جامعة الحسين التقنية
Al Hussein Technical University

School of Engineering Technology

Bachelor Degree in

Industrial Engineering

Study Plan

2023

Program General Objectives:

1. Provide world-class, flexible, STEM-based education which combines in-depth technical knowledge with professional, leadership, and entrepreneurial skills.
2. Prepare graduates to define, analyze, and solve complex problems within and between enterprises.
3. Build advanced practical and technical skills to enable the student to conceive, design, build, and test complex engineering systems.
4. Enable students to discover, understand, and incorporate appropriate new technologies in the design and operation of enterprises.
5. Provide the student with a hands-on understanding of the evolving market needs through a tailored and intensive industry-based apprenticeship scheme.
6. Create opportunities to enhance the student's character, soft skills, and adaptation abilities within different multidisciplinary teams and changing professional environments.
7. Emphasize the need for engaging in life-long and independent learning and professional development.

Program Specific Objectives:

1. Develop technical knowledge and skills in core industrial engineering fields, including operations research, production planning, quality control, and manufacturing.
2. Develop technical knowledge and skills in Information Technology and Automation fields, including data analytics, artificial intelligence, enterprise resource planning, and industry 4.0.
3. Prepare graduates for a range of career paths, including operations management, engineering consultancy, business analysis and transformation, quality assurance, and logistics/supply chain.
4. Enhance critical thinking, decision strategy, and problem-solving skills to solve complex industrial engineering problems.
5. Promote professional management and effective communication skills.

Program Learning Outcomes

1. Apply technical knowledge, scientific principles, and mathematical skills to solve complex engineering problems in various fields, including logistics, operations, and production.
2. Use computer-aided tools to model, simulate, and optimize business operations and industrial systems.
3. Analyze data to make strategic decisions using statistical methods, data analytics tools, quality engineering techniques, and operations research methodologies.
4. Analyze and modify industrial systems using breakthrough technologies, such as Industry 4.0 and artificial intelligence.
5. Lead teams to develop and implement practical solutions to business operations and industrial engineering systems that consider social, environmental, and economic factors.
6. Communicate effectively in written, oral, and graphical forms with diverse audiences, including technical and non-technical stakeholders.

Framework for BS Degree

Classification	Credit Hours		
	Compulsory	Elective	Total
University Requirements	24	3	27
School Requirements	35	0	35
Program Requirements	**77**	**9**	**86**
Professional Apprenticeship Training	18	0	18
Total	**154**	**12**	**166**

University Requirements: (27 credit hours)

University Compulsory: (24 credit hours)

Course ID	Course Title	Credit Hours	Contact Hours		Prerequisite
			Lecture	Practical	
30301121	Pre-Intermediate English Intensive + Lab	4	3	6	30301120 Pre-Foundation English Elementary Intensive
30301122	English Intermediate	3	6	0	30301121
30301123	English Upper-Intermediate	3	6	0	30301122
30301124	English Advanced	3	6	0	30301123
40302111	Professional Skills	1	2	0	-

40302211	Professional Practice	3	4	0	40302111
40302231	Entrepreneurship Bootcamp	4	2	6	30301123 & 40302211
30302232	Leadership Camp	1	3	0	30302231 or 40302231
30301111	Arabic Language & Communication Skills	1	1	0	30301110
30302129	Military Science	1	0	0	-
	Total	**24**			

University Electives: 3 Credit Hours (three courses out of the following)

Course ID	Course Title	Credit Hours	Contact Hours		Prerequisite
			Lecture	Practical	
30301130	Foundational French Language	*1*	*3*	*0*	-
30301131	French Language Level 1	*1*	*3*	*0*	30301130
30301232	French Language Level 2	*1*	*3*	*0*	30301131
30301233	French Language Level 3	*1*	*3*	*0*	30301232
30301140	Foundational German Language	*1*	*3*	*0*	-
30301141	German Language level 1	*1*	*3*	*0*	30301140
30301150	Foundational Spanish Language	*1*	*3*	*0*	-
30301160	Foundational Turkish Language	*1*	*3*	*0*	-
30301170	Foundational Italian Language	*1*	*3*	*0*	
30301171	Italian Language	*1*	*3*	*0*	30301170
30301180	Chinese 1	*1*	*3*	*0*	
30301221	Development Academic Writing	*1*	*3*	*0*	30301124
30301222	Research and Technical Writing	*1*	*3*	*0*	30301124
30302121	Science & Society Seminar I: Arab Contributions to Science and Arts	*1*	*3*	*0*	-
30302122	Science & Society Seminar II: Philosophy of Science	*1*	*3*	*0*	-
30302123	Art Appreciation and Techniques	*1*	*3*	*0*	-
30302124	Civil & Professional Culture	*1*	*3*	*0*	-
30302125	Rights and Responsibilities: Understanding Human Rights	*1*	*3*	*0*	-
30302126	Introduction to cultural Anthropology-Focus on Urban Anthropology	*1*	*3*	*0*	-
30302127	Jerusalem, History and Civilization	*1*	*3*	*0*	-
30302128	Jordan: History and Civilization	*1*	*3*	*0*	-
30302133	Principles of Management	*1*	*3*	*0*	-
30302134	Strategies for Industry Competitiveness: Tools & Techniques	*1*	*3*	*0*	-
30302135	Principles of Accounting	*1*	*3*	*0*	-
30302136	Principles of Economics	*1*	*3*	*0*	-

30302237	*Free Choice Elective*	*1*	*0*	*0*	-
40302233	*Business Analytics*	*1*	*3*	*0*	-
40302221	*Speech and Debate*	*1*	*3*	*0*	-
30301223	*Introduction to Translation*	*1*	*3*	*0*	30301124
	Total	**3**			

School Requirements (35 credit hours)

Course ID	Course Title	Total	Theory	Lab	Type	Prerequisite
30303111	Functional Math	3	3	0	HTU	Placement test
30303112	Functional Physics	3	3	0	HTU	-
40303130	Fundamentals of Computing	4	3	3	HTU	-
00101100	Introduction to Engineering Drawing	1	0	3	HTU	-
00103101	STEM Lab I	1	0	3	HTU	-
00102102	STEM Lab II	1	0	3	HTU	00103101
00101103	Workshop I	2	0	6	HTU	-
00101104	Workshop II	1	0	3	HTU	00101103
00103110	Engineering Math	4	3	3	HNC	30303111
00102111	Engineering Science	4	3	3	HNC	30303112
00101112	Engineering Design	4	3	3	HNC	00101100
00102220	Managing a Professional Engineering Project	4	3	3	HNC	00101112
00106200	Intro to AI and Data Science	3	2	3	HTU	40303130 & 00103110
	Total	**35**				

IE Compulsory (77 Credit hours)

Course ID	Course Title	Theory	Lab	Total	Type	Prerequisite
103230	Electrical and Electronics Principles	3	3	4	HNC	102111
103250	Instrumentation and Control	3	3	4	HNC	103230
106231	Quality and Process Improvement	2	3	4	HNC	106230
106230	Statistical Process Control	3	3	4	HNC	103110
106201	Data Analytics	2	3	3	HTU	106200
106502	Business Process Support	2	3	3	HTU	106201
106310	Operations Research	2	3	3	HTU	106201
103553	Industry 4.0	0	3	1	HTU	103250
106260	Financial Analysis	2	3	3	HTU	103110
106561	Industrial Cost analysis	2	3	3	HTU	106260
106321	Supply Chain Management	2	3	3	HTU	106320
106522	Logistics	2	3	3	HTU	106321
106511	Facility and Asset Management	2	3	3	HTU	106310
106591	Capstone Project for IE I	1	0	1	HTU	106490
106592	Capstone Project for IE II	2	0	2	HTU	106591
106512	Decision Analysis and Strategy	2	3	3	HTU	106511
106523	ERP Systems	1	3	2	HTU	106321
103213	Further Math	3	3	4	HND	103110
102321	Professional Engr. Management	3	3	4	HND	102220
106340	Sustainability	3	3	4	HND	102321
106332	Lean Manufacturing	3	3	4	HND	101362
101362	Advanced Manufacturing Technology	3	3	4	HND	106231
106320	Manufacturing Systems Engineering	3	3	4	HND	106201
106490	Research Project for IE	4	0	4	HND	100 hrs
	Total			77		

IE Electives (9 Credit hours)

Course ID	Course Title	Credit Hours	Contact Hours		
			Lecture	Practical	
00103555	Industrial Robotics	3	2	3	
00106563	Principles of Sales and Marketing	3	2	3	106561
00102522	Maintenance Engineering	3	2	3	106495
00106513	Special Topics in Optimization and Decision Making	3	2	3	106310
00106504	Special Topics in Industrial Engineering	3	2	3	106495
00106503	Machine Learning Operations	3	2	3	106502
00102523	Health, Safety and Environment	3	2	3	106495
00106550	Ergonomics	3	2	3	106495
00106562	Business and Labor Law	3	3	0	106495
00103383	Programming Logic Controllers	3	2	3	103250
00106533	Industrial Engineering application in healthcare	3	2	3	106495
00106570	Introduction to electronics manufacturing	3	2	3	101362
00106524	Supply Chain Risk, Disruption, and Resilience	3	2	3	106321
00106525	Supply Chain Technologies	3	2	3	106321
00106526	E-commerce and Omni-channel Logistics	3	2	3	106321
	Total	**9**			

Professional Apprentice Requirements (18 credit hours) (8 months)

Course ID	Course Title	Credit Hours	Contact Hours		Type	Prerequisite
			Lecture	Practical		
106493	Apprenticeship for Industrial Engineering I (Student must pass 100 CH)	6	0	10	HTU	40302231
106494	Apprenticeship for Industrial Engineering II	6	0	15	HTU	106493 or (up to 12 hrs Concurrent)
106495	Apprenticeship for Industrial Engineering III	6	0	15	HTU	106494 or (up to 12 hrs Concurrent)
	Total	**18**				

SCHOOL REQUIREMENTS

Functional Math

This course reviews the fundamental concepts in numerical analysis, linear algebra, geometry, statistics, and probabilities. It strengthens problem-formulation skills (i.e., the ability to translate real application problems into a series of mathematical processes). It also focuses on developing the mathematical reasoning skills, such as mathematical deductions and proofs.

Functional Physics

This course demonstrates understanding and application of essential physics topics such as: Physics and measurements, motion in one dimension, vectors, motion in two dimensions, the laws of motion, forces and motion, applications of Newton's laws (projectile, angular velocity, etc.), energy of a system, static equilibrium, and electricity and magnetism.

Fundamentals of Computing

This course provides a comprehensive route to developing an in-depth exposure to personal computers, hardware, a range of operating systems, and in-depth programming in C. Students learn the functionality of various hardware and software components and best practices in maintenance and safety issues as well as programming in C, including variables, operations, functions, structures, and pointers.

Introduction to Engineering Drawing

This course provides the fundamentals of engineering graphics and drawing. Among the topics covered are: drawing of orthographic, isometric and auxiliary projections, sectioning, dimensioning, scaling and documentation. Students learn and use the interface, structure, and commands of the latest version of a conventional computer-aided design (CAD) software.

STEM Lab I

This course develops the basic skills in the fields of science, technology, engineering and mathematics through a set of practical experiments covering mechanical, electrical, electronics, automation, mechanics of materials, robotics,

computer applications and process control.

STEM Lab II

This course provides students with a modern hands-on technical perspective of STEM education as they are applied in professional settings. The lab is equipped with state-of-the-art educational technologies in fields related - but not limited - to electromechanical systems, robotics, pneumatic systems, automation, image processing, sensor installation and calibration and material manufacturing processes.

Workshop I

This course develops the following basic skills: Hand filing, turning, welding, piping and plumbing, carpentry, brick laying, constructional works, surveying measurements, sheet metal fabrication, household electric circuits and installation of simple computer networks.

Workshop II

This course covers hands-on training on manual and electric driven tools, electric arc welding, spot welding, resistance welding, sand casting, sheet-metal forming, longitudinal lathing, longitudinal and inclined turning and metal milling.

Engineering Math

This course aims to develop students' skills in the mathematical principles and theories that are directly applicable to the engineering industry. Students will be introduced to mathematical methods and statistical techniques that enable them to analyze and solve problems within an engineering context. Among the topics included in this course are: Arithmetic and geometric progressions (exponential, logarithmic, circular and hyperbolic functions), mean and standard deviation of grouped data, linear regression, binomial and normal distributions. In addition to sine waves and their applications, trigonometric and hyperbolic identities, vector functions and the use of differential and integral calculus in solving engineering problems.

Engineering Science

This course introduces the fundamental laws and applications of the physical sciences within engineering and the application of this knowledge in finding solutions to a variety of engineering problems. Among the topics included in this

course are: international system of units, interpreting data, static and dynamic forces, fluid mechanics and thermodynamics, material properties and failure, in addition to A.C./D.C. circuit theories.

Engineering Design

This course introduces the methodical steps that engineers use in creating functional products and processes, starting from a design brief to the work and the stages involved in identifying and justifying a solution to a given engineering need. Among the topics included in this course are: Gantt charts and critical path analysis, stakeholder requirements, market analysis, design process management, modelling and prototyping, manufacturability, reliability life-cycle, safety and risk management, calculations, drawings and concepts and ergonomics.

Managing a Professional Engineering Project

This course introduces students to the techniques and best practices required to successfully create and manage an engineering project designed to identify a solution to an engineering need. Among the topics covered in this course are: roles, responsibilities and behaviors of a professional engineer, planning a project, project management stages, devising solutions, theories and calculations, management using a Gantt chart, evaluation techniques, communication skills, and the creation and presentation of a project report.

Introduction to AI and Data Science

This course provides a comprehensive introduction to the fundamental concepts and applications of artificial intelligence (AI) and data sciences. Students will explore key algorithms and methodologies essential for problem-solving in the fields of search, adversarial search, knowledge-based agents, machine learning, natural language processing, and analytics domains. Practical implementation of these concepts through Python programming will be a core component of the course.

IE COMPULSORY COURSES

Further Mathematics

This course introduces additional mathematical topics to students, advancing their knowledge of the underpinning mathematics gained in the Engineering Mathematics course. The purpose of this course is to prepare students to analyze and model engineering situations using mathematical techniques. Among the topics included in this course are Number theory, complex numbers, matrix theory, linear

equations, numerical integration, and graphical representations of curves for estimation within an engineering context. Furthermore, this course expands students' knowledge of calculus to discover how to model and solve engineering problems using first and second order differential equations.

Statistical Quality Control

Control charts and measurements are methods used to detect trends and quality variations in the output of processes, allowing early warnings of deviations from specifications. These signals are then used to initiate corrective actions in production planning, process method, modification and maintenance of systems. SPC forms an important part of most process improvement methodologies, such as Total Quality Management and Six Sigma. This unit introduces the student to the statistical techniques used in process control, variables inspection and attributes inspection. The collection and handling of data and its interpretation using process control charts is covered. These skills will allow the student to assess process capability and recognise types of variability that may occur in different processes. By the end of this unit, students will be able to apply relevant statistical techniques used in process quality control and to evaluate the outcome of a process against the desired specification

Data Analytics

This course introduces the theoretical foundation of data analytics and a range of data analytic processes and techniques to provide hands-on experience for enhancing students' skills. Topics included in this course are: Data analytic terminologies; types of data analytics; data exploration and visualization; understanding data with descriptive, predictive and prescriptive analytics.

Business Process Support

This unit introduces students to a range of tools, techniques and technologies used for acquiring data and processing it into meaningful information that can be used to support business functions and processes. Students will examine how data and information support business processes, the mechanisms to source and utilise data and turn it in to usable, and valuable, information output. Students will explore real-world business problems, the emergence of data science and how the application of data science can be used to support business processes. Finally, students will demonstrate practical application of data science techniques to support real-world business problems.

Operations Research

Students learn principles of linear programming as well as modelling techniques of simple production problems, network problems, and binary integer problems. Students learn solving models graphically for a two-dimensional model, using Simplex Method for more than two variables, and coding a linear program on Python and use the package Pulp to solve the models to optimality. Students learn post-optimality analysis as well as duality theory and their uses.

Quality and Process Improvement

This unit introduces students to the importance of quality assurance processes in a manufacturing or service environment and the principles and theories that underpin them. Topics included in this unit are: tools and techniques used to support quality control, attributes and variables, testing processes, costing modules, the importance of qualifying the costs related to quality, international standards for management (ISO 9000, 14000, 18000), European Foundation for Quality Management (EFQM), principles, tools and techniques of Total Quality Management (TQM) and implementation of Six Sigma.

Manufacturing Systems Engineering

Manufacturing systems engineering is concerned with the design and on-going operation and enhancement of the integrated elements within a manufacturing system, which is a very complex activity, even for simple products. The art of manufacturing systems engineering is essentially designing systems that can cope with that complexity effectively. The aim of this unit is to develop students' understanding of that complexity within a modern manufacturing environment. Among the topics covered in this unit are: elements that make up a manufacturing system, including production engineering, plant and maintenance engineering, product design, logistics, production planning and control, forecast quality assurance, accounting and purchasing, all of which work together within the manufacturing system to create products that meet customers' requirements. On successful completion of this unit students will be able to explain the principles of a manufacturing system and consider how to design improvements. They will be introduced to all the elements that make up a modern manufacturing system, and they will learn how to optimise the operation of existing systems through discerning use of monitoring data. Some of the elements will be developed in greater depth; of particular importance will be looking at the systems of production planning and control, which are the day-to-day tools used to manage the manufacturing system effectively.

Financial Analysis

This course provides an in-depth understanding of the principles and methods used to

evaluate the financial health and performance of businesses. The course covers a wide range of topics, including financial statements analysis, financial ratios, cash flow analysis, capital budgeting, valuation, and risk analysis. The course also covers cash flow analysis, which involves examining a company's cash inflows and outflows to determine its ability to generate cash and meet its financial obligations. Students will learn how to use discounted cash flow (DCF) analysis to evaluate the potential value of a company, project or investment.

Industrial Cost Analysis

Students gain knowledge regarding managerial accounting and cost concepts, classifications and calculations. Module also introduces ABC and other costing methods such as cost for pricing, cost evaluation and improvement, costs for decision making, budgeting, and variance analysis. Students are introduced to financial balance sheet calculations, depreciation, assets and liabilities, and taxes. This will include the following: Cost estimation and the budgeting process:, scheduling and allocating resources techniques such as PERT and CPM, managing projects through information systems, and monitoring/controlling projects.

Supply Chain Engineering

The module covers topics related to supply chain design, planning, and integration. This includes sourcing decisions, logistic systems, capacity analyses, aggregate planning, and distribution networks. The module also discusses latest development in supply chain management including sustainability and technology applications. The team project portion of the module allows the students to model and evaluate a real-world supply chain. This includes developing a SIPOC structure, setting KPIs, and optimizing the supply chain network.

Logistics

This course introduces students to practical concepts of warehousing and inventory management including the types of equipment, storage processes and systems, the technologies used to identify and track units in a warehouse, and the regulations designed to ensure safety in warehouse operations.

ERP Systems

The Enterprise Resource Planning (ERP) course is designed to provide students with a comprehensive understanding of the principles, concepts, and tools used in modern ERP systems. The course covers a wide range of topics, including the role of ERP systems in business operations, ERP implementation strategies, ERP modules, and ERP system customization. Students will learn how to use ERP software to manage and analyze data, and how to configure and customize an ERP system to meet the

specific needs of a business.

Advanced Manufacturing Technology

The ability of successful companies to meet the growing demand of customers is heavily influenced by the development of advanced manufacturing technologies. Customers expect high complexity products, on demand, and with a growing element of customisation. In adopting advanced manufacturing technologies, successful companies will ensure faster time to market of new products, improve products and processes, use new, sustainable, materials, and customise to customer requirements. Manufacturing systems engineering underpins this development. In order to meet changing customer expectations and gain competitive advantage, focus needs to be applied to developing smart factories and advanced manufacturing technologies. Manufacturing organisations will seek integration between manufacturing technology, high performance computing, the internet, and the product at all stages of its life cycle. Industry 4.0 is the term that has been adopted to describe the 'fourth' industrial revolution currently underway, at present, in the manufacturing and commercial sectors of our society. It is a revolution based on the integration of cyber-physical systems with the Internet of Things and services. For the manufacturing sector, this integration has been enabled by successfully combining high performance computing, the internet and the development of advanced manufacturing technologies. Industry 4.0 is changing the way the world's most successful companies produce the products that their global customers demand. On successful completion of this unit students will be able to analyse and evaluate the potential of using advanced manufacturing technologies to improve the competitive advantage of the organisations adopting them. The student will develop knowledge and understanding of advanced manufacturing technologies, digitalisation and a range of advanced manufacturing technologies. They will also develop their own research activities into the latest developments.

Facility and Asset Management

Students learn the concepts and methodology of facilities planning as well as layout planning, optimization algorithms applied to facilities layout, selection of material handling systems, and operations of warehouse. Students acquire knowledge and skills in the areas of strategic facilities planning and manufacturing facilities design. Students carry independent project work and research in the field.

Professional Engineering Management

This course aims to continue building-up the knowledge gained by Managing a Professional Engineering Project course, to provide the students with common

professional standards and guide them on how to develop a range of employability skills. Among the topics included in this course are: engineering strategy and services delivery planning, the role of sustainability, Total Quality Management (TQM), engineering management tools, managing people and becoming a professional engineer

Sustainability

This course provides an in-depth discussion of modern sustainability concepts, challenges, and strategies in a global perspective. Topics covered include: Natural cycles and eco-systems, United Nations millennium goals, national and regional sustainability planning, climate change and greenhouse gas management, energy-water-food nexus, pollution and waste, environmental justice, corporate and organizational sustainability management, ISO 14001, ISO 26000.

Lean Manufacturing

The aim of this course is to introduce the principles and processes of lean manufacturing and explore the tools and techniques that are applied by organizations practicing lean. Among the topics included in this course are: scoping and defining lean manufacturing, the benefits and challenges of adopting Lean, The Toyota Production System (TPS), common tools and techniques associated with lean manufacturing and process improvement, and the most appropriate improvement tool(s) to tackle a problem.

Electrical and Electronic Principles

This course provides students with a good and wide-ranging grasp of the fundamental principles of electrical and electronic circuits and devices. Topics included in this course are: Analysis of simple circuits with constant voltages and currents, using circuit laws, Kirchhoff's and Thevenin's laws, and the superposition principle. In addition to the analysis of simple circuits with sinusoidal voltages and currents, basis of semiconductor action and its applications to simple electronic devices, such as junction diode, Zener diode, light emitting diode, bipolar transistor, junction field-effect transistor (FET), and metal-oxide-semiconductor FET (MOSFET), highlighting the difference between analogue and digital electronics and their applications.

Instrumentation and Control

This course discusses the main components of measuring systems including various types of sensing elements (such as: displacement, speed, pressure, temperature, and strain), variable conditioning and signal processing techniques, in addition to signal representation methods. The course also introduces the concepts and terminology of control systems, such as: open and closed loop, discrete and analogue systems. It focuses on process controllers as a main part of control systems. Proportional-Integral-Differential (PID) controllers are investigated in details and according to their mathematical models. Multiple practical experiments and simulation exercises are conducted throughout the course demonstrating conventional instrumentation circuits.

Industry 4.0

The aim of this unit is to provide a principle understanding of why and how smart factories are changing the face of manufacturing. Students are first introduced to the factors and consequences behind industrial revolutions and the definition of smart factories followed by the wide range of technologies that make smart factories work. Students will then be able to reflect on successful case studies of transitioning to Industry 4.0 followed by considering possible future directions with respect to Industry 5.0 – personalisation.

Research Project for IE

This course introduces the skills necessary to deliver a complex, independently conducted research project that fits within an industrial engineering context. Topics included in this course are: Finding a research problem, project proposal, selection of project approach, literature review,

data analysis and interpreting findings, project management and key milestones, reporting the research, project oral presentation, and research publication methods.

Capstone Project for IE

This course focuses on how choose and refine capstone project based on feedback from faculty, peers and partner organizations. It introduces technical methods for analyzing, designing, prototyping, synthesizing, troubleshooting, and testing a project relevant to industrial engineering. The students practice project documentation, formal design review presentations, oral defense of the project, and writing a final report. Presents various guest speakers from different IE fields and industries to open the door for possibilities.

Decision Analysis and Strategy

This course focuses on applying quantitative methods and decision-making techniques to real-world industrial problems. The course covers topics such as optimization, linear and integer programming, simulation, game theory, and heuristics. Students will learn how to gather and analyze data, build models, and make informed decisions to improve processes and increase efficiency in industrial settings. Additionally, students will explore various strategy formulation and implementation techniques, including SWOT analysis, Porter's Five Forces, and strategic management frameworks. The goal of the course is to equip students with the analytical and strategic skills necessary to be effective leaders and decision-makers in industrial engineering.

IE PROGRAM ELECTIVES

Manufacturing Process

This course introduces the students to the techniques and capabilities of different manufacturing processes for metals and polymers. Fundamental topics include Manufacturing processes (cutting, casting, forming, machining, joining, finishing,

assembly, additive manufacturing etc.), dimensional measurements, quality engineering, design for manufacturing, production planning.

Industrial Robotics

The aim of this course is for students to investigate the range, operations, and benefits of industrial robots within manufacturing applications. The course covers the fundamentals of robot systems, including their kinematics, dynamics, and control. Among the topics included are industrial robot selection, programming and safety protocols that anticipate future developments in industrial robot technology. Students will learn the different robot structures with emphasis on six-degree of freedom manipulators. Students will understand the electrical, mechanical, hydraulic and pneumatic operation of common industrial robots. Students will learn how to program an industrial robot for automated process applications and will understand the communication protocols. Through lectures, lab experiments, and hands-on projects, students will learn how to design and program industrial robots for various applications. By the end of the course, students will have a strong foundation in industrial robots and automation systems, enabling them to develop and implement robotic solutions in real-world settings.

Discrete Event Simulation

This course provides an in-depth introduction to discrete event simulation, a powerful analytical tool essential for studying complex industrial systems. Through a combination of theory and practical application, students will develop the skills necessary to effectively model, simulate, and analyze various systems. Key topics covered in the course include Input/output analysis, random number generation, Queuing models, and model validation and verification. The “theory” of simulation involves probability and statistics, thus a good background in probability and statistics is required. The “theory” of simulation involves probability and statistics, thus a good background in probability and statistics is required. Throughout the course, emphasis will be placed on practical application, hands-on exercises, and case studies to reinforce theoretical concepts and develop students' proficiency in simulation modeling and analysis. By the end of the course, students will be equipped with the skills and knowledge necessary to leverage discrete event simulation effectively in the study and optimization of complex industrial systems.

Digital Transformation

In this unit, students will explore the impact of both the current and emerging digital technologies across different industries and investigate how organisations and businesses use digital technologies to meet their needs. They will also look at how an organisations strategy and leadership decision making is impacted by digital technology implementation. They will plan a solution for a specific organisation to use a new or emerging technology.

Maintenance Engineering

This course introduces the concepts of Reliability, maintainability, availability, and safety of products and systems, with practical applications and case studies. Topics covered include: Building and analyzing reliability models using block diagrams, Fault Tree Analysis (FTA), Failure Mode & Effect Analysis (FMEA), concepts and methods of maintenance planning and management with a focus on corrective and preventive maintenance, cost estimation and scheduling of maintenance activities, forecasting of spare parts needed for equipment maintenance, inventory control models, introduction to computerized maintenance management systems.

Ergonomics

Basic concepts of anthropometry, to match the physical dimensions of workplaces and products with the body dimensions of intended users; An introduction to occupational biomechanics, the structure and properties of the musculoskeletal system, and related upper extremity related cumulative trauma disorders; Physiological aspects of muscle work and the implications of work capacity limits for ergonomic job design; Nature of light stimulus, eyeball anatomy and characteristics of the visual sensory system; Human information processing model, cognition processes, limitations of the human cognitive system, implications and solutions for design problems; Human factors principles in the design of displays and controls.