Master Study Program (in English language)
Practical Integrated Methods for engines engineering

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

YEAR I

1st Semester

I.1.1. Measuring techniques used in manufacturing and Quality Assurance: Dimensional metrology. Geometrical Dimension & Tolerance. 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' architectures, probes, auxiliaries. Dimensional coordinate measurement – software. Quality assurance with Measuring software. Quality assurance with Q-Das software. Quality assurance with Minitab software. Dimensional scanning metrology – scanners. Dimensional scanning metrology – software. Knowledge refreshment.

I.1.2. General economics: Size and structure of organisations. Separation of ownership and control. Price competition. Entry deterrence and entry accommodation. Product differentiation and price discrimination. Vertical relations. Market structure. Industrial policy.

I.1.3. Mechanics of materials: Introduction Models. Description, classification, areas of use. Elastic properties of composite materials. Stress and strain in fibre-reinforced multilayer composite structures. Mechanical behaviour of fibre-reinforced multilayer composite tubes, non-stressed tubes required under internal pressure. Numerical and theoretical approaches. Determination of mechanical properties for some types of composites.

I.1.4. Reformulated fuels and bio-fuels: Definitions, classification. Characteristics of engine fuels. Conventional engine fuels. Methods of manufacturing. Petrol fuel and diesel fuel. Characteristics. Gaseous fuels. Natural gas. Liquefied petroleum gas. Hydrogen. Reformulated fuels. Reformulation of petrol and diesel fuel. Biofuels. Oxigenated 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.1.5.1. Noise and vibrations in manufacturing (01): Basic of vibrations. The cutting process. Identification of the cutting process system parameters. Particular cases of cutting process systems. Variation of the parameters of the cutting process depending on the machining conditions. The elastic structure of the machine tools. Stability of the time invariant dynamic machining systems. Noise. Noise protection systems.

I.1.5.2. Predictive maintenance for industrial equipment (O1)Course description (Syllabus): Predictive maintenance basics. Data acquisition. Signal processing. Vibration sources, path, response. Machine fault diagnosis based on vibration analysis. Different predictive maintenance technique. Correcting faults that cause vibrations. Correcting faults that cause vibrations – 2 (machine elements). Correcting faults that cause vibrations – 3 (machine tools).

I.1.6. Ethics and Academic Integrity: Introductory course (presentation of the course and administrative aspects). Introductory notions in the field of ethics of scientific research. The concept of ethics and the general aspects of the research ethics in engineering sciences. Ethical conduct of the researcher. Scientific integrity. Ethics of scientific research in the European Community and Romania. Legislation on the ethics of scientific research. Ethical and non-ethical in scientific research. Problems, dilemmas, solutions. Ethical codes and legislation regarding the research, innovation, development activity

I.1.7. Professional internship I: Setting the theme for professional practice. Identifying the development directions of the theme. Analysis of the real situation. Determining the solutions to the problems encountered. Project presentation.

2nd Semester

I.2.1. Shopfloor management: Lean – concept, principles and methodology. Gemba, gembutsu. Value, Value Stream, Flow, Pull, Perfection. Lean measurement: Cycle time, Takt time, Lead time. Value stream mapping- Current state mapping. Value stream mapping- Future state mapping. 4 P model - Philosophy, Process, People and partners, Problem solving. Hexagon of Shop Floor Management. Problem solving. Change point management. Visual management. 5 M. Standards. 5 S. 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, Match code. Basic concepts in SAP: Organization elements, Master Data, Transactions. Sales and Distribution (SD). Production Planning. Material Requirements Planning. Purchasing. Outbound delivery, Picking, Transfer Order.

I.2.3.1. Design for manufacturing (02): Parts' machinability. Criteria used to assess the machinability of the parts. Putting the allowances and quality surface in accordance with needs related to parts' working. Technological and non-technological shapes. Parts families and group technologies. Parts produced in large dimensional ranges. Involvement on shapes design. Dimensions for assembly. Concurrent engineering.

I.2.3.2. CNC Machining (02): Presentation of course objectives, general and introductory notions, definitions. Main components of numerical driving equipment. Classification of numerical driving equipment and five-axis milling machines. Structure of programmes, subprograms and fractions in numerical management. Coordinate systems in numerical management. Geometric and technological addresses. Preparatory G Functions. Auxiliary functions M.

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 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.

YEAR II

1st Semester

II.1.1. Advanced manufacturing technology**:** Machining processes (turning, milling, drilling, broaching, boring, threading). Additive fabrication. Non-traditional machining processes. Cold plastic deformation processing technologies. Incremental deformation processing technology. Abrasive machining and finishing operations (honing, superfinishing, lapping). Specific technologies to manufacture parts of motor vehicle engines.

II.1.2. Automation in manufacturing: Energy sources used in automation of technological processes. Symbols and notations used in pneumatics. Control elements used in the automation of technological processes. Processing elements for automation of technological processes. Control of actuators in automation systems. Execution elements used in the automation of parts manufacturing. Handling elements. Electropneumatic control in the automation of technological processes. Elements of electromechanical execution in the automation of technological processes. Automation of semi-finished machine supply 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 manufacturing processes.

II.1.3. Product development process: Introduction in the design of the development of a product from the motor vehicle industry. Product development strategy. The phases of the evolution of a production process. The virtual design process of a product in the automotive industry. Systems Engineering Processes. Management processes for complete vehicle development. Primary and complete features relevant to the client. Process stages and steps in product development. Increase success in product development. Develop a product brand strategy. Using resources in product development. Writing the Single Selling Proposal. Life cycle stages of the product. Improve the success rate of the new product.

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: Numerical methods applied in the FEM (Introduction/Recap). Double articulated flat bar element. Plane stress element. Symmetrical axial plane state element. Hexahedral finite element. Finite element homogeneous plane plate. Procedures in. the method of finite elements applied in the field of nonlinear. Method of finite elements applied in non-linear problems in the elastic field

II.1.6. Professional 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 internship IV: Setting the theme for professional practice. Identifying the development directions of the theme. Analysis of the real situation. Determining the solutions to the problems encountered. Project presentation. It is recommended that the topic of the practice is adapted to the topic of the dissertation project.

II.2.2. Dissertation project activity: Establishing the table of contents and bibliography. Analysis of current status and trends in the field of the degree project (scientific importance, applicability, achievement). Identifying directions for theme development in the dissertation project. Theoretical foundation of the project. Experimental foundation of the project.