DSIE Program Requirements:

The B.Sc. degree in Industrial Engineering is awarded upon completing a total of 164 credit hours according to the credit hour distribution as shown in the next table.

Table 1: Credit Hour Distribution in DSIE

No.	Courses' Type	Credits
I.	University Requirements	22
II.	Engineering Requirements	32
III.	Industrial Engineering Part	29
IV.	Mechnical Engineering Part	31
V.	Electrical Engineering Part	26
VI.	Practice	18
VII.	Gradutaion Project Modules	7
	Total	**165**

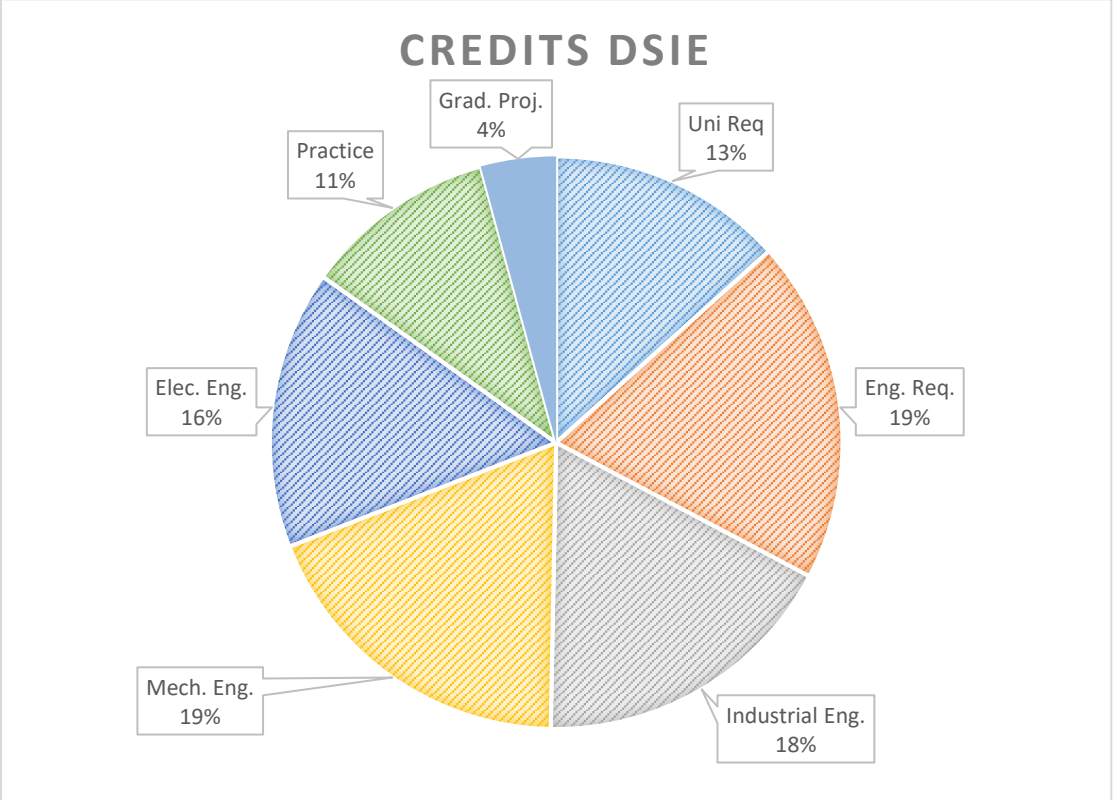

Figure 1:

Graphical representation of the course type distribution in DSIE

Table 2: Courses numbers and corresponding credit hours during the theory phases at the University

Year 1		
Course	**Course Code**	**Theory**
Mathematics for Engineers I	1810101	3
Physics	1810102	3
Fundamentals of Electrical Engineering I	1810103	3
Fundamentals of Electrical Engineering I Lab	1810104	1
Basics of Business Administration	1800001	2
Low-Intermediate English	1800002	2
Communications Skills	1800012	2
Engineering Workshop and Safety	1810105	2
Mathematics for Engineers II	1810106	3
Fundamentals of Electrical Engineering II	1810107	3
Fundamentals of Electrical Engineering II Lab	1810108	1
Physics Lab	1810114	1
Introduction to Industrial Engineering	1840101	2
Chemistry	1840102	2
Informatics I	1810111	2
Informatics I Lab	1810112	1
Intermediate English	1800003	2
Principles of Marketting	1830251	2
		Sum: 37
Year 2		
Course	**Course Code**	**Theory**
Mathematics for Engineers III	1810201	3
Chemistry Lab	1840203	1
Informatics II	1810204	2
Informatics II Lab	1810205	1
Thermodynamics & Heat Transfer	1840204	3
Maintenance Management	1840217	2
Statics	1840205	2
Upper-Intermediate English	1800004	2
Electronics	1840206	2
Manufacturing Technology I	1840208	3
Instrumentation and Measurement	1810208	3
Instrumentation and Measurement Lab	1810209	1
Dynamics	1840232	2
Electrical Workshop I	1810301	2
Advanced English	1800010	2
Engineering Materials (Metallurgy)	1840209	2
Engineering Drawing & Machine Elements Design	1840219	3

		Sum: 36
Year 3		
Course	**Course Code**	**Theory**
Electrical Machines	1810323	3
Electronics Lab	1840310	1
Mechanics of Materials	1840311	2
Sustainability (Environment, Recycling, Alt. Energy)	1840312	2
Control Systems I	1810330	3
Manufacturing Technology I Lab	1840313	1
Fluid Mechanics	1840314	2
Entrepreneurship	1800011	2
Factory Layout & Organization Planning	1840315	2
Elective Course		2
Project Management	1830305	2
Production & Operations Management	1830301	2
Human Resource Management	1830302	2
Electrical Machines Lab	1810324	1
Quality Control	1840307	2
Cost Accounting	1840353	2
Advanced Machine Design	1840333	3
		Sum: 34
Year 4		
Course	**Course Code**	**Theory**
International Supply Chain Management	1831402	2
Numerical Engineering Analysis	1810309	2
Manufacturing Technology II	1840421	2
Management Information Systems	1840434	3
University Requirement I	180007X	2
University Requirement II	180007X	2
Introduction to Graduation Project	1840402	3
Engineering Economy	1840424	2
Total Quality management	1840425	3
Manufacturing Technology II Lab	1840422	1
Pneumatics & Hydraulics	1840416	3
Special Topics in Industrial Engineering	1840426	3
Operations Research & Optimization	1840428	3
University Requirement III	180007X	2
		Sum: 33
	Total	**140**
Graduation Project	**Module Number**	**Credit Hours**
Graduation Project I	1840490	3
Graduation Project II	1840491	4

Total	**7**

Table 3: Practice module numbers and corresponding credit hours during the practice phases in a company

Module Number	Module Name	Year	Semester	Credit Hours
1840190	Practice 1	1	1	3
1840191	Practice 2		2	3
1840290	Practice 3	2	1	3
1840291	Practice 4		2	3
1840390	Practice 5	3	1	3
1840391	Practice 6		2	3
			Total	**18**

1.1 Courses' Descriptions, Objectives and their Relation to the DSIE Objectives

1.1.1 DSIE Courses

1810101 Mathematics for Engineers I 3 credits

This course contents the basics of mathematics for usage in specific courses for Electrical Engineering: System of linear equations and elementary row operations, linear transformations and matrix representation. Vectors in plane and polar functions: vectors, polar coordinates and graphs- introduction of complex numbers, operations and functions. Derivate: the derivate as a function and as a rate of change, derivate of products, quotients and negative powers, derivate of trigonometric functions, the chain rule, implicit differentiation and related rates.

1810106 Mathematics for Engineers II 3 credits

Transcendental functions and differential equations. Integrals, definite integrals, substitution in definite integrals, application of integrals, the mean value and fundamental theorems of calculus first order separable differential equations and first order linear differential equations. Infinite series: limit of sequence of numbers subsequences and bounded sequences, test for convergence, alternating series, absolute and conditional convergence, power series, Taylor and McLaurin series, application of power series.

1810201 Mathematics for Engineers III 3 credits

Multivariable calculus, limits and continuity, partial differentiation, multiple integration, Gradient theorem, Stoke's theorem, Gauss's theorem, probability principles and set theory.

Random variables and operations performed on random variables. Various distribution functions.

1810102 Physics 3 credits

This course gives an introduction to basics of physics, except those subjects that are taught in the two courses Fundamentals of Electrical Engineering I and II. Units, vectors, motion in 1, 2 and 3 dimensions, work and energy, linear and angular momentum, kinematics, kinetics, geometrical optics.

1810114 Physics Lab 1 credit

Density and measurements of π, kinematics, vectors, Newton's second law, inclined plane, spring, simple pendulum, projectile motion, conservation of energy, conservation of momentum, free falling, electric field, magnetic field, induction, specific heat capacity.

1840102 Chemistry 3 credits

This course provides an introduction to chemistry to ensure a basic understanding of the structure and properties of chemical systems using the tools of the discipline including: models, data analysis, and the use of symbolic representations. The main topics include measurement and units, matter and energy, chemical equations, thermochemistry, electronic structure of atoms, periodic trends, molecular bonding and structure, gases, intermolecular forces, solution chemistry, equilibrium, oxidation-reduction reactions, and nuclear chemistry.

1840203 Chemistry Lab 1 credits

In the chemistry laboratory, students will examine, test, and establish for themselves the chemical principles studied in class and from textbooks; will collect experimental data; and will use their reasoning to draw logical conclusions about the meaning of these date. It will help students to make scientific predictions of natural phenomena using chemical concepts, express their results, and apply chemical concepts to draw logical conclusions about the applicability of data to real-life problems.

1840219 Engineering Drawing & Machine Elements Design I 2+1 credits

The main objective of this course is to build the students' capacity of analyzing, designing, and developing technical solutions for mechanical components and assemblies. This course includes

design and analysis of machine elements such as shafts and shafts components, screws & fasteners, rolling-contact bearings, gears, and spur & helical gears. An integrated approach is employed where components' functionality and survivability at system level are part of the design scheme. Case studies are conducted to reinforce the concepts and practicalitybehindthedesign and analysis of components and their roles at assembly or system le vel. Engineering fundamentals such as materials engineering, solid mechanics, fracture mechanics, and dynamics will be implemented in the design process. In addition, students will have the chance to practice the engineering drawing in the Lab using related CAD/CAM software.

1840333 Advanced Machine Design 3 credits

The main objective of this course is to build the student's capacity of analysing complex mechanical systems. It includes integrated motion and power analysis that are necessary to design mechanical systems, machine drawings, machine controls, sensors, and interpreting technical design parameters. After this course students will be able to find mechanical solutions for problems in addition to the ability to evaluate the machine design.

1810105 Engineering Workshop and Safety 1+1 credits

This workshop gives the student basic knowledge and ability for simple mechanical tasks for metalworking shop layout, industrial safety, materials, soldering, welding, fitting, metal cutting, drilling, milling and tapping. Safety engineering and management with emphasis on control of hazardous materials, fire prevention, safety considerations in production facility design and maintenance, and operation of effective safety programs.

1840208 Manufacturing Technology 1 3 credits

The main objective of this course is to enhance the student's ability to decide on the most appropriate manufacturing processes for a specific task. It summarizes the main manufacturing processes, tools, machine tools, and equipment. Common manufacturing operations will be presented such as cutting, lathing & milling, heating, welding, forging, and casting…etc.

The main factors related to the manufacturing operations will be covered such as production plant setup, human factors, safety, power, time management, production planning & monitoring, information management, warehouse management, and handling…etc.

1840313 Manufacturing Technology 1 Lab 1 credits

Manufacturing Technology 1 Lab allows the students to practice the main production processes in the workshop. They will have the chance to operate common production machinery and practice processing cases of real materials in real life work environment.

1840421 Manufacturing Technology 2 2 credits

This course focuses on modern manufacturing technologies. The main objective is to make the students aware of the latest manufacturing technologies such as CNC, laser, water jet, ultrasonic machining, chemical and electrochemical machining, electro-discharge machining, energy beam technologies in machining, advanced welding technologies, robotics, 3D printing, and other cases and topics of modern manufacturing technologies.

1840422 Manufacturing Technology 2 Lab 1 credit

Modern manufacturing lab allows the students to practice the main modern manufacturing technologies. They will practice the production of samples using several advanced technology manufacturing processes that might be found in the market.

1810208 Instrumentation & Measurement 3 credits

Instrumentation and Measurement is an important issue in processing and manufacturing where students should be able to carry out. The main objective of this course is to make students understand how to measure the common measured factors, how the measurement devices are designed, how do they work, and how to calibrate them. The course covers a variety of measurements that might be needed in daily activities such as measurement of displacement, velocity and acceleration, force, torque, vibration and shock, measurement of pressure, flow, temperature and liquid level, measurement of pH, conductivity, viscosity and humidity.

1810209 Instrumentation & Measurement Lab 1 credits

Instrumentation and Measurement lab allows the students to deal with measurement devices and use them in measurement. In addition they will have the chance to understand their functionality and calibration process.

1840307 Quality Control 2 credits

This course offers a comprehensive coverage of modern quality control techniques to include the design of statistical process control systems, acceptance sampling, and process improvement. The main objectives of this course are:

- Understand the philosophy and basic concepts of quality improvement.
- Describe the DMAIC process (define, measure, analyze, improve, and control).
- Demonstrate the ability to use the methods of statistical process control.
- Demonstrate the ability to design, use, and interpret control charts for variables.
- Demonstrate the ability to design, use, and interpret control charts for attributes.
- Perform analysis of process capability and measurement system capability.
- Design, use, and interpret exponentially weighted moving average and moving average control charts.

1840312 Sustainability (Environment, Recycling & Alternative Energy) 2 credits

The main objective of this course is to highlight the impact of the industry on the environment and how to minimize that impact. It focuses on the following main topics:

- **Pollution**

Classification of pollution and pollutants, causes, effects and sources of pollution, primary and secondary pollutants, automobile pollution, industrial pollution, ambient air and water quality standards, meteorological aspects of air pollution, global water crisis issues, marine and nuclear pollution, misuse of international water for dumping of hazardous waste, land/soil pollution, and effect of urbanization on land degradation…etc.

- **Efficiency**

Efficiency enhancement is one of the key solutions to minimize the waste and pollution in which it focuses on using only the necessary amount of materials and power needed to perform an operation. It focuses on eliminating waste in raw materials and processing.

- **Recycling**

It covers waste management, hazardous waste, common recycling technologies and processes, and energy recovery etc.

- **Renewable and alternative energy**

It focuses on the clean sources of energy such as solar power, hydropower, geothermal power, and wind power with their efficiency and related technologies.

1840315 Factory Layout & Organization Planning 2 credits

The main objective of this course is to give the students a comprehensive understanding of the issues involved in the design of an industrial production system and the ability to create the optimal plant design that can help in optimizing time, cost, effort, capacity, or investment. It covers many related factors such as in plant location, product analysis, process design, equipment selection, materials handling, and plant layout. It allows the students to learn several techniques to handle the layout design taking in consideration the previous factors.

1840101 Introduction to Industrial Engineering 1 credit

This course is designed to give the students the basic knowledge about industrial engineering. It covers basic overview of industrial engineering concepts including systems optimization, variability in systems, production systems, development concepts, industrial management concepts, and quality improvement concepts…etc. In addition, the course will discuss the position of the industrial engineer and what he is supposed to do including tasks, technical and managerial responsibilities, tools, necessary skills, and importance of proper communication etc.This course is supposed to clarify the idea of the industrial engineering and its role so that students will not be confused of any similar topics or terminology.

1840428 Operations Research & Optimization 3 credits

Operations research & Optimization has many applications in science, engineering, economics, and industry. Being able to solve the real life problems and obtaining the right solution requires understanding and modeling the problem correctly and applying appropriate optimization tools and skills to solve the mathematical model. The goal of this course is to teach students to formulate, analyze, and solve mathematical models that represent real life problems.

In particular, it will cover linear programming, network flow problems, integer programs, nonlinear programs, dynamic programming and queuingmodels. Students will be able to interpret real life cases into models and analyse them to identify the optimal solution according to predefined parameters.

1840434 Management Information Systems 3 credits

This course qualifies students to be able to utilize the computer in business and operation’s management. It provides students with an overview of the utilization of business application software and problem-solving using that software. Topics include computer systems, management information systems, microcomputer operating systems, word processing, electronic spreadsheets, database management, business graphics, networks, and integrated packages. It covers the following main topics:

- IT management practices such as intelligentsupply chain management, IT in business process management…etc.
- Data analyses in Microsoft Excel and Access
- Enterprise resource planning (such as SAP, Primavera…etc.)

1800011 Enterneurship 2 credits

The course will cover the basic skills needed to improve the personality characteristics and enhance the interpersonal skills of the students. Broadening the student's visions and focusing on internal success factors are key elements of the course. The course will tackle issues like; entrepreneurship and entrepreneurial life, SMEs successes and failures, motivation and self-management, creativity and innovation, leadership and teamwork, networking and negotiation and developing personal goals and objectives, basic fundamental skills and functions needed to start a new business. Thinking of being unique, able to produce and sell and understanding the product life cycle are issues to be covered in this course.

1840402 Introduction to Project 3 credits

During the study project, which extends over one semester, the student will be assigned a specialized engineering application problem of limited scope under the supervision of a faculty member. The problem definition spans from gathering all pertinent information and data through studying, analyzing and recording the problem. This study project must be done at Al-Quds University and it can be a design project, an analytical paper or an experimental work in the form of hard- or software. The associated work is an individual effort that demands initiative, creativity and individual responsibility. At the end of the project, the result of the student's findings must be provided in form of a report, and an additional system demo and/or an oral examination.

1810103 Fundamentals of Electrical Engineering I 3 credits

Basic definitions, power, circuit schematic and ideal basic circuit elements, voltage and current sources, resistance, Ohm's law, Kirchhoff's laws, circuit analysis techniques: nodal, mesh, linearity, superposition. The venin's and Norton theorems, source transformation capacitance, I-V relationship for capacitance and inductors.

1810104 Fundamentals of Electrical Engineering I Lab 1 credit

Introduction to basic safety rules, instrument familiarization, and usage of multimeter: Measuring of voltage, current, Ohm´s Law, basic DC circuits, and characteristics of passive electronic components, Diode DC characteristics, half-wave rectification, full-wave diode rectification.

1810107 Fundamentals of Electrical Engineering II 3 credits

This course gives the student the knowledge for analyzing AC fundamentals and single-phase analysis: Harmonic frequency in AC circuit, AC voltages and currents, complex representation of sinusoids, phasors, complex impedances of inductors and capacitors, driving-point impedance, frequency response of circuits, Bode Plots, power in AC circuits, energy storage in capacitors and induction, parallel and serial combination of capacitors and inductors.

1810108 Fundamentals of Electrical Engineering II Lab 1 credit

Oscilloscope, AC amplitude measurements, measuring AC voltage, current and impedance, inductors, inductive reactance and impedance, phase angles, serial and parallel RL/RC circuits.

1810309 Engineering Numerical Analysis 2 credits

Floating point number system, error analysis, solutions of equations, interpolation, splines, numerical differentiation and integration, numerical methods in linear algebra, systems of linear equations, method of least squares, eigenvalues, eigenvectors, solution of ordinary and partial differential equations. This subject is to be supplemented with extensive MATLAB exercises.

1810330 Control Systems I 3 credits

Modeling of electrical, mechanical control systems, Open and closed-loop systems, Block diagrams, second order systems, Step and impulse response, Performance criteria, Steady state error, Sensitivity, s-plane system stability, Analysis and design with the root loci method, Frequency domain analysis, Bode plots, Nyquist criterion, gain and phase margins, Nichols charts. The State-space method, state equations, flow graphs, stability, compensation techniques. Simulation and Controller design using MATLAB.

1840206 Electronics 2 credits

Insulators, conductors and semiconductors, intrinsic and extrinsic semiconductors, impurities, doping, n-type and p-type semiconductors, the p-n junction diode, characteristic and applications. The Zener diode: characteristics and applications. Special purpose diodes, npn, pnp BJTs, DC biasing techniques.

1840310 Electronics Lab 1 credit

Rectification, power supply filtering, voltage doubler, Zener diode and its regulation, testing the junction of a transistor, emitter-based bias potentialsBJT’s and FETs: characteristics, DC

biasing, circuit design, amplifiers and frequency responses, differential amplifiers, operational amplifiers basic applications filters.

1810323 Electrical Machines 3 credits

Electrical Machinery Principles: Magnetic Field and Circuits, Magnetization curves Characteristics of hard and soft magnetic materials, losses. Transformers: Ideal Transformer, Single Phase transformer: Operation and Equivalent Circuit, auto-transformer. DC Machinery fundamentals: Basics, loop rotating between pole faces, Commutation, Windings, Armature reaction, Induced Voltage and torque equation. Power flow and losses, Types of DC motors, Permanent magnet DC motors. AC Machinery fundamentals: Rotating Magnetic Field, Magneto motive force and flux distribution, Induced Voltage and Torque, Windings, Power Flow and Losses, Introduction to Induction Machines. Special Purpose Motors: Introduction to Single phase Induction Motors, Switched Reluctance motors, Hysteresis motors, Stepper, brushless DC motors.

1810324 Electrical Machines Lab 1 credit

DC machines, AC machines, three-phase asynchronous machines, three-phase synchronous machines, servomotors, single- and three-phase transformers.

1810111 Informatics I 3 credits

Introduction to computing, computer organization and architecture, main & mass storage, operating systems, information representation, numbering systems, Boolean operations, gates Boolean circuits, machine language/instruction set traditional programming concepts , procedure & functions, implementation (translation, linking and loading), algorithm representation & discovery, flowcharting, pseudo coding, iterative structures, introduction to C-programming, formatted input/output in C-language, expressions in C-language, one-way, two-way & multiple-way selections in C.

1810112 Informatics I Lab 1 credit

Computer architecture, hardware & software, maintenance, Windows & Linux, file & folders, internet, MS Office; Word/ Excel/PowerPoint/Access/Visio, writing C-programs, C-language.

1810204 Informatics II 2 credits

Revision of C language, basic types, iterative structures, loops, arrays, functions recursion, local and global variables, pointer and arrays, pointer and functions, strings, dynamic data structures, files, introduction in OOP, standard algorithms: linear search, binary search, sorting, file handling.

1810205 Informatics II Lab 1 credit

Implementing C programs, C language, basic data types, iterative structures, loops, arrays, function, recursion, local and global variables, pointers and arrays, pointer and functions, dynamic data structures, files, classes and objects.

1840205 Statics 2 credits

Statics is the branch of engineering mechanics that is concerned with the analysis of forces on physical systems in static equilibrium. It will also help you interpret the forces supporting objects we encounter in our daily lives. Course objectives are to understand the basic principles that govern the static equilibrium of bodies under the action of forces and to apply the knowledge and tools of statics to solve engineering problems. The course analysis the static forces of objects and systems in their equilibrium state. This knowledge is fundamental for a wide range of engineering applications.

1840311 Mechanics of Materials 2 credits

Mechanics of Materials allows understanding of solid body mechanics. It is essential for the prediction of structural failure in any industry application. This course is the pre-requisite to Machine Design and any further study in deformable mechanics. The objectives of the course are to understand the concepts of different loads on material behavior. It includes a variety of topics such as stress and strain, design of simple connections, stress analysis and materials' behavior, basic static laws and calculations, axially loaded members, torsion, change of length, angle of twist, transmission of power by shafts, statically indeterminate structures, bending, shear and moment diagrams, shear force, transverse loading relationship, flexure formulas, concepts of deflection of beams, differential equation of deflection curve, method of superposition, and other related theories and applications.

1840232 Dynamics 2 credits

This course deals with dynamics of particles and rigid bodies, applications of free-body diagrams, Newton's second law, the impulse-momentum method and the work-energy principle to solve dynamic problems in mechanical systems. The objective of the course is to introduce the physical principles to the analysis of particle and rigid-body motion problems. The course

covers a variety of topics including rectilinear motion, curvilinear motion, Newton's equations of motion and angular momentum, conservation of energy, impulse, momentum, impact, kinematics of rigid bodies, plane motion of a particle, forces and accelerations in plane motion, and principles of energy and momentum in addition to many other related applications.

1810301 Electrical Workshop I 1+1 credits

Drawing of electrical networks and building installations, electrical wiring, main supply, protective measures, lightning and excess voltage protection, residential circuit protection, network quality, lightning systems and circuits.

1840314 Fluid Mechanics 2 credits

This course includes an introduction to principal concepts and methods of fluid mechanics. The main objectives of this course include understanding of fluid dynamics in a variety of engineering fields and how to use control volume and pressure analysis to develop basic equations and to solve problems. Topics covered in the course include pressure, hydrostatics, and buoyancy; open systems and control volume analysis; mass conservation and momentum conservation for moving fluids; viscous fluid flows, flow through pipes; dimensional analysis; boundary layers, and lift and drag on objects. Students will work to formulate the models necessary to study, analyze, and design fluid systems through the application of these concepts, and to develop the problem-solving skills essential to good engineering practice of fluid mechanics in practical applications.

1840204 Thermodynamics & Heat Transfer 3 credits

This course covers the basic concepts, properties of pure substances and ideal gases. The main objective of the course is to enable students to solve typical problems involving the application of the first and second laws of thermodynamics to pure substances. This will include understanding and using the property tables. The course includes properties of a pure substance, first law of thermodynamics (closed system and open system), and second law of thermodynamics.

1840209 Engineering Materials (Metallurgy) 2 credits

This course offer the necessary knowledge to make students capable to select a metal system and/or an alloy and select casting and/or mechanical forming methods. The main course objective is to help students understand relationship of material processing, structure, properties, key principles of physical metallurgy, and know commercially important metals and alloys.

1840416 Pneumatics and Hydraulics 3 credits

This course introduces the basic components and functions of hydraulic and pneumatic systems. Topics include standard symbols, pumps, control valves, control assemblies, actuators, maintenance procedures, and switching and control devices. Upon completion, students should be able to understand the operation of a fluid power system, including design, application, and troubleshooting.

1840424 Engineering Economy 2 credits

This course covers the main engineering economy topics such as Economic and cost concepts, Interest formula derivations, Calculations of economic equivalence, Inflation and purchasing power of money, Bases for comparison of alternatives, Decision making along alternatives, Evaluating replacement alternatives, Breakeven and minimum cost analysis, and Evaluation of public activities.

1830253 Cost Accounting 2 credits

Cost accounting is primarily used as a decision-making tool for individuals in charge of business operations. Managers use standardized methods to control cost in order to meet the desired level of profitability. Students learn about pricing, budgeting, and performance analysis to determine overall success based on predetermined objectives. Students apply cost accounting methods to identify profitable products and services, to analyse reports to make sound pricing decisions, to compare cost systems and choose the one that’s right for your company and to evaluate results against budgets with greater accuracy. The use cost accounting methods to optimize the use of people, resources and materials.

1830251 Principles of Marketing 2 credits

This course examines the dynamics of marketing and its important role in today's society. In addition to discussing marketing functions (pricing, product development and management, promotion and channels of distribution), marketing organizations, marketing research and other key dimensions of marketing, the course will address cultural, social, ethical, legal and international aspects of the field. Case Study and examples of business and non-business organizations will be discussed.

1830305 Project Management 2 credits

This course is designed to teach students about major principles of efficient project management. The aim is to learn a systematic approach to implement and conduct projects. The course offers various tools for planning, controlling and managing projects. Students will learn the definition of project management, the assessment and selection of projects, the organization

of new projects, the cost control, project planning, supervision and control, selection of team members, the coordination of a project team and more.

1830301 Production &Operations Management 2 credits

This course is an examination of the role of operations within manufacturing and service organizations. Emphasis is placed upon recognizing operational opportunities and trade-offs, and employing quantitative and qualitative tools and decision-support systems to assist strategic and operational decision making. Topics include: process design, quality management, capacity planning, supply chain management, and production planning.

1831402 International Supply Chain Management 2 credits

Interntional supply chains interact with all facets of business and society. In this interdisciplinary course, students will gain a multi-faceted perspective on the global dimensions of to-day's business operations. Students will explore the interrelationships between global supply chains, logistics operations, society, and the environment. The study of business production operations will be set in the context of social science theories and popular perspectives on the history, geography, structure and ethics of trade. Students will examine the impacts of current trade systems on both production and consumption regions and the human and environmental consequences of trade patterns.

1830302 Human ResourceManagement 2 credits

This course focuses on the analysis of professional practice issues in personnel and human resource management. Students will form in-class enterprises to explore topics including: human resource planning, recruitment, staffing, performance appraisal, compensation and reward system design, training and development, employee rights and safety, labor management relations, and legal and international dimensions of human resource management.

1840425 Total Quality Management 3 credits

Total quality management (TQM) is a philosophy, methodology and system of tools aimed to create and maintain mechanism of organization's continuous improvement. It involves all departments and employees into improvement of processes and products. It helps to reduce costs and to meet and exceed needs and expectations of customers and other stakeholders of an organization. TQM encompasses the concepts of business and social excellence that is sustainable approach to organization's competition, efficiency improvement, leadership and partnership. The objectives of this course is to introduce the main principles of business and social excellence, to generate knowledge and skills of students to use models and quality

management methodology for the implementation of total quality management in any sphere of business and public sector.

1840217 Maintenance Management 2 credits

This course will introduce the design, development, operation, and administration of maintenance in industrial systems. The main objectives of this course include renovation concepts, operational efficiency analysis, maintenance process management, and machine reliability analysis. Students will be able to assess the machine conditions and to what extent it can fulfill quality and feasibility requirements. They will be able to offer accurate indicators about the machine behavior and manage the maintenance process to keep the machine operation within the stated quality and feasibility measures.

1840426 Special Topics in Industrial Engineering 3 credits

This course is very flexible and has a varied outline that covers variouse topics depending on the research interests of the academic instructor teaching this course.

1.1.2 Dual Study Requirements

The DSIE students must complete during their study all courses listed in Table 4.

Table 4: Dual Study Requirement courses

1800001	Basics of Business Administration	2 credits
1800002	Low-Intermediate English	2 credits
1800003	Intermediate English	2 credits
1800004	Upper-Intermediate English	2 credits
1800010	Advanced English	2 credits
1800011	Entrepreneurship	2 credits
1800012	Communications Skills	2 credits

1.1.3 University Requirements

For the three requirement courses needed to be completed by the DS students, the student can select three courses from the following table:

Table 5: Cultural Course Requirements

1800070	History of Jerusalem	2 credits
1800071	Nature and Environment of Palestine	2 credits
1800072	Language and Logic	2 credits
1800073	Islamic Culture	2 credits
1800074	International Civilizations	2 credits

1.1.4 Electives

Students must successfully complete two credit hours as elective course from the following table:

Table 6: Elective courses

1800005	German I	2 credits
1810213	Probability and Engineering Statistics	2 credits

1.1.5 DSIE Practice Modules

1.1.5.1 General Objectives of Practice Periods in Dual Study Industrial Engineering

In the practical phases, students link their acquired knowledge from the theory phase with the practical activity in their company. According to a planning drawn up by the company, a "practice plan" is set up. It has to be regarded that not for each theory module will be an equivalent activity in the company, i.e. courses and work in a company has not to fit 1:1. This is obvious for example in mathematics but also in other subjects. The practice schedule should be adapted in time and content to the specificities of the company and take into account the individual level of knowledge of students. Adjustments of the plan according to the priorities and needs of the company are possible.

The students transferred projects and tasks contribute to the personal and professional development and creating value for internal and external customers.The following non-academic qualifications and learning outcomes must be learned and deepened throughout the practical periods in companies:

- Communication and cooperation skills, in addition to teamwork
- Problem-solving ability and creativity
- Reporting and documentation creation
- Learning, working and presentation techniques

The practical period should therefore be designed not only for deepening the professional experience but in addition also for developing the important broad spectrum of non-professional soft qualifications and competences. Industry and the labour market claim that there is a broad gap and lack of competences from regular graduates. Such the Dual Study model aims to improve the employment conditions for graduates by having them incorporated for almost 4 years already in the Industrial Engineering work environment.

1.1.5.2 DSIE Practice Module Description

1840190	**Practice I**	**3 credits**
1840191	**Practice II**	**3 credits**

In the first year, the fundamentals of Industrial Engineering will be taught. They enable students to understand the design of electrical circuits and to use them in applications. In addition, multidisciplinary basic knowledge is taught and skills are built up for personal development.In the practical phases of the first year, the DSIE student should get to know the organization and area of business of their company. The students have learnt basic theory to understand the simple networks of electric elements and will apply this in this period under intensive

monitoring. In addition to the understanding of the workflow processes, out of the knowledge and skills acquired in the theory modules, they will be applied and deepened through little practical tasks. The student has to write a practice report and to submit it. The following lists contain some examples of the knowledge and skills to be acquired during this practice phase:

- General Industrial Engineering knowledge
    - Simple Electrical Applications and Installations
    - Measurement techniques
    - Mechanical Basic Skills
    - Introduction to computer systems
    - Machine design
    - Working with standard computer applications
    - Basics of programming
- Additional Skills:
    - Organization structure
    - Documentation
    - English

1840290 Practice III 3 credits
1840291 Practice IV 3 credits

In the second year of theory, the manufacturing systems are introduced and the analytical skills of the students had been increased. Furthermore, the soft skills are further developed.The practical phases of the second year are typically characterized by use in projects in which the students already perceive small, independent tasks. Ideally, the knowledge of the theory phases is immersed in at least one or two of the module topics. A personal project of the practical phase shall be documented as a practical report and be provided as a presentation for discussion. The following lists contain some examples of the knowledge and skills to be acquired during this practice phase:

- Industrial Engineering knowledge
    - Production management
    - Basic understanding of materials and processes
    - Instrumentation and measurement
    - Machine design
    - Engineering Design and Drawing
- Additional skills:
    - Cost and budgets

- time management
- product quality
- production

1840390 Practice V 3 credits
1840391 Practice VI 3 credits

The third year will take care of the professionalization of students. It will deepen existing knowledge and topics and, at the same time, expanded the horizon by the treatment of specific methods and research-related technologies. They can specialize in this year towards their future professional focus, normally in line with the demand of their employer. The students become in this year already a valuable, esteemed staff member in their companies, taking over responsibility for limited tasks. With supervision, they are used to work on their own and to deliver their problem solutions in time. The following lists contain some examples of the knowledge and skills to be acquired during this practice phase:

- Industrial Engineering knowledge
  - Optimization
  - Economics & Costing
  - Control Systems
  - Product comparison and market analysis
- Additional skills:
  - Cost and budgets
  - time management
  - project management
  - Business skills

1840490 Graduation Project I 3 credits
1840491 Graduation Project II 4 credits

The last year will take care of the professionalization of students. Theory and practice have to match and the student shows being capable of solving market related problems. The graduation project demonstrates the student's ability to deal and solve practice-related problems from the respective field by using practical and scientific knowledge and methods.The graduation project is a specific, well-described task out of the company. The students have to apply their acquired complex theoretical knowledge and practical experiences to solve this task by a scientific and systematic approach. Note that the project is monitored and assessed by two counsellors, lecturer from the university and a qualified supervisor from the company. The various attributes and specifications of the DSIE program's graduates after successfully completing the graduation project are listed in the following:

- Knowledge and Understanding
    - The student demonstrates in an autonomous work that he/she can work out or to develop solutions for complex technical problems in Industrial Engineeringby applying scientific methods.
    - The student understands the scientific basis of Industrial Engineeringand has demonstrated that he/she can deepen and apply it.
    - The student knows the current state of research in his/her specific project area.
    - The student writes the project report according to the rules of scientific work.
    - The student can create a project plan for monitoring and tracking of the project.
- Cognitive/Intellectual/social skills
    - The student has analyzed the problems and evaluated alternative solutions.
    - The student can expand his knowledge and interpret current knowledge.
    - He can formulate subject-specific solutions and can communicate to customers and colleagues.
    - As a team member, he/she takes over responsibility for a task.

Graduation project and study project regulations

1. At the end of his Industrial Engineering study, the student is required to carry out a study project (Introduction to Project) (1840402) at AQU, and a Graduation Project (1840490 & 1840492) at the company where he is located.
2. The graduation project is a specific, well-described task out of the company. The students have to apply their acquired complex theoretical knowledge and practical experiences to solve this task by a scientific and systematic approach.
3. The study project extends over one semester and must be carried out at Al-Quds University. It can be a design project, an analytical paper or an experimental work reated to DSIE. The student is responsible of finding a study project advisor who chairs the student's study project review committee and becomes the student's academic advisor.
4. At the end of the project, the result of the student's findings must be provided in form of a report, and an additional system demo and/or an oral examination.
5. The student, in consultation with her/his advisor and training officer in the company he/she trains in, suggests an idea to work on for the aim of producing a graduation project. The supervisor and the company-training officer are responsible to monitor the student while he is carrying out the graduation project. After a while, the student submits a report containing his findings and the proposed solution. After that, he must work

closely with his/her supervisor and the training officer in implementing the proposed solution.

6. The student is expected to present his/her graduation project at the end of the fourth year to a joint committee composed of Dual Studies faculty and partner companies.

The university requirements must be completed as in the following:

- The DSIE students must successfully complete during their study ALL dual-study requirements courses listed in Table 7.
- The DSEE students must successfully complete during their study THREE cultural requirement courses listed in Table 7.
- Students must successfully complete a two credit-hour elective course fromTable 6.

The DSEI students must complete during their study all courses listed in the following tables.

Table 7: Dual Study Requirements

Type	Course Number	Module Name	Credit Hours	Required Credits
Dual Study Requirements	1800001	Basics of Business Administration	2	14
	1800002	Low-Intermediate English	2	
	1800003	Intermediate English	2	
	1800004	Upper-Intermediate English	2	
	1800010	Advanced English	2	
	1800011	Entrepreneurship	2	
	1800012	Communications Skills	2	
Cultural Course Requirements	1800070	History of Jerusalem	2	6
	1800071	Nature and Environment of Palestine	2	
	1800072	Language and Logic	2	
	1800073	Islamic Culture	2	
	1800074	International Civilizations	2	
Elective courses	1800005	German I	2	2
	1810213	Probability and Engineering Statistics	2	
Total			**22**	

Table 8: General Engineering Requirements

Course	Course Code	credits
Mathematics for Engineers I	1810101	3
Physics	1810102	3
Mathematics for Engineers II	1810106	3
Physics Lab	1810114	1
Chemistry	1840102	2
Informatics I	1810111	2
Informatics I Lab	1810112	1
Mathematics for Engineers III	1810201	3
Chemistry Lab	1840203	1
Numerical Engineering Analysis	1810309	2
Management Information Systems	1840434	3
Engineering Economy	1840424	2
Informatics II	1810204	2
Informatics II Lab	1810205	1
Introduction to Graduation Project	1840402	3
	Total	**32**

Table 9: Industrial Engineering – Management & Optimization Part

Course	Course Code	credits
Introduction to Industrial Engineering	1840101	2
Quality Control	1840307	2
Cost Accounting	1830253	2
Sustainability (Environment, Recycling & Alternative Energy)	1840312	2
Factory Layout & Organization Planning	1840315	2
Project Management	1830305	2
Production & Operations Management	1830301	2
Human Resource Management	1830302	2
International Supply Chain Management	1831402	2
Total Quality Management	1840425	3
Special Topics in Industrial Engineering	1840426	3
Operations Research & Optimization	1840428	3
Principles of Marketting	1830251	2
	Total	**29**

Table 10: Industrial Engineering – Mechanical Part

Course	Course Code	Credits
Statics	1840205	2
Dynamics	1840232	2
Mechanics of Materials	1840311	2
Maintenance Management	1840217	2
Thermodynamics & Heat Transfer	1840204	3
Fluid Mechanics	1840314	2
Pneumatics & Hydraulics	1840416	3
Engineering Materials (Metallurgy)	1840209	2
Engineering Drawing & Machine Elements Design	1840219	3
Advanced Machine Design	1840333	3
Manufacturing Technology I	1840208	3
Manufacturing Technology I Lab	1840313	1
Manufacturing Technology II Lab	1840422	1
Manufacturing Technology II	1840421	2
	Total	**31**

Table 11: Industrial Engineering – Electrical Part

Course	Course Code	Credits
Fundamentals of Electrical Engineering I	1810103	3
Fundamentals of Electrical Engineering I Lab	1810104	1
Engineering Workshop and Safety	1810105	2
Fundamentals of Electrical Engineering II	1810107	3
Fundamentals of Electrical Engineering II Lab	1810108	1
Electronics	1840206	2
Electronics Lab	1840310	1
Electrical Workshop I	1810301	2
Instrumentation and Measurement	1810208	3
Instrumentation and Measurement Lab	1810209	1
Electrical Machines	1810323	3
Control Systems I	1810330	3
Electrical Machines Lab	1810324	1
	Total	**26**

Table 12: Graduation Project Modules

Course Number	Module Name	Credit Hours
1840490	Graduation Project I	3
1840491	Graduation Project II	4
	Total	**7**

Table 13: Practice phases of three months that must be carried out in a dual study partner company

Course Number	Module Name	Credit Hours
1840190	Practice I	3
1840191	Practice II	3
1840290	Practice III	3
1840291	Practice IV	3
1840390	Practice V	3
1840391	Practice VI	3
	Total	**18**

1.2 Execution Plan and Course Distribution

DSIE combines academic learning with the direct application and expansion of knowledge in professional practice. A Dual Study student will spend an essential part of his study time (approximately 50%) in a training company and the rest at the University. The DSIE B.Sc. degree program lasts four years. The year is divided in two semesters of 24 weeks and 4 weeks leave:

- 2 Semester per year, each 24 weeks
- each semester (24 weeks) consists of 12 weeks theory and 12 weeks practice (4 quarters)
- 4 weeks leave (only taken in practice periods)

The student will generally change every 3 months between the two places of learning. However, the two partners can arrange within one academic year the periods also in different ways. Therefore, it may be an advantage if the last two theoretical phases follow each other very soon and only with a short break. The two practice phases of 4th year are then at the end of the study time and allow then enough time for the graduation project and a smooth transition into the professional career.

The following tables, Table 14, Table 15, Table 16 and Table 17, show the course distribution during the four year of study.

Table 14: Courses distribution in the first academic years

1st Year of Study		**Credits**			
Semester #		**Semester 1**		**Semester 2**	
Course	**Course Code**	**Theory**	**Lab**	**Theory**	**Lab**
Mathematics for Engineers I	1810101	3			
Physics	1810102	3			
Fundamentals of Electrical Engineering I	1810103	3			
Fundamentals of Electrical Engineering I Lab	1810104		1		
Basics of Business Administration	1800001	2			
Low-Intermediate English	1800002	2			
Communications Skills	1800012	2			
Engineering Workshop and Safety	1810105	1	1		
Mathematics for Engineers II	1810106			3	
Fundamentals of Electrical Engineering II	1810107			3	
Fundamentals of Electrical Engineering II Lab	1810108				1
Physics Lab	1810114				1
Introduction to Industrial Engineering	1840101			2	
Chemistry	1840102			2	
Informatics	1810111			2	
Informatics I Lab	1810112				1
Intermediate English	1800003			2	
Principles of Marketting	1830251			2	
Total (Semester)		**16**	**2**	**16**	**3**
Total (Year)		**37**			

Table 15: Courses distribution in the second academic years

2nd Year of Study		Credits			
Semester #		Semester 3		Semester 4	
Course	Course Code	Theory	Lab	Theory	Lab
Mathematics for Engineers III	1810201	3			
Chemistry Lab	1840203		1		
Thermodynamics & Heat Transfer	1840204	3			
Maintenance Management	1840217	2			
Statics	1840205	2			
Upper-Intermediate English	1800004	2			
Electronics	1840206	2			
Informatics II	1810204	2			
Informatics II lab	1810205		1		
Engineering Materials (Metallurgy)	1840209			2	
Manufacturing Technology I	1840208			3	
Instrumentation and Measurement	1810208			3	
Instrumentation and Measurement Lab	1810209				1
Dynamics	1840232			2	
Electrical Workshop I	1810301			1	1
Engineering Drawing & Machine Elements Design	1840219			2	1
Advanced English	1800010			2	
Total (Semester)		**16**	**2**	**15**	**3**
Total (Year)		**36**			

Table 16: Courses distribution in the third academic years

3rd Year of Study		**Credits**			
Semester #		**Semester 5**		**Semester 6**	
Course	**Course Code**	**Theory**	**Lab**	**Theory**	**Lab**
Electrical Machines	1810323	3			
Electronics Lab	1840310		1		
Mechanics of Materials	1840311	2			
Sustainability (Environment, Recycling & Alternative Energy)	1840312	2			
Control Systems I	1810330	3			
Manufacturing Technology I Lab	1840313		1		
Fluid Mechanics	1840314	2			
Entrepreneurship	1800011	2			
Elective Course		2			
Factory Layout & Organization Planning	1840315			2	
Project Management	1830305			2	
Production & Operations Management	1830301			2	
Human Resource Management	1830302			2	
Electrical Machines Lab	1810324				1
Advanced Machine Design	1840333			3	
Quality Control	1840307			2	
Cost Accounting	1840353			2	
Total (Semester)		**16**	**2**	**15**	**1**
Total (Year)		**34**			

Table 17: Courses distribution in the fourth academic years

4th Year of Study		**Credits**			
Semester #		**Semester 7**		**Semester 8**	
Course	**Course Code**	**Theory**	**Lab**	**Theory**	**Lab**
Operations Research & Optimization	1840428	3			
Numerical Engineering Analysis	1810309	2			
Manufacturing Technology II	1840421	2			
University Requirement I	180007X	2			
University Requirement II	180007X	2			
Introduction to Graduation Project	1840402	3			
Engineering Economy	1840424	2			
Total Quality Management	1840425			3	
Management Information Systems	1840434			3	
Manufacturing Technology II Lab	1840422				1
Pneumatics & Hydraulics	1840416			3	
Special Topics in Industrial Engineering	1840426			3	
International Supply Chain Management	1831402			2	
University Requirement III	180007X			2	
Total (Semester)		**16**	**0**	**16**	**1**
Total (Year)		**33**			