Course Descriptions for the Joint Study Programme
"International Master of Science in Engineering, Entrepreneurship and Resources (MSc. ENTER)

Version 07.2024

Courses at **University of Sarajevo**
with the Specialization "**Industrial Engineering and Management**"

Module Name	**Project Management**
Code	IIM-06
ECTS Credits	**5**
Responsible	prof. dr. Mugdim Pašić
Duration	Winter semester
Teaching Language	Bosnian/English
Learning Outcome (Competencies)	The main goal of this course is to be introduced with the importance and role of projects in the business operations of business entities with an understanding of the logic and application of project management techniques and models. The focus of the course is introducing with knowledge areas, process groups, all processes within each process group, as well as project phases and project life cycle.
Contents	Introduction to project management. The importance of projects in modern business. Defining the project. The difference between a project and day-to-day operations. Processes, knowledge areas, phases and project life cycle. Project initiation. Product life cycle. Time value of money. Organizational strategy and project selection criteria. Risk management in project management. WBS (Work Breakdown Structure) of projects. Cost estimation, resource allocation and project budget. Resource leveling. Project duration estimation. Project schedule planning. Crashing – reducing the duration of projects. Outsourcing. Measurement and evaluation of project implementation progress and performance, project monitoring and control. MS Project. Closing projects.
Teaching Methods	Lectures: 3; Exercise: 1
Materials/literature	Mandatory: 1. Materials for lectures and exercise Supplementary: 2. Project Management Institute, "A Guide to the Project Management Body of Knowledge – PMBOK ® Guide", Project Management Institute Inc., Pennsylvania, USA 3. Larson E., Gray C., Project Management: The Managerial Process with MS Project. Mc Graw Hill, New York, USA

Module Name	**Industrial Logistics**
Code	IIM-19
ECTS Credits	**5**
Responsible	prof. dr. Hadis Bajrić
Duration	Winter semester
Teaching Language	Bosnian/English
Learning Outcome (Competencies)	Students will get familiar with the nature and functional areas of logistic systems, as well as to understand the role of logistics in building competitive advantage by increasing the efficiency of the process and overall business operations in industrial enterprises.
Contents	Definition of Logistics. Historical development of logistics. Logistics activities and concepts. Relationship between logistics and other functions in companies. Business Logistics. Supply chain management. Information Technology and Supply Chain Management. Inventory control, Warehouse Management. Transportation Systems. Order Fulfillment. Organizational Aspects of Logistics.
Teaching Methods	Lectures: 3; Exercise: 1
Materials/literature	1) Lectures and exercise materials 2) Bajric, H., 2024. Upravljanje lancem snabdijevanja: Zalihe. Mašinski fakultet Sarajevo

Module Name	**Intelligent Industrial Systems**
Code	IIM-53
ECTS Credits	**5**
Responsible	prof. dr. Edin Kadrić
Duration	Winter semester
Teaching Language	Bosnian/English
Learning Outcome (Competencies)	Introducing students with basic concepts of artificial intelligence and machine learning and training for the analysis and design of intelligent industrial systems
Contents	Data collection and data mining. Clastering. Artificial intelligence. Artificial neural networks. Artificial neural networks structure for system modelling and control. Genetic algorithms. Machine learning. Algorithm Evaluation.
Teaching Methods	Lectures: 3; Exercise: 1
Materials/literature	Mandatory: 1. Alpaydin, E., 2014. Introduction to Machine Learning. 3rd ed. Cambridge: The MIT Press Additional: 1. Giudici, P.; Figini, S., 2009. Applied Data Mining for Business and Industry. Chichester: John Wiley & Sons 2. Negnevitsky, M., 2011. Artificial Intelligence: A Guide to Intelligent Systems. 3rd ed. Esex: Pearson Education Limited

Module Name	CAM (Computer Aided Manufacturing)
Code	MPI-48
ECTS Credits	5
Responsible	prof. dr. Maida Čohodar-Husić
Duration	Winter semester
Teaching Language	Bosnian/English
Learning Outcome (Competencies)	To provide understanding of modern trends in manufacturing using CNC machine and industrial robots. The students will get familiar with automated generated NC program based on integration of CAD/CAM and offline robot programming.
Contents	Introduction. Brief history of CNC systems and industrial robots. NC machines, CNC machines, CNC control system (Motion controller, Interpolation, incremental Absolute system, DNC machines, Part programming, CAM Software, CAD/CAM integration, Case studies. Robot programming: On line and Off line programming, software for off line robot programming, Case studies. Automated Guided Vehicles (AGV), Programming of AGV. Automated Production Lines, Assembly systems and Line Balancing, Automated Material Handling. Automated inspection procedure. Role of Mechatronics in Manufacturing, Elements, procedure, benefits and applications.
Teaching Methods	Lectures: 2; Exercise: 2
Materials/literature	1. Tien-Chien C.; Richard A. Wysk; Hsu-Pin W., 2005. Computer-Aided Manufacturing. Prentice Hall International Series on Industrial and Systems Engineering 2. Groover, M. P., 2016. „Automation, Production System and Computer Integrated Manufacturing, Global Edition, Pearson Education Limited 3. Zeid I., 2009. CAD/CAM theory and practices. McGraw Hill International Edition 4. Robot Studio manual 5. CATIA manual

Module Name	Industrial Marketing
Code	IIM-07
ECTS Credits	5
Responsible	prof. dr. Maja Arslanagić Kalajdžić
Duration	Winter semester
Teaching Language	Bosnian/English
Learning Outcome (Competencies)	The primary aim of the course is to familiarize students with the role and functions of marketing within a company. It seeks to highlight the importance of identifying marketing opportunities for the company through an understanding of environmental influences, consumer behavior, market size analysis, and the company's market share. A further objective is to acquaint students with strategic decisions regarding market segmentation, targeting, and positioning. Finally, the course aims to introduce students to the elements of the marketing mix – product, price, distribution, and promotion – and to strengthen their ability to understand and contemplate specific situations where marketing decisions are made.

Contents	Marketing – Creating Value and Satisfaction for Customers; Strategic Planning and the Marketing Process; Marketing Environment; Consumer Behavior and the Decision-Making Process in Purchasing; Business Markets and the Buying Behavior of Business Customers; Market Segmentation, Target Market Selection, and Positioning; Product, Service, and Brand Strategies; Pricing Formation and Strategies; Distribution Marketing Channels and Supply Chain Management; Integrated Marketing Communications Strategy; Personal Selling and Direct Marketing
Teaching Methods	Lectures: 2; Exercise: 2
Materials/literature	Obligatory: 1. Tihi, B., Čičić, M., Brkić, N., redaktori, 2006. Marketing. treće izdanje, Ekonomski fakultet Univerziteta u Sarajevu Additional: 1. Grupa autora, Urednik Fedor Rocco, 1998. Poslovni marketing – Business-to-Business marketing. Školska knjiga, Zagreb 2. Gligorijević, M., 2009. Poslovni marketing, Ekonomski fakultet u Beogradu, Beograd 3. Hutt, M.D., Speh, T.W., 2012. Business Marketing Management: B2B", 11.ed., SWCP

Elective courses: Students must choose at least 5 ECTS points (CP) from the elective course list.

Module Name	**Finite Element Method in Mechanical Engineering**
Code	IIM-46
ECTS Credits	**5**
Responsible	prof. dr. Izet Bijelonja
Duration	Winter semester
Teaching Language	Bosnian/English
Learning Outcome (Competencies)	The goal of the course is to provide the student with basic theoretical knowledge of the finite element method and its application to engineering problems. The emphasis of the course is on solving structural problems. In addition to the theoretical foundations, the student should be able to use computer programs to solve structural problems.
Contents	Introduction to the Finite Element Method (FEM). Variational formulation of FEM. Direct method. Residue method. Finite elements (FE) trusses, beams, shells, plates. 2D FE. Three-dimensional FE. Global stiffness matrix. Dynamic structural analysis of FEM.
Teaching Methods	Lectures: 2; Exercise: 2
Materials/literature	Compulsory: 1. Bijelonja I., 2012. Metod konačnih elemenata i strukturna optimizacija, Mašinski fakultet Sarajevo (available via courseware) Additional: 1. Bathe K.-J., 2014. Finite Element Procedures. Prentice-Hall (http://web.mit.edu/kjb/www/Books/FEP_2nd_Edition_4th_Printing.pdf 2. Zienkiewicz O. C.; Taylor R. L.; Zhu J. Z., 2013. The Finite Element Method, Elsevier

Module Name	**Ergonomics and Biomechanics**
Code	IIM-09
ECTS Credits	**5**
Responsible	prof. dr. Adisa Vučina
Duration	Winter semester
Teaching Language	Bosnian/English
Learning Outcome (Competencies)	The main goal of this course is for the student to know how to design an optimal workspace in function of the action of internal and external mechanical forces on the human body and to know how to give technical requirements for product design.
Contents	Introduction. Historical development of ergonomics and biomechanics. Introduction of general terms from mechanics (mass, density, force, moment, force reduction, mass distribution, segmental mass in man). Possibilities of applying biomechanics in medical engineering, technology and ergonomics. Defining forces and consciousness through the use of electromyography (EMG) and electroencephalography (EFG). Human gait. Measurement of kinematic and dynamic characteristics during walking. Reference standing, sitting and lying position of a person. Defining the human position in the coordinate system. Basic research in biomechanics. Motion systems and models in biomechanics. Biomechanics of the human locomotor system. Determination of dynamic moments of inertia and their changes depending on position during movement.

	Bone and soft tissue mechanics. Soft tissues. Muscles and cartilaginous tissue, division and mechanical properties of soft tissues. Nervous system of man. Functioning and work of muscle tissue. Cartilage and its mechanical properties. Mathematical models of muscle tissue. Biomechanical function of the spinal column in humans. Mathematical statistics adapted to ergonomics. Application of probability theory and mathematical statistics in design. Psychology. Mental loads, information and communication. Stress. Anthropometry. Static, kinematic and dynamic anthropometry. Anthropometric variables in construction and design. Physiology. Physiological anthropology. Design of work in function (energy, metabolism, classification of work, workload, temperature, noise, vibrations, lighting, speed of air flow, air humidity). The physical structure of human consciousness. The possibility of determining segmental masses in humans. Donskij Zacijorskij method. The harmonic structure of man and the determination of anthropological measures by means of the harmonic circle of Zederbaure and Muftic. Determining the position of the body's center of gravity System man-machine-environment. Ergonomic principles. Principles of designing workplaces, machines and tools. Principles of determining working hours. Determining the amount of human effort at work. Abdominal pressure as a measure of work difficulty. Examples for determining the difficulty of work and working conditions. Labour organization. The relation between work organization and ergonomics. Good and bad workplace. Physical properties of bones. Biomechanics of soft tissues. Biomechanics of the circulatory system. Prosthetic technique. Arm and leg prostheses. Joint prostheses.
Teaching Methods	Lectures: 3; Exercise: 1
Materials/literature	Mandatory: 1. Power point lectures 2. Veljović, F., 2001. Fundamentals of ergonomics. Faculty of Mechanical Engineering, Sarajevo. Additional: 1. Muftić, O., 2003, Biomechanics and ergonomics, Faculty of Mechanical Engineering and Naval Architecture, Zagreb. 2. Muftić, O., Rudan, P.; Taboršak, D., 1983. Ergonomija, Zbor liječnika Hrvatske, Zagreb. 3. Muftić, O., Veljović, F., Jurčević, T., Milčić, D., 2001. Osnovi ergonomije, Sarajevo.

Module Name	**Flexible Manufacturing Systems**
Code	MPI-27
ECTS Credits	**5**
Responsible	prof. dr. Đerzija Begić-Hajdarević
Duration	Winter semester
Teaching Language	Bosnian/English
Learning Outcome (Competencies)	The aim of this course is to introduce students with the basics of flexible manufacturing, the role of flexible manufacturing systems in production, the concept of group technology and cellular manufacturing, as well as the benefits of automation.

Contents	Structure of Production Systems. Production cell. Group Technology and Cellular Manufacturing. System Classification and Coding. OPITZ system classification. Production Flow Analysis. Analysis of Cellular Manufacturing. Definition of Flexible Manufacturing Systems (FMS). Flexible Manufacturing System - Overview. FMS Types. Components of FMS: workstations, automated material handling and storage system and controlled computer system. FMS Application and Benefits. FMS Analysis. Planning and Implementation FMS.
Teaching Methods	Lectures: 3; Exercise: 1
Materials/literature	Recommended: 1. Groover, M. P., 2016. Automation, Production Systems, and Computer-Integrated Manufacturing, Global Edition, Pearson Education Limited 2. Wang, J. X., 2015. Cellular Manufacturing, CRC Press,. 3. Shivanand, H.K., Benal, M.M., Koti, V., 2006. Flexible Manufacturing Systems. New age International Publishers 4. Cebalo R., 1999. Fleksibilni obradni sustavi. Zagreb

Module Name	**Expert Systems and Knowledge Bases**
Code	RIM-29
ECTS Credits	**5**
Responsible	Prof. dr. Senad Burak
Duration	Winter semester
Teaching Language	Bosnian/English
Learning Outcome (Competencies)	The aim of this course is to introduce expert systems and knowledge bases, technology that is the current trend, but also the future of information technology development. Systems based on knowledge based applications, as well as those based on artificial intelligence, are today a reality in many disciplines of science, engineering and in particular defense technologies.
Contents	Introduction to Expert Systems. Basic concepts of expert systems and knowledge base. Application of expert systems. Trends in the development of expert systems and systems based on knowledge bases. Advantages and problems in introducing expert systems. Directions for future development and anticipated expectations.
Teaching Methods	Lectures: 2; Exercise: 2
Materials/literature	1. Rattz J. C., 2008. Pro LINQ Language Integrated Query in C# 2008. Apress 2. Silberschatz, A., Korth, H. F., Sudarshan, S., 2013. Database System Concepts. McGrawHill 3. Gunderloy, M., Jorden J. L., 2001. Mastering SQL Server 2000. Sybex 4. Luger, G. F., 2009. Artificial Intelligence: Structures and Strategies for Complex Problem Solving. Pearson, Addison-Wesley 5. Hancock, J. C., Toren, R., 2007. Practical Business Intelligence with SQL Server 2005. Pearson, Addison-Wesley

Study schedule MSc. ENTER (from October 2024)

Modules	1st term L/E/S/P	2nd term L/E/S/P	3rd term L/E/S/P	4th term L/E/S/P	CP
Compulsory modules					
Project Management	3/1/0/0 UNSA				5
Industrial Logistics	3/1/0/0 UNSA				5
Intelligent Industrial Systems	3/1/0/0 UNSA				5
CAM (Computer Aided Manufacturing)	2/2/0/0 UNSA				5
Industrial Marketing	2/2/0/0 UNSA				5
Elective modules: Students must choose at least **5 CP** to achieve 30 CP in total.					
Finite Element Method in Mechanical Engineering	2/2/0/0 UNSA				5
Ergonomics and Biomechanics	3/1/0/0 UNSA				5
Flexible Manufacturing Systems	3/1/0/0 UNSA				5
Expert Systems and Knowledge Bases	2/2/0/0 UNSA				5
Compulsory modules					
Current Issues in Enabling Technologies for Circular Economy		LUT Online Teaching			5
Knowledge Discovery and Process Data Analysis		LUT Online Teaching			5
Process Intensification		LUT Blended Teaching			5
Academic Entrepreneurship		LUT Blended Teaching			6
Start-ups and venture formation		LUT Blended Teaching			6
Elective modules: Students must choose at least **3 CP** to achieve 30 CP in total.					
Simulation, Laboratory Course		LUT Online Teaching			5
Advanced Course in Life Cycle Assessment		LUT Blended Teaching			8
Integration of Product's Design, Sustainable Production and Material Selection		LUT Blended Teaching			5
Bioeconomy		LUT Blended Teaching			5

Modules	1st term L/E/S/P	2nd term L/E/S/P	3rd term L/E/S/P	4th term L/E/S/P	CP
Development of New Sustainable Products and Solutions		LUT Blended Teaching			5
Power-to-X processes		LUT Online Teaching			5
Fluid Dynamics in Chemical Engineering		LUT Contact Teaching			5
Compulsory modules					
Training in Particle Technology			1/2/0/0 TUBAF		4
Training in Endurance and Design			1/2/0/1 TUBAF		6
Conception of Process Equipment			2/1/0/0 TUBAF		5
Sustainable Engineering			2/1/0/0 TUBAF		4
Project - Process Design Mineral Processing / Recycling			0/0/2/8 TUBAF		5
Elective modules: Students must choose at least **6 CP** to achieve 30 CP in total.					
Maintenance Engineering			2/1/0/0 TUBAF		4
Process Development in Mechanical Process Engineering			2/0/1/0 TUBAF		4
Recycling - Secondary Raw Materials			3/0/1/0 TUBAF		6
Master Thesis (Mechanical and Process Engineering)				22 Wo (UNSA/ *LUT / TUBAF*)	30

Legend - Teaching Methods:

In contact hours per week

L= Lecture
E= Exercise
S= Seminar
P= Practical application