Brief course description- Course Plan Development and Updating Procedures\ Mechanical Engineering	QF09/0409-3.0E

Faculty	**Engineering and Technology**	Academic Department	**Mechanical Engineering**	Number of the course plan (1)
Number of Major requirement courses	6	Date of plan approval	7/09/2023	

This form is just for the major requirement courses.

- **Compulsory requirements (18) Credit hours:**

Course number	Credit hours	**Title of the course**	Prerequisite-co-requisite
0912741	3	Research Methodology (Mandatory)	
This course covers topics such as searching and reviewing the literature, identifying a research problem, research ethics, research questions and objectives, types of research, designing a methodology, methods of data collection and analysis using statistical tools, interpretation of data, and drawing conclusions.			

Course number	Credit hours	**Title of the course**	Prerequisite-co-requisite
0912742	3	Manufacturing Control and Automation (Mandatory)	
This course provides an understanding of the technology of manufacturing automation, the common manufacturing processing, mathematical modeling of manufacturing process, the sensors to measure process output variables, the actuators available on machines and the control systems that enable operation of machines. The course covers the following topics: Manufacturing process modeling; Automation technology: robots; Automation Technology: machines; Robotic control; Machine control.			

Course number	Credit hours	**Title of the course**	Prerequisite-co-requisite
0912743	3	Materials Selection for Design and Applications (Mandatory)	
The aim of this course is to train each participant in design-oriented materials selection. The course introduces analytical tools and methods for qualified materials selection for engineering applications. Principles for material design for typical applications are also treated where the importance of behavior of specific materials and classes of materials are considered with respect to temperature stability, thermal and electrical conductivity, strength, toughness and chemical resistance, etc.			

Course number	Credit hours	**Title of the course**	Prerequisite-co-requisite
0912744	3	Management of Global Manufacturing (Mandatory)	
Global manufacturing introduction; Enterprise architecture in global manufacturing; Missing link between corporate strategy & manufacturing; Industry 4.0 and computer integrated manufacturing; Industry 4.0 applications in global manufacturing; Inflection and value chain in global manufacturing; Control of value chain; Framework of manufacturing strategy formulation; Competing for the future; Technology value chain; change management.			

Course number	Credit hours	Title of the course	Prerequisite-co-requisite
0912745	3	Industry 4.0 (Mandatory)	
This course aims to provide an overview of Industry 4.0 with a specific focus on manufacturing companies that are planning for, or on the path of, digital transformation. The offering will also introduce some tools and models for Industry 4.0 readiness assessment. The course introduces the basics of industrial communications, essential Industrial IoT sensing and data analysis technologies with a focus on industrial/manufacturing automation applications. The technology of "Digital Twins" and how Digital Twins can be used in industrial applications. Digital Twins are able to make decisions independently, use model simulations and communicate with other Digital Twins and the production plant. Digital Twins-enabled, decentralized and autonomous optimization will be covered.			

Course number	Credit hours	Title of the course	Prerequisite-co-requisite
0912753	3	Engineering Measurements and Internet of Things (Mandotory)	
This course aims at introducing the students to the fundamentals of engineering measurements, discussing about various relevant concepts & terminologies. The mathematical background required to categorize & analyze various measurement devices will be presented. Subsequently several classical and modern procedures for measuring parameters of scientific interest, such as displacement, motion, stress, force, flow, pressure, temperature etc., will be discussed in detail. Introduction to the Internet of Things (IoT) technologies and system design concepts; important IoT topics, which includes: industrial standards, sensor/actuator/data devices, hardware, software, security, system design and performance analysis techniques.			

- **Elective Courses (6) Credit hours:**

Course number	Credit hours	Title of the course	Prerequisite-co-requisite
0912750	3	Advanced Design and Manufacturing Processes (Elective)	
Design overview and design principles for manufacturing; Design for manufacturing; Design for assembly; Design for maintainability; Design for customer orientation and quality; Design for automated assembly equipment and devices; Robotic assembly; Selection of materials; Selection of manufacturing processes. Overview of manufacturing; Solidification processes; Metal forming; Material addition processes; Material removal processes; Particulate processing of metals and ceramics; Assembly technologies; Manufacturing process selection and process planning.			

Course number	Credit hours	Title of the course	Prerequisite-co-requisite
0912751	3	Molds and Die Design and Manufacturing (Elective)	
This course enables the students to demonstrate mold making process as well as to work on different types of molds. Will be capable to design various injection molding set up components like core, cavity etc. Understanding & interpreting results and molding parameters, and also troubleshooting molding problems. To analyze scanned data for checking interference between the components etc. This			

enables to configure the motion, evaluate the analysis results. It enables to understand various machining processes.

Course number	Credit hours	**Title of the course**	Prerequisite-co-requisite
0912752	3	Systems Simulation & Modeling (Elective)	
Discrete-event simulation; Basics model-building blocks; Simulation case studies; Simulation modelling of manufacturing facilities; Supply-chain simulation; Simulation workshop; Continuous simulation; Simulation in the process industry; Input-output analysis; Simulation life-cycle analysis; Model verification and validation, Simulation paradigms and languages.			

Course number	Credit hours	**Title of the course**	Prerequisite-co-requisite
0912755	3	Robotics Mechanics and Control (Elective)	
This course provides the student with the ability to devise and direct the specification and installation of advanced manufacturing processes compliant with Industry principles within an engineering company.			

Course number	Credit hours	**Title of the course**	Prerequisite-co-requisite
0912756	3	Fundamentals And Advances in Additive Manufacturing (Elective)	
Introduction to additive manufacturing; Vat photo polymerization; Material jetting; Material extrusion; Sheet lamination; Powder bed fusion; Directed energy deposition; Binder jetting; Design for additive manufacturing and file formats; Applications of additive manufacturing; Benchmarking and future trends; Conventional contact printing techniques for printed electronics; 3D freeform electronics printing techniques; Materials and inks for 3D printed electronics; Substrates and processing for 3D printed electronics; Sintering techniques for metallic nanoparticle inks; Computational design and simulation; Applications of 3D printed electronics and future trends; Lab tour; Workshop.			

Course number	Credit hours	**Title of the course**	Prerequisite-co-requisite
0912757	3	Special Topics in Smart Manufacturing (Elective)	
This course covers a range of topics centered on “smart manufacturing”, which is a key to provide novel products and solutions for critical industries and special situations.			

Course number	Credit hours	**Title of the course**	Prerequisite-co-requisite
0912757	3	Machine Learning and Data Science (Elective)	
Context of machine learning and data science in Smart Manufacturing for Industry 4.0; Types of machine learning; Unsupervised learning; Supervised learning; Neural networks and reinforcement learning; Model evaluation and improvement.			

- **Thesis (9) credit hours:**

Course number	Credit hours	**Title of the course**	Prerequisite-co-requisite
0912799	3	Thesis (Mandatory)	
The aim of the thesis is to allow the student to demonstrate their ability in undertaking an independent research project for developing theoretical perspectives, addressing research questions using data, or analyzing and developing real world solutions. They will be expected to utilize appropriate methodologies and demonstrate the skills gained earlier in the course when implementing the project.			

Approved by department council	Dr. Nabeel Abu Shaaban	Date of approval	7/09/2023