣΧΟΛΗ

UNIVERSITY OF WESTERN MACEDONIA
SCHOOL OF ENGINEERING

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ΑΚΑΔΗΜΑΪΚΟ ΕΤΟΣ 2023-2024
ACADEMIC YEAR 2023-2024

ΚΟΖΑΝΗ, ΣΕΠΤΕΜΒΡΙΟΣ 2023

www.ide.uowm.gr

1. Course guide

Course Program

The aim of the Department is the study of the holistic design of products and systems, which begins with the conception of the idea and results in the completion of the finished product. It is also the methodical, multidisciplinary approach to the design, implementation, technical management, and operation of a production system.

It is thus directly related to the concept of Industrial Design and includes the imprinting and designing of geometry (CAD), the selection of materials, the production organization, the digital guidance of machine tools (CNCs), the technical study of strength, the interfacing and interactivity issues in the case of digital systems as well as market research and product identity processes.

Duration of study

The minimum possible duration of studies is 10 semesters. Each semester includes at least 13 full weeks of instruction. The workload required to successfully complete the study program and receive the diploma corresponds to 300 ECTS, including the thesis, which corresponds to 30ECTS.

Types and Categories of Courses

The Course Program includes the following types/categories of courses:
Mandatory (Y). The Course required to have secured a passable grade in order to complete enrollment for a Diploma.
Mandatory Choice of Direction (YEK). Elective course with specific restrictions (obligations) in relation to the known directions. *[Obligation to have secured a passable grade for nine (9) YEK courses of which one (1) Project per direction* and four (4) YEK belong to one direction and of (2) two YEK in each of the remaining two directions [(1+4)+2+2].*
** Project in the design of interactive systems (first direction)*
** Project in product design and manufacturing (second direction)*
** Project in system design (third direction)].*
Free Choice (EE). When selected and secured a passable grade, are accumulated in order to gather the necessary ECTS for the Diploma.

Courses

Semester 1

COURSE	CODE	TYPE	ECTS	THEORY	LABORATORY
History of Design	**1201**	Y	6	3	0
Studio 1 - Technical Drawing	**1202**	Y	6	0	4
Computer Science	**1101**	Y	6	2	2
Design Theory and Methodologies	**1203**	Y	6	3	0
Mathematics I	**1001**	Y	6	3	0

Semester 2

COURSE	CODE	TYPE	ECTS	THEORY	LABORATORY
Studio 2 - Freehand Drawing & Colour	**1204**	Y	6	0	4
Design Terminology in English	**1002**	Y	2	3	0
Mathematics II	**1003**	Y	6	3	0
Methodologies and Technologies of Programming	**1102**	Y	6	2	2
Introduction to Materials Science	**1004**	Y	6	3	0
Ergonomics	**1205**	Y	4	3	0

Semester 3

COURSE	CODE	TYPE	ECTS	THEORY	LABORATORY
Introduction to Computer Aided Design (CAGD)	**2201**	Y	6	3	0
Studio 3 - Ideation	**2202**	Y	6	2	2
Production and operation management	**2301**	Y	6	3	0
Probability - Statistics	**2001**	Y	6	3	0
Algorithms and Data Structures	**2101**	Y	6	3	0

Semester 4

COURSE	CODE	TYPE	ECTS	THEORY	LABORATORY
Studio 4 - Concept Design	**2203**	Y	6	2	2
Materials Technology	**2002**	Y	6	3	0
Computer Aided design (CAD)	**2204**	Y	6	3	0
Human-Computer Interaction	**2205**	Y	6	3	0
Production Management	**2302**	Y	6	3	0

Semester 5

COURSE	CODE	TYPE	ECTS	THEORY	LABORATORY
Engineering Mechanics	**3001**	Y	6	3	0
Studio 5 - Product Design I	**3201**	Y	6	2	2
Operational Research	**3301**	Y	6	3	0
Design of Information Systems	**3101**	Y	6	3	0
Marketing	**3302**	Y	6	3	0

Semester 6

COURSE	CODE	TYPE	ECTS	THEORY	LABORATORY

Interaction Design	**3202**	Y	6	3	0
Studio 6 - Product Design II	**3203**	Y	6	2	2
Computer Integrated Manufacturing	**3303**	Y	6	3	0
Computer Aided Analysis and Manufacturing (CAE/CAM)	**3204**	Y	6	3	0
Computer Graphics	**3102**	Y	6	3	0

Semester 7

COURSE	CODE	TYPE	ECTS	THEORY	LABORATORY
Machine Elements	**4003**	Y	6	3	0
Reaserch Methodology	**4004**	Y	6	3	0
K1- Advanced Interaction Technologies and Applications	**4101**	YEK1	6	3	0
K1- Image processing	**4102**	YEK1	6	3	0
K1- Fuzzy Logic Systems	**4103**	YEK1	6	3	0
K2-Computational Design and Biomimetics in product design	**4201**	YEK2	6	3	0
K2-Sustainable Design and Circular Economy	**4202**	YEK2	6	3	0
K2- Exhibition and Interior Design	**4203**	YEK2	6	0	3
K2-Special Topics in Computer Aided Design	**4205**	YEK2	6	3	0
K3- Introduction in Mechatronics	**4301**	YEK3	6	3	0
K3-Special topics in Material Science	**4303**	YEK3	6	3	0
K3- Consumer Behavior and Marketing Research	**4311**	YEK3	6	3	0
K3 - Education in Environmental Issues	**4312**	YEK3	6	3	0
Craft and Street Art	**5201**	EE	6	0	3
Advanced Materials for Eco-friendly Applications	**5001**	EE	6	3	3
Web Design and Programming	**5101**	EE	6	3	0
Entrepreneurship and Innovation	**5309**	EE	6	3	0
Introduction to Macroeconomic Theory (Department of Economic Sciences)	**5401**	33	6	3	0

Semester 8

COURSE	CODE	TYPE	ECTS	THEORY	LABORATORY

K1-Design and Applications Programming for Mobile Devices	**4104**	YEK1	6	3	0
K1-Virtual and Augmented Reality	**4105**	YEK1	6	3	0
K1-Artificial Intelligence	**4106**	YEK1	6	3	0
K2-Packaging Design	**4206**	YEK2	6	3	0
K2-Special Topics in Design and Manufacturing Simulation	**4207**	YEK2	6	3	0
K2-Engineering and Materials Design	**4204**	YEK2	6	3	0
K2-Prototyping for Product Design Engineers	**4210**	YEK2	6	0	3
K2-The teaching of Robotics, STEAM and New Technologies	**4212**	YEK2	6	3	0
K2- Design of Wearable Products	**4211**	YEK2	6	0	3
K3- Supply Chain Management	**4306**	YEK3	6	3	0
K3-Maintenance and Reliability of Systems	**4302**	YEK3	6	3	0
K3-Design of Services	**4309**	YEK3	6	3	0
Introduction to Animation	**5202**	EE	6	0	3
Robotics and Digital Fabrication	**5203**	EE	6	3	0
Design for all	**5302**	EE	6	3	0
Complexity of Design Processes	**5303**	EE	6	3	0
Information Design	**5304**	EE	6	3	0
Special topics in Mechatronics	**5305**	EE	6	3	0
Brand Building and Brand Management	**5307**	EE	6	3	0
Modern Architectural Design	**5209**	EE	6	3	0
Microeconomic Analysis (Department of Economic Sciences)	**5402**	EE	6	3	0

Semester 9

COURSE	CODE	TYPE	ECTS	THEORY	LABORATORY
K1-Project in the Design of Interactive Systems	**4107**	YEK1	6	0	4
K1 - Computer Vision	**4108**	YEK1	6	3	0
K1-Machine Learning	**4109**	YEK1	6	3	0
K2-Project in Product Design and Manufacturing	**4208**	YEK2	6	0	4

K2-Furniture and Wooden Product Design	**4209**	YEK2	6	3	0
K3-Algorithm Optimization	**4304**	YEK3	6	3	0
K3-Project in Systems Design	**4307**	YEK3	6	0	4
K3-Total Quality Management	**4305**	YEK3	6	3	0
K3-Motion design methods and autonomous moving units	**4308**	YEK3	6	3	0
K3-Decision Support Systems	**4310**	YEK3	6	3	0
Digital Games and Game-based Learning	**5102**	EE	6	3	0
Natural language processing	**5103**	EE	6	3	0
Transportation Planning	**5308**	EE	6	3	0
Automotive Design	**5205**	EE	6	0	3
Graphic Design	**5206**	EE	6	3	0
Traditional Popular Arts	**5207**	EE	6	0	3
Digital Cultural Heritage	**5208**	EE	6	3	0

Semester 10

COURSE	CODE	TYPE	ECTS	THEORY	LABORATORY
Diploma Thesis	**5001**	Y	**30**	**0**	**0**

Course Content

Semester 1

History of Design

This course will provide you with an overview of the historical context of design and introduce you to the core principles and theories that underpin design history. At the conclusion of this course, you will understand the relevance and purpose of the study of history to the practice of design in relation to your own developing design practice. Design is ubiquitous and infiltrates everyday life via its many forms, including design objects, environments, processes and systems. But, how did we get here? Practicing designers need to understand that design does not operate in a closed loop, rather that it is contingent on the wider context of the world we live in and, importantly, it's historical precedence.

This course introduces you to the ways in which design artefacts are shaped by, and understood within, ranging historical frames and narratives. Through a series of tasks, you will explore the various trajectories of design history theory and, through applied academic research skills, demonstrate the contingency of historical understanding and knowledge in relation to design practice.

The course "History of Design" proposes a sequence of knowledge from the wider field of the history of cultures and arts. Students are asked to find answers to questions such as: what is the social context of specific works from different art eras, what is their meaning in a specific historical context, what is the relationship of the works with humans and what needs do they seek to cover the projects. Through the deepening of the historical environment, the social and political contexts, the aesthetic choices, the understanding

of the intentions and methods related to the design of objects, graphic arts products and interiors is attempted.

Studio 1 - Technical Drawing
Student start by drawing simple geometric shapes and thus learn to use drawing instruments. Then they are introduced in more abstract concepts, such as those of scale and the performance of space in a geometric way (ie plan, section, view, axonometric). In addition, they understand graphical projection techniques, as well as that the right and quality design are the main axes of the course. The course "STUDIO 1_TECHNICAL DRAWING" organized in two sections: A. introduction to basics of technical drawing skills for drawing basic geometric shapes, β. graphical projection techniques (Perspective and Parallel projection -Isometric and Orthographic drawings). The content of the course is as follows: Section A: 1. Introduction to Technical drawing and its significance in industry. Description of Instruments used in technical drawing and their use, 2. International design standards and regulations: paper size, line types and their application, 3. International design standards and regulations: Lettering and numbering and scaling, 4. Drawing of basic geometric shapes. Section B: 1. Methods for representing shapes in plane, 2. Orthographic projection method; Definition, significance and drawing applications, 3. Isometric projection method; Definition, significance and drawing applications, 4. Perspective projection method; Definition, significance and drawing application, 5. Section design; Definition, type of sections, conventions used in section drawing, 6. Dimensions. Teaching is developed at two levels, theoretical and practical. There is a number of theoretical lectures and preparation of laboratory exercises applying the respective topics.

Computer Science
The course attempts an introduction to the field of computer science with an emphasis on their use for problem solving. The aim of the course is to introduce students to basic concepts of software technology and algorithmic thinking. In particular, in terms of computer problem solving, concepts such as algorithms, programming languages, elements of a program (variables, operations, operators), program architecture (functions), control structures and iteration structures, programming methods, data analysis, simulations and graphical representations are presented. The MATLAB / Octave programming environment and programming language is used as the main platform for program development and information processing. The content of the course is as follows: Introduction to MATLAB, Vectors and Matrices, Introduction to MATLAB programming, Selection Statements, Loop statements and Vectorizing code, MATLAB programs, String manipulation, Data structures

Design Theory and Methodologies
The main axis of the course attempts to cover ontological and epistemological aspects of the design process. The second axis is based on combining and applying different methods to exploring a topic, developing ideas, evaluating, etc. In the third axis, the existing approaches to three-dimensional modeling and product development are analysed taking into account the production process. The following methods for modeling products and systems will be studied: aesthetic and functional product analysis, morphological analysis and optimization of complex systems, holistic view of the product development cycle, support for collaboration between design teams / engineers.

Mathematics I

The purpose of this course is to introduce the student to the notions and techniques of Linear Algebra and Differential/ Integral Calculus. The student learns to handle problems concerning matrices, determinants, linear systems, derivatives and integrals of real functions of a single real variable. Various problems related to the above subjects are examined. Course contents: Matrices: Basic operations on matrices(sum, scalar product, matrix product and its properties, inversion of a matrix, characteristic polynomial and characteristic values), Determinants: The notion of determinant, calculation of determinants, properties of determinants and applications, Linear Systems, Derivative of a real function of a single real variable, tangent equation at a point of a curve, applications, Integral of a real function of a single real variable (integration methods, definite integral and applications).

Semester 2

Studio 2 - Freehand Drawing & Colour

The course "Studio 2 – Drawing - Color" introduces the students to the representation of a subject with a free hand, ie without the help of geometric instruments, capturing real objects in correct proportion and scale, following the rules of linear perspective. The course is based on the investigation of the student's visual perception through the creative observation, analysis and synthesis of the relationships of the space that surrounds us. The objective of the course is to train the student to see, to observe and not just to look. To be able to finally realize three-dimensional forms through tone, light, texture and shadow, and finally to become familiar with color techniques and to acquire design skills.

Design Terminology in English

The course aims at enabling students to acquire the theoretical and practical background in English for Product & Systems Design Engineers and develop the skills required to understand and use scientific and academic English texts (e.g. papers, manuals, bibliography, etc.). The content of the course is as follows: TEXTS: Industrial Design, Elements & Principles of Design, Materials I: Metals, Materials II: Plastics, CAD, 3D Modelling, Prototyping, Brand Identity & Iconic Design, Manufacturing Processes, Packaging. GRAMMAR: Tenses in academic discourse (revision), Comparisons, Relative clauses, Passive Voice, Gerunds – Infinitives.

Mathematics II

The purpose of this course is to complete the student the basic Mathematical Knowledge, essential to manipulate problems concerning the scientific subject of the Department of Product and Systems Design Engineering. The content of the course is as follows: Functions of two or more variables, Differential Calculus: Partial derivatives and total differential of functions of more than one variable, Taylor expansion of a function, Complicated Functions, Laplace and Cauchy equations, Extremities, Exercises. Integral Calculus: double and triple integrals, properties and applications. Differential Equations: ordinary differential equations of 1st and 2ed order, Exercises

Methodologies and Technologies of Programming

The aim of this course is to enrich students' knowledge of basic programming principles, good software development practices and the ability to use software libraries to solve specialized problems. For this purpose, the use of Python was chosen, which is a powerful and rapidly evolving programming language, capable to function as an introductory programming language but also to offer a reliable and almost universal software development tool. Its open character has contributed to the existence and continuous development of software libraries pertaining to it for all areas of interest (graphics, data analysis, artificial intelligence, web programming, distributed programming, etc.). The content of the course is as follows: An Introduction to Computing and Problem Solving, Core objects, Variables, Input and Output (string functions, Print Formatting, list Object), Structures that control Flow, Relational and Logical Operators, Decision structures, The while loop, The for loop, Lists, strings, tuples, dictionaries, Functions, User Defined Functions, Scope of Variables, Lambda Expressions, Object-Oriental Programming

Introduction to Materials Science

The course is the first contact of students with the subject of Materials Science and Technology. The aim of the course is to introduce students to the basic concepts of materials and to give them the best background so that they can attend the next courses in the field of materials. The content of the course is as follows: Introduction ,Atomic Structure and Bonds between Individuals, Basic Principles of Crystallography, The Structure of Crystalline Solids, The Structure of Polymers, Imperfections of Solids., Movement of atoms in materials, Mechanical Properties of Metals, Disorders and Mechanisms of Strengthening, Failure of materials.

Ergonomics

The "Ergonomics" course is an introduction to the basic concepts of the science of ergonomics and the elements of anthropometry with an emphasis on new product development. The content of the course is as follows: Introduction to Ergonomics: Definitions, objectives, fields of study, Ergonomic work analysis, Systems and senses of the human body, Muscular work and nervous control of movements, Anthropometry, Design of workplaces and product design, Work-related musculoskeletal disorders, Evaluating physical workload and lifting, Controls and displays, Design of human-machine interface, Lighting environment, Sound environment, Thermal environment.

Semester 3

Introduction to Computer Aided Design (CAGD)

The purpose of this course is to introduce the students to the computer aided design of products in two and three dimensions. The students acquire knowledge on design methodologies, geometric modelling and design of basic two-dimensional and three-dimensional geometric entities. The content of the course is as follows: Basic concepts of a CAD system, Preliminary concepts, Design tools, Tools for modifying a drawing, Dimensioning, Introduction to three-dimensional design, Tools for three-dimensional design, Shading and rendering, Printing of a drawing.

Studio 3 – Ideation

The Studio-3 course is an essential introduction to the creative design process through the practices proposed by the "Design Thinking" and "Development Concept" product and system design methodologies. It also presents in detail a series of tools for recording, editing and creating new design ideas. All tools are described for their operation, use and application in specific design problems.

The module "Studio 3 - Ideation" is a comprehensive reference of the "Design Thinking" methodology that provides solutions to design problems by approaching them, based on their solutions. This method is extremely useful in dealing with complex problems that are not strictly defined and are related to the understanding of human needs. The anthropocentric approach to this design methodology creates new design opportunities using appropriate tools that are described in detail in the section "Creative Ideation Tools". At the same time, it is mentioned the "Concept Design" procedures with the specific sections: a) Concept development (clarification of the problem, exploration of the problem, determination of design directions), b) Selection of Concept and c) Testing the Concept. The "Creative Ideation Tools" describe and analyze in detail methodologies that help the Design Engineer in finding and defining possible solutions and applications of problems in the design process. Specifically, the tools described in the course are: brainstorming, mind-map, mood-board, Design Scenario construction and deconstruction, storyboard, etc. The main goal of the course is also the development of skills in the representation of ideas in 2D and 3D space with the selective use of basic conceptual tools. Also, the proposed tasks are not aimed at a final product but, based on a goal, to capture a final prototype that meets the specifications set up in the description of the project with emphasis on the possible functionality of the product, usability and quality of the final result.

Production and operation management

The purpose of this course is to introduce the students to the processes and methods for the production and operation management. The topics covered in the course are related to critical decisions, which must be made before the start-up of the business and significantly affect its subsequent operation. The students are introduced to the following concepts: Classification of organization, Functions of business, Scientific management, Choice of business location, Design of production process, Material handling system, Human resource planning, Structure and work organization, Approaches to organization and management and Financial utility. The content of the course is as follows: Classification of organization, Functions of business, Scientific management, Choice of business location, Design of production process, Human resource planning, Material handling system, Structure and work organization, Approaches to organization and management

Probability - Statistics

The purpose of this course is to introduce the students to the Probability theory and the statistical data processing resulting from surveys. The content of the course is as follows: Basic concepts of statistics. Measuring scales - variable categories. Description of quality data. Charts - Frequency Tables - Percentages. Crosstabs Tables. Description of quantitative data. Data grouping. Histograms. Numeric descriptive measures. Chebyshev inequality. The normal distribution. Confidence intervals. Statistical Conclusion. Testing for the mean of a population. Testing for the means of two populations (independent

samples, paired samples). Ccombinatorics. Probability theorems. Conditional Probability. Distributions of continuous and distinct random variables.

Algorithms and Data Structures

An algorithm is a well-designed computational process that processes incoming data and produces results corresponding to solution of a particular problem. The aim of this course is to introduce students to the understanding of the complexity of algorithms in terms of processing speed and computational resource requirements (memory), to provide them with basic knowledge about the design data structures so that they can design algorithms that manage computer memory efficiently, and also to provide them with basic knowledge of techniques for designing efficient computational processes by studying classical problem-solving algorithms. The content of the course is as follows: Algorithm analysis, Asymptotic behavior of algorithms, Data structures (arrays, stacks, queues, binary trees, graphs), Sorting algorithms, The divide and conquer technique, Recursion, Searching in tree structures, The greedy method, Dynamic programming.

Semester 4

Studio 4 - Concept Design

The course "Studio 4 - Concept Design" is related to the implementation of a design project based on the ideas-solutions that were produced and evaluated based on the courses of the previous semesters "Design Theory and Methodology" and "Studio 3 - Idea". More specifically, the course is developed in three different areas of the design process, a) Development of product sketches, c) 3D modeling of products and photorealism and c) prototyping and manufacturing of products. The aim of the course is to integrate sections from the design theory and tools for the development and management of ideas into the functional use of traditional and new tools in order to create design products with an emphasis on functionality, usability and quality of the final object.

The course "Studio 4 - Concept Design" is divided into three main sections that aimed at completing holistic design projects. The first section deals with the theory and practice of digital product sketch. Emphasis is giving on the methodologies of creative sketch development in order to visualize ideas as two-dimensional designs in order to indicate possible forms, functions or applications for innovative products. The final function of sketches or forms is the further detection of solutions and assumptions concerning forms and functions of the final products. At the same time, a special mention is made to the use and importance of color in product design through applications and exercises examples. The second section aims at a brief presentation of the three-dimensional modeling of products and their photorealism.

This report summarizes the following elements: a) the process of using computers and special software to create virtual 3D or 2D models, b) the variety of CAD software that meet all the requirements and applications of the industry and c) emphasizes the role of three-dimensional modeling in the stage of creation and elaboration of the design idea (concept). The third section deals with the techniques of product prototyping and construction. Prototyping is a design method that uses physical or technical prototypes to study and test how a new product will be used, as well as how it looks like before the production. In general, the main features of prototyping (material replacement, iterations, prototype fidelity, audience and user interface) and the main uses of

prototyping (idea generation, testing by users, communication, design validation) are mentioned. Finally, through specific examples and exercises, prototyping techniques are presented: clay / paper modeling, maquette development, product gamification, wood and other natural materials constructions. Sub-objectives of the course are: Methodological design with emphasis on the implementation of design objectives, Introduction to design through understanding the needs and requirements of users, Introduction to conceptual design with emphasis on functionality, usability, aesthetic quality) and technical precision, capturing design ideas in three dimensions with traditional and new tools. Evaluation of ideas.

Materials Technology

The course is the training of students in the field of Materials Technology. It seeks to understand them in basic concepts of the mechanical properties of materials and aims to acquire the necessary knowledge to processing of materials. The aim of the courses is to understand the principles and context of the processing: structure - properties - performance of materials, the structure of the solids and the relationship between structure - morphology and behavior of their properties. The content of the course is as follows: Introduction to Materials Science and Technology, Mechanical Properties: Part One, Mechanical Properties: Part Two, Strain hardening and Annealing, Basic Principles of Solidification, Solid Solutions and Phase Equilibria, Strengthening with Dispersion and Diagrams, Dispersion through Transformation, Categories of materials and processes

Computer Aided design (CAD)

The purpose of this course is to introduce the students to the processes and methods for the computer aided design of products in three dimensions. The students are introduced to the three-dimensional design with the aid of computers. They acquire knowledge on the following concepts: design methodologies, geometric models, internal representation of solid geometric models, parametric design, assembly methodologies, representation of curves and surfaces, and rendering techniques. The content of the course is as follows: The product cycle, Introduction to CAD Systems, Curves, Surfaces, Geometric modeling, The solid geometric model, Methods for the internal representation of solids, Solid modeling systems

Human-Computer Interaction

Human-Computer Interaction (HCI) is concerned with the design, development and evaluation of interactive products and systems that effectively support humans in everyday activities, and the study of relevant phenomena that stem out of the interaction process. The content of the course is as follows: Introduction to Human-Computer Interaction (HCI), Human centered approach in HCI, Research and enquiry, literature survey, Design and prototyping with respect to HCI, Empirical evaluation of HCI systems.

Production Management

The purpose of this course is to introduce the students to the methods and algorithms used in the organization of a production process with the aim of its best possible operation. It includes methodologies for making administrative decisions with mathematical standards and quantitative methods. The students acquire knowledge on the following concepts: Configuration program production, Inventory management, Forecasting Methods, Scheduling projects and Queuing theory. A common feature of all

these problems is that their solution can be determined in detail, after first building a mathematical model or model that describes them. The content of the course is as follows: Forecasting, Inventory management, Stochastic inventory models, Probabilistic EOQ, Fixed time ordering, ABC Analysis, Project Management, Queuing theory.

Semester 5

Engineering Mechanics

Basic concepts of Statics, two-dimensional force and moment, resultants, force-couple systems, three-dimensional force and moment, equilibrium in 2 and 3 dimensions, free-body diagram, plane trusses, space trusses, frames and machines, centers of mass, moments of inertia, beams-shear force and bending moment diagrams, friction, normal and shear stress, allowable stress, normal and shear deformation, stress-strain diagram, brittle and ductile materials, strain energy, stress and strain components, Hooke's law, Axial stress, bending, shearing, combined loading and design, stress and strain transformations, principle stresses.

Studio 5 - Product Design I

Studio 5 – Product Design I is an introduction to the process of integrated product design while the project themes and structure place prioritize concept quality and the generation of high validity data to supply the process with. A condition for the above is the employment of methodologies relevant to activity observation as well as field research for the production of high validity original data that may support the identification of unmet user needs. With the completion of research and analysis the user groups, the context within which they operate and the object of design have been comprehended and analyzed to sufficient depth so as to draft a complete, organized and prioritized list of design specifications that summarize research findings, form a structure for the phase of ideation and act as evaluation criteria.

Innovation, creativity and breadth of experimentation is the aim in the phase of ideation where student teams will employ modern as well as traditional tools to generate an extensive idea pool for the solution of all issues that have been identified with the design specifications.

The aim of the synthesis of integrated design proposals is balancing the influence of aesthetics, functionality and technology on the experience of the user and the investigation of alternative strategies in solving the wider problem. Condition for the success of the phases of ideation and synthesis of preliminary designs is the extensive employment of physical and virtual prototyping to evaluate and further develop ideas and designs. In the end an essential goal of the course is to familiarize students with tackling complex problems that may have multiple solutions and the necessary levels of confidence and initiative.

Operational Research

The purpose of this course is to introduce the students to the processes and methods of operation research. The students are introduced to the following concepts: problem modeling, methods of optimization, linear programming, and decision analysis. The content of the course is as follows: Introduction and history of Operation Research, Overview of the Operation Research Modeling Approach, Linear Programming, Graphical

LP Solution, Simplex method, Integer Linear programming, Binary Integer Linear programming, Transportation problem, The assignment model, Decision Analysis.

Design of Information Systems
This course introduces methods and techniques used today for the development of large and complex Information Systems (IS), in addition to specific software technologies. In this context, a systematic overview of the process is presented, which includes the phases of analysis, design and implementation of an IS, and also the specifics and difficulties of the process are highlighted. Emphasis is placed on the object-oriented view of an IS and the Unified Modelling Language (UML) is presented as the standard language for object-oriented description, analysis and design of Information Systems. The students are introduced to the following concepts: Introduction to system analysis and design, Identification and analysis of requirements, Functional modeling with UML diagrams, Structural modeling with UML class diagrams, Behavior modeling, From analysis to design, Design of classes and methods, Implementation, testing and maintenance.

Marketing
The purpose of this course is to introduce the students to the marketing. Topics covered in the course include Marketing Philosophy, Concepts and Definitions of Marketing, Strategic Marketing Planning, Marketing Information System, Marketing Environment Analysis, Consumer Behavior Model, Market Segmentation, Marketing mix and the Marketing plan. The content of the course is as follows: Dimensions of marketing, Marketing Information system, Analysis of marketing environment, Customer behavior, Competitiveness, Market Segmentation, Strategic innovation and new product development, SWOT Analysis, Marketing Research, Marketing mix, Marketing plan: Strategies, plans and tactics. analysis, final stages of the survey.

Semester 6

Interaction Design
Interaction Design concerns itself with analyzing and modelling the structure of the composite dialogue that develops between actors/subjects and interactive artefacts (interactive objects, products and services). It also concerns the interactive activities and interrelations that co-develop based on the actual interaction. The understanding of this complex network of relations is afforded by the analysis of the interacting actors/subjects, their activities, the contexts that these take place and the technologies in use.
The primary goal of this course is the study of the aforementioned relations, to eventually transform to the design and development of interactive artefacts, systems and services that could potentially fulfil user needs and desires. The underlying theoretical background and the methods used in this course follow the human-centered design paradigm and current theories for the design of interactions.
However, the types of interaction, as well as the type of interactive products & systems being studied, are not restricted to computer-based examples. This is because the objective in the design of interactive products & systems is not only to optimize the technological system to be more flexible or usable, but rather an effort to add value to the user experience through his/her interaction with these systems.

Studio 6 - Product Design II

In Studio 6 – Product Design II the level of difficulty of the design project is higher as the complexity of the functionality, the technology and the manufacturing of the designed object are higher compared to those in Product Design I. Moreover, a greater degree of independence is expected as teams are expected not only to adapt the design process to their project but also to determine a direction for their design brief.

The design projects pertain to the development of technology platform products where a given state of the art technology is the basis for the redesign or reinvention of a product or a system. In this light design teams are asked to adopt a position regarding current issues and seek for new user groups, new contexts and needs for everyday technological products that may involve not only interaction but also service design.

The multi-level functionality and the inherently greater complexity of the objects of design necessitate more extensive research and analysis, while higher number of design specifications increases the importance of creating a large amount of basic design solutions during the phase of ideation.

The observation of human activity, field research and the production of physical and virtual prototypes are still a condition for supplying the process with data of high validity, however student teams are expected to devise their own programs of research and prototyping according to their project requirements.

The higher level of technology and complexity of designed objects and systems requires students to delve deeper into the areas of reverse engineering, engineering design and manufacturing technology, so that design proposals mature from a preliminary design to a more detailed design. Towards that direction the employment of methods of rapid prototyping is encouraged. At the same the interaction between the user and the product is designed in the context of the integrated product design process.

Computer Integrated Manufacturing

The purpose of this course is to introduce the students to the processes and methods for the computer integrated manufacturing. The students are introduced to the subsystems Computer Aided Design (CAD), Computer Aided Process Planning (CAPP), Computer Aided Manufacturing (CAM), Product planning control (PPC), Enterprise Resource Planning (ERP) Computer Aided Quality Assurance (CAQ), Flexible manufacturing systems (FMS), and integration of these components. The content of the course is as follows: Computer Integrated Manufacturing (CIM), Product planning control (PPC), Capacity Requirements Planning (CRP), Quality control, Flexible manufacturing systems (FMS).

Computer Aided Analysis and Manufacturing (CAE/CAM)

Introduction to CAE and computational mechanics methods, theoretical basis of the finite element method, theory of elasticity, failure theories and design methodologies, simplifications in FEM, element types and discretization, material properties, loads and boundary conditions, post-processing, structural optimization. Process study and schedule (procedure, computer aided design). CNC program generation - CAM (methodology, definition of workpiece, machine selection, tools and conditions selection, CNC machining centers, NC sequences). Machine structure. Process control. Post processors.

Computer Graphics

Computer graphics refer to techniques and algorithms that allow the design of two-dimensional shapes as well as the projection and display of three-dimensional objects on the plane of the computer screen and their partial or total visibility on the computer screen which is considered a window in the corresponding plane.

Initially, this course introduces the techniques for graphically displaying basic shapes on a two-dimensional computer screen, such as a straight line, a circle, a zigzag line, a polygon, and filling in closed shapes with color. Next, the transformations that allow the movement of shapes and the change of the coordinate system in both two-dimensional space (2D) and three-dimensional space (3D) are examined. In the three dimensions, additional issues of projection and point of view are examined, as well as the modeling of curves and surfaces in the space. Also presented are photometry issues and coloring models, as well as the issue of identifying the visible parts of 3D objects depicted on a camera. It also introduces the graphical Application Programming Interfaces (APIs) Direct 2D, Direct 3D, OpenGL. The content of the course is as follows: Two-dimensional drawing. Geometric transformations and projections in two and three dimensions, Representation of 3D objects, Color and texture, Lighting models, Representation and management of graphics scenery, Synthetic movement.

Semester 7

Machine Elements

The content of the course is as follows: Motion and power transmission. Mechanical constructions analysis. Shape-connections and tribo-connections. Introduction to strength of materials. Operational stresses, static and dynamic strength. Connecting elements. Bolts, welds, bonds and their strength calculations. Element and methods of power transmission. Axle, bearing and powertrain systems design. Friction, wear, lubrication and sealing. Belts, gears, chains.

Research Methodology

Definition and objective of science. Scientific research. Definition of quantitative research methods. Definition of a research topic and research questions. Scientific ethics. Literature review. Design of research. Selection of research methods for data collection. Reliability and validity of the research. Quantitative and qualitative research methods. Definition of parameters in quantitative methods: population, subject, sample, variable, measurement, measurement tools. Collection of quantitative data, processing quantitative data, presentation of results, linking results to existing knowledge in the field of Product and Systems Design. Sampling methods. Presentation, data interpretation and conclusions. Techniques for presenting the results of a survey. Measuring scales. Types of variables. The questionnaire. Descriptive statistics and inferential statistics. Definition of qualitative research methods. Data collection in qualitative research. Interview. Observation. Case study. Content analysis. Critical review of published research. Post-analysis.

K1- Advanced Interaction Technologies and Applications

Human-computer interaction has gone through many stages. Starting with the keyboard and reaching the modern forms of interfaces, the tendency is to use more and more human ways of communication (voice, gaze, movement, gestures, etc.) especially in new

application environments and ubiquitous computing. The aim of the course is to present the basic principles in terms of user requirements, design, modeling and evaluation of advanced and physical user interfaces. The content of the course is as follows: Introduction to physical interaction, Kinesthetic interaction, Gaze Interaction, Haptic interaction, Vocal Interaction, Brain Computer interfaces.

K1- Image processing
The course covers the following topics: Introduction to digitization and processing of one-dimensional signal. Fast Fourier Transform (FFT). Image digitization (two-dimensional signal). Application of 2D FFT to digital image. Image filtering (quality improvement). Image compression. Edge detection. Image segmentation (use of separation threshold, separation and merging of areas based on geometric proximity of image elements). Image color processing. Motion detection in image. The opencv open source library will also be imported and used. The content of the course is as follows: Image Representation, Image Filtering and Enhancement (both in Spatial and Fourier domain), Recovering Image Quality, Image Color Processing, Image Compression, Image Morphology and Segmentation, Object Recognition.

K1- Fuzzy Logic Systems
The course deals with the following topics: Transition from crisp sets to fuzzy sets. Union, section and complement of obscure sets. Fuzzy numbers and arithmetic operations with them. Fuzzy relationships of equivalence, compatibility, ranking. Vague logic. Information and uncertainty, principles of uncertainty. Fuzzy systems, systems control based on fuzzy logic. The content of the course is as follows: Introduction to Fuzzy Logic, Algebra of fuzzy sets, Fuzzy Arithmetic, Geometry of Fuzzy Sets, Applications of Fuzzy Logic in Technology (Fuzzy Systems, fuzzy control methodology).

K2-Computational Design and Biomimetics in product design
The course explores the relationship between computational tools and product design, in an effort to attain a new insight into the relationship between design intent and built form. Students will have the opportunity to develop computational design skills and acquire hands on cutting-edge fabrication experiences, while cultivating analytical and creative thinking on the applications of computation in design. Furthermore, the course of computational design focuses to biomimetic design approach. Students face design problems according to nature approach. The content of the course is as follows: Theory of computational design, Evolution of computational design, Digital fabrication, Computational design processes, Programming languages, Advanced CAD, Modern production techniques, Interactive design, Performance based Design, Research methodology in design and technology, Special topics in nature-based design.

K2-Sustainable Design and Circular Econom
Product design is the vehicle by which designers choose the way which manufacturers can develop the product. Therefore, Sustainable planning is the key to achieving sustainable goals. The concept of sustainable development has many implications and completely different dimensions related to social, environmental and economic elements, so a long-term view and the overall impact of the life cycle must be taken into account. The content of the course is as follows: Exploring and defining sustainability, Overview of creating sustainable design, Define a project task., Structure of the sustainability framework,

Creating design solutions, Integration of environmental methodologies in the product life cycle during design process, LCA process in the eco-design, Sustainable design evaluation tools, Environmental aspects in strategic decisions, Optimizing sustainability in products and services, Green marketing and development of new products.

K2- Exhibition and Interior Design

The course "Exhibition Design / Organization and Interior Decoration" refers to all the elements that compose the theoretical and practical framework for the design and communication of an exhibition. The aim of the course is to familiarize students with the design and editing of integrated exhibitions with emphasis on the display of industrial objects. Topics that will be developed in the context of the implementation of the course are: composition and elaboration of an initial idea, creation of theme and purpose of the exhibition, design and production of three-dimensional representations and models of the overall exhibition and / or individual elements that complete it. Finally, reference is made to elements of architectural space design, interior design composition, presentation of works, lighting, use of new technologies and design of communication material (exhibition catalogs, advertising posters, etc.).

K2-Special Topics in Computer Aided Design

The purpose of this course is to introduce the students to advanced processes and methods for the computer aided design of products in three dimensions. The students are introduced to the state-of-the-art tools in CAD systems that aid the process of creating new products. They acquire knowledge on modern techniques and processes used in modern CAD systems. Also, they are introduced to product data management systems. The content of the course is as follows: Representation of curves and surfaces with Ferguson, Bezier, B-Splines, Nurbs. Assembly methodologies. Assembly analysis. Support systems for the design process. Product Data Management Systems (PDM). Management of the Product Life Cycle. Data exchange between CAD systems.

K3- Introduction in Mechatronics

Introduction to Mechatronics, measurement systems, control and feedback systems, design principles, mathematical model processing, transfer functions, structural diagrams, introduction to sensors, sensor types and principle of operation, sensor characteristics, sensor selection, signal processing input, time response and system stability, operational amplifier, analog and digital signals, analog-digital and digital-analog (A/D and D/A) converter, mechanical systems (wheels, chains, belts, gears, bearings), AC and DC motors (DC and AC) - stepper motors and servomotors, motor selection, electric motor drive, power electronics - converters (DC-DC, voltage drop, DC-AC, voltage rectifiers), pulse width modulation (PWM), switches and solenoids, hydraulic and pneumatic systems (actuators, valves), microprocessors, microcontrollers and logic programming, logic system design communications systems (networks, protocols, interfaces).

K3-Special topics in Material Science

The subject matter is the study of composite materials. The aim of the course is for the student to understand the basic principles of composite materials, structure and properties of the constituent materials, the way of their combination, their mechanical behavior, the methods of their construction and forming. The student is asked to

understand the principles and context of synthesis-processing-structure-properties and the final structure of composite materials. The content of the course is as follows: Nature of composite materials, (Polymeric matrices, Polymerization, Polymer Classification, Polymer Chemistry, Ordinary polymeric, ceramic, carbonated and metal matrices), Stratified composite materials, Reinforcing Fibers, Interfaces of Composite Materials, - Mechanical properties of Composite Materials, Formulations and Behavior of Composite Materials, Introduction to special categories of composites: Foams, Biosynthetically, Porosity and Membranes.

K3 - Consumer Behavior and Marketing Research

Knowledge of consumer behavior is very important for marketing as it helps businesses understand, anticipate and respond to the demand for products and services. The aim of the course is to understand consumer behavior with the help of the sciences of human behavior, that is, psychology and sociology. The marketing philosophy requires companies to focus on the needs and desires of their customers. The marketing people should discover consumer needs that then the cover products and services. Market research seeks to identify, process, analyze and present all the factors that influence the consumer in his various consumer reactions. The content of the course is as follows: Definition and importance of the concept of "consumer behavior", Consumer behavior models, The environment, Consumer characteristics, Motivation, Theories of human motivation, Perception, Learning, Beliefs and Attitudes, Purchasing process,Market Research, Product research, Data collection, Questionnaire, Sampling research, Data analysis.

K3 - Education in Environmental Issues

The subject matter is the introduction of students to the concepts and principles of Environmental Education and Training. The aim of the course is for the student to understand the concepts of Environmental Education and Training and through the study of environmental programs to understand the formation of environmental behavior and attitudes and how they are applied to. The content of the course is as follows: Environmental problems, their causes and sustainability, Science, matter, energy and systems, Ecosystems: what they are and how they work, Biodiversity and evolution, Species interactions, ecological successor, and population control, The human population and urbanization, Climate and biodiversity, Conservation of biodiversity, Food production and environment, Water resources and water pollution, Geology and non-renewable mineral resources, Energy resources, Environmental risks and human health, Air pollution, climate change and dilution of the ozone layer, Solid and hazardous waste, Environmental economics, environmental policy, and environmental worldviews.

Craft and Street Art

The course "Craft and street art" is related to practical applications of construction, decoration and design of objects for indoor and outdoor spaces. It is a craft-based art course for students interested in the creative process. The aim of the course is to fully understand the theoretical background for the cultural movements "Arts & Crafts" and "Street Art" in order to produce manual works aimed at understanding the aesthetics and technique of the form and form of objects and works.

Advanced Materials for Eco-friendly Applications

The course "Design of Advanced Materials for Energy and Environmental Applications" is an approach to the synthesis, characterization, and evaluation of materials for energy and environmental applications, such as solar thermochemical processes, catalytic processes, CO2 capture from the atmosphere, processing of solid organic waste for energy production. Students study the synthesis, characterization, and evaluation of advanced materials for energy and environmental applications. The content of the course is as follows: Introduction, Concept of catalysis, Catalysis species and reactors, Environmental catalysis, Catalytic processes for the capture/destruction of substances, Sources of industrial by-products harmful to the environment, Recycling-reuse-utilization of by-products by industrial units, Categories of by-products, Technologies and technical methods for the conversion of by-products and their reuse, Clean energy technologies and management/reduction of air pollutants, Systems of catalytic advanced materials for the reduction of air pollutants and particles, Technologies for carbon capture and utilization, Synthetic Fuels, Alternative fuels, Production of clean energy, Alternative methods of solar energy utilization and uses, Energy storage, Categories of advanced material systems used for energy storage, Advanced materials with application to environmental catalysis , Synthesis technologies, Formatting techniques, Categories of materials and uses, Preparation of materials with specific properties adapted to the application, Methods of characterization and evaluation of materials

Web Design and Programming
The aim of the course is to present the technologies related to the Internet and the World Wide Web with emphasis on the design and programming of interactive web services and applications. It covers topics related to communication protocols and models, architectures, services, security and programming languages used to develop related applications (e.g PHP and Javascript). The content of the course is as follows: Introduction to Computer Networks -Internet Communication Protocols, Introduction to the World Wide Web, Basic Development Technologies Website Performance Factors, Heuristic Evaluation of Web Usability, Typography and color on the web, Visual hierarchy in web design, Navigation on websites, Search engines Search engine optimization, Web accessibility, Web CMS presentation, Dynamic web programming using HTML, CSS, Javascript, PHP, MySQL technologies.

Entrepreneurship and Innovation
Upon completion of this course, students are introduced to concepts of doing business in a documented and scientific way. In addition to understanding the theoretical concepts, emphasis is placed on the proper documentation of a business plan, so that it is feasible and therefore sustainable during its implementation. The subjects analyzed in the course are the following: general economic environment and basic economic concepts, introduction to entrepreneurship and innovation, legal forms of business, size of companies, introduction to management, choice of installation site, introduction to the business strategy, intellectual property protection, introduction to marketing, introduction to production management, introduction to financial management, introduction to human resource management and internationalization.

Introduction to Macroeconomic Theory (Department of Economics)
The purpose of the course is to understand the functioning of a closed (without trade with other countries) economy. The main macroeconomic parameters are examined, and the

basic operating model of a closed economy is presented. After successful completion of the course the student will be able to: Understand the functioning of the closed economy. Deepens the basic concepts of macroeconomics, understands how fiscal policies affect the produced product, Distinguishes the exercise of economic policy, Evaluates macroeconomic policies.

Semester 8

K1-Design and Applications Programming for Mobile Devices

Mobile devices are now ubiquitous, and they are the primary platform for communication, entertainment, information and organization. Thus, advanced design and development knowledge is valuable and provides a fertile ground for research, commerce, and business. The topics covered in the course include a) design principles and technologies for the development of mobile web applications, b) development of applications for mobile devices with the development platform of the Android operating system and c) techniques for the development of augmented reality mobile applications. At the same time, issues related to the wider field of mobile technologies and its current developments are presented. The content of the course is as follows: The ecosystem of mobile applications, Introduction to mobile web, Introduction to Pervasive Computing, Privacy issues in Mobile and pervasive computing, Wireless access and wireless local area networks (WLANs), Introduction to mobile user experience, Design templates in mobile applications (mobile design patterns), Development cycle (mobile) applications: Iterative design, GPS & Sensor-based augmented reality applications, Mobile-specific websites development, Responsive web design, Development of native mobile applications on the Android platform

K1-Virtual and Augmented Reality

Virtual reality is related to the computer simulation or reconstruction of a real environment or situation. The user is immersed in the virtual world and feels that s/he coexists within it with proper use of the senses of sight, hearing and touch. On the other hand, augmented reality aims to enhance the sensory perception of the existing, real environment with the aim of easier understanding and interaction with it.

The aim of the course is the study and understanding of the processes of design, development and evaluation of Virtual and Augmented Reality systems. Immersion, desktop, augmented reality and virtual world environments are examined and analyzed, and relevant issues and approaches are studied. The practical application of some of the issues analyzed is examined as a case study using relevant software (Unity, Blender, etc.). The content of the course is as follows: Introduction to Virtual and Augmented Reality, Virtual worlds, Human Factors in Virtual Reality, Imaging and Motion, Input-output units and VR system architectures, Experience and Interaction Design, Evaluation, Applications.

K1-Artificial Intelligence

Artificial Intelligence is the field of computer science that deals with the design of intelligent computer systems, i.e., systems that exhibit features related to intelligence in human behavior. The course introduces the structure of intelligent agents and examines problem solving with search methods (uninformed or blind search as well as informed search), the search for solutions to constraint satisfaction problems and the search for successful actions in rivalry problems (e.g., games between two opponents). Also, the

methods of representation of knowledge and reasoning are presented, where the propositional logic, the first-order predicate calculus, inference in the first-order calculus and the concept of semantic networks are introduced. The problem of action planning is studied, and an introduction to probabilistic reasoning is also made examining the Bayesian networks and Markov chains. The content of the course is as follows: Problem Representation – Search Trees, Problem Solving Techniques based on Blind (Uninformed) Search, Problem Solving Techniques based on Informed Search, Constraint Satisfaction Problems, Adversarial Search, Propositional Logic, First-Order Predicate Calculus, Reasoning in First First-Order Logic, Knowledge Representation, Automated Planning, Probabilistic Reasoning, Decision making.

K2-Packaging Design

The course of packaging design is for any student interested in Packaging Design. Students will use software applications employed as tools by Graphic Designers for two-dimensional and three-dimensional surfaces. This course is a project-driven exploration of Packaging Design which is defined as stylized functional design for carrying, protecting, or presenting a product. Research and Analysis: Contemporary case studies of 3D form and function of brand packaging. Visual research and communication of message through graphic design solutions.

Design and Development: Exploration of appropriate ideas, creative thinking and generating original ideas. Formulation of creative solutions in relation to set briefs. Recognize the production values and design requirements of studio based photography for packaging design.Topics include: the Principles and Elements of Design, current technical and creative methods and styles employed by Package Designers as well as well as sustainability, advanced critical concepts, and professional practices. This course includes portfolio building with an emphasis on professional standards.

K2-Special Topics in Design and Manufacturing Simulation

The content of the course is as follows: Kinematics, mechanisms, tools and cutting conditions of standard machining operations with material removal (turning, drilling, milling). Machine tools (types, structure). Micro-cutting (mechanism, types, tools). Wear of cutting tools and tool life. Measurement of surface roughness and cutting forces by experimental methods (profilometer, dynamometer). Analytical and numerical methods of simulation of cutting processes. Finite element method (FEM) in cutting processes. Simulation through linear regression and neural networks.

K2-Engineering and Materials Design

The course includes the familiarization of students with the selection of appropriate materials for solving problems in product design studies. It seeks to achieve students understanding of basic concepts of the chemical properties of materials and how they are related to their processing and selection in Design. The purpose of the course is to understand the principles and methodology of material selection in the context of Product Design. The content of the course is as follows: Materials-History and character. Family trees: Organization of materials and processes. Matching materials and design. Physical Properties. Engineering Characteristics. Thermal Behavior. Electrical, magnetic, and optical response. Durability. Processes and how they affect properties. Environmental issues.

K2-Prototyping for Product Design Engineers
The content of the course is as follows: Ergonomics and prototyping, Materials, their use and prototyping techniques for design engineers, Use of 3D printing together with digital prototyping tools, Use of 3D Scanning together with digital manufacturing, Use of materials for developing unusual geometries, Mold prototyping methods, Combining CAD, vector design and cut/engraving with non-conventional manufacturing processes, Prototyping small scale structures and applications that relate to them (i.e. infokiosks)

K2-The teaching of Robotics, STEAM and New Technologies
The aim of this module is for the students to respond with success and being able to prepare the appropriate level of education material. The content of the course is as follows: Introduction in new technologies and robotics, Synthesis and analysis of robotic structures, Programming robotics structures, Introduction in robotics for education, Contemporary learning theories., The role of the educator in the class, AI in education, Development of educational plan and material, Teaching technics and resources, Implement a complete educational plan.

K2- Design of Wearable Products
The content of the course is as follows: Anthropometric data and ergonomics, Management and programming of sensors and circuits on wearables, IoT, 3D and 4D printing of wearables, Use of materials for wearables and new technologies.

K3- Supply Chain Management
Driven by globalization and ever-increasing customer demands, the Supply Chain plays a key role in creating an advantage for all businesses. It is becoming increasingly visible that business competition is shifting from the business level to the Supply Chain level, as e-Business and Information Technology drastically change business requirements and rules. The course discusses supply chain management by examining the key concepts and giving the student the opportunity to understand the main components of each chain. The content of the course is as follows: The Evolution of Logistics and the Supply Chain, Significance, Object and environment, Business Value Chain, Logistics Activities: procurement, production, distribution, warehousing, transportation, customer service, Third party logistics-3PL, 4PL, Reverse Logistics, Information Systems and Technologies, Internet and supply chain, Supply chain evaluation.

K3-Maintenance and Reliability of Systems
The aim of the course is to introduce students to modern techniques of reliability and maintenance. The engineer is responsible for the design, construction and operation of systems. Traditionally, the design and implementation of a system concerned with the operation and not the failure of the system. The modern requirements for high security, reliability and quality of technological systems make the relevant reliability studies necessary. Engineers must design, build, and maintain systems with the proper procedures to minimize failure and assess the level of reliability. The content of the course is as follows: Concepts of maintenance and reliability, Maintenance methods, Corrective, Preventive, Opportunistic and Predictive maintenance, Total preventive maintenance (TPM), Reliability features, Reliability assessment techniques, Risk analysis.

K3-Design of Services
The course aims to educate students in the use of tools and techniques of service design within a climate of better user experience (UX) and more productive organisations. Students learn theoretical precepts as well as models. They undertake exercises in the use of the most common tools. They learn about how to understand the emerging trends within the field, such as public sector design, community design, social innovation design and social entrepreneurship. In this way students will be well placed to situate developments as they occur, and understand what tools there are to build good services.

Introduction to Animation
The course is dedicated to traditional and digital animation techniques. Understanding how to render rhythmic actions for narrative purposes is the main objective of the course. Both character and object animations approaches are taught in the classroom, based on traditional Disney animation principles. During compulsory laboratory sessions, students are invited to create their own concepts, storyboards, walking cycle exercises, and final short films.

Robotics and Digital Fabrication
The content of the course is as follows: Terminology and types of robotic manipulators. Degrees of freedom and kinematic analysis of robotic manipulators. Velocities and static forces. Determination of driving forces and torques. Trajectory description of the end effector and workspaces. Position control. Categories, structure and operation of 3D printers. Categories, structure and operation of laser CNC engraving machines. Numerical control of 3D printers, engravers and similar Cartesian mechanisms.

Design for all
In this course, students are taught the concepts and necessity of Design for All, the need for awareness, as well as the values, principles, international recommendations and guidelines for Design for All. Emphasis is placed on issues related to accessibility in Information and Communication Technologies (ICT), such as accessible content, accessible input and output of ICT systems. New forms of ICT interaction, processes, principles and examples of innovative human-computer interactions, as well as methods and techniques for designing accessible anthropocentric systems are also studied. The Design for All course refers to a design ethic that seeks to design solutions that do not exclude people. Design for All enriches the Design brief, resulting in a more robust design solution. Frequently it is the base for motivation and inspiration of innovative designs.

Complexity of Design Processes
Initially the course focuses on fundamental issues of the organizational / systemic framework for the analysis, understanding and description of complex organizations (basic processes of constitution and interaction, regulation of constitution and interaction, ways of integration between constitution and interaction, as well as the implications of different forms of this integration regarding the evolvability of each type of organization) in the whole range of organizational complexity. Explain the fundamental concepts of the organizational framework of analysis and description of complex organizations, such as: simple and complex self-organization, autopoiesis, closure, autonomy, function, regulation, self-regulation, self-directedness, integration,

representation, intention, goal/purpose, anticipation, emergence , identity / character, levels of organization.
Use of the above framework for the analysis, explanation, and modeling of the design process as a form of cognitive interaction between highly complex organizations, as well as of the related aesthetic and creative interaction processes as special forms of bio-cognitive interaction directly or indirectly related to the realization of the design process. Organizational approach to the ontological and epistemological problem of design, as well as to the analysis of human-centered organizations with the aim of analysing and implementing non-reductive design interventions in them.

Information Design
Particular importance is given to the design of information in digital culture, taking into account the great potential of Greece in this field, offering students knowledge and tools for designing information in digital applications of culture and cultural heritage. Importantly, the course "Information Design" is in line with the main goal of IIID (International Institute of Information Design), ie to convert data into high quality information to support people for achieving goals.
Nowadays, Information Design is an interdisciplinary field that deals with how information and data are translated into comprehensible visual and audio formats, descriptions and interfaces. Information Design deals with the understanding of data and information by humans. It has to do with understanding. This can be translated into receiving data and information and rewriting it into another "language" (for example, numbers in images) or making an animated film.
Such transformations require agreement between the sender of the message on the substance of the message, as well as knowledge of the capabilities of the receivers. The first transformation is necessary for the information designer to become familiar with the subject, the second is for the information designer to study the needs, preferences and abilities of the target audience. In addition, Information Design deals with the search and creation of information spaces (information spaces), used in search, browsing (wayfinding) and learning.

Special topics in Mechatronics
The content of the course is as follows: Energy conversion between electrical and mechanical mechanisms. Micro-electromechanical systems (MEMs): micro-sensors, micro-motors, nano-machines. Modern models of linear automatic control systems based on state equations. Design of feedback controllers using state space models. PID controllers. Control systems based on microprocessors and microcontrollers. Digital filters. Digital signal processors (DSP).

Brand Building and Brand Management
The content of the course is as follows: Brand management and brand building principles, Product design trends, effective trend management. Corporate strategic design. Product innovation. Enterprises and their role in Brand Building and Brand Management. Customer behavior. Customer perception for a product. Market segmentation. Case studies.

Modern Architectural Design
This course serves as an introduction to fundamental concepts of design, architecture, construction and the organization of the man-made environment in general. The course aims to familiarize students with the main methodological tools of analysis, synthesis and representation required to solve a small-scale synthetic problem of high complexity. The content of the course is as follows: Evolutionary process in architecture. Capture, read and interpret an architectural composition. Local and international architecture. Mild architecture. Basic design principles. Methodology for solving an architectural problem. Typology and metric design. Architectural elements. Open space architecture. Greek architectural heritage. Critical examination of architectural ensembles in Greece. Critical examination of architectural ensembles in the international space. Building regulations and standards.

Microeconomic Analysis (Department of Economic Sciences)
The purpose of the course is to study and understand the operation of economic units and how they balance in the market. Upon successful completion of the course, the student will be able to: Know the operation of financial units. Understands the key role of consumers and businesses. Understands how economic units, consumers, and businesses balance in the economic system, Realizes the effects on business profits and consumer welfare from different forms of market.

Semester 9

K1-Project in the Design of Interactive Systems
The aim of the course is to complete the knowledge and skills that students have acquired from the core courses and the direction of Interactive Systems Design by implementing an authentic and original project. The topics are open and may include projects and systems related to education, entertainment, skills training, culture, etc. The content of the course is as follows: Use of methodologies and tools for development and research. Requirements analysis and field research. Systems design. Interoperability of software and hardware systems. Development of operational standards and their evaluation. Documentation writing.

K1 - Computer Vision
One of the key elements that an autonomous interactive system must have is the ability to perceive the space and environment in which it is located. Computer vision comes to provide solutions to problems of object recognition, scene comprehension, reconstruction of models of three-dimensional entities from two-dimensional images, video analysis (motion, point monitoring), etc. The aim of the course is to present the basic topics of computational vision and to build on the knowledge gained from the courses Graphics and Image Processing. In the lesson, the opencv open source library will be used. The content of the course is as follows: Image formation, Image processing, Feature detection and matching, Image Segmentation, Feature-based alignment, Structure from motion, Classification, Detecting Objects in Images.

K1-Machine Learning
Machine Learning is a subfield of Artificial Intelligence related to the ability of computers to learn and act without being explicitly programmed. The study and construction of

algorithms that can draw conclusions from a variety of data and make predictions related to them is the main object of investigation in this field. It is closely related to concepts from Statistics, Probability Theory and Optimization. With the abundance of data that exists in our time due to the internet and the World Wide Web, the appropriate environment is provided for the application and evaluation of machine learning algorithms and related applications are search engines, computational vision, natural language processing, recognition of user behavior patterns. in a social network, autonomous vehicles and more generally autonomous interactive systems. The aim of the course is to present the concepts and basic elements of Machine Learning (neural networks, deep learning, decision trees, categorical logic, Bayesian networks, genetic algorithms, etc.) and students' understanding of the importance and prospects it offers. this space.

K2-Project in Product Design and Manufacturing
The module is aiming in combining all aspects of the design and manufacturing lessons taught under the same roof. The main idea is for the students to be able to design, prototype and manufacture innovative and impressive products. The students should feel like being working for an external collaborator in order to imitate realistically the working conditions after completing the degree.

K2-Furniture and Wooden Product Design
The course "Furniture and wooden objects design" refers to the fields of wood technology, furniture, and wooden objects production technology with an emphasis on development and design at the level of composition and development of concept - sketches (Concept Design & Product Sketching) aimed at three-dimensional representation (CAD) and photorealism (Rendering) of innovative products. Finally, the course provides knowledge and skills for 2D and 3D product design with an emphasis on wood and contributes to the development of know-how and innovation through the application of this knowledge. Techniques and methodologies for manufacturing prototype products and mock-ups from wood materials or combined with other materials (e.g. wood and fabric) are proposed.

K3-Algorithm Optimization
The purpose of this course is to introduce the students to the theory, algorithms, and applications of combined optimization, with emphasis on problems related to flows, paths and matching graphs. The aim is to familiarize students with the basic principles of algorithm design and with discrete optimization algorithms as well as to investigate applications of such problems to real optimization problems. The content of the course is as follows: Optimization problems, Complexity, Computational solubility, Precise algorithms, Integral programming, Approximation algorithms, Local search, Simulation.

K3-Project in Systems Design
This course is a practical educational process that completes the knowledge and skills that students have already acquired in the context of core courses and in the field of Systems Design. The main objective of the course is the practical application of systems design methods through the design of a specific system related to real-world issues but adapted to a specific context of a project-type educational process.

K3-Total Quality Management
In recent decades, quality is the most important variable of competitiveness, since in combination with price it determines the value that the customer buys. In this course the student can get acquainted with the basic concepts of Total Quality Management, quality assurance-management systems, the standards of the series ISO 9000, ISO 14OOO and HACCP, the application of the principles of Total Quality in Greek companies, the most important quality improvement techniques, customer satisfaction indicators, benchmarking. The content of the course is as follows: Basic concepts of Total Quality Management, Quality assurance-management systems, Standards of ISO 9000, ISO 14OOO and HACCP series, other standards, Application of Total Quality in Greek companies and the public sector, Quality and innovation, Quality improvement techniques, Customer satisfaction indicators, Total quality management and redesign of business processes, Benchmarking.

K3-Motion design methods and autonomous moving units
The content of the course is as follows: Factory cargo transport (robotic transport systems and loading-unloading systems). Robot motion design methods (cell decomposition, artificial potential fields, roadmaps). Solving motion problems of robotic manipulators and robotic vehicles (kinematics, constraints, workspace, configuration space, obstacles). Interaction of robotic systems with humans and the environment. Task scheduling.

K3-Decision Support Systems
The aim of the course is to understand the basic concepts of decisions and to consolidate the main principles of Decision Support Systems. The content of the course is as follows: The role of Decision Analysis, Cognitive Functions in Decision Making, Value and Usefulness, Methods of Analysis and Decision Making, Decisions under Certainty and Uncertainty, The role of DSS in the decision-making process, Degree of Building and Decision Making, Characteristics and capabilities of DSS, Principles and basic concepts of Multi-Criteria Decision Support, Modeling of Preferences and Criteria, Preference Structures, Types of Criteria, Interactive Methods, Phases of the Decision Making Process, Structure of DSS, Group Decision Support Systems, Operational, Knowledge Based, Intelligent DSS, Design and Development of DSS.

Digital Games and Game-based Learning
Electronic (digital) videogames have played an integral part of modern culture for over four decades. They provide their user with fun, active employment, motivation and interaction, adapt and create winning situations increasing the confidence of the players. A special category is educational games whereby integrating educational content and purpose, learning can be achieved in a more relaxed environment. The aim of this course is to present topics related to the design and development of digital games as well as the relevant technologies. Also, to present elements of the educational approach and methodology that should be followed. The content of the course is as follows: History of digital games and major milestones in their evolution, Stages of designing and developing a digital game, Digital game player profile, Social issues (violence, addiction), Uses in education, educational theories and approaches, Basic principles and good practices of video game design, Organization, management, and specializations of a development team, Software technologies and tools used to write game code, Process and tools for developing video game content.

Natural language processing
The ability to chat with a computer has always been one of the dreams of human-computer interaction. Natural language processing (speech comprehension, voice synthesis, automatic translation) is a very important feature that greatly enhances the effectiveness of an interactive system that operates as an interface between a human and a device. The aim of this course is to present the basic principles on topics such as speech processing, syntactic and semantic analysis of speech, morphology of speech, automatic translation, voice synthesis from text as well as all related technologies. The content of the course is as follows: Introduction and historical background. Regular expressions. Computational phonology and text-to-speech conversion. Syntax analysis. Types of grammars. Semantic analysis. Pragmatological analysis. Dialogue agents. Areas of application of natural language processing.

Transportation Planning
Transportation Planning is a branch of scientific research which includes the formulation of general transportation and traffic problems as well as the formulation of solutions to deal with them in the long run. The subject of the course is the design of transport systems and includes the conceptual and quantitative approach of the analysis of the transport system as well as the related subsystems. The aim of the course is to understand the transport systems at a basic level, so that students can go ahead and design transport systems and programs based on sufficient knowledge and good understanding of how modern systems work. The content of the course is as follows: The framework of transport and traffic studies, Basic concepts and principles of the urban transport system, Quantitative expression and characteristics of transport, Land transport, Typical traffic sizes, Traffic junctions, Circulatory capacity, Marking, Signaling.

Automotive Design
The course aims to cover the broadest spectrum of automotive and transport design focusing on design-driven innovations. . The content of the course is as follows: Form design and visual communication. Design methods and the industries based on automotive design. Design, function, and users. Design automotive innovation. Concept creation. Design delivery. Physical prototyping. Additive manufacturing. Reverse engineering.

Graphic Design
Graphic Design is a foundation course that develops a student’s ability to analyze design using basic principles and theory applicable to all forms of art. The course is based on the application of the fundamental elements of art. The student is introducing to tools and techniques used in today’s communication industry. This course lays the foundation for more advanced design courses. The content of the course is as follows: Introduction to Modern Graphic Design. Design Building Blocks Essentials. Typography. Color and Color Theory. Advertisements, Publications, Photography and Visual Identity. Logotype Shape Designs and Organization of Documents. Layout Design and Collage. Graphics Enhancement and Systems. Preparing your Portfolio and Course Consolidation.

Traditional Popular Arts
The main pillars of the course "Traditional Folk Arts" are the definitions and the interpretation of the words "Culture", "Tradition" and "Popular". "Culture" can be

interpreted as anything that is a product of life that is the creation of an organized society. On the other hand, "Tradition" consists of all that has been handed over to the present from the past, in such a way that there is a living relationship of the present with them, in a field of modern life. Finally, the word "Folk" can identify the time frame developed by the arts and the technical and aesthetic criteria that govern its entire identity. More specifically, the course "Traditional Folk Arts" expresses the recording and dissemination of folk arts through reference examples and work on the repetition of techniques that define tradition as an element of aesthetics.

Digital Cultural Heritage

The course "Digital Cultural Heritage" offers an introduction to the basic principles of digital recording, documentation, archiving, dissemination and promotion of Cultural Heritage and will give all the necessary knowledge needed to create digital (digital library) and analog (3D printing).) applications. The aim is to understand the contemporary needs arising from the convergence of the digital world with the Cultural Heritage and the development of new innovative applications for the management and promotion of content of cultural interest. Finally, the aim of the course is to familiarize students with current trends, both in experimental and applied level, in the field of Digital Object Recording Technology and advanced tools for research, documentation and promotion of Cultural Heritage.

The course Digital Culture analyzes the basic concepts (culture, cultural heritage, digitization, technology, etc.), documents the need to digitize our culture, examines the factors that affect the outcome of a digital culture application, analyzes examples of 'good practice' and presents the designing cultural applications using technology. Students through a series of exercises (during the course), understand theoretically and practically the complex issue of Digital Culture and understand the challenges and opportunities in this field.

Semester 10

Diploma Thesis

The diploma thesis should be an original multidisciplinary project that incorporates the knowledge and experience acquired from the students during their studies. It should deal with a subject relevant to the department directions. The student is heavily collaborating with his supervisor and keeps close contact with him. Every student chooses the scientific area that wants to write the thesis. The area should be closely related with the departmental directions thus it should relate the direction selected by the student.