Course Description
Bachelor of Science in Industrial Engineering (BSIE)

==== Jan 2023 ====

Course Code	Course Title	Credit Hours	Pre-Requisites	Course Description
Mathematics and Science Courses				
MTH 104	Calculus I	Please visit the website of Department of Mathematics and Natural Sciences https://yu.edu.sa/academics/coea/department-of-mathematics-and-natural-sciences/#course-description		
MTH 106	Discrete mathematics			
MTH 204	Calculus II			
MTH 301	Linear Algebra			
MTH 304	Differential Equations			
STT 103	Probability and Statistics			
PHY 103	Physics - I (Mechanics)			
PHY 203	Physics - II (EM+Electronics)			
CHM 101	General Chemistry			
General Education Courses				
ARB 102	Communication Skills in Arabic	Please visit the website of Humanities Department https://yu.edu.sa/academics/college-of-law/humanities-department/#Course-Description		
ARB 202	Writing Skills in Arabic			
ISL 101	Foundation of Islamic Culture			
ISL 201	Foundation of Islamic Economy			
ENG 101	English Essay Writing			
XXX	Humanities/Social Science Elective			
Engineering Sciences Courses				
ENR 203	Statics and Strength of Materials	Please visit the website of Department of Mathematics and Natural Sciences https://yu.edu.sa/academics/coea/department-of-mathematics-and-natural-sciences/#course-description		
CIS 103	Programming Fundamentals-1	Please visit the website of Software Engineering https://yu.edu.sa/academics/coea/swe/#courses		
ENR 201	Engineering Drawing and CAD	3	ENG 101	Engineering drawing types; Drawing equipment; Layout of drawings, Tangencies, Isometric drawing; Orthographic, oblique and pictorial projection, computer graphics; Basic mathematical functions for graphics, Basic of engineering drafting using computer software (such as AutoCad, CATIA). CAD system examples, Generating basic sketch, layout, dimensioning, tolerance, sectioning and generating different views using computer aided drafting software,; Geometric Modeling, and Assembly of components and generating bill of material, Detailed drawings including sections and assemblies

MEG 211	Fundamentals of Materials Engineering	3	PHY 103, CHM 101	Engineering materials properties testing and processing parameters; Material compositions and structures; physical and mechanical of materials; Ferrous materials; Heat treatment; Non-Ferrous alloys; Ceramics, Polymers, Composites; introduction to Nano materials; Material selection.
Industrial Engineering Core Courses				
IEG 201	Introduction to Engineering Design	2	ENR 201	Engineering profession, jobs, and disciplines; Elements of engineering analysis; Introduction to Engineering Design and team formation; Engineering problem definition; Sustainability in Engineering Design (Economic, Environmental and Social factors); Engineering system Architecture and physical function decomposition; human factor, environment, and safety issues in design; Generation of alternative concepts; Evaluation of alternatives and selection of a concept, Design defense, performance evaluation, and reporting; Intellectual Property – Legal Factors. Engineering ethics.
IEG 202	Social and Ethical Aspects in Engineering	2	IEG 201	Introduction: Engineering ethics and society Impact of ethics-based engineering solution on: – *safety: Safety and risk; Risk assessment; Reducing risk* – *economics: Ecology and economics* – *environment: Ethics impact on environment* – *global: Technology Transfer; Computer ethics and internet* – *social context: Socially conscious engineering; Social impact of ethics; ethical frameworks* – *Public health and welfare: The code of ethics and the law of the public health, safety, and welfare* Moral Reasoning and Code of Ethics: Ethical dilemmas and making moral choices; Importance, limitations, abuse and justification of codes Workplace responsibilities and Rights: Team work; Confidentiality and conflict of interest Honesty: Truthfulness and truth worthiness; Expert witness and advisors; Research integrity
IEG 301	Design of Experiments	3	STT 103	Introduction to Design of Experiments and its applications in industry; Hypothesis testing; Analysis of variance; Residual analysis; Block design; Randomized complete and incomplete designs; Two and multi factor factorial design; Introduction to response surface methodology.
IEG 302	Engineering Reliability	2	IEG 301, MTH 204	Introduction to the concept of reliability; Failure distributions; Reliability characteristics; Estimation of system reliability both for the independent and dependent cases. Maintenance workload analysis and calculations

IEG 303	Quality Control	3	IEG 201, IEG 301	An understanding of the basic concepts of quality; An appreciation of the functions served by a quality management system; the ability to design quality into products so as to satisfy both internal and external customer; The study of frequency distributions and probability models in quality control; Preparation and use various control charts; Construction of different sampling plans for different applications (manufacturing, health, and safety considering economic factors); Quality improvement Methods and analysis of quality costs; Application of computer in the above areas.
IEG 304	Engineering Economy and Costing	3	MTH 304, IEG 202	Cost concepts; Time value of money operations; Measuring the worth of investments; Comparison and evaluation of alternatives considering economic and public welfare; Economic analysis of public projects; Inflation, Breakeven analysis; Product costing and pricing. Role of Engineering ethics in decision making (economical and environmental perspective)
IEG 311	Production and Inventory Systems	3	STT 103	Introduction to operations management and productivity; Forecasting methods and analysis: Naïve approach, Moving and Weighted Moving Averages, Exponential Smoothing, Regression method; Capacity planning: Design Capacity, Effective Capacity, Utilization, Bottleneck Analysis: Break-even point; Inventory management: ABC analysis, EOQ, POQ; Material requirement planning: BOM, lot-size using LFL, EOQ and POQ.
IEG 312	Operation Management	3	IEG 311	Introduction in operations management; Aggregate planning (concept, capacity options, demand options); Developing economical aggregate planning methods (Graphical method; Mathematical method); short term scheduling (assignment method, sequencing rules); assembly line balancing; Project planning, Just in Time (JIT) and lean operations; Supply chain management; Decision making (methods, tools, environments).
IEG 321	Operation Research-1	3	MTH 301, CIS 103	Introduction to mathematical programming and optimization; Characteristics of linear programs; Modeling of various industrial programs as linear programs; Graphical solutions; Introduction to the theory of simplex methods; Big M method, Unbounded and infeasible solutions; Sensitivity analysis and introduction to the duality theory; Transportation and assignment problems and solution techniques to minimize the cost; Shortest path, Minimum spanning tree, and maximum flow problems; Goal Programming.
IEG 322	Operation Research-2	3	IEG 321	Deterministic dynamic programming; Forward and backward procedures; Application of Dynamic programming – Backward approach in Inventory problem and selection the best production plan among different alternate by considering an economic factor; Integer programming; Branch and Bound methods; Nonlinear programming; Single and multi-variable unconstrained optimization; KKT conditions and quadratic programming; Markov chains; Queuing Theory
IEG 323	Systems Simulation	3	IEG 321	This course provides an introduction for the fundamental simulation concepts: an introduction to the concept of simulation including modeling and simulation languages; Appropriate inputs to a simulation model; and random number generation; Analysis of the output from a simulation model; Validation of the simulation model, Application of

				simulation in industrial system and selection the best utilizes machines and workers among different alternate with considering an economic factor
IEG 332	Work Design and Analysis	3	IE 341	Introduction to work analysis and design; Methods engineering and prioritizing economic methods; Study of the basic work measurement techniques; Applications and limitations of the stop-watch time study; pre-determined motion time systems; Reengineering management.
IEG 341	Manufacturing Processes-1	3	MEG 211	Introduction Engineering materials processing considerations, product quality and production costs; Definition of stress, strain and mechanical properties of materials applied to metal forming processes; sheet metal forming, processes (deep drawing, stretch shearing and bending) ; bulk forming processes (forging, rolling , extrusion and wire drawing); basic casting techniques, Pattern Designing with shrinkage and machining allowances; Calculations on solidification time; Welding processes.
IEG 342	Manufacturing Processes-2	3	IEG 341	Part specification and geometrical Tolerance; Traditional machining processes (turning, milling, drilling, grinding,….); Process-capability analysis and Decision; optimization of cutting variables for machining operations; Principles of NC (Numerical Control), and CNC (Computer NC); Assembly design; Non-traditional machining; introduction to rapid prototyping and 3 printing machines; introduction to process planning.
IEG 345	Industrial Control Systems and Automation	3	CIS 103, PHY 203	The course familiarizes students with basic concepts and technologies of process control and automation systems. It covers Process control fundamentals; Control theory principles; Modeling analogy; Sensors and actuators; Digital control using programmable logic controller (PLC); and Industrial automation, Control system application in (healthcare and Manufacturing system)
IEG 351	Manufacturing Systems	3	IEG 302, IEG 342	The aim of the course is to provide the students with the knowledge and tools used for factory models; Process time variability; Multi stage single product factory models; Multiple product factory models; Models of various forms of batching; Buffers in Manufacturing systems, Serial limited Buffer models; Impact of buffers on system economics; Simulations techniques in manufacturing.
IEG 400	Product Development and Innovation	3	IEG 201, IEG 303	Introduction to manage innovation; product development stages; local product VS a global product, Customer needs; Product specification; Quality function deployment; Product structure and components; Function Analysis; Value engineering principles; principle of reverse engineering; Idea generation; Design for manufacturing and assembly (DFMA); Design for Environment, Product Development Economics, Health and Safety in product design, Implementing prototype metrologies;
IEG 411	Project Management	3	IEG 312, IEG 304	The course covers the project management process from the beginning to the end, focusing on practical skills that make students able to immediately complete projects on time and on budget, while achieving their targets. It discusses Project Participants and organizational; Project Life Cycle; Projects Planning Processes and Bar Chart; Network Model; Scheduling

				using activity-on-node and Time Scaled.; Resource Allocation and Optimization; Project Time-Cost Trade-Off; Project Time and Cost Control; Analysis of Scheduling Delay; Ethics and Risks in Project Management: global and environmental impacts.
IEG 431	Ergonomics	3	IEG 332	Introduction to human factors; Human-Machine Systems; Information theory; Human Capabilities; Environmental, Health, and thermal factors. Social and Legal aspects; Workplace Design, Physical Work and Manual Materials Handling and Speech Communications; Industrial hazard avoidance concepts and techniques; Plant safety applications; Analytical trees and fault tree analysis; Risk assessment; Emergency planning.
IEG 430	Safety Engineering	3	IEG 431	Introduction to regulations and standards; Management and its safety responsibilities; Safety system design; Training Methods, Management and its Responsibilities for Safety, Statistical methods, Network Analysis, Hazard Analysis, Risk Analysis, and Decision Theory.
IEG 450	Industrial Facility Design and Material Handling	3	IEG 332, IEG 321	Facility design stages of Industrial Factory Product, process and material handling analysis; Area allocation and space analysis with considering an economic factor, facility layout for social and cultural needs; Flow analysis; Plant layout and plan; Concepts and methodologies for the analysis and design of material handling systems. Automated material handling systems. Concept of storage analysis. Location problem analysis with considering an economic factor;. Computerized facility layout and allocations.
IEG 490	Graduation Design Project-1	2	▪ Complete 85 credit hours. ▪ All Mathematics, Basic Sciences, and IE courses in level 1-5 ▪ IEG 431 ▪ IEG 450	Students work in teams on an independent engineering project under the supervision of a project advisor. The design process is emphasized, encompassing project definition, design constraints, feasibility analysis, alternative designs, evaluation of alternative designs, and design computations. For each project, the scope of work is clearly defined. The scope of work may also include prototyping, fabrication, and testing. The incorporation of appropriate and relevant engineering standards and ethics are the mandatory parts of the design project. Progress reports, a final written report, and oral presentations are submitted and presented to the student's project advisor and examiners.
IEG 491	Graduation Design Project-2	2	IEG 490	Students work in teams as on an independent engineering project under the supervision of a project advisor. The design process is emphasized, encompassing project definition, design constraints, feasibility analysis, alternative designs, evaluation of alternative designs, and design computations. For each project, the scope of work is clearly defined. The scope of work may also include prototyping, fabrication, and testing. The incorporation of appropriate and relevant engineering standards and ethics are the mandatory parts of the design project. Progress reports, a final written report, and oral presentations are submitted and presented to the student's project advisor and examiners.
IEG 497	CO-OP Practical Training	6	Pass 90 credit hours	The CO-OP is a 6-credit-hour course. A CO-OP student is required to spend 24-26 continuous weeks of practical work in a relevant field of industry. The CO-OP duration

				spans one regular semester and one summer. The student is required to register for the CO-OP course in both semesters. A student should not take the CO-OP until he/she completes at least 124 credit hours. During performing the CO-OP program, each student is supervised by internal advisor from the department and external mentor from the company/organization who assess the student continually. The student is required to submit monthly progress report and after finishing the CO-OP period, the student submits a final report and gives a presentation about their experience and knowledge gained during their work.
CSK001	Career Skills	-	-	
Industrial Engineering Elective Courses				
IEG 403	Six Sigma and Lean Operations	3	IEG 301, IEG 303	This course focuses on waste identification and removal. Lean six sigma seeks to establish flow and pull production systems and most importantly end to end value systems that deliver only value to the customer. It uses techniques that are intended to eliminate waste in all forms (e.g. defects, over production, transportation, waiting, inventory, motion and over processing) Thus, it creates efficiency, productivity, reduced costs and increased quality.
IEG 413	Supply Chain	3	IEG 312	Methods and models of supply chain, supply chain design, multi-location inventory-distribution models, bullwhip effect, delayed differentiation, and e-commerce and supply chain. Supply chain design: customer service, quality, logistics, inventory, business processes, system dynamics, control, design, and re-engineering. Supply chain operations: issues, opportunities, tools, approaches, inter-corporate relationships, incentives and risk factors. The key insights provided by such system-wide models will be illustrated through the use of software packages, real cases discussion and presentations and term projects. In addition, the course will highlight the role of information technology in supporting supply chain operations.
IEG 414	Production System Operations	3	IEG 312	Business plans to production operation systems, strategies to reach targets, production operations system's contribution to competitiveness, balancing production operations system and strategies; Production System Operations performance, world-class successful production operations systems, productivity and efficiency what should be measured? overall equipment effectiveness; Advance Production System Operations dynamic, bottleneck rates, internal benchmarking, labor constrained production operation system; Just in time revolution and lean manufacturing, implementing just in time, pull production operation system, kanban, comparison of conwip with kanban and material requirement planning, production scheduling in pull environment; Advance aggregate and work force planning, product mix planning, combined modeling insides; Modern views of capacity management, forcing cycle time compliance, factory physics approach, capacity allocation

				and production line balancing; Production systems operation development in the future, key areas and success factors, future production from an international perspective.
IEG 433	Ergonomic Design	3	IEG 431, IEG 332	This course covers mainly theories/methods that influence the assessment of physical, social, and psychological human factors. Development of user needs with application to designed products that interact with human body. In addition, application of design to meet human needs. Design of fabricated products, tools/machines, software/hardware interfaces, art/culture, living environments, and complex sociotechnical systems.
IEG 446	Direct Digital Manufacturing	3	IEG 342	The course familiarizes students with basic concepts and technologies of 3D technologies in both design and manufacturing. It includes scanning methods, additive manufacturing technologies, software issues for digital manufacturing, Guidelines for Process Selection, Design for Digital Manufacturing, Applications of Digital Manufacture
IEG 447	Computer Integrated Manufacturing	3	IEG 345	Introduction and Manufacturing Systems; Industrial Robots; Material handling systems; Automated storage and retrieval system; Automated identification and data capture; Industrial Networks and Communication Systems; Industrial Information Systems; Computer Aided Process Planning; Inspection principles and technologies.
MIS 327	Data Management	3	CIS 103, IEG 342	Please visit the website of Management Information Systems https://yu.edu.sa/academics/coba/mis/#course-description