Universitatea Transilvania din Brașov
FACULTATEA DE INGINERIE MECANICĂ

Str. Politehnicii 1, 500024 - Brașov
tel.: (+40) 268 474761 | fax: (+40) 268 474761
f-im@unitbv.ro | www.unitbv.ro/fim

Master's degree program (in English)
Integrated Practical Methods in Propulsion Systems Engineering

Faculty: Mechanical Engineering
Study period: 2 years (4 semesters – 120 credits)

1st Year of study
1st Semester

I.1.1. Measurement Techniques used in Manufacturing and Quality Assurance: Dimensional metrology. Geometrical Dimension & Tolerancing. Quality assurance and quality management. Measurement small tools and data management. Optical measurement. Profile (micro and macro) and form measurement. Dimensional coordinate measurement – Coordinate Measuring Machines's architectures, probes, auxiliaries. Dimensional coordinate measurement – software. Quality assurance with Measurlink software. Quality assurance with Q-Das software, Quality assurance with Minitab software. Dimensional scanning metrology - scanners software

I.1.2. General economics: Analysis of the business microenvironment. Analysis of the business macro environment. Particularities in the product strategy for industrial goods. Product strategies used in B2B markets. Distribution strategies used in B2B markets. Promotion strategies used in B2B markets

I.1.3. Mechanics of Materials: Introduction in the mechanics of composite materials. Mechanical particularities of lamina. Mechanical particularities of composite laminate. Standardization and testing methods of polymer matrix composites. Materials testing equipments and data analysis software. System for optical analysis of 3D deformations for materials and components using the DIC method (Digital Image Correlation). Accomplishment of specimens from various composite structures. Determination of mechanical properties of various composite structures.

I.1.4. Reformulated fuels and biofuels: Definitions, classification. Characteristics of motor fuels. Conventional motor fuels. Manufacturing methods. Gasoline and diesel fuels. Characteristics. Gaseous fuels. Natural gas. Liquefied petroleum gas. Hydrogen. Reformulated fuels. Reformulation of gasoline and diesel. Biofuels. Oxygenated compounds. Alcohols and ethers. Biofuels. Fatty acid methyl esters. Straight vegetable oils. Biofuels. Biogas. Biogas to liquid. Biofuels. Carbon footprint. Global warming potential. Toxicity indices.

I.1.5. Academic ethics and integrity: Introductory notions in the field of scientific research ethics. The concept of ethics and general aspects of research ethics in engineering sciences.

Str. Politehnicii 1, 500024 - Brașov
tel.: (+40) 268 474761 | fax: (+40) 268 474761
f-im@unitbv.ro | www.unitbv.ro/fim

Ethical behavior of the researcher. Scientific integrity. Ethics of scientific research in the European Community and in Romania. Legislation on the ethics of scientific research. Ethical and non-ethical in scientific research. Problems, dilemmas, solutions. Ethical codes and legislation on research, innovation, development activity.

I.1.6.1. Noise and vibrations in manufacturing (01): Theoretical basics of vibratory motion. Cutting process. Identification of the parameters of the cutting process system. Particular cases of cutting process systems. Variation of cutting process parameters depending on the processing conditions. Elastic structure of machine tools. Stability of time-invariant dynamic processing systems. Noise. Noise protection systems.

I.1.6.2. Predictive maintenance for industrial equipment (O1): Fundamentals of predictive maintenance. Data acquisition. Signal processing. Vibration sources, propagation path, response. Diagnosis of machine and equipment faults based on vibration analysis. Predictive maintenance technique. Correction of faults causing vibrations – 1 (general). Correction of faults causing vibrations – 2 (machine elements). Correction of faults causing vibrations – 3 (machine tools).

I.1.7. Professional practice (practical internship) I: Identify issues for project practice. Establishing project design practice. Identification of development directions of the theme. Analysis of the actual situation. Determination of the solutions encountered problems. Presentation of projects.

2nd Semester

I.2.1. Shopfloor management: Lean – concept, principles and methodology. Gemba, gembutsu. Value, Value Stream, Flow, Attraction, Perfection. Lean measurement: cycle time, Takt time, lead time. Value stream mapping - Current state mapping. Value stream mapping - Future state mapping. 4P model - Philosophy, Process, People and partners, Problem solving. Shop floor management hexagon. Problem solving. Change point management. Visual management. 5M. Standards. 5S. Communication. Efficiency improvement.

I.2.2. ERP Systems (SAP): Introduction: ERP, SAP. ERP Software systems. ERP systems architecture. SAP ERP modules. Logging On, Interface, Menus. SAP navigation, Sessions multiple, Matchcode. Basic concepts in SAP: Organization elements, Master Data, Transactions. Sales and Distibution (SD). Production Planning. Material Requirements Planning. Purchasing. Outbound delivery, Picking, Transfer Order.

I.2.3.1. Design for manufacturing (02): Machinability of parts. Criteria used to evaluate the machinability of parts. Matching dimensions and roughness to the needs of the parts' function. Technological and non-technological shapes. Part families and group technologies. Parts produced in large dimensional ranges. Shape design. Dimensions for assembly. Concurrent engineering.

Str. Politehnicii 1, 500024 - Brașov
tel.: (+40) 268 474761 | fax: (+40) 268 474761
f-im@unitbv.ro | www.unitbv.ro/fim

I.2.3.2. Computer Aided Numerical Control (02): Presentation of course objectives, general and introductory concepts, definitions. CNC equipment classification. Coordinate systems.. SCMU, CSP. Organization of numerical control files.. Classification of addresses/functions. Geometric addresses, technological addresses, other addresses. G codes. Drilling cycles.

I.2.4. Advanced design for engines systems: Advanced design of modern gas exchange system, variable distribution system, electrohydraulic distribution system design, variable compression engine design requirement. Advanced design of the SI engines fuelling system. Advanced design of the GDI engines fuelling system. Advanced design of the CI engines fuelling system. Advanced design of the engines lubricating system. Advanced design of the engine supercharging system. Advanced design of the engines cooling system. Modern design of the engine exhaust gas system after treatment.

I.2.5. Technical analysis in mechanical engineering: Prototype parts analysis of the development of products using various methods (measurements of geometric and material property determination, analysis wear by various optical methods, etc.). Correlation of results obtained from tests with product specifications for the establishment of optimization measures. Competitive product analysis activities and establishing product development strategy. Product testing following factors durability and functionality of products and mechatronic systems. Statistical analysis of data.

I.2.6. Professional practice (practical internship) II: Identify issues for project practice. Establishing project design practice. Identification of development directions of the theme. Analysis of the actual situation. Determination of the solutions encountered problems. Presentation of projects.

2nd Year of study
1st Semester

II.1.1. Advanced Manufacturing Technology: Machining processes (turning, milling, drilling, broaching, boring, threading). Additive manufacturing. Non-traditional machining processes. Cold plastic deformation processing technologies. Incremental deformation processing technology. Abrasive machining and finishing operations (grinding, overfinishing, lapping). Specific technologies for the manufacture of automotive engine parts.

II.1.2. Automation in Manufacturing: Energy sources used in the automation of technological processes. Symbols and notations used in pneumatics. Control elements used in the automation of technological processes. Processing elements for the automation of technological processes. Actuator control in automation systems. Execution elements used in the automation of parts production. Handling elements. Electropneumatic control in the automation of technological processes. Electromechanical execution elements in the

Str. Politehnicii 1, 500024 - Brașov
tel.: (+40) 268 474761 | fax: (+40) 268 474761
f-im@unitbv.ro | www.unitbv.ro/fim

automation of technological processes. Automation of the supply of semi-finished machines of machine tools. Optical processing in the automation of technological processes. The GRAFCET concept used in the automation of technological processes. Ladder language used in the automation of technological processes. Examples of automation applications in production processes.

II.1.3. Product Development: Introductory elements. Industrial products made of injected plastics/injected light alloys. The temporary stages of development of the design and manufacture of an industrial product. Introduction to the manufacture of parts made of thermoplastic materials injected into molds. Production of injected plastic parts from the automotive field (specific conditions for visible parts and functional parts). Making parts of the passenger compartment of cars: additional technologies. Acquisition of the contract for the development and manufacture of an industrial product in the field of interior components of a high-performance vehicle. Digital manufacturing of industrial products in the context of Industry 4.0, 5.0. Development directions in the context of AI implementation, virtual spaces and Metaverse. Finite element analysis implemented in the simulation for validation of mechanical parts injected from thermoplastic materials. Dedicated PLM platforms used in product development. Prototypes for mechanical industrial products definition, classification, details of use, methods of obtaining. Physical prototypes and digital prototypes. DFM (Design For Manufacturing) analysis for parts made of plastic materials injected into molds - case study.

II.1.4. Project management: The project – general aspects, types of projects. Project development main elements. Phases and processes involved in the projects. Project management – general aspects. The project management knowledge areas

II.1.5. FEM simulation in mechanical engineering: Numerical methods applied in MEF. Double-pinned flat bar element. Plane tension element. Axisymmetric plane state element. Hexahedral finite element. Homogeneous plane plate with finite elements. Procedures in the finite element method applied in the nonlinear domain. The finite element method applied in nonlinear problems in an elastic field.

II.1.6. Professional practice (practical internship) III: Identify issues for project practice. Establishing project design practice. Identification of development directions of the theme. Analysis of the actual situation. Determination of the solutions encountered problems. Presentation of projects.

2nd Semester

II.2.1. Professional practice (practical internship) IV: Identify issues for project practice. Establishing project design practice. Identification of development directions of the theme. Analysis of the actual situation. Determination of the solutions encountered problems. Presentation of projects.

Str. Politehnicii 1, 500024 - Brașov
tel.: (+40) 268 474761 | fax: (+40) 268 474761
f-im@unitbv.ro | www.unitbv.ro/fim

II.2.2. Disertation project activity: Establishing the table of contents and bibliography. Analysis of the current status and trends in the field of the diploma project (scientific importance, applicability, achievement). Identification of directions for developing the theme in the dissertation project. Theoretical substantiation of the project. Experimental substantiation of the project.