UNDERGRADUATE PROGRAM STUDENT GUIDE 2024-2025

Chania, July 2024

TECHNICAL UNIVERSITY OF CRETE

TECHNICAL UNIVERSITY OF CRETE
School of Production Engineering and Management

ADMINISTRATION

DEAN

Professor Michalis Doumpos

VICE DEAN

Professor Michalis Konsolakis

DEANERY

Professor Anargiros Delis

Professor Constantin Zopounidis

Professor Vassilis Kouikoglou

Representative of the Laboratory Teaching Personnel

Message from the Dean

The School of Production Engineering and Management was founded as a Department in 1983 and admitted students for the first time in 1984. It is the first School in Greece that has been established in this field of engineering, trying to bridge the gap between production, technology, management and administration. The main goal is to educate engineers that, apart from their ability to cope with purely technical problems, will be able to handle administrative and management issues.

The School of Production Engineering and Management has been constantly growing over the last 40 years. Today, the school has 26 Faculty Members and 21 Laboratory Teaching and Technical Personnel, and each year it accepts about 120 first-year students. There are four academic divisions supporting multidisciplinary teaching and research: Sciences, Production Systems, Decision Sciences, and Engineering Management.

The School has a modern, broad and carefully designed curriculum that combines mathematics, physics, humanities, production systems, operational research, information systems, applied economics and management science. Such a broad-based education aims to empower students towards recognizing and solving complex technical problems, which require a holistic approach that covers technological, economic, societal, and environmental aspects. Undergraduate courses are offered in Greek for all students except for Erasmus exchange students who can attend courses and seminars offered in English and other languages.

In addition to the curriculum, students have the opportunity to acquire knowledge, skills and abilities through direct collaboration with the faculty and participation in research and extroversion activities. The School keeps up with current trends in the scientific field of Production Engineering and Management and the labor market, and implements innovative changes in the curriculum to provide graduates with the necessary abilities and skills to foster their professional or academic career. Today, there are Production and Management Engineers in construction sectors, consulting companies, industry, public services, education, private businesses or even as freelance engineers or business owners.

The basic strategy of the School of Production Engineering and Management is to invest in human resources, as well as on the harmonic and creative cooperation between staff, students, and graduates to maintain a strong, modern, and progressive academic environment.

Professor Michalis Doumpos
Dean of the School of Production Engineering and Management

Table of Contents

1. General Information

1.1 School mission

The education at the School of Production Engineering and Management (PEM) provides students with knowledge and skills necessary to design, manage and operate production systems of goods and services. PEM is the first school established in Greece in this area and admitted the first students in September 1984.

A number of societal and economic developments favored the establishment of PEM:

- The need to maintain competitiveness at a national and international level by implementing cost-effective methodologies that enhance productivity and improve the production of goods and services.
- The inherent complexity of new technologies and innovations, their high acquisition costs and the impact they can have on humans and the environment, which create the need to adopt a holistic approach that ensures a technologically, economically, socially and environmentally acceptable way for their implementation.
- The requirement of Greek organizations (companies, industry, public services) for highly educated and skilled engineers who can successfully and efficiently handle not only technological/engineering problems, but also administrative and management issues.

The undergraduate curriculum of PEM comprises courses in mathematics, physics, humanities, production systems, operational research, information systems, applied economics, finance and management sciences. Students have also the opportunity to attend courses in universities across Europe via student exchange programs.

Today, production and management engineers are employed in construction, consulting companies, industry, public services, education, private businesses, and as freelance engineers. Indicative fields of employment are:

- Production systems design and management;
- Information systems design, development and management;
- Electrical and mechanical systems consulting;
- E-business, e-marketing and applications development;
- Computer-aided product design and rapid product design;
- Health and safety;
- Logistics and dynamic resource allocation;
- Robotics, unmanned vehicles and automation designs;
- Industrial operation and control of production plants;
- Project management;
- Supply chain and time planning;
- Enterprise resource and material requirements planning;
- Transportation systems;
- Quality management;
- Financial decision and investment planning;
- Financial engineering and financial risk management;
- Artificial intelligence;

- Machine learning and data mining;
- Decision support systems and intelligent systems;
- Environmental studies;
- Marketing;
- Consumer behavior analysis;
- Operational research and multi-criteria decision making;
- Business intelligence and business analytics;

The Diploma in Production and Management Engineering of the Technical University of Crete is recognized (Government Gazette 3900B/7-9-2018) as **Integrated Master** (level 7 of the National and European Qualifications Framework).

Additional detailed information on the professional rights of School graduates can be found on the website of the Panhellenic Association of PEM Graduates (www.mpd.gr).

1.2 Administrative structure of the School

The School, officially founded with a single department of the same name, is administered by the Deanery and the School Assembly. The latter consists of all regular faculty members, the members of the Undergraduate Students Committee, and representatives of the laboratory teaching and technical personnel. The Dean bears the administrative and financial responsibilities of the department. The personnel of the School is divided into the following categories:

1. Faculty members hold a Ph.D. degree, teach undergraduate and graduate courses and conduct research; they are appointed at the following ranks: Professor, Associate Professor, tenured and tenure-track Assistant Professors.
2. Adjunct faculty consists of hired educators and instructors who support the undergraduate curriculum.
3. Laboratory-Teaching Personnel (LTP) provide instruction services at the departmental laboratories.
4. Specialized Technical Laboratory Personnel (STLP) provide technical support services.
5. Administrative staff perform bookkeeping activities essential to the educational and research objectives of the department.

The General Assembly receives recommendations from the following committees:

A. Undergraduate Studies Committee

D. Ipsakis, Assistant Professor (coordinator)
E. Ioannidis, Associate Professor
E. Siskos, Assistant Professor
Member of the Undergraduate Students Committee

B. Graduate Program Committees

Master in Business Administration (MBA)

M. Doumpos, Professor (coordinator)
C. Zopounidis, Professor
G. Atsalakis, Associate Professor
T. Kontogiannis, Professor
S. Tsafarakis, Associate Professor

Product Design and Manufacturing (PRODES)

I. Nikolos, Professor (coordinator)
N. Tsourveloudis, Professor
G. Stavroulakis, Professor

C. Doctoral Program Committee

V. Kouikoglou, Professor, coordinator
C. Zopounidis, Professor
I. Papamichail, Professor
M. Konsolakis, Professor
A. Delis, Professor

D. Alumni and Professional Rights Committee

E. Doitsidis, Assistant Professor
President of the Undergraduate Students' Committee

E. Summer Internship Committee

A. Delis, Professor
P. Alevras, Assistant Professor
M. Marinaki, LTP

F. Public Relations Committee

K. Tsagarakis, Professor

E. Ioannidis, Associate Professor
E. Doitsidis, Assistant Professor

G. Arampatzis, Associate Professor
S. Piperidis, LTP
N. Spanoudakis, LTP

G. ERASMUS+ Committee

I. Marinakis, Professor
E. Doitsidis, Assistant Professor (deputy)

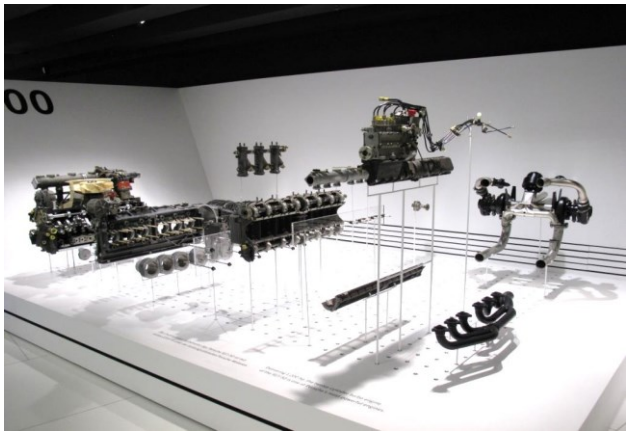
H. Library Committee

T. Kontogiannis, Professor
E. Ioannidis, Associate Professor (deputy)

I. Health and Safety Committee

G. Arampatzis, Associate Professor
N. Chairetis, STLP
M. Bakatsaki, LTP
I. Kontaxakis, STLP

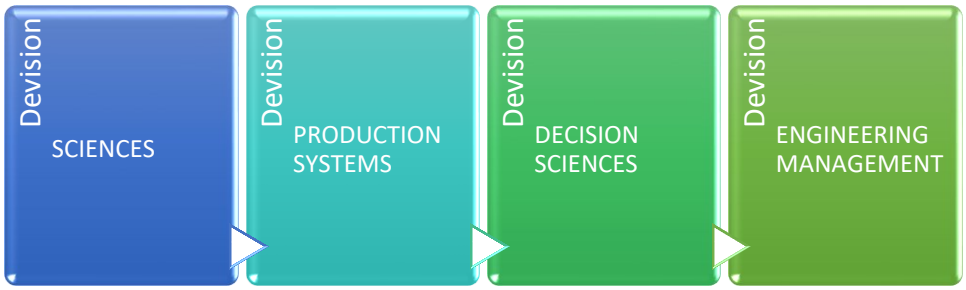
The members of the Internal Evaluation Team are Professor V. Kouikoglou (coordinator) and Assistant Professors D. Katzourakis and P. Fafalios.



2. School Organization and Personnel

2.1 School divisions

The School of Production Engineering and Management is organized into four divisions encompassing a number of interrelated scientific fields. The School divisions are:



2.1.1 Division of Sciences

The division's scope lies on the scientific training of students in fundamental courses and promotes research in physical science, applied mathematics, social science, and humanities).

REGULAR FACULTY

Anargiros Delis Professor	PhD, University of the West of England, Bristol, 1998; MSc, University of Manchester – UMIST, 1994; BS, Department of Mathematics, University of Crete, 1993. Specialty: Computational Mathematics
Michalis Konsolakis Professor	PhD, Department of Chemical Engineering, University of Patras, 2001; Diploma, Department of Chemical Engineering, University of Patras, 1997 Specialty: Surface Analysis and Catalysis
Dimitrios Patelis Professor	PhD, Lomonosov Moscow State University, 1991; BS, Department of Philosophy, Lomonosov Moscow State University, 1988. Specialty: Philosophy and History of Science
Yiannis Saridakis Professor	PhD, in Applied Mathematics and Computer Science from Clarkson University, New York, 1985; MSc, in Applied Mathematics and Computer Science from Clarkson University, New York, 1983; BS, Department of Mathematics, University of Crete, 1981. Specialty: Applied Mathematics

2.1.2 Division of Production Systems

The division of production systems focuses on the analysis and optimization of production and energy systems and modern manufacturing and production technologies (flexible manufacturing systems, robotics, automatic control, computer-aided design, computer-aided manufacturing, material handling, environmental technology, thermodynamics, fluid mechanics etc.).

REGULAR FACULTY

Panagiotis Alevras Assistant Professor	PhD, Mechanical Engineering, Heriot-Watt University UK, 2015; Diploma, Mechanical Engineering, National Technical University of Athens, Greece, 2011 Specialty: Machine Elements and Mechanical Structures.
Aristomenis Antoniadis Professor	PhD, Department of Mechanical Engineering, Aristotle University of Thessaloniki, Greece, 1989; Diploma, Department of Mechanical Engineering, Aristotle University of Thessaloniki, Greece, 1984 Specialty: Production Systems
George Arampatzis Associate Professor	PhD, Department of Chemical Engineering, National Technical University of Athens, Greece, 2000; Diploma, Department of Chemical Engineering, National Technical University of Athens, Greece, 1991 Specialty: Heat Transfer
Lefteris Doitsidis Assistant Professor	PhD, School of Production Engineering and Management, Technical University of Crete, 2008; MSc, School of Production Engineering and Management, Technical University of Crete, 2002; Diploma, School of Production Engineering and Management, Technical University of Crete, 2000 Specialty: Robotic Vehicles
Stratos Ioannidis Associate Professor	PhD, Department of Production Engineering and Management, Technical University of Crete, Greece, 2004; MSc, Department of Production Engineering and Management, Technical University of Crete, Greece, 1997; Diploma, Department of Production Engineering and Management, Technical University of Crete, Greece, 1995 Specialty: Analysis and Optimization of Production Lines and Production Networks

Dimitris Ipsakis Assistant Professor	PhD, Department of Chemical Engineering, Aristotle University of Thessaloniki, Greece, 2011; MSc, Department of Mathematics, Aristotle University of Thessaloniki, Greece, 2013; Diploma, Department of Chemical Engineering, Aristotle University of Thessaloniki, Greece, 2005 Specialty: Control Systems with Emphasis in Renewable Energy Systems and Energy Saving
Diomidis Katzourakis Assistant Professor	PhD, Technical University of Delft, 2012; MSc, Technical University of Crete, 2008;Diploma, Department of Computer and Informatics Engineering, Inveristy of Patras, 2006 Specialty: Industrial Innovation in Autonomous Technological System
Vassilis Kouikoglou Professor	PhD, Department of Production Engineering and Management, Technical University of Crete, Greece, 1989; Diploma, Department of Electrical and Computer Engineering, National Technical University of Athens, Greece, 1985 Specialty: Production Networks
Ioannis Nikolos Professor	PhD, Department of Mechanical Engineering, National Technical University of Athens, Greece, 1996; Diploma, Department of Mechanical Engineering, National Technical University of Athens, Greece, 1990 Specialty: Thermal and Hydrodynamic Machines.
Spiros Papaefthimiou Professor	PhD, Department of Physics, University of Patras, Greece, 2001; MSc, Department of Physics, University of Patras, Greece, 1997; BS, Department of Physics, University of Patras, Greece, 1995 Specialty: Energy Management Systems and Energy Efficiency Technologies
Nikolaos Tsourveloudis Professor	PhD, Department of Production Engineering and Management, Technical University of Crete, Greece, 1995; Diploma, Department of Production Engineering and Management, Technical University of Crete, Greece, 1990 Specialty: Manufacturing Technology

PRODUCTION SYSTEMS LABORATORIES

Computer-Aided Manufacturing (CAM) (Director: V. Kouikoglou)	The laboratory serves educational needs and research activities in the areas of flexible production systems, production technology and production with the aid of computers.

Intelligent Systems and Robotics Laboratory (Director: N. Tsourveloudis)	The laboratory serves educational needs and research activities in the areas of robotic systems, kinematics, use of vision systems, sensors and other peripherals, in the development of integrated robotic applications and systems, self-propelled robots, unmanned vehicles, autonomous navigation systems and navigation systems.
Industrial, Energy and Environmental Systems (Director: S. Papaefthimiou)	The laboratory of Industrial, Energy and Environmental Systems provides training and promotes research in the field of automatic control and on the development of novel materials, systems and technologies for environmental and energy applications. Indicatively, the laboratory is active in the following scientific areas: fault diagnostics in industrial systems, control systems, energy savings in buildings (BEMS), sustainable management of water resources, research and development of advanced materials, technologies for the exploitation of conventional / alternative fuels, development of catalytic systems of environmental and energy interest, production of high value-added chemicals / fuels, gaseous pollution, air pollution management, intelligent energy management in ports, life cycle analysis, research on advanced solar panels / photovoltaic cells.
Micromachining and Manufacturing Modeling (m3) (Director: A. Antoniadis)	Micromachining and Manufacturing Modeling Lab (m3) was created in 2010 in order to cover the educational and research needs in advanced manufacturing fields, and micromachining in particular. In addition, the m3 supports manufacturing subjects of mechanical engineers in general. m3 lab provides advanced scientific knowledge to students, while being actively involved in research collaborations with other Universities and Research Institutions and promoting collaborations with enterprises for the resolution of practical problems. The research fields where m3 is actively involved or provides services via the Special Research Fund Account of the Technical University of Crete, are: Simulation of manufacturing processes, Microtechnologies, CAD/CAM/CAE, Finite elements method analysis for production technologies, Reverse engineering and Specialized subjects of bioengineering and nanotechnology.
Turbomachinery and Fluid Mechanics (Director: I. Nikolos)	The laboratory meets the training and research needs in the field of turbomachinery and fluid mechanics, focusing further on Computational Fluid Dynamics, Optimal Turbine Components Design, as well as, on the optimal design of systems, processes and systems related to turbines.

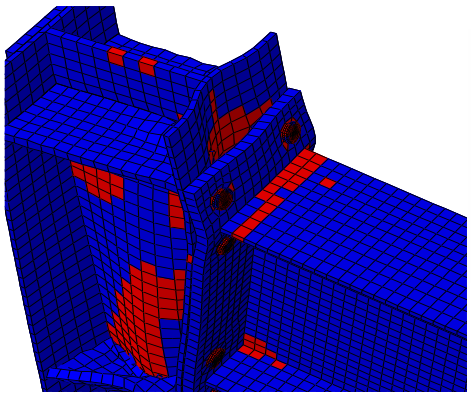
2.1.3 Division of Decision Sciences

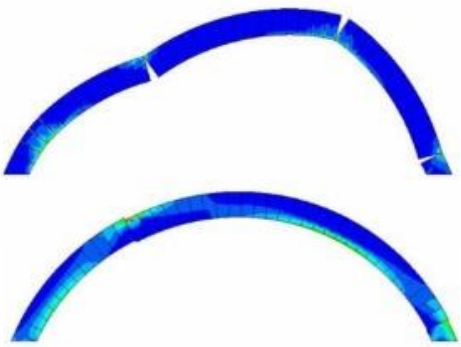
The division of decision sciences specializes in the development of operational research methodologies and techniques that directly aim on decision making, and on the design, control and optimization of production systems, telematic applications and service provision.

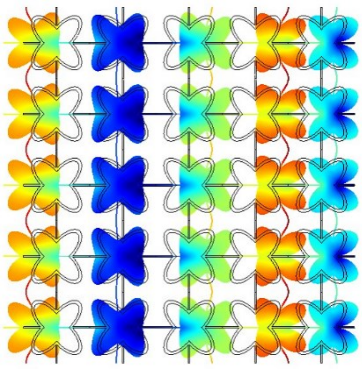
REGULAR FACULTY

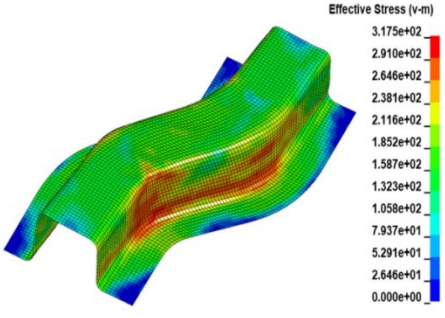
Michalis Doumpos Professor	PhD, Department of Production Engineering and Management, Technical University of Crete, Greece, 2000; MSc, Department of Production Engineering and Management, Technical University of Crete, Greece, 1997; Diploma, Department of Production Engineering and Management, Technical University of Crete, Greece, 1995 Specialty: Computational Methods in Operations Research.
Yannis Marinakis Professor	PhD, Department of Production Engineering and Management, Technical University of Crete, Greece, 2005; MSc, Department of Production Engineering and Management, Technical University of Crete, Greece, 2001; Diploma, Department of Production Engineering and Management, Technical

	University of Crete, Greece, 1999 Specialty: Stochastic Optimization and Applications.
Ioannis Papamichail Professor	PhD, Department of Chemical Engineering and Chemical Technology, Imperial College London, United Kingdom, 2002; MSc, Process Systems Engineering, Imperial College London, United Kingdom, 1999; Diploma, Department of Chemical Engineering, National Technical University of Athens, Greece, 1998 Specialty: Mathematical Programming and Algorithms.
Eleftherios Siskos Assistant Professor	PhD, School of Electrical and Computer Engineering, National Technical University of Athens, Greece, 2018; Diploma, School of Chemical Engineering, National Technical University of Athens, Greece, 2011. Specialty: Decision Analysis and Modeling.
George Stavroulakis Professor	PhD, Department of Civil Engineering, Aristotle University of Thessaloniki, Greece, 1991; Diploma, Department of Civil Engineering, Aristotle University of Thessaloniki, Greece, 1985; Habilitation, Department of Civil Engineering, Carolo-Wilhelmina Technical University, Braunschweig, Germany, 2000 Specialty: Non-smooth Mechanics and Optimization.









DECISION SCIENCES LABORATORIES

Dynamic Systems and Simulation (Director: I. Papamichail)	The laboratory serves educational needs and research activities in the areas of dynamic systems, simulation, optimization and telematics applications.
Decision Support Systems (Director: I. Marinakis)	The laboratory serves educational needs and research activities related to the areas of operational research, information systems and decision support systems, multi-criteria decision analysis, artificial intelligence, business analytics, e-marketing, e-business, multi-agent systems and logistics.
Computational Mechanics and Optimization (Director: G. Stavroulakis)	The laboratory deals with the development and use of computational mechanics and optimization, with emphasis on non-smooth and non-convex problems. The laboratory supports the static and dynamic calculation of materials and constructions, the use of AI in engineering applications, the optimal design, the control of constructions (intelligent constructions) and the problems of parameter identification. Finite and borderline methods of optimization, loose programming and related software packages are developed.

2.1.4 Division of Engineering Management

The division offers courses that cover a wide range of administrative systems and management operations that include, among others: systems administration, marketing, ergonomics, work safety, financial management, project management, information systems, e-business, artificial intelligence, quality control, contract management, technological economics, etc.

REGULAR FACULTY

George Atsalakis Associate Professor	PhD, School of Production Engineering and Management, Technical University of Crete, Greece, 2006; MSc, School of Production Engineering and Management, Technical University of Crete, Greece, 1999; BS, Business Administration, Athens University of Economics and Business, Greece, 1986 Specialty: Technological Forecasting
Pavlos Fafalios ***Assistant Professor***	PhD and MSc, University of Crete, 2016 and 2012, respectively; Diploma Information and Communication Systems Engineering, University of the Aegean, 2009; Specialty: Information Systems and Knowledge Management
Tom Kontogiannis Professor	PhD, Department of Mechanical Engineering, Loughborough University of Technology, United Kingdom, 1988; MSc, Department of Mechanical Engineering, University College London, United Kingdom, 1986; Diploma, Department of Mechanical Engineering, Aristotle University of Thessaloniki, Greece, 1983 Specialty: Ergonomics
Stelios Tsafarakis Associate Professor	PhD, Technical University of Crete, Greece and Université Paris Dauphine, France, 2010; MSc, School of Production Engineering and Management, Technical University of Crete, Greece, 2007; MSc, in Management Information Systems, University of Southampton, UK, 2002; Diploma, Department of Electrical and Computer Engineering, National Technical University of Athens, Greece, 2000 Specialty: Scientific Marketing
Konstantinos Tsagarakis Professor	PhD, in Public Health from the School of Civil Engineering from the University of Leeds, UK, 1999; BS, Department of Economics of the University of Crete, Greece, 2002; Diploma, Department of Civil Engineering of the Democritus University of Thrace, 1995

Constantin Zopounidis ***Professor***	Specialty: Economics of Environmental Science and Technology Doctorat d'État, Université de Paris–Dauphine (Paris IX), France, 1986; D.E.A., Université de Paris–Dauphine (Paris IX), France, 1982; BA, Department of Business Administration, University of Macedonia, Greece, 1981 Specialty: Financial Management

ENGINEERING MANAGEMENT LABORATORIES

Data Analysis and Forecasting (Director: C. Zopounidis)	The laboratory serves educational needs and research activities related to data analysis, forecasting, marketing and quality systems.
Work Safety and Cognitive Ergonomics (Director: T. Kontogiannis)	The laboratory serves educational needs and research activities related to the measurement of working variables, such as noise, lighting and temperature, anthropometric design of workplaces, the simulation of working activities and the development of educational programs with the aid of computers.
Management Systems (Director: S. Tsafarakis)	The laboratory serves educational needs and research activities related to the use of information systems in management and supply chain management, entrepreneurship and management systems and processes.
Financial Engineering (Director: C. Zopounidis)	The laboratory serves educational needs and research activities related to issues of financial analysis, investment planning, as well as infrastructure development in stock market decision studies, business viability, feasibility studies and general financial risk management studies.

2.1.5 Other educational activities, laboratories, and provisions

Machine Tools Laboratory (Director: N. Tsourveloudis)

The laboratory is involved in educational and research activities in machine tools, manufacturing technology material processing, welding, drilling, and milling. This laboratory supports the manufacturing of experimental set-ups and prototypes at the Technical University of Crete.

Laboratory of Applied Mathematics and Computers (Director: A. Delis)

The laboratory with its modern electronic infrastructure, supports the educational and research work of the School in the areas of Mathematics. Its goal is the effective transfer of knowledge in the basic fields of Mathematics, but also its substantial promotion in cutting-edge fields of Applied and Computational Mathematics and Scientific Computing.

Laboratory of Matter Structure and Laser Physics (Director: M. Konsolakis)

The laboratory provides both the educational laboratory support of Physics to the undergraduate students as well as research support for the completion of postgraduate studies. At the same time, intense research activity has been developed, both in basic and applied research.

Computer-Aided Design (CAD) (Director: G. Stavroulakis)

The laboratory supports educational needs and research activities related to product design and the use of Computer Aided Design tools. Its educational and research activities are related to various sectors, such as Mechanical, Textile, Leather, Garment and Footwear

Language Research and Resource Centre

The Language Centre at the Technical University of Crete, established in September 1997. Initially, the only offered language was English until the spring semester of 2002. Then, German language was included. The center is primarily a working environment with autonomous access to resources in English and German, for the successful completion of the required four semesters of foreign

language during the five-year degree program. The tutorials/lectures involve a two-hour course on a weekly basis. Consequently, students have the opportunity to use the resources of the Centre, which include:

- workstations where students have access to online classroom and other online activities,
- forms of exercises that focus on improving the comprehension of texts, grammar, vocabulary and written language,
- collection of videos and DVDs in a combination with their watching media,
- commercial multimedia packages,
- a small library offering novels,
- possibility of guidance and supportive teaching on a personal level from the faculty,
- magazines (general and special topics).

The Language Research and Resource Centre participates in educational activities through the exchange of ideas on language teaching and through collaboration with other centers and teachers from all over Europe. It has welcomed visiting teachers and administrators of Language Centers from foreign and domestic universities. Examples include the Confucius Institute Headquarters (Office of the International Council of Chinese Language, Hanban), Helsinki University of Technology, the Louis Pasteur University and the University of Iceland, the University of Dortmund, the Language Centre and the Stuttgart City Library, the Ilmenau University, the Julich Research Center, the Evangelical Institute of Reutlingen-Ludwigsburg, as well, as the University of Ioannina and the Technological Institute of Piraeus.

2.2 Professors emeriti

Nikolaos Matsatsinis Emeritus Professor	Dr. Matsatsinis was Professor of the School of PEM from 1998 to 2022. He is the president of Hellenic Operational Research Society, Editor-in-Chief in two scientific journals, and has served as head of the department for two terms, director of graduate studies and director of the Decision Support Systems Laboratory. PhD, Department of Production Engineering and Management, Technical University of Crete, Greece, 1995; BSc, Department of Physics, Aristotle University of Thessaloniki, Greece, 1980
Markos Papageorgiou Emeritus Professor	Dr. Papageorgiou was Professor of the School of PEM from 1994 to 2021 and director of the Dynamic Systems and Simulation Laboratory. He has been accredited as a distinguished Visiting Professor and Scholar in a great number of international universities. He was awarded two ERC Advanced Investigator Grants. Dr.-Ing. (1981) and Dipl.-Ing. (1976) in Electrical Engineering, Technical University of Munich
Yannis Phillis Emeritus Professor	Professor Phillis served as the Rector of the Technical University of Crete for four terms and 12 overall years and also as the Head of the Department of PEM. He founded the Laboratory of Computer Aided Manufacturing (CAM) and the Park for the Preservation of Flora and Fauna of the Technical University of Crete. PhD and Postgraduate Diploma, University of California Los Angeles, 1980 and 1978. Diploma in Mechanical and Electrical Engineering, National Technical University of Athens, 1973.

We also highlight the tremendous work and efforts of the late professor Evangelos Grigoroudis, who was the Director of the Decision Support Systems Laboratory and also the dean of the School of Production Engineering and Management during the period Sept/2021-Nov/2023. At this period

substantial institutional collaborations and research activities were performed and aimed to the development of joint entrepreneurship and research actions.

2.3 Other staff

2.3.1 Laboratory Teaching Personnel (LTP)

The 18 members of the Laboratory Teaching Personnel have laboratory teaching duties and also support other academic functions within the School and the University.

Nektarios Arnaoutakis	*Industrial, Energy and Environmental Systems* MSc, School of Mineral Resources Engineering, Technical University of Crete, Greece. Diploma, School of Production Engineering and Management, Technical University of Crete, Greece.
Bakatsaki Maria	*Computational Mechanics and Optimization Laboratory and Managements Systems Laboratory* PhD, Technical University of Crete. MSc and Diploma in Production Engineering and Management, Technical University of Crete.
Nektarios Chairetis	*Interdepartmental Machine Tools Laboratory* MSc and PhD in Production Engineering and Management, Technical University of Crete. Diploma in Mechanical Engineering, Aristotle University of Thessaloniki.
Artemis Kalliataki	*Matter Structure and Laser Physics Laboratory* *MSc in Applied and Technological Physics and Laser Technology, Technical University of Crete. BS in Physics, University of Crete.*
Pavlos Koulouridakis	*Computer Aided Design Laboratory (CAD)* PhD, Technical University of Crete. MSc in Environmental Engineering, Technical University of Crete. BS in Physics, University of Crete.
Lia Krsassadaki	*Decision Support Systems Laboratory* PhD and MSc in Production Engineering and Management, Technical University of Crete. MSc ICAMAS-Mediterranean Agronomic Institute of Chania. BS in Business Administration. University of Piraeus.
Aggeliki Liadaki	*Financial Engineering Laboratory* BS and MSc, Department of Economics, University of Crete.
Magdalene Marinaki	*Computational Mechanics and Optimization Laboratory* PhD, MSc and Diploma, Production Engineering and Management, Technical University of Crete.
George Papadakis	*Cognitive Ergonomics and Industrial Safety (CEIS) Laboratory* PhD and MSc, University of Manchester (UMIST). Diploma in Chemical Engineering, Aristotle University of Thessaloniki.
Marianna Papadomanolaki	*Applied Mathematics and Computers Laboratory* PhD and MSc in Applied and Computational Mathematics, Technical University of Crete. BS in Mathematics, University of Crete.
Panagiotis Petrakis	*Matter Structure and Laser Physics Laboratory* MSc, University of Kent, BS in Physics, University of East Anglia
Savvas Piperidis	*Intelligent Systems and Robotics Laboratory* MSc and PhD in Production Engineering and Management, Technical University of Crete. Diploma, Computer Engineering and Informatics, University of Patras.
Andreas Samaras	*Decision Support Systems Laboratory* MSc in Production Engineering and Management, Technical University of Crete, Diploma in Electrical and Computers Engineering, Aristotle University of Thessaloniki.
Anastasios Sifalakis	*Applied Mathematics and Computers Laboratory* PhD and MSc in Applied and Computational Mathematics, Technical University of Crete, Technical University of Crete. BS in Mathematics, University of Crete.

Nikolaos Spanoudakis	*Applied Mathematics and Computers Laboratory* PhD, Université Paris Descartes. MSc in Production Engineering and Management, Technical University of Crete, Diploma in Computer Engineering and Informatics, University of Patras.
Polychronis Spanoudakis	*Interdepartmental Machine Tools Laboratory* PhD and MSc in Production Engineering and Management, Technical University of Crete. Diploma in Mechanical and Aeronautical Engineering, University of Patras.
George Tsinarakis	*Computer Aided Manufacturing Laboratory* PhD, MSc and Diploma in Production Engineering and Management, Technical University of Crete.
Vangelis Vountourakis	*Dynamic Systems and Simulation Laboratory* *MSc in Production Engineering and Management, Technical University of Crete. BS in Physics, University of Crete.*

2.3.2 Specialized Technical Laboratory Personnel (STLP)

The following personnel provide administration and laboratory support:

Iosif Kontaxakis	*Decision Support Systems* MSc and Diploma in Electrical and Computer Engineering, Technical University of Crete, Greece
Agapi Mavraki	*Secretariat*

2.3.3 Administrative personnel

The School administration is supported by permanent Personnel:

Dorothea Fragomichelaki	*Head of Secretariat* BA in Business Administration, TEI of Crete (Hellenic Mediterranean University), Greece

3. Other Information

3.1 Research and collaborations

The School faculty, postdocs, and graduate students carry out significant research work, both independently and in collaboration with national and international partners including universities, companies and other institutions.

The main goal of the School is pursuing joint research with companies to develop, improve, and modernize their assets.

The cooperation with Greek companies offers students with the opportunity to develop their skills through practical training, delving into specific problems and applying acquired knowledge in practice. This cooperation strengthens the connection with the job market and facilitates the professional career of graduates.

The School participates in European Union Research Programs, as well as in programs financed by the Greek General Secretariat for Research and Technology, which, among others, provide opportunities for exchanging students and faculty personnel between the collaborating Universities and companies.

3.2 Honorary doctorates and professors

The following honorary doctorates have been awarded by the School (in chronological order):

- **5 May 1993, Dr. Rudolf Kalman** for contributions to the field of automatic control;
- **3 May 1996, Sir David Cox** for contributions to the field of modern statistics;
- **10 June 2002**, **Dr. Bernard Roy** for contributions to the field of decision support systems and multicriteria analysis;
- **15 December 2004, Dr. Mohammad Jamshidi** for contributions to the field of automatic control;
- **1 September 2008, Dr. Pravin Varaiya** for contributions to the field of automatic control and applications to production, communication and transportation systems;
- **10 November 2008, Dr. Roman Słowiński** for contributions to the fields of decision support systems, rough sets and soft computing;
- **29 May 2009, Dr. Dimitri Bertsekas** for contributions to the field of optimization and operational re-search.

- **12 September 2012, Dr. Asad Madni** for contributions to the field of systems design and signal processing.
- **14 December 2012, Dr. Jaime Gil-Aluja** for contributions to the field of decision support under uncertainty.

Also, the following honorary Professors have been awarded by the School (in chronological order):

- **13 November 2014**, Dr. Asad M. Madni for contributions to the field of smart sensors, systems design and signal processing.
- **13 June 2018, Dr. Ioannis Siskos** for contributions to the field of multicriteria decision analysis.




4. Undergraduate Program and Regulations

4.1 Structure

The academic year starts on September 1st and ends on August 31st of the following year. Each academic year has two semesters, the fall semester and the spring semester. Each course has duration of one semester and includes:

- lectures,
- tutorials,
- laboratory exercises,
- practical training,
- seminars (given by industry experts), and
- visits to production plants and companies.

The undergraduate program has a total duration of ten (10) semesters, with the first nine semesters devoted to coursework and the final semester to a diploma thesis. Courses are grouped into three categories: (a) core (obligatory) courses, (b) electives, and (c) general electives. The undergraduate degree is conferred upon the successful completion of all core courses, a specific number of elective courses and the diploma thesis.

4.2 Program compilation

The detailed curriculum to be adopted for each academic year comprises course offerings decided at the end of the previous spring semester. The detailed curriculum provides the following information for each of the courses to be offered:

- title of course (core and elective);
- number of lecture hours per week;
- number of tutorial hours per week;
- number of laboratory-exercise hours per week;
- credit units, ECTS.

In Section 5 of this document, the detailed curriculum for the academic year 2022-2023 is presented. To aid students with course selection, a study path is also provided giving recommendations for course selection per semester. To ensure successful completion in the allotted time, to account for interdependencies between courses, and to ensure a balanced workload, students are strongly advised to follow the suggested path.

4.3 Academic year and semester duration

The exact start and end dates of each semester and the exam periods can be found in the academic calendar available at https://www.tuc.gr/index.php?id=3624.

Each semester contains a total of 13 weeks of coursework. There is a break of one week between fall and spring semesters. There are no classes on the following holidays:

Fall Semester	Spring Semester
28th October (National holiday)	Ash Monday
17th November	25th March (National Holiday)
21st November (Local holiday)	Easter break
Christmas Break &New Year's Eve	1st May (Labor Day)
6th January, Epiphany	Holy Spirit Monday

4.4 Course selection and attendance

Online registration for courses takes place during the first two weeks of each semester. Depending on the individual study plan, each student typically registers for 6 or 7 courses per semester; this represents a typical workload for a full-time student corresponding to 23-38 lecture, tutorial, and laboratory hours per week.

Depending on the semester of attendance, certain limits apply regarding the maximum number of courses that a student may register for credit. During the registration period students are allowed to add or drop courses, but no changes are permitted after the registration period expires. Students are not allowed to participate in labs, exams, or take credit for classes they have not registered. In the undergraduate syllabus fall semesters are odd-numbered and spring semesters are even-numbered.

4.5 Exams - Grading

In the beginning of each semester each instructor provides a course syllabus with the course description, office hours, grading policy, and course requirements. Topics to be covered have to match closely with the approved course contents contained in this student guide. Lecture and tutorial attendance is highly recommended but not mandatory. Students have to successfully complete the course requirements which may include midterm exams, assignments, projects, laboratories, and the final exam which is only given during the final exam period.

In each academic year there are three examination periods: the first, in January, after the end of the fall semester; the second, in June, after the end of the spring semester; and the third, in September, after the end of the summer break. The dates for the exam periods are included in the academic calendar; the exam schedule is announced in advance on the department and university websites. The winter examination period is for courses offered in the fall semester, whereas the summer examination period is for courses offered in the spring semester. Students who miss or fail the final exam of one or more courses, they can retake the final exam in the third examination period in September. Students who fail to pass a course during the two exam periods are required to enroll and repeat the course in the following academic year(s).

The final grade issued by the course instructor represents an overall performance assessment in midterm exams, assignments, projects, laboratory exercises, and the final exam. The grading policy is announced by the instructor at the beginning of each semester. The final grades are announced within a period of fifteen (15) days after the final exam and are given on a scale from zero (0) to ten (10), rounded to the nearest half (½). A grade of five (5) or higher is required for successful completion of the course. A linguistic grade is assigned to the final numerical grade according to the following table:

	Excellent	Very Good	Good	Insufficient	Poor
GRADE	8,50 – 10	6,50 – 8, 00	5 – 6,00	3 – 4,50	0 – 2,50

4.6 Diploma thesis

The diploma project and the writing of diploma thesis have a duration of at least one semester. Diploma thesis topics are assigned and supervised by regular and adjunct faculty members in relevant subject areas. Students can start their diploma theses in any semester, yet they can only defend their thesis after having successfully completed their coursework. Upon completion, students publicly present and defend their thesis before an examination committee comprising three faculty members. The thesis grade is the average of the grades assigned by the three committee members, based on 3 criteria: quality of work (50%), quality of the written text (30%), and quality of the oral presentation and defense (20%). At least two members of the thesis examination committee are regular faculty members of the school and at most one member can be a faculty member of another department or school, a member of the laboratory teaching personnel or adjunct faculty with a PhD, or a researcher of an accredited research institution with proven experience in the thesis topic.

4.7 Annual grade and annual success series

The annual grade of the student is calculated according to the following:

a. The student has successfully attended all the semester courses of the previous academic year (i.e., all the compulsory courses and the relevant number of elective courses as defined by the curriculum), taught by both the PEM School and the other Departments.
b. All semester courses are taken into account for the calculation of the annual grade.
c. To calculate the annual grade, the grade of each course is multiplied by a factor called the course weight and the sum of the individual products is divided by the sum of course weights. Course weights are calculated according to the ECTS credits of each course as it results from the following table:

CREDITS (ECTS)	1 – 2	3 – 4	>4
COURSE WEIGHT	1,0	1,5	2,0

Annual class rankings are calculated every September, after the 2nd examination period. Each class rank corresponds to one of the five (5) years of study and comprises those students who have successfully attended all the semester courses provided in the study program. The four (4) academic years following the student's first enrollment in the School are considered as the first four years of study. Students beyond these four years are considered to be in the 5th year of study. Annual class rankings are used for the award of scholarships, honorary distinctions, etc.

4.8 Degree requirements

An undergraduate degree is conferred upon successful completion of all the following requirements:

a. *Enrollment Residence Requirement*: Registration in the Department and attendance for at least 10 semesters.
b. *Required Coursework Requirement*: Successful completion (final grade ≥ 5) of all required courses, for a total of 300 ECTS.
c. *Elective Coursework Requirement*: Successful completion (final grade ≥ 5) of a certain number of required electives. Courses are grouped according to their subject areas in seven (7) groups:

   Group I: Mathematical - Physical Sciences;
   Group II: Humanities – Foreign Languages;
   Group III: Electromechanical Systems;

Group IV: Information Systems;
Group V: Production Systems;
Group VI: Operations Research;
Group VII: Engineering Management.

Students should select and successfully complete exactly two (2) courses from electives in Group II and at least: one (1) course from electives in Group III; one (1) course from electives in Group IV; one (1) course from electives in Group V; one (1) course from electives in Group VI; one (1) course from electives in Group VII.

d. *Diploma Thesis Requirement*: Students should successfully complete and defend their diploma thesis.

A total of 300 ECTS are required for the undergraduate degree. The coursework Grade Point Average (GPA) is computed as a weighted average of the grades received for each of the courses successfully completed. The course weights depend on the course ECTS, as tabulated in Section 4.7. The Diploma Grade is computed by adding the course GPA multiplied by a coefficient of 4/5 and the diploma thesis grade multiplied by 1/5.

According to Greek Regulation, the Diploma of Production Engineering and Management is recognized as Integrated Master's degree.

5. Undergraduate Curriculum

5.1 Undergraduate Curriculum

1st SEMESTER

Code		Courses	Hours/Week Lecture	Tutorial	Lab	Credits/ECTS
ΜΑΘ 101	1	Differential and Integral Calculus I	4	1	-	5
ΦΥΣ 101	2	Physics I	2	1	2	5
ΜΠΔ 101	3	Methodology of Computer Programming	2	-	2	5
ΜΠΔ 102	4	Methodology of Operations Research	2	2	-	5
ΜΗΧ 101	5	Mechanical Drawing	2	-	2	5
ΜΑΘ 201	6	Linear Algebra	3	1	1	5
TOTAL			**15**	**5**	**8**	**30**
General electives						
ΓΛΣ 101 ΓΛΣ 103		English I or German I	2	2		3

2nd SEMESTER

Code		Courses	Hours/Week Lecture	Tutorial	Lab	Credits/ECTS
ΜΑΘ 102	1	Differential and Integral Calculus II	4	1	-	5
ΦΥΣ 102	2	Physics II	2	1	2	5
ΜΗΧ 102	3	Mechanics – Statics	3	-	1	5
ΧΗΜ 103	4	Chemistry	2	-	2	5
ΜΠΔ 121	5	Electric Circuits	3	-	1	5
ΜΠΔ 122	6	Algorithms and Data Structures	2	-	2	5
TOTAL			**16**	**2**	**8**	**30**
General electives						
ΓΛΣ 102 ΓΛΣ 104		English II or German II	2	2		3

3rd SEMESTER

Code		Courses	Hours/Week Lecture	Tutorial	Lab	Credits/ECTS
ΜΑΘ 203	1	Ordinary Differential Equations	3	1	-	5
ΜΠΔ 204	2	Probability for Engineers	3	-	-	5
ΜΗΧ 201	3	Mechanics – Strength of materials	3	-	1	5
ΜΠΔ 202	4	Science and Technology of Materials	3	1	-	4
ΜΠΔ 208	5	Environmental Analysis and Planning	3	1	-	4
ΓΛΣ 201 ΓΛΣ 203	6	English III or German III	2	2	-	3
Required electives: Students should select one (1) course from the following list:						
ΚΕΠ 203	1	Philosophy and History of Science (II)	3	-	-	4
ΜΠΔ 203	2	Electronics (III)	3	-	2	4
ΚΕΠ 101	3	Sociology (II)	3	-	-	4
TOTAL			**20**	**5**	**1-3**	**30**
General electives						
KIN 101		Chinese I	2	2		3

4th SEMESTER

Code		Courses	Hours/Week Lecture	Tutorial	Lab	Credits/ECTS
ΜΑΘ 202	1	Numerical Analysis	3	1	1	5
ΜΠΔ 228	2	Engineering Statistics	3	-	-	6
ΜΠΔ 221	3	Linear Programming	2	2	-	6
ΜΠΔ 305	4	Machine Elements	2	2	-	6
ΓΛΣ 202 ΓΛΣ 204	5	English IV or German IV	2	2	-	3
Required electives: Students should select one (1) course from the following list:						
ΚΕΠ 102	1	Political Economy (II)	3	-	-	4
ΚΕΠ 202	2	History of Civilization (II)	3	-	-	4
ΚΕΠ 302	3	Industrial Sociology (II)	3	-	-	4
ΜΠΔ 407	4	Game Theory (VI)	3	-	2	4
ΚΕΠ 104	5	Introduction to Philosophy (II)	3	-	-	4
TOTAL			**15**	**7**	**1-3**	**30**
General electives						
KIN 102		Chinese II	2	2		3

5th SEMESTER

Code		Courses	Hours/Week Lecture	Tutorial	Lab	Credits/ECTS
ΜΠΔ 301	1	Production Technology I	4	-	2	6
ΜΠΔ 303	2	Stochastic Processes	4	-	-	5
ΜΠΔ 222	3	Management Systems and Processes	3	1	-	5
ΜΠΔ 224	4	Thermodynamics	3	1	-	5
ΜΠΔ 426	5	Combinatorial Optimization	3	-	2	5
Required electives: Students should select one (1) course from the following list:						
ΚΕΠ 201	1	Micro-Macro Economics (II)	3	-	-	4
ΚΕΠ 301	2	Art and Technology (II)	3	-	-	4
ΜΠΔ 230	3	Electronic Business	2	-	2	4
ΜΠΔ 505	4	Ergonomic Work Analysis (VII)	2	1	-	4
ΜΠΔ 432	5	Structural Dynamics, Vibrations and Control (III)	2	2	-	4
TOTAL			**19-20**	**2-4**	**4-6**	**30**
General electives						
ΚΙΝ 103		Chinese III	2	2		3

6th SEMESTER

Code		Courses	Hours/Week Lecture	Tutorial	Lab	Credits/ECTS
ΜΠΔ 321	1	Production Technology II	4	-	2	6
ΜΠΔ 322	2	Production Systems	4	-	-	5
ΜΠΔ 324	3	Decision Support Systems	2	-	2	5
ΜΠΔ 325	4	Non-Linear Programming	2	1	-	5
ΜΠΔ 223	5	Fluid Mechanics	3	1	-	5
Required electives: Students should select one (1) course from the following list:						
ΜΠΔ 306	1	Introduction to Artificial Intelligence (IV)	3	-	2	4
ΜΠΔ 323	2	Data Analysis (VII)	2	2	-	4
ΜΠΔ 302	3	Human Resource Management (IV)	3	1	-	4
ΚΕΠ 204	4	Elements of Law and Technical Legislation (II)	3	-	-	4
ΜΠΔ 436	5	Technical Design of Building Electromechanical Services (III)	2	-	2	4
ΜΠΔ 329	6	Sustainable Finance (VII)	2	-	1	4
ΜΠΔ 327	7	Power Electronics and Applications (III)	3	-	-	4
ΜΠΔ 515	8	Computational Mechanics (III)	3	-	2	4
TOTAL			**17-18**	**2-4**	**4-6**	**30**
General electives						
ΜΠΔ 328		Practical Training I				**5/μήνα**
ΚΙΝ 104		Chinese IV	2	2		3

7th SEMESTER

Code		Courses	Hours/Week Lecture	Tutorial	Lab	Credits/ECTS
ΜΠΔ 401	1	Control Systems I	3	1	2	6
ΜΠΔ 402	2	Financial Management	2	-	1	5
ΜΠΔ 405	3	Quality Control	2	2	-	5
ΜΠΔ 406	4	Marketing	3	-	2	5
ΜΠΔ 304	5	Heat Transfer	3	1	-	5
Required electives: Students should select one (1) course from the following list:						
ΜΠΔ 504	1	Environmental Science and Technology	2	2	-	4
ΜΠΔ 517	2	Energy and Environmental Economics (III)	2	-	2	4
ΜΠΔ 435	3	Enterprise Resource-Planning Systems (ERP/CRM) (IV)	2	-	2	4
ΜΠΔ 410	4	Occupational Health and Safety at Work (VII)	2	1	-	4
TOTAL			**15**	**4-6**	**5-7**	**30**

8th SEMESTER

Code		Courses	Hours/Week Lecture	Tutorial	Lab	Credits/ECTS
ΜΠΔ 421	1	Production Networks (CAM)	4	-	2	6
ΜΠΔ 422	2	Decision Investment Analysis	2	-	1	4
ΜΠΔ 423	3	Computer-Aided Design (CAD)	3	-	2	4
ΜΠΔ 424	4	Ergonomics	3	-	3	4
ΜΠΔ 326	5	Hydrodynamic and Combustion Engines	3	1	-	4
Required electives: Students should select two (2) courses from the following list:						
ΜΠΔ 434	1	Microscale Manufacturing Technologies (III)	1	-	3	4
ΜΠΔ 425	2	Dynamic Programming (VI)	2	1	2	4
ΜΠΔ 430	3	Control Systems II (V)	3	-	2	4
ΜΠΔ 408	4	Total Quality Management (VII)	3	-	-	4
ΜΠΔ 433	5	Small and Medium Enterprises (SMEs) and Innovation (VII)	2	-	1	4
ΜΠΔ 506	6	Strategic Planning (VII)	3	-	-	4
ΜΠΔ 516	7	Renewable Energy Sources (III)	3	-	-	4
ΜΠΔ 518	8	Business Intelligence, Analytics and Big Data Analysis (IV)	2	-	2	4
ΜΠΔ 438	9	Environmental Impact Assessment Studies (V)	2	1	-	4
ΜΠΔ 520	10	Composite & Smart Materials & Structures (III)	2	1	-	4
TOTAL			**18-21**	**1-3**	**9-14**	**30**
General electives						
ΜΠΔ 437		Practical Training II				**5/month**
Field Trip						

9th SEMESTER

Code		Courses	Hours/Week Lecture	Tutorial	Lab	Credits/ECTS
ΜΠΔ 502	1	Introduction to Robotics	3	-	2	5
ΜΠΔ 409	2	Project and Production Management and Scheduling	2	2	-	5
Required electives: Students should select four (4) courses from the following list:						
ΜΠΔ 431	1	Mechatronics (V or VI)	2	-	2	5
ΜΠΔ 501	2	Simulation (V)	4	-	2	5
ΜΠΔ 514	3	Design and Optimization in Supply Chain Management (VI)	3	-	2	5
ΜΠΔ 427	3	Financial Engineering (VII)	2	2	-	5
ΜΠΔ 507	5	Technological Forecasting (VII)	2	2	-	5
ΜΠΔ 510	6	Engineering Economics and Business Plan Analysis (VII)	3	-	2	5
ΜΠΔ 521	7	Additive Manufacturing (III)	2	2	-	5
ΜΠΔ 522	8	Computational Dynamics of Mechanical Systems (III)	2	2	-	5
TOTAL			**13-17**	**2-10**	**2-10**	**30**
General electives						
ΣΕΜ 101		3D Scanning	2	-	2	3

10th SEMESTER

Code	Courses	Hours/Week Lecture	Tutorial	Lab	Credits/ECTS
ΔΙΠ	Diploma Thesis				30
TOTAL		**-**	**-**	**-**	**-**
General electives					
ΣΕΜ 102	3D Printing	2	-	2	3

TOTAL ECTS	**300**

300 ECTS are required to fulfill the requirements for the Diploma of Production Engineering and Management. Students must successfully complete at least one (1) and no more than two (2) courses from the electives in Group II and at least one (1) course from the electives of each Group III, IV, V, VI and VII.

Group II
Humanities - Foreign Languages

1. Art and Technology
2. Micro-Macro Economics
3. History of Civilization
4. Political Economy
5. Philosophy and History of Science
6. Introduction to Legal Systems and Technical Legislation
7. Industrial Sociology
8. Introduction to Philosophy
9. Sociology

Group III
Electromechanical Systems

1. Electronics
2. Dynamics, Vibrations and Control of Structures
3. Environmental Science and Technology
4. Renewable Energy Sources
5. Computational Mechanics
6. Energy and Environmental Economics
7. Technical Design of Building Electromechanical Services
8. Power Electronics and Applications
9. Technology of Non-Metallic Materials
10. Microscale Manufacturing Technologies
11. Computational Dynamics of Mechanical Systems
12. Composite & Smart Materials & Structures

Group IV
Information Systems

1. Electronic Business
2. Introduction to Artificial Intelligence
3. Enterprise Resource Planning Systems (ERP/CRM)
4. Business Intelligence, Analytics and Biga Data Analysis

Group V
Production Systems

1. Simulation
2. Control Systems II
3. Mechatronics
4. Environmental Impact Assessment Studies
5. Computational Mechanics

Group VI
Operational Research

1. Game Theory
2. Dynamic Programming
3. Design and Optimization in Supply Chain Management
4. Mechatronics
5. Business Intelligence, Analytics and Big Data Analysis

Group VII
Engineering Management

1. Data Analysis
2. Occupational Health and Safety at Work
3. Total Quality Management
4. Financial Engineering
5. Small and Medium Enterprises (SMEs) and Innovation
6. Ergonomic Work Analysis
7. Strategic Planning
8. Technological Forecasting
9. Engineering Economics and Business Plan Analysis
10. Human Resource Management
11. Sustainable Finance

Group I, not listed above, consists of core (obligatory/required) courses in mathematics and natural sciences.

5.2 Course descriptions

Group I (Mathematical-Physical Sciences)

Required Courses

DIFFERENTIAL AND INTEGRAL CALCULUS I (ECTS 5) **(ΜΑΘ 101)**

Functions of one variable (Lines, Graphs, Combination, Sifting and Scaling, Trigonometric and Hyperbolic Functions, Inverse Functions). Limits and continuity. Differentiation (Derivative at a point and as a function, Differentiation Rules, Chain Rule, Implicit Differentiation, Differentials). Applications of derivatives (Extreme Values, Mean Value Theorem, Monotonicity, Concavity, Antiderivatives). Integration (Indefinite Integrals, Substitution Method, Riemann Sums, Definite Integrals, Fundamental Theorem of Calculus). Applications of Definite Integrals (Areas, Volumes, Arc Length, Surfaces of Revolution, Work). Transcendental Functions (Derivatives and Integration of Logarithmic, Exponential and Hyperbolic Functions and their inverses). Separable First Order Differential Equations. Techniques of Integration (Integration by parts, Trigonometric substitutions, Partial Fractions). Improper Integrals. Infinite Sequences and Series.

DIFFERENTIAL AND INTEGRAL CALCULUS II (ECTS 5) **(ΜΑΘ 102)**

Vectors. Equations of surfaces and solids. Polar, cylindrical, and spherical coordinates. Parametric representation. Dot and cross vector products. Multivariable functions. Limits and Continuity. Partial derivatives of multivariate functions, Directional Derivative, Gradient, Divergence, Curl. Fundamental theory of vector fields. Lagrange multipliers and multivariate function extrema. Line integrals, multiple integrals (double and triple) and applications to physics and geometry: volume calculation, mass, torque, surface area. Surface integrals and applications in fluid flow. Green's theorem. Parametric representation of surfaces and applications. Stokes' theorem. The divergence theorem.

LINEAR ALGEBRA (ECTS 5) **(ΜΑΘ 201)**

Introduction to Linear and Matrix Algebra. Direct methods for the solution of linear systems. Pivoting strategies, condition number, error analysis, determinants. Eigenvalues and eigenvectors. Diagonalization. Iterative methods for sparse linear systems. Laboratory exercises.

NUMERICAL ANALYSIS (ECTS 5) **(ΜΑΘ 202)**

Solution of algebraic equations in one variable. Interpolation and polynomial approximation. Numerical differentiation and integration. Approximation theory. Initial and Boundary Value Problems for ordinary differential equations. Laboratory exercises.

ORDINARY DIFFERENTIAL EQUATIONS (ECTS 5) **(ΜΑΘ 203)**

Introductory concepts, initial value problems. First- and second-order ordinary differential equations, separable, homogeneous, Bernoulli, Ricati, Euler, variation of parameters, exact equations and integrating factors. Applications in problems from mechanics. Linear independence and the Wronskian. Linear differential equations with constant coefficients. Laplace transform. Homogeneous and non-homogeneous equations with constant coefficients. Linear differential equations with varying coefficients. The power series method.

PROBABILITY FOR ENGINEERS (ECTS 5) **(ΜΠΔ 204)**

Introduction to the theory of probabilities (definition of probability, events, elements of combinatorial analysis). Conditional probability. Independence. Random variables. Distributions. Moments and moment-generating functions. Random-variable functions. Identically-distributed random variables. Conditional random variables and distributions. Sequences of random variables. Laws of large numbers. Limit theorems.

ENGINEERING STATISTICS (ECTS 6) **(ΜΠΔ 228)**

Descriptive statistics (summary statistics, graphical methods for data description, numerical descriptive indices). Sampling (definition of population and sample, collection and processing of statistical data, basic statistical measures, and empirical distributions). Estimation theory (unbiased estimators, Bayes estimators, maximum likelihood estimators). Confidence interval formation for estimators. Hypothesis testing. Neyman-

Pearson lemma. Z-test (normal). Student's t-test. Chi-square test. F-test. Linear regression models, correlation, analysis of variance, design of experiments.

STOCHASTIC PROCESSES (ECTS 5) **(ΜΠΔ 303)**

Introduction. Definition of stochastic processes, probability, distribution and probability density functions, correlation, moments, mean square calculus, independence, stationary processes. Wiener process. White noise. Random walk. Poisson process. Linear systems with stochastic inputs. Ergodicity. Markov chains. Introduction to information theory.

PHYSICS I (ECTS 5) **(ΦΥΣ 101)**

Introduction to the mathematical formalism of Physics using (a) vector calculus, derivatives, and integrals, (b) Generalized coordinates, Lagrange and Hamilton equations. Linear motion, accelerating motion, motion in two dimensions (planar motion). Newton's laws. Dynamics of rotational motion, angular frequency, torque, momentum of inertia. Static equilibrium and elasticity, strength of materials, Young's law and breaking limit. Conservation laws. Kepler's laws, gravitation, satellite orbits. Wave physics, modes of oscillations, wave superposition, resonators, tuning, propagation, and dependence of wave propagation as function of medium properties. Acoustics, fluids, mechanics of fluids and Bernoulli law. Gases and the law of ideal gas. Basic concepts of thermodynamics, laws of thermodynamics. The course is completed with solutions of selected exercises and laboratory exercises.

Laboratory: Familiarization with the operation and use of measuring instruments, the methods of experimental data analysis. Application of error theory, graphical representation of data using the least squares method. Topics covered during the experimental exercises include: mechanics, kinematics, heat - calorimetry and hydrodynamics. Introduction to the use of spreadsheets (Excel) for use in experimental data processing and graphical representations.

PHYSICS II (ECTS 5) **(ΦΥΣ 102)**

Introduction to Electromagnetism. Electrostatics, Magnetostatics, Gauss's and Coulomb's Law, vector and gradient field. Electric charges and dipoles in a field. Ampere's Law. Generation of magnetic fields, motion of charges in electric and magnetic field. Charges in a Conductor, Faraday's law, induction, inductance, transformers, inductive currents, direct current and alternating current generation. Kirchhoff's rules. Simple circuits, RC and RL circuits, tuning-resonance circuits. Introduction to Electrodynamics. Forces between conductors and power lines. Electromagnetic waves. Electromagnetic Wave Energy and Poynting's Vector. Maxwell Equations. Production and propagation of electromagnetic waves. Optics for engineers. Geometric optics, Snell law, optical elements, lenses and mirrors, systems of lens and mirror, optical instruments, interferences effects, diffraction. Photons, electrons, and atoms. Black body radiation. Theory of metals and semiconductors, free electrons, energy zones, n and p type semiconductors, LED diodes and photodiodes. Interaction of electromagnetic waves and light with matter. Photoelectric phenomenon. The course is completed with solutions of selected exercises and laboratory exercises.

Laboratory: Training in the use of electronic and electrical measuring instruments such as: oscilloscope, frequency generators, multimeter, power supply, spectrometer, and Mickelson's interferometer. Topics covered during the experimental exercises include: electric circuits, RLC circuits, electromagnetism, wave theory, optics and optoelectronics.

CHEMISTRY (ECTS 5) **(ΧΗΜ 103)**

Atomic structure. Atomic models. Atomic orbitals. Electron configuration. Periodic Table. Periodic properties. Ionic bond. Covalent bond. Valence bond theory. Hybridization. Hybrid orbitals. Molecular orbitals theory. Intermolecular forces. Metallic bond. Chemical kinetics. Chemical equilibrium. Chemistry and Environment. Solutions. Acid/bases. Course material is completed with lab exercises: safety rules in chemical labs, chemical analysis, volumetric analysis, solutions, chemical reactions, chemical equilibrium.

Group II (Humanities-Foreign Languages)

Required Courses

ENGLISH III OR GERMAN III (ECTS 3) **(ΓΛΣ 201 or ΓΛΣ 203)**

English III: English III combines an independent study program in the Language Center with a series of department- and field-of-study-specific work modules. These modules focus on developing verbal, written and comprehension language skills. Students are required to register and participate in the e-class of this course as well as use the required or recommended resources of the Language Center. The final grade is determined by a series of assignments and quizzes throughout the semester and a final exam.

German III: In German III special emphasis is placed on the introduction of students to technical terminology both in verbal and written communication. In this class students are trained using articles and technical texts properly adapted to the type of exercise and their field of study. The goals of the class are to further enhance writing and comprehension skills developed as part of the German I and II courses. Complementary to regular lectures, students are encouraged to utilize department- and field-of-study- specific audio-visual material available at the Language Center as well as electronically available exercises.

ENGLISH IV OR GERMAN IV (ECTS 3) **(ΓΛΣ 202 or ΓΛΣ 204)**

English IV: Students in English IV will be required to study texts and vocabulary using material related to their fields of study. Students are expected to register and participate in the e-class of the class and use the required or recommended resources of the Language Center. Assignments and quizzes in the duration of the semester in conjunction with a final exam are used to determine the student's final grade.

German IV: Students following the sequence of German courses in the Technical University of Crete have significantly developed their German language skills. The aim of this course is to further enhance language skills through complex texts and exercises, and help students reach a language competence at the level of Mittelstufe (ZMP). Complementary to regular lectures, students are encouraged to utilize department- and field-of-study- specific audio-visual material available at the Language Center as well as electronically available exercises.

Students can register in practice groups to further enhance verbal and writing communication skills.

Elective Courses

SOCIOLOGY (ECTS 4) **(ΚΕΠ 101)**

The course is an introduction to Sociology, with detailed and combining study of concepts related to basic components of the social context within which the human productive activity is taking place. Concepts elaborated include: society, social positions and roles, social change, social stratification and mobility, social categories and classes, socio-political institutions, socio-economic institutions and transformations.

POLITICAL ECONOMY (ECTS 4) **(ΚΕΠ 102)**

Economic knowledge and skills for non-economists. The relation between economic freedom and political freedom. The role of government in a free society. International financial and trade arrangements. The Control of Money. Fiscal Policy. The Role of Government in Education. Capitalism and Discrimination. Monopoly and the Social Responsibility of business and Labor. Occupational Licensure. The Distribution of Income. Social welfare measure. Alleviation of Poverty.

MICRO-MACRO ECONOMICS (ECTS 4) **(ΚΕΠ 201)**

Includes an analysis of commodity supply and demand, consumer theory and corporate theory. On a macroscopic level the issues analyzed include the income and employment determination, inflation, the role of investments, and the problems or development trends within the world economy.

HISTORY OF CIVILIZATION (ECTS 4) **(ΚΕΠ 202)**

The objective of the course is the introduction to the history of culture and the critical analysis of basic concepts and theories of philosophy and of social sciences on culture. Philosophy and culture, theoretical and interdisciplinary approach to the structure and history of culture. The relation between "culture" and "civilization", the mental and the material culture. Continuity and discontinuity, modernism and traditions, progress, and regression in the history of culture, evolution, and development. Socioeconomic formations and types of culture in history. Causality and determinism and historical inevitability. Activity and communication in forming and developing culture and personality. Periodisation criteria. Global, general, and specific, panhuman, national, and local. Freedom and necessity. Cultural identity, dialogism of cultures and multiculturalism. Alienation and "mass culture". Nationalism, xenophobia, racism, cosmopolitism, "globalization", cultural imperialism, and internationalization. Ideology, value orientations, values, evaluations, meritocracy, and crisis of values. Modernity and post-modernity.

PHILOSOPHY AND HISTORY OF SCIENCE (ECTS 4) **(ΚΕΠ 203)**

Science as a social-cultural phenomenon. The role of science within the social structure. Theoretical issues concerning knowledge, logic and methodology of scientific research. Sciences in History. Differentiation, integration and interdisciplinarity of science. Traditions and innovations in the development of science. The subject of scientific activity. Philosophy of science: theories, trends, and different approaches.

INTRODUCTION TO PHILOSOPHY (ECTS 4) **(ΚΕΠ 104)**

A brief review of the history of philosophy. From myth to logos. Fundamental philosophical concepts, categories, and dialectical laws in the areas of theory of knowledge, ontology, and logic (formal and dialectical). Philosophy, science, and technology. Elements of social philosophy: the structure of the development of society as an organic whole, the social consciousness, and its forms. Philosophy as: a necessary element of personality consciousness, self-awareness, and self-consciousness of the culture of each era.

ELEMENTS OF LAW AND TECHNICAL LEGISLATION (ECTS 4) **(ΚΕΠ 204)**

Introduction to legal systems (the role of law, the legal theory of state, ASP of human rights), industrial relations (introductions to the individual contract of employment, trade union rights, collective bargaining, industrial accidents and hygiene and safety at work), introduction to the law of environment protection (principles of environment protection constitutional and general law protection), introduction to the law of natural resources (principles of rights for exploration and exploitation of natural resources in the constitution and the general law).

ART AND TECHNOLOGY (ECTS 4) **(ΚΕΠ 301)**

Technology and Art within the social structure. Technology as objectification, as a framework for human impact on nature and for the relations among people, as a forerunning conception-knowledge and as an instrument implicated upon Nature. The particularity of the aesthetic moment. The aesthetic moment as a specific activity in the division of labor (Art). Art and technology in the. Metaphysical discourse on "Appollonean" and "Dionysean" elements.

INDUSTRIAL SOCIOLOGY (ECTS 4) **(ΚΕΠ 302)**

The scope of the course falls within the field of Sociology of Labor and of Development and has at its core the changes of the productive systems in general and more specifically in the processing sector (crafts, industry), in combination with related sectors of productive and scientific activity. Issues related to industrial relations, productive processes, research, and development (R&D), know-how, industrial policy, inter-sectoral and inter-industrial relations are investigated in detail and in a combinational manner, on several scales (international, national, local-regional).

Group III (Electromechanical Systems)

Required Courses

MECHANICAL DRAWING (ECTS 5) **(MHX 101)**

Introduction to Mechanical Drawing. Basic rules. Views and sections. Dimensioning. Drawing of threads, screws, rivets, gears, cams, bearings, seals and other machine elements. Drawing of welds. Intersections and developments. Indication of Machining processes. Indication of dimensional and geometrical tolerances. 3D drawing.

MECHANICS – STATICS (ECTS 5) **(MHX 102)**

Systems of units. Equilibrium of particles. Rigid bodies (forces, moments, moment of couples, equivalent force-moments systems). Equilibrium of rigid bodies. Centre of gravity and centroids of surfaces. Moments of inertia and second moments of area. Truss analysis using the method of joints and the method of sections (Ritter). Internal forces in beams and cables. N,V,M diagrams. Friction and equilibrium via the Virtual Work method.

LAboratory: Solving frames and trusses using dedicated software. Analyses of internal forces and moments in complex structural systems.

MECHANICS – STRENGTH OF MATERIALS (ECTS 5) **(MHX 201)**

Internal forces, stresses. Strains. Stress-strain relationship. Statically indeterminate problems. Temperature effects. Shear deformation. Stress and strain distribution. Torsion. Pure bending. Asymmetric bending. Transverse loading. Transformation of stress and strain. Stresses under combined loading. Mohr's circle. Stresses and deflections in beams. Energy methods.

ELECTRIC CIRCUITS (ECTS 5) **(ΜΠΔ 121)**

Electrical quantities: charge, current, potential, energy, power. Elements of electric networks: resistor, inductor, capacitor, dependent and independent sources, switches. Electric network theorems: Kirchhoff's laws, voltage and current division, combination of resistors in series and parallel, principle of superposition, combination of inductors in series and parallel, combination of capacitors in series and in parallel, Kennelly's theorem, source transformations, Thévenin's and Norton's theorems, Millman theorem, symmetric circuits, nodal and loop methods. Elementary transient phenomena. Sinusoidal steady-state analysis of electric circuits: phasors, impedance, power, network theorems. Three-phase circuits: delta and star connection of three-phase windings, power, power factor correction, transformers.

Laboratory: Simulation of electric circuits using the LTSPICE software.

SCIENCE AND TECHNOLOGY OF MATERIALS (ECTS 4) **(ΜΠΔ 202)**

Atomic and Molecular Structure. Structure of Crystalline Solids. Structure-Properties relationships. Mechanical Properties of Metals. Metal Alloys. Dislocations and Strengthening Mechanisms. Failure. Imperfections in Solids. Diffusion. Phase diagrams. Optical-Thermal-Electrical-Magnetic Properties. Physicochemical Characterization of Materials. Materials for Energy and Environmental Applications.

FLUID MECHANICS (ECTS 5) **(ΜΠΔ 223)**

Introduction. Fluid properties. Hydrostatics. Hydrostatic pressure prism. Eulerian and Langragian flow description, streamlines, pathlines. Integral flow equations. Differential flow equations. Stream function. Velocity potential. Laplace equation. Bernoulli equation. Rotational and irrotational flow fields. Newton's law for viscosity. NavierStokes equations. Euler equations. Laminar and turbulent flow in piping systems. Laminar flow inside straight pipes. Laminar flow inside noncircular ducts. Turbulent flow inside straight pipes Moody diagram. Major and minor losses. Flow in pipe networks.

THERMODYNAMICS (ECTS 5) **(ΜΠΔ 224)**

Introduction. Thermodynamic systems and control volume. Microscopic and macroscopic viewpoints. Properties of state. Specific volume, temperature, pressure. Processes and cycles. Zeroth law of thermodynamics. Temperature scales. The pure substance. Phase equilibrium; independent properties of a pure substance. Equations of state; Ideal gas law. Concept of Energy, Heat and Work. The First Law of Thermodynamics for closed and open systems. The Second Law of Thermodynamics for closed and open

systems. Entropy. Irreversibility and availability. The Rankine cycle; effects of pressure and temperature on the Rankine cycle; the reheat cycle; the regenerative cycle. Air-standard power cycles. Diesel and Otto cycles.

HEAT TRANSFER (ECTS 5) **(ΜΠΔ 304)**

Introduction, modes of heat transfer. Conduction, Fourier's law, heat diffusion equation, one-dimensional thermal conduction, thermal-resistance, fins. Numerical methods in steady-state heat conduction problems, discretization of differential equations. Transient conduction, the lumped-capacitance method, numerical methods in transient heat conduction. Convection, heat and mass transfer equations, velocity and thermal boundary layers, laminar and turbulent flow, boundary-layer equations, dimensionless parameters, internal flow in circular pipes, energy balance in pipes. Basic principles of radiative heat transfer.

MACHINE ELEMENTS (ECTS 6) **(ΜΠΔ 305)**

Introduction to Mechanical Design. Strength of materials. Criteria of static failure. Fatigue and failure criteria under dynamic loading. Shafts, failure analyses under static and dynamic loads. Manufacturing materials. Spur, helical, bevel gears and planetary systems. Gear tooth bending failure and tooth surface pitting. Mechanical power transmission with geartrains. Mechanical power transmission with elastic components. Screws and fasteners. Welds. Ball bearings and selection. Computational methods. Miscellaneous mechanical components.

HYDRODYNAMIC AND COMBUSTION ENGINES (ECTS 4) **(ΜΠΔ 326)**

Introduction. Internal Combustion Engines (development, types, parts, basic operation). Thermal Turbomachines (development, types, parts, basic operation). Pumps and hydro-turbines (development, types, parts, basic operation). Basic design and operation principles of turbomachines. Energy equation, and moment-of-momentum theorem. Differences between compressible and incompressible flows. Velocity components, relative frame of reference and velocity triangles. Euler equation for turbomachines. The blade element concept; application in radial and axial flow impellers. The conservation of angular momentum. Alternative designs; radial flow, axial flow, mixed flow turbomachines. Multi-stage turbomachines. Radial diffusers, spiral casings, and volutes. Isentropic efficiencies, flow coefficient, load coefficient, degree of reaction. Shaft-power gas turbines; ideal and non-ideal air standard basic cycles (Joule-Brayton); modified cycles (preheat, steam injection, water injection, air intercooling, reheat). Closed-cycle gas turbines. Radial flow pumps; general principles of design and operation, velocity triangles, ideal efficiency, optimum flow rate, ideal and actual impeller’s characteristic curve, hydraulic efficiency, volumetric efficiency, mechanical efficiency. Characteristic curves and their modification with rotation speed. Pump’s operating point, pump selection, combination of pumps (serial, parallel, mixed designs).

ROBOTICS (ECTS 5) **(ΜΠΔ 502)**

Introduction, history of robotics. Current state of the art of robotics, with emphasis on industrial applications. Types of robotic systems. Basic principles of robotic manipulators, robotic joints, open-closed kinematic chains. Criteria of kinematic performance. Classification of robots based on their geometric configuration. Robotic grippers, sensors, and actuators. Terminology and mathematic tools for the kinematics of solid bodies. Homogeneous transformations: coordinate frames, position vectors, rotation matrix. Orientation description using Euler angles. Kinematic analysis, Denavit-Hartenberf algorithm. Inverse kinematics, workspace, and methodologies to solve the inverse kinematic problem in a robotic manipulator. Jacobian. Path planning of a robotic manipulator. Types of autonomous robots, mechanisms of motion of autonomous robots, kinematics of autonomous robots. Introduction to Robotic Operating System (ROS).

Laboratory: Analysis of robotic manipulators in a simulated environment (Using Matlab/Octave). Develop simulated models (ROS/Gazebo). Robotics actuators and sensors. Mobile robots (using simulated and real TurtleBot robots).

Elective Courses

ELECTRONICS (ECTS 4) **(ΜΠΔ 203)**

Analog electronics: semiconductor physics, rectifying diodes, special diodes, diode circuits and applications, bipolar junction transistor, common emitter voltage amplifiers, operational amplifiers, JFET, MOSFET. Digital electronics: digital circuit analysis and design. Binary systems: binary numbers, binary codes, binary logic.

Boole algebra. Digital logic gates. Integrated circuits. Combinational logic: adders, subtractors, comparators, coders and decoders, multiplexers. Sequential logic: flip-flops, design and analysis of flip-flop circuits, counter design. Registers, counters, and memory units. Use of the SPICE software for the simulation of analog and digital electronic circuits.

POWER ELECTRONICS AND APPLICATIONS (ECTS 4) (ΜΠΔ 327)

Fundamentals of power electronics: semiconductor physics and basic semiconductor elements (diodes, JFET, MOSFET, GTO, IGBT). Introduction to power converters. Single- and three-phase diode rectifiers. Thyristor-based, controlled single- and three-phase rectifiers. Single- and three-phase inverters. Sinusoidal pulse width modulation. Total harmonic distortion. Real power coefficient. Distortion factor. Introduction to filter design. Power electronics applications: electric motors, wind turbine systems, photovoltaic systems, electric vehicles, electric power transmission.

STRUCTURAL DYNAMICS, VIBRATIONS AND CONTROL (ECTS 4) (ΜΠΔ 432)

Single-degree-of-freedom linear oscillator: free vibration response, eigenfrequency, damping, forced vibration. Multiple-degree-of-freedom systems: simulation, eigenmodes, eigenfrequencies, eigenvalue analysis. Analytical dynamics: generalized coordinates, kinematic constraints, virtual work, Langrage equation, Hamilton equation. Continuous systems: axial vibrations of a bar, torsional vibrations of a shaft, transverse vibrations of a beam. Applications in lumped capacity systems, and finite elements. Fundamental principles of signal processing: frequency analysis, Fourier series, Fourier transform, spectrum, applications. Structural control: problem formulation, passive and active control, application of linear-quadratic regulator.

Laboratory: Solution of dynamics and vibration examples using educational software (codes in MATLAB/SIMULINK and compatible software). Demonstration of specialized software for dynamics and vibrations of multi-body-dynamics and the finite element method.

TECHNICAL DESIGN OF BUILDING ELECTROMECHANICAL SERVICES (ECTS 4) (ΜΠΔ 436)

Types of Technical Drawing. Electromechanical installations in buildings. Electrical drawing. Basic connections of electrical installation. Drawing of low voltage panels, building installations, low current installations, grounding. Heating, cooling and air conditioning drawings. Water supply and sewerage drawings. Lift design. Fire safety and lightning protection system drawings. Examples of building installations. AutoCAD software and drawing of Electromechanical installations by CAD.

Laboratory: Introduction to AutoCAD. Description of the environment of the software and basic commands for drawing and editing. Drawing of Blocks. Advanced drawing commands. Electromechanical installations drawing. Basics of AutoLisp programming language.

ENVIRONMENTAL SCIENCE AND TECHNOLOGY (ECTS 4) (ΜΠΔ 504)

Environmental pollution: air, water, soil, biosphere. Technology, industry, and environment. Air pollution: sources and impacts. Air emissions control technologies. Technologies for removal particulate matter. Wastewater treatment technologies. Management and energy utilization of solid waste.

COMPUTATIONAL MECHANICS (ECTS 4) (ΜΠΔ 515)

Numerical methods in structural mechanics: classical methods Rayleigh, Ritz, Galerkin, finite differences and finite elements. The finite element method: equilibrium conditions, compatibility material constitutive law, Discretization, stiffness and mass matrix, matrix assembly, solution, post processing of data. Variational principles, detailed study of finite elements for rods, beams and two-dimensional linear elasticity problems, technology of finite element programs. Related applications to heat transfer and fluid mechanics problems. Application examples using existing software.

Laboratory: Solution of computational mechanics examples using the finite element method and educational software (MATLAB and compatible software codes, or alternatively FORTRAN, C, BASIC, PYTHON codes). Solution of more complicated examples using general purpose finite element software (free codes like Z88, code aster) and demonstration of commercial codes (COMSOL).

RENEWABLE ENERGY SOURCES (ECTS 4) (ΜΠΔ 516)

Introduction and general definitions. Forms of energy and energy needs. Solar energy: photothermal, photoelectric and passive solar systems. Wind energy: key characteristics of wind - wind turbine technology.

Biomass - Biofuels. Geothermal energy. Hydraulic power and hydropower plants. Ocean and tidal wave energy. Principles of energy saving and energy efficiency.

ENERGY AND ENVIRONMENTAL ECONOMICS (ECTS 4) (ΜΠΔ 517)

Introductory Concepts: Energy Balance, Installed Electrical Power Units, Energy Production and Consumption, Basic Energy Sources. Power Production Technologies: Energy Autonomy, Power and Combined Heat and Power Plants, Electricity Demand / Load Curves. Environmental Economics: Environmental Assessment and Impacts of Energy Production and Use, Analysis of Environmental Decisions, Economic Impacts of Pollution and Climate Change. Energy and Environmental Policy: Energy Markets, Environmental and Macroeconomic Energy Costs, European Union and Greek Energy Policies, Estimation of macroeconomic models of CO_2 emissions. Details of Energy Investments and Projects - Techno-Economic Terms: Investment Costs, Operating Costs, Cash Flow, Net Present Value, Feasibility Studies and Evaluation of Energy Investments, Estimation of operating costs and energy production costs by including CO2 emissions. Design of Energy and Environmental systems through Economic Analysis: Delving into a) power plant design issues, b) hybrid RES systems, c) combined heat and power systems, reduction of CO2 emissions.

Laboratory: Tutorials on the US EPA Waste Reduction Model (WARM) and online statistical tools. Tutorials with Energy Systems Design and Financial Evaluation Packages (Aspen Plus, HOMER).

NON-METALLIC MATERIALS TECHNOLOGY (ECTS 4) (ΜΟΠ 428)

Introduction to non-metallic materials. Ceramics: microstructure, properties, synthesis and preparation, clay ceramics, glasses, oxides, bioceramics, advanced ceramics materials, applications. Polymers: structure, mechanical properties, synthesis, preparation and processing, applications. Composites: properties, applications, fiber, and self-reinforced nanocomposites.

MICROSCALE MANUFACTURING TECHNOLOGIES (ECTS 4) (ΜΠΔ 434)

Introduction to microfabrication. Micrometrology and materials characterization. Micromolding, Micromachining, Microgrinding. Diamond microcutting tools. Laser microfabrication. Micro waterjet. Microelectrodischarge machining. Ultrasonic micromachining. Materials. Simulation of microfabrication processes.

Laboratory: Manufacturing of mold with free form surfaces using CNC Machine Tools and CAD/CAM software.

COMPOSITE AND SMART MATERIALS AND STRUCTURES (ECTS 4) (ΜΠΔ 520)

The course provides knowledge relevant to the design and manufacturing technology of composite amd smart materials and structures using classical and additive manufacturing. Production technology and applications. Composite materials, homogenization theory, and elements of anisotropic elasticity. Fiber-reinforced composites (CFRP) and materials with functionally graded properties (Functionally Graded Materials). Classical theories of laminated materials/structures, computational methods using finite elements (as a continuation of the computational mechanics course and advanced discussion of shell structures). Smart materials / metamaterials / intelligent structures, smart materials due to microstructure and geometry or due to the integration of multi-physics elements (piezoelectric, microelectronic, and other related elements). Smart materials with mechanical logic gates.

Exercises and laboratory projects: Applications of anisotropic elasticity and theory of composite structures, evaluation of experimental measurements, homogenization calculations and structural analysis using finite elements. Piezocomposites.

ADDITIVE MANUFACTURING (ECTS 5) (ΜΠΔ 521)

Introduction to additive manufacturing, classification of engineering materials (polymers, ceramics, composites, biomaterials) and their principal properties-applications. Additive manufacturing techniques of metallic materials (SLM, SLS, DED, WAAM), microstructure and mechanical properties. Additive manufacturing of polymers (FFF, FDM, SLA) and ceramics (LBCP). Additive manufacturing of composite materials and biomaterials. Design for additive manufacturing, optimization of the 3D model and rapid prototyping. Parameters of additive manufacturing, optimization and new research fields, effect on the product quality. Investigation of additive manufactured parts: surface, mechanical, physical and chemical properties. 3D printing and 3D scanning. Application of additive manufacturing on the fabrication of metastructures and multimaterials. Financial aspects of additive manufacturing. Hybrid manufacturing.

COMPUTATIONAL DYNAMICS OF MECHANICAL SYSTEMS (ECTS 5) **(ΜΠΔ 522)**

Approximate modal analysis using appropriate commercial finite element software. Galerkin reduction, method of assumed mode shapes. Numerical integration of the equations of motion for complex mechanical systems using mathematical modelling software. Numerical determination of periodic responses (collocation method, harmonic balance method). Local and global bifurcations. Free and forced nonlinear vibrations, stability of steady-state solutions, existence and stability of periodic solutions. Self-excited oscillations. Parametric resonance. Continuation method for periodic solutions. Identification of dynamic characteristics of existing systems and components. Basic methods and description of equipment for experimental vibration analysis of mechanical systems. The syllabus and theory are organized around the following applications with concurrent training in modern computational analysis tools: Determination of the dynamic behaviour of vehicle components and other complex mechanical systems. Dynamic response determination of electromechanical systems and vibration energy harvesters. Vibration suppression of machines with vibration absorbers. Dynamic power transmission with geartrains. Machining vibrations (chatter) and CNC machining centres, aeroelastic vibrations of blades and structures. Vibrations of machines with rotating parts and rotating blades. Mechanical vibrations of Micro-Electro-Mechanical Systems (MEMS). Assessment with assignments.

Group IV (Information Systems)

Required Courses

METHODOLOGY OF COMPUTER PROGRAMMING (ECTS 5) **(ΜΠΔ 101)**

Introduction to software technology and programming: history of software, types of software, fundamentals, problems and challenges, fundamental activities, algorithms and data structures, algorithmic efficiency, algorithm representation, logic diagrams, pseudocode. Familiarity with the C programming language. The Integrated Development Environment (IDE) Code::Blocks. Learning the C programming language up to the level of manipulating arrays and structures: variables, data types, constants, operators, user input and output, selection statements, iteration statements, functions, arrays, strings, structures. Software development processes, requirements engineering, use case diagrams, activity diagrams.

Laboratory: Practice in programming in C language and implementation of assignments using the Code::Blocks IDE.

ALGORITHMS AND DATA STRUCTURES (ECTS 5) **(ΜΠΔ 122)**

Analysis of algorithms, C programming (pointers, input/output from/to files, structures, unions, enumerations). Abstract data types, stacks, queues, lists, trees, binary trees, binary search trees. Recursive algorithms. Search and sorting algorithms.

Laboratory: Programming exercises using the C language for pointers, input/output from/to files, structures, recursive algorithms, Abstract data types stacks, lists, soring algorithms.

DECISION SUPPORT SYSTEMS (ECTS 5) **(ΜΠΔ 324)**

Introduction to information systems and information technology. Data, information, knowledge. Decision making and decision theory. Decision making under risk and uncertainty. Multi-criteria decision analysis. Outranking and functional multicriteria decision models. ELECTRE I and II, PROMETHEE I and II methods. Criteria importance elicitation and calculation methods. The linear and additive value function. Group decision making and negotiations. Decision Support Systems (DSS). Architecture of a DSS. Human-computer interaction systems. Database management systems. Model database management systems. Intelligent DSS. Applications of DSS in energy, administration, production, environment, etc. Case studies.

Laboratory: Excel: Pivot Tables and Solver, Expert Choice, SPSS package, UTASTAR, AHP and MUSA methods, MARKEX DSS, Introduction to the Python language.

Elective Courses

ELECTRONIC BUSINESS (ECTS 4) **(ΜΠΔ 230)**

Introduction to e-Business and e-Commerce: brief history, Intranet/Extranet/Internet, World Wide Web, mobility platform, basic types of e-commerce, main trends. Business models and related concepts: categories of business models, capital raising, pricing strategies, payment systems, impact on industry and business. Digital marketing and advertising: consumer profiling, consumer behavior, search engine marketing, display ads marketing, email marketing, social marketing, other digital marketing strategies (collaborative, viral, flash, personal, location-based), web analytics. Internet technology: history, technological components (IP, TCP/IP, HTTP, packet switching, network infrastructure, domain names, DNS, URLs, client-server model). Developing an e-commerce presence: website construction and hosting, hardware selection, design principles, presence on mobile devices. Web Technologies: Introduction to HTML, Introduction to CSS, Bootstrap Framework. The online security environment (cybersecurity): threats, solutions, cryptography, protection of communication channels, protection of servers and clients, management policies, laws. Ethical issues, privacy, intellectual property, governance.

Laboratory: Practice in designing and developing websites (HTML, CSS, Bootstrap)

INTRODUCTION TO ARTIFICIAL INTELLIGENCE (ECTS 4) **(ΜΠΔ 306)**

Introduction to Artificial Intelligence. Problem Solving. Knowledge Representation and Reasoning. Uncertainty and Fuzzy Knowledge. Planning. Expert Systems. Machine Learning. Rough Sets. Neural Nets. Evolutionary and Genetic Algorithms. Fuzzy Sets. Data Mining. Intelligent communication methods (natural language processing, vision, robotics). Agents: intelligent agents, multi-agent systems, applications. Laboratory

ENTERPRISE RESOURCE PLANNING SYSTEMS (ECTS 4) **(ΜΠΔ 435)**

Introduction to Information Systems, Enterprise resource planning systems (ERPs), Customer Relationship Management Systems (CRMs), System architectures, components, modules and technical infrastructure of ERPs, System's analysis and design, Business processes in ERPs, Business Process Reengineering, Specific ERP components (Manufacturing, Financials, Supply chain management, Warehouse Management, Distribution, Marketing, Sales, Human Resources Management, Logistics), Operations that ERP support, pros and cons of using ERPs, E-commerce and ERP, Business Intelligence and ERP, ERP and Data Warehouses – OLAP, Success factors of ERPs, Feasibility study of getting an ERP, Evaluating, selecting, installing, configuring and customizing an ERP, Production Planning through ERPs, Material requirements and resource planning (MRP I and MRP II), Demonstration of the MBS Navision ERP, MBS Navision CRM. Special issues: Enterprise Application Integration, Interoperability, Service-Oriented Computing, Web Services.

BUSINESS INTELLIGENCE, ANALYTICS AND BIG DATA ANALYSIS (ECTS 5) **(ΜΠΔ 518)**

Business Intelligence, Customer Intelligence, Cloud Business Intelligence, Mobile Business Intelligence. Business Analytics. Data Science, Big Data, Big Data analytics technologies, distributed systems, MapReduce, Apache Hadoop, relational and non-relational (NoSQL) databases, Cloud Computing, big data and business. Decisions, decision support systems, decision making process, decision making under uncertainty and risk, decision trees. Data, information, knowledge, understanding, wisdom. Knowledge management. Data Warehouses. Online Analytical Processing (OLAP) systems. Data Mining and Machine Learning, models of knowledge discovery processes, Machine Learning paradigms, categories of Machine Learning problems, limitations and issues of Machine Learning. Data preprocessing: quality, integration, cleaning, completion, smoothing, inconsistency resolution, redundancy removal, data reduction, dimensionality reduction, numerosity reduction, data normalization. Classification: decision trees, classification algorithms, evaluation. Clustering: clustering algorithms, hierarchical algorithms, partitioning algorithms, density-based algorithms, quality measurement.

Laboratory: Training in the use of the Weka tool.

Group V (Production Systems)

Required Courses

MANUFACTURING TECHNOLOGY I (ECTS 6) **(ΜΠΔ 301)**

Introduction. Mechanical behavior of materials: tension, compression, torsion, hardness, creep. Structure and manufacturing properties of metals: grains and boundaries, failure and fracture, recovery, recrystallization. Dimensional tolerances. Casting processes: solidification of metals, casting alloys, ingot casting and continuous casting, expendable and permanent mold. Cutting Processes: machine tools, chip formation, tool wear, tool materials, tool life, cutting fluids. Production economics, introduction to CNC programming, G-code. Laboratory.

MANUFACTURING TECHNOLOGY II (ECTS 6) **(ΜΠΔ 321)**

Introduction, Deformation Processes: forging, rolling, extrusion. Sheet-Metal Forming Processes: shearing, bending, deep drawing. Powder metallurgy, sintering. Joining Processes: arc-welding with consumable and non-consumable electrode, laser and electron beam welding, friction, resistance, explosion and ultrasonic welding. Manufacturing flexibility, types, definitions and measurement models. Laboratory.

PRODUCTION SYSTEMS (ECTS 5) **(ΜΠΔ 322)**

Introduction. Inventory systems with static and dynamic demand. Production planning: static mixing problems, aggregate production planning, process planning. Stochastic demand, single-replenishment (newsvendor) model. Multi-item economic lot sizing and sequence-dependent setup scheduling problems. Demand forecasting: linear regression, moving average, simple exponential smoothing, minimum mean square error, Bayes estimation, Box-Jenkins (ARMA) models. Production scheduling: sequencing of n jobs in one machine and in two- and three-machine flow lines. Single-machine sequencing with due dates and with required precedence among jobs.

CONTROL SYSTEMS I (ECTS 6) **(ΜΠΔ 401)**

Introduction and Definition Terms: Open and Closed Loop Systems, Feedback Control, Basic elements in a control system. Mathematical Concepts: Input/Output Signals, Laplace Transformation, Mathematical Models based on Differential Equations, Dynamic/Time Response. System Description: Block Diagrams, Transfer Functions, 1st -2nd- nth order systems. Control System Features: PID Controller (proportional, integral, derivative/differential actions), Stability, Root Locus, Effect of poles/zeros/dead time in a Control System, Tuning of PID Controllers.

Laboratory: Introduction to MATLAB, Control-related functions and computational codes, Design and Simulation of control-based problems, Individual student projects.

QUALITY CONTROL (ECTS 5) **(ΜΠΔ 405)**

Introduction to quality and quality improvement methods. Concept and techniques for quality control. Basic categories of statistical quality control. Introduction to statistics. Acceptance sampling. Single, double and multiple sampling plans. Sequential sampling plans. Other acceptance sampling techniques. Introduction to statistical process control and control charts. Control charts for variables and attributes. Other statistical process quality control techniques.

PRODUCTION NETWORKS (CAM) (ECTS 6) **(ΜΠΔ 421)**

Production Networks (CAM): Introduction. Continuous time Markov chains, Kolmogorov equations. Birth-death models, steady state, stability. M/M/1 system and extensions. Non-birth-death Markovian models: Erlang distribution, z transform, batch arrivals/service, Burke theorem, open Jackson networks. Advanced models: M/G/1, M/G/m/m, G/G/1, G/G/m. Introduction to flexible manufacturing systems (FMS) – analytical tools and control issues.

Laboratory: Review of mathematical tools used in the theoretical part of the course. Introduction to CNC machines programming. G and M code CNC programming. Denford Orac lathe and Haas Minimill CNC machines programming for the manufacturing of products with given specifications.

COMPUTER-AIDED DESIGN (CAD) (ECTS 4) **(ΜΠΔ 423)**

Introduction to Computer-Aided Design (CAD). CAD and the product design process. Three-dimensional geometric modeling systems. Wire frame, surface, solid and parametric modeling. Representation of curves and surfaces (Ferguson, Bezier, B-Splines, NURBS). Solid modeling Systems. Constructive solid geometry CSG, boundary representation (B-Rep).

Laboratory: Siemens NX

ENVIRONMENTAL ANALYSIS AND PLANNING (ECTS 5) **(ΜΠΔ 208)**

Humanity and the environment. Concepts and principles of ecology. Environmental ethics and legislation. Environment and sustainable development. Environmental problems: global warming and climate change, stratospheric ozone depletion, acid rain, urban smog, ecosystems' destruction. Environmental Management Systems. Life Cycle Analysis. Environmental - ecological footprint. Ecological and energy labelling. European legislation and international standards and regulations on environmental and energy management and planning issues.

Elective Courses

CONTROL SYSTEMS II (ECTS 4) **(ΜΠΔ 430)**

Advanced Single Input - Single Output Control Design / Synthesis: Feedback Control, Feedforward Control, Feedforward/Feedback Control, Cascade Control. Introduction to multivariable control systems: State-space models, Linearization of Differential/Algebraic Equations, Controllability, Observability, Stability. Multivariable Control: Pole placement, State-Feedback control, LQR Control, State-Observer. Introduction to Optimal Control.

Laboratory: Advanced model-based control simulations, applications on engineering aspects (energy, environmental and mechanical –related).

SIMULATION (ECTS 5) **(ΜΠΔ 501)**

Models of dynamic and stochastic systems. Discrete event systems. Detailed simulation of inventory, production and queuing systems, and Markov chains. Random variate generators. Statistical techniques for performance estimation and comparison of alternative systems, variance reduction techniques. Introduction to perturbation analysis and optimization of queuing systems.

Laboratory: Introduction to simulation software. Simulation of simple queuing systems with one server and several servers in parallel and production lines.

MECHATRONICS (ECTS 5) **(ΜΠΔ 431)**

Introduction and examples. Simulation of engineering systems. System dynamics and oscillations. Types and simulation of sensors and actuators. Processing of measurement data. Intelligent control (hierarchical control, hybrid control, fuzzy, neural and fuzzy-neural control). Dynamical system diagnostics. Applications.

Laboratory: Simulation of NeuroFuzzy systems and applications in mechatronic systems (Using Matlab/Octave).

ENVIRONMENTAL IMPACT ASSESSMENT STUDIES (ECTS 4) **(ΜΠΔ 438)**

The Greek legal framework for environmental permitting is presented, involving the steps required for an Environmental Impact Assessment Study. A thorough discussion on Articles of the L.4014/11 “Environmental Permitting of Projects and Operations” takes place. Students are evaluated on their ability to classify projects in the basic categories and subcategories (A1, A2, B) specified in the legal framework. The Environmental Permit Process for Small Project and Activities (B class) is analyzed and representative projects, from those more relevant to the students’ field of study, are studied: hydraulic, environmental infrastructure, commercial centres, parking - sport –education facilities, electric power production, car service stations, renewable energy, and high voltage centres. The content of the environmental impact assessment studies is detailed. Finally, public consultation legal framework for environmental impact assessment studies is presented.

Group VI (Operational Research)

Required Courses

METHODOLOGY OF OPERATIONS RESEARCH (ECTS 5) **(ΜΠΔ 102)**

Methodological framework of operations research. Introduction to graph theory with applications to project management. Inventory control. Wilson's model and extensions. Introduction to linear programming. Multiple-criteria decision making, Case studies.

LINEAR PROGRAMMING (ECTS 6) **(ΜΠΔ 221)**

Modeling of linear programming (LP) problems. The geometry of LP. The Simplex method: theory and the tableau implementation. Duality theory. The dual Simplex method. Sensitivity analysis. Parametric programming. Robustness analysis. Integer programming. Special LP problems: transportation problem, assignment problem. Introduction to multi-objective programming. Case studies.

NON-LINEAR PROGRAMMING (ECTS 5) **(ΜΠΔ 325)**

Mathematical Background. Unconstrained Optimization: Conditions for local minima, ad-hoc methods, algorithmic properties, quadratic models, descent methods and stability. Newton-like methods. Conjugate gradient methods. Constrained optimization: Elimination and other transformations, Lagrange multipliers, first-order conditions, second-order conditions, convex optimization problems. Quadratic Programming. Linearly constrained optimization, penalty functions, multiplier penalty functions. Sequential Quadratic Programming. Nonlinear elimination and feasible direction methods. Global optimization

PROJECT AND PRODUCTION MANAGEMENT AND SCHEDULING (ECTS 5) **(ΜΠΔ 409)**

Introduction to project management and scheduling. Mathematical tools. Optimal time-scheduling with and without constraints. Resource allocation scheduling, time-cost relationship. Taxonomy of production systems. Production Process Selection and Scheduling. Layout planning, layout algorithms. CPM, PERT methods. Production line balancing. Main production planning. Material requirements planning

COMBINATORIAL OPTIMIZATION (ECTS 5) **(ΜΠΔ 426)**

Mathematical models and applications of combinatorial optimization. Differences between linear and integer programming. Graphs and networks. Data structures for graphs and networks. Graph search. Shortest paths and discrete dynamic programming. Minimal spanning trees and greedy algorithms. Flow problems. Problem and algorithm complexity. Linear and Lagrangian relaxation. The branch-and-bound method. Local search. Heuristic and meta-heuristic algorithms. Approximation algorithms.

Elective Courses

GAME THEORY (ECTS 4) **(ΜΠΔ 407)**

Introduction, Games with two players. Zero-sum games. Pure and mixed strategies. Matrix and bi-matrix games. Equilibria and saddle points. Minmax theorem. Solution of matrix games using linear programming. Solution of Bi-matrix Games using nonlinear programming. Nash equilibriums and Pareto points. Hierarchical games. Stackelberg equilibria and disequilibria. Bi-level programming. Application to microeconomics: Cournot duopoly. Application to traffic planning: traffic assignment problem.

DYNAMIC PROGRAMMING (ECTS 4) **(ΜΠΔ 425)**

Discrete and continuous dynamic systems. The principle of optimality. Combinatorial problems. Optimal control problems. Dynamic programming algorithm. Applications to selected discrete and continuous optimal control problems. Discrete and continuous Linear-Quadratic control. Stochastic optimal control problems. Stochastic dynamic programming algorithm. Applications to selected stochastic optimal control problems. Stochastic Linear-Quadratic control.

MECHATRONICS (ECTS 5) **(ΜΠΔ 431)**

Introduction and examples. Simulation of engineering systems. System dynamics and oscillations. Types and simulation of sensors and actuators. Processing of measurement data. Intelligent control (hierarchical control, hybrid control, fuzzy, neural, and fuzzy-neural control). Dynamical system diagnostics. Applications.

Laboratory: Simulation of NeuroFuzzy systems and applications in mechatronic systems (Using Matlab/Octave).

DESIGN AND OPTIMIZATION IN SUPPLY CHAIN MANAGEMENT (ECTS 5) **(ΜΠΔ 514)**

Role of supply chain management. Planning demand and supply in a supply chain. Applications and mathematical modeling. Algorithmic complexity. Traveling salesman problem, bin packing problem. Transportation and distribution of products in supply chain. Network design problem. Distribution channels. Route selection. Fleet-size problems. Vehicle-routing problem. Variants of the vehicle-routing problem (time windows, multicommodity, dial-a-ride, pickup and delivery problems). Vehicle scheduling problem. Ship routing problem. Inventory routing problem: single-period inventory routing problem, multi-period inventory routing problem, infinite horizon inventory routing problem. Location problems. Covering problems. P-center and P-median problems. Capacitated and uncapacitated facility problems. Location routing problem. Integrated logistics. E-Supply chain management. Case studies (modeling, development, and solution methodologies).

BUSINESS INTELLIGENCE AND BUSINESS ANALYTICS. KNOWLEDGE MANAGEMENT (ECTS 5) **(ΜΠΔ 518)**

Decision Making and Business Intelligence. Optimizing business performance using Business Intelligence Systems. Knowledge Management Systems. Big Data Analysis. Data, Information, Knowledge. Pre-processing. Data transformation. Similarity and Dissimilarity Measures. Intelligent Big Data Analysis Methods: Knowledge Acquisition and Representation. Expert Systems, Machine Learning, Knowledge Acquisition from Big Data, Classification and Clustering. Association Rules. Outlier Analysis. Process Mining., Web Content Mining. Web Use Mining. Internet Structure Mining. Computational Intelligence. Deep learning. Fuzzy Logic. Data Warehouses and OLAP systems. Visualization. Multi-Criteria Analysis and Data Analytics. User Modeling and Personalization. Personalized Recommendation Systems and Application in Business Intelligence. Business Intelligence Tools.

Group VII (Engineering Management)

Required Courses

MANAGEMENT SYSTEMS AND PROCESSES (ECTS 5) **(ΜΠΔ 222)**

Management processes: planning, organizing, directing, and controlling. Management skills: conceptual skills, technical and communication. Coupling process with skills. Systems theory. Systems and functioning of private and public organizations. Operations management and management of supply chain processes. Group management. Principles of management problem solving. Introduction to system thinking. Management processes: planning, organizing, directing, and controlling. Principles of management problem solving. Discussion of case studies.

FINANCIAL MANAGEMENT (ECTS 5) **(ΜΠΔ 402)**

The operation of a firm and its goals. The evolution of financial management. Credit system. Basic financial statements: Balance sheet, net income statement. Working capital. Financial ratios. Financial analysis methodologies. Profitability. Financial leverage. Industrial and financial risks. Break-even point analysis. Sources and uses of funds. Financial forecasting methods. Corporate financing: self-financing, share capital increases, loans, leasing. Case studies.

Laboratory: The laboratory courses deal with case studies concerning the credit system, financial statements, financial indicators, break-even point analysis, financial forecasting methods and financing methods. For the settlement of the exercises and the case studies, spreadsheet software program excel is applied.

MARKETING (ECTS 5) **(ΜΠΔ 406)**

Marketing: definition, marketing environment. Development of a competitive advantage in marketing. Marketing strategies. Market research. Market segmentation. Consumers, factors affecting consumer behavior. Lifecycle of products. Functions to express product lifecycle. Sales forecasting. Product policy and strategy. Adoption and distribution of new products. Pricing and distribution policy. Product promotion, advertising, personalized sales. Management in marketing

Decision Investment Analysis (ECTS 4) **(ΜΠΔ 422)**

Financial Mathematics. Time value of money. Capitalization. Annuities. Investment decision under certainty. Overview of the investment evaluation criteria. Investment decision under uncertainty. Uncertainty and risk. Investment decision under indefinite future. Investment decision under probabilities. Risk and Return of a portfolio. Portfolio selection and management; market model, capital asset pricing model. Case studies.

Laboratory: The laboratory courses deal with case studies concerning financial mathematics, investment decision under uncertainty, investment decision under indefinite future and portfolio selection. For the settlement of the exercises and the case studies, spreadsheet software program excel is applied.

ERGONOMICS (ECTS 4) **(ΜΠΔ 424)**

Ergonomic approaches to occupational safety, safety management systems, factors affecting human performance, human information processing and mental processes, task analysis and human reliability, risk assessment using failure and event trees, occupational hazards, musculoskeletal disorders, accident analysis techniques, ergonomic design of safety measures, staff training in high-risk facilities, participatory ergonomics, business safety culture.

Elective Courses

DATA ANALYSIS (ECTS 4) **(ΜΠΔ 323)**

Introduction. Basic concepts. Time-series analysis. Regression analysis. Principal component analysis. Simple and multiple correspondence analysis. Factor analysis. Discriminant analysis. Cluster analysis. Q-analysis. Conjoint analysis. Hierarchical analysis. Forecasting. Forecasting techniques. Technology forecasting. Applications and case studies.

OCCUPATIONAL HEALTH AND SAFETY AT WORK (ECTS 4) **(ΜΠΔ 410)**

Principles of safety in the workplace, legal framework for the HSE, methodologies for assessing occupational hazards, hierarchical framework for considering safety measures and good practices, accident analysis, risks from work at heights, precautions against machinery hazards, safety measures for heavy vehicles, hazards of electricity and electromagnetic radiation, fires and explosive atmospheres, manual handling, noise and oscillation hazards, temperature environment, chemical and biological hazard control, welding work and work at confined spaces.

TOTAL QUALITY MANAGEMENT (ECTS 4) **(ΜΠΔ 408)**

Introduction to quality (definitions, history and importance, dimensions). Principles of Total Quality Management (TQM). TQM as a new culture. Quality management philosophies (Deming, Juran, Crosby, Ishikawa, Taguchi, Feigenbaum). Customer satisfaction and customer relationship management. Quality awards (Deming, EFQM, Malcolm Baldridge). Benchmarking. Tools for TQM (quality improvement, SPC, QFD, Taguchi techniques, etc.). Quality standards and quality assurance systems. Cost of quality.

FINANCIAL ENGINEERING (ECTS 5) **(ΜΠΔ 427)**

Introduction to financial markets. Financial risk management. Portfolio management theory. Portfolio optimization models. Fixed income securities. Valuation models. Risk management for fixed income securities (credit risk, country risk, interest rate risk). Financial derivatives. Options and valuation models. Forwards and futures. Hedging strategies with derivatives. Value-at-risk.

SMALL AND MEDIUM ENTERPRISES (SMES) AND INNOVATION (ECTS 4) **(ΜΠΔ 433)**

Establishment and operation of SMEs. Classification of SMEs. Organization and management of SMEs. Management accounting. Corporate and tax legislation for SMEs. Cost accounting for SMEs. Financing of SMEs. Financial investment, analysis. Preparation of business plans. Project and resource management. SME development models. SME sustainability. Leadership. Innovation and SMEs. Innovative ideas. Creativity, Marketing. Marketing Plan. Competition, Market Segmentation. New product design and development, Sales Promotion, SMEs' evaluation, Strategy Development and Evaluation, Laboratories: Projects.

ERGONOMIC WORK ANALYSIS (ECTS 4) **(ΜΠΔ 505)**

General model of ergonomic interventions, ergonomic work analysis, human reliability analysis, design of noise reduction measures, design of thermal environment, design of control panels and lighting environment, anthropometry and workplace design, design of computer workstations, design of hand tools, musculoskeletal loads, human information processing, skills and decision making, mental models of attention and memory, design of mental work support techniques, trends in work organization.

STRATEGIC PLANNING (ECTS 4) **(ΜΠΔ 506)**

Concept, definition, and role of strategic planning. The strategic planning process: Specification of strategies, types of objectives, assessment of the external environment, internal analysis, generation of alternative strategies, strategy implementation, strategic control. Pro-forma statements, predefined costs, analysis of deviations. The balanced scorecard approach. Applications of strategic planning in firms and organizations.

TECHNOLOGICAL FORECASTING (ECTS 5) **(ΜΠΔ 507)**

Definitions. Technique, technology, and culture. Polynomial models, binomial models. Coleman, Logistic, Bass and other models. Distributions: normal, lognormal, Weibull and Gompertz. New models: NSRL, GRM I and II. Non-linear regression analysis. Applications to technological and other time-series.

ENGINEERING ECONOMICS AND BUSINESS PLAN ANALYSIS (ECTS 5) **(ΜΠΔ 510)**

Methods for assessing mutually exclusive alternatives: Present worth, annual worth, benefit-cost ratio, internal rate of return. Life-cycle costing. Cost estimation: volume-based costing and activity-based costing. Benefit/cost assessment in engineering planning. Business plan modeling. Overview of real-world examples.

SUSTAINABLE FINANCE (ECTS 4) **(ΜΠΔ 329)**

Business finance, financial decisions, time value of money, investment assessment criteria, socially responsible investment, ESG criteria, environmental analysis, social behavior, business management, new approach to risk assessment, ecological leverage, multicriteria decision analysis, case studies.

Laboratory: Financial analysis software, ESG multicriteria analysis models.

HUMAN RESOURCE MANAGEMENT (ECTS 4) **(ΜΠΔ 302)**

Introduction and framework of Human Resource Management (HRM). Historical background of HRM. Job analysis and design and job description. Performance assessment. Salary systems. Training and development. Human resource planning. Work safety. Leadership. Communication and work group dynamics. Emotional intelligence. Innovation management.

General Elective Courses without grades

PRACTICAL TRAINING I & II **(ΜΠΔ 328 & 437)**

Internship of students in public organizations or private sectors, lasting up to two (2) calendar months during the summer vacation period and during the 6th or 8th semester of studies. The Internship is declared as a free elective at the beginning of the respective semester. The aim of the Internship is to get the students to familiarize with their future working environment and the requirements of a full professional, dealing with real problems related to the science of Production Engineering and Management in the market.

SEMINARS

The curriculum also includes seminars on various topics. The seminars aim to expand the opportunities of students to deepen into subjects they are being taught, and also to get in touch with a number of Greek and foreign scientists. The seminars are offered according to the available resources of the School and are declared as a free electives, without grade but with ECTS credits.

6. Contact Information

The mailing address of the School is:

Technical University of Crete
School of Production Engineering and Management
University Campus
731 00 Chania, Greece

School website	https://www.pem.tuc.gr	
Rector of Technical University of Crete		
Michael Zervakis, Professor	rector@tuc.gr	+30 28210 37005-6
Dean of the School		
Michalis Doumpos, Professor	pem_dean_office@tuc.gr	+30 28210 37346
Vice Dean of the School		
Michalis Konsolakis, Professor	mkonsolakis@tuc.gr	+30 28210 37238
Head of Secretariat		
Dorothea Fragomichelaki	dfragomichelaki@tuc.gr	+30 28210 37255
Secretariat	pem_info@tuc.gr	
Agapi Mavraki	amavraki@tuc.gr	+30 28210 37305
Anastasia Chantzi	achantzi@tuc.gr	+30 28210 37301
Loukia Papadaki (graduate programs)	lpapadaki@tuc.gr	+30 28210 37161
Student Service Center		
Department of Studies		+30 28210 37279

Faculty

Name	Email	Office	Phone
1. Alevras, Panagiotis	palevras@tuc.gr	G3.1.08	+30 28210 37159
2. Antoniadis, Aristomenis	aantoniadis@tuc.gr	D4.106	+30 28210 37293
3. Arampatzis, George	garampatzis@tuc.gr	D4.105	+30 28210 37365
4. Atsalakis, George	gatsalakis@tuc.gr	G3.1.10	+30 28210 37263
5. Delis, Anargiros	adelis@tuc.gr	145.B.103	+30 28210 37751
6. Doitsidis, Eleftherios	edoitsidis@tuc.gr	D4.008	+30 28210 37313
7. Doumpos, Michalis	mdoumpos@tuc.gr	D5.110	+30 28210 37318
8. Fafalios, Pavlos	pfafalios@tuc.gr	G3.1.01	+30 28210 37359
9. Ipsakis, Dimitris	dipsakis@tuc.gr	G3.1.04	+30 28210 37362
10. Ioannidis, Stratos	eioannidis@tuc.gr	D4.104	+30 28210 37312
11. Konsolakis, Michalis	mkonsolakis@tuc.gr	G3.1.02	+30 28210 37682
12. Kontogiannis, Tom	tkontogiannis@tuc.gr	D5.006	+30 28210 37320
13. Kouikoglou, Vassilis	vkouikoglou@tuc.gr	D4.108	+30 28210 37238
14. Katzourakis, Diomidis	dkatzourakis@tuc.gr	D4.009	+30 28210 37247
15. Marinakis, Ioannis	imarinakis@tuc.gr	D5.003	+30 28210 37288
16. Nikolos, Ioannis	inikolos@tuc.gr	D4.107	+30 28210 37300
17. Papaefthimiou, Spiros	spapaefthimiou@tuc.gr	G3.1.03	+30 28210 37428
18. Papamichail, Ioannis	ipapamichail@tuc.gr	D5.102	+30 28210 37422
19. Patelis, Dimitrios	dpatelis@tuc.gr	145.B.91	+30 28210 37267
20. Saridakis, Yiannis	isaridakis@tuc.gr	145.B.101	+30 28210 37740
21. Siskos, Eleftherios	esiskos@tuc.gr	G3.1.09	+30 28210 37367
22. Stavroulakis, Georgios	gestavroulakis@tuc.gr	D5.109	+30 28210 37418
23. Tsafarakis, Stelios	tsafarakis@tuc.gr	D5.009	+30 28210 37160
24. Tsagarakis, Konstantinos	ktsagarakis@tuc.gr	D5.107	+30 28210 37252
25. Tsourveloudis, Nikolaos	ntsourveloudis@tuc.gr	D4.103	+30 28210 37285
26. Zopounidis, Constantin	kzopounidis@tuc.gr	D5.108	+30 28210 37236

Professors Emeriti

1. Matsatsinis, Nikolaos	nmatsatsinis@tuc.gr	D5.004	+30 28210 37348
2. Papageorgiou, Markos	mpapageorgiou@tuc.gr	D5.111	+30 28210 37240
3. Phillis, Yannis	yphillis@tuc.gr	D4.109	+30 28210 37321

Laboratories and Laboratory Assistants

1. ***Decision Support Systems Laboratory***
   Lia Krassadaki (ekrasadaki@tuc.gr)..... +30 28210 37350
2. ***Dynamic Systems and Simulation Laboratory***
   Vangelis Vountourakis (vvountourakis@tuc.gr) ..... +30 28210 37308
3. ***Computer Aided Manufacturing Laboratory***
   George Tsinarakis (gtsinarakis@tuc.gr) ..... +30 28210 37306
4. ***Intelligent Systems and Robotics Laboratory***
   Savvas Piperidis (spiperidis@tuc.gr) ..... +30 28210 37292
5. ***Industrial, Energy and Environmental Systems Laboratory***
   Nektarios Arnaoutakis (narnaoutakis@tuc.gr) ..... +30 28210 37340
6. ***Data Analysis and Forecasting Laboratory***
   Aggeliki Liadaki (aliadaki1@tuc.gr) ..... +30 28210 37360
7. ***Cognitive Ergonomics and Industrial Safety (CEIS) Laboratory***
   George Papadakis (gipapadakis@tuc.gr) ..... +30 28210 37316
8. ***Management Systems Laboratory***
   Maria Bakatsaki (mbakatsaki@tuc.gr) ..... +30 28210 37361
9. ***Financial Engineering Laboratory***
   Aggeliki Liadaki (aliadaki1@tuc.gr) ..... +30 28210 37360
10. ***Computer Aided Design Laboratory (CAD)***
    Pavlos Koulouridakis (pkoulouridakis@tuc.gr) ..... +30 28210 37256
11. ***Computational Mechanics and Optimization Laboratory***
    Maria Bakatsaki (mbakatsaki@tuc.gr) ..... +30 28210 37241
12. ***Micromachining and Manufacturing Modeling Laboratory***
    Aristomenis Antoniadis, Professor (aantoniadis@tuc.gr)..... +30 28210 37293
13. ***Interdepartmental Machine Tools Laboratory***
    Nektarios Chairetis (nchairetis@tuc.gr)..... +30 28210 37349
14. ***Applied Mathematics and Computers Laboratory***
    Nikolaos Spanoudakis (nispanoudakis@tuc.gr) ..... +30 28210 37744
15. ***Matter Structure and Laser Physics Laboratory***
    Panagiotis Petrakis (panpetrakis@tuc.gr)..... +30 28210 37697
16. ***Turbomachinery and Fluid Mechanics Laboratory***
    Ioannis Nikolos (inikolos@tuc.gr) ..... +30 28210 37300