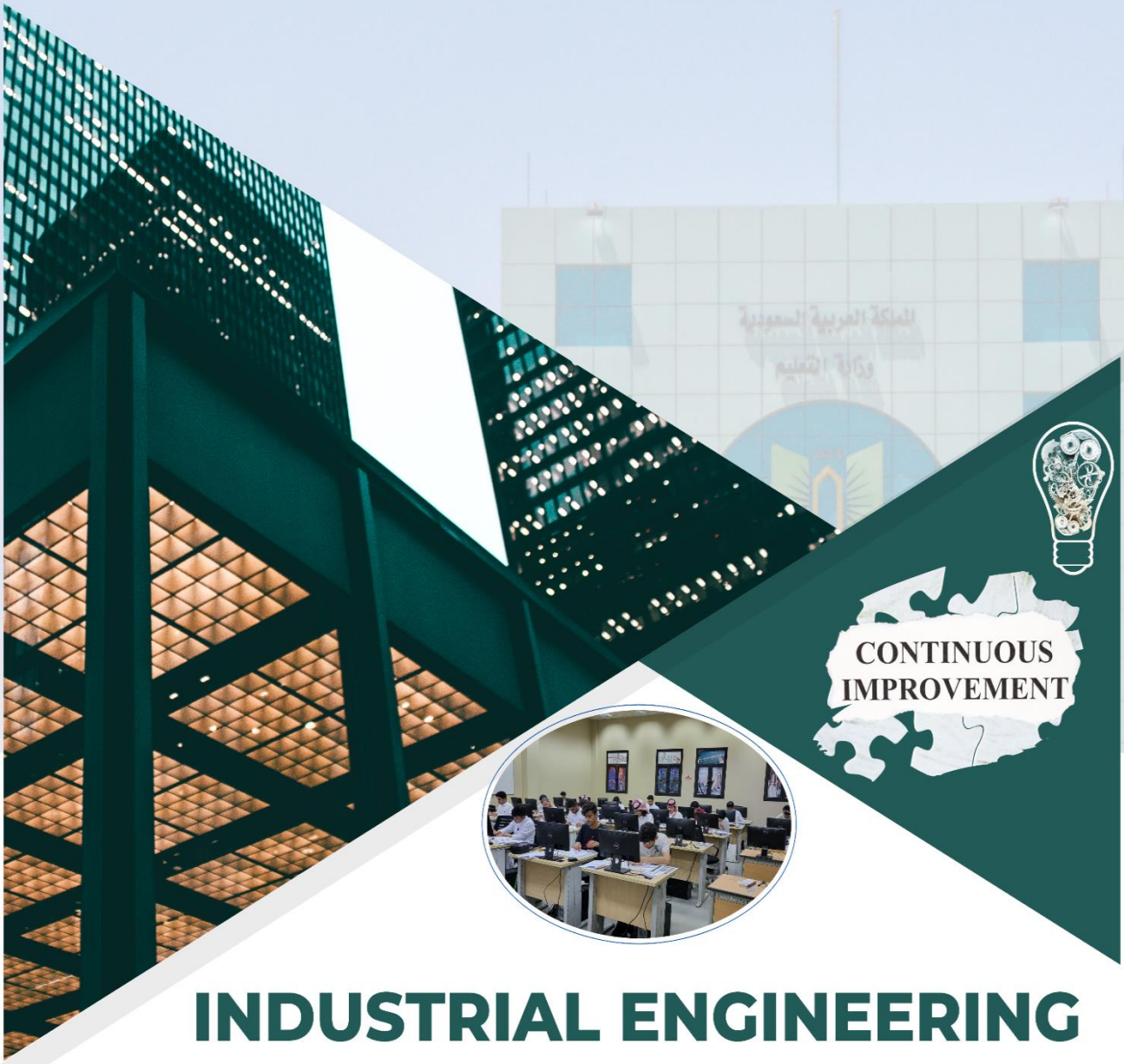
4TH EDITION, 2023

معتمد
ACCREDITED

جامعة تبوك
University of Tabuk

كليـــة الهندسة
Faculty of Engineering

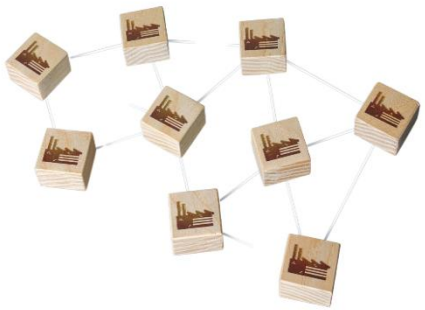


INDUSTRIAL ENGINEERING

HANDBOOK 2023

FACULTY OF ENGINEERING, UNIVERSITY OF TABUK

Tabuk City , Saudi Arabia




بسم الله الرحمن الرحيم

Table of Contents

Chair's Message

Dear Students, Faculty Members, and Local Communities,

I hope this message finds you all in good health and high spirits. As we embark on a new academic year, I am filled with immense pride and enthusiasm to address all of you as the Chairman of the Industrial Engineering Department at the Faculty of Engineering, University of Tabuk. It is both an honor and a privilege to be a part of this distinguished institution, which stands at the forefront of education and innovation in Saudi Arabia. At the University of Tabuk, we understand the immense responsibility we bear in shaping the future of our students and contributing to the development of our local communities. As we aim to align ourselves with the Vision 2030 of Saudi Arabia, we are committed to providing world-class education in the field of industrial engineering, preparing our students to become future leaders and catalysts of change. Our vision is deeply rooted in the principles of excellence, innovation, and transformation. We strive to empower our students with the knowledge, skills, and ethics required to address the emerging challenges of the industry. By fostering an environment of academic rigor and hands-on learning experiences, we aim to cultivate a generation of engineers who can drive sustainable industrial growth, promote technological advancements, and contribute to the diversification of the national economy. In line with the broader mission of the University of Tabuk, we are dedicated to creating an inclusive and vibrant campus community. As we navigate the challenges of the ever-changing world, we remain focused on continuous improvement and adaptation. We strive to enhance our curriculum, facilities, and research programs to ensure that they are at par with the highest international standards. By collaborating with industry partners and encouraging research and development endeavors, we aim to bridge the gap between academia and the real-world, fostering innovation, and creating opportunities for our students and faculty to contribute to the socio-economic development of our nation.

Finally, I would like to express my sincere gratitude to the entire University of Tabuk community for the unwavering support and dedication shown in achieving our collective goals. Together, we shall continue to inspire greatness, encourage innovation, and shape the future of industrial engineering education in Saudi Arabia. I extend my warmest wishes to all the students embarking on this new academic journey, and I encourage you to embrace every opportunity that comes your way. Let us all work together to build a brighter future for ourselves, our communities, and our beloved nation.

Best regards,

Dr. Jasim Alnahas. Chairman

Department of Industrial Engineering (IE)

The Industrial Engineering (IE) Department was established in the Fall/Winter Semester of 2010-2011, with students participating in a general Engineering curriculum in 2011-2012. The department currently offers one program, Bachelor of Science in Industrial Engineering. The study is of 5 years' duration including the preparatory year (10 semesters) in addition to a summer training of 8 weeks in companies and agencies under the supervision of the faculty members.

Vision

Towards innovation and excellence in industrial engineering education, conducting research work in collaboration with the local industry and stand by our community by providing helpful services and contribute to their activities .

Mission

Providing high-quality education in Industrial Engineering and prepare qualified engineers and providing services to local societies through scientific research and partnership with industrial sectors in the region.

Program Goals

1. Provide effective solutions that add value to engineering, business and industry processes.
2. Engage in life-long learning and career development.
3. Demonstrate professional, ethical, and leadership qualities in engineering practice.

Program Educational Objectives

The Bachelor of Science in Industrial Engineering has established three broad program educational objectives (PEOs) for graduates as they progress through their careers. Within a few years of graduation, our graduates

PEO 1: Provide effective solutions that add value to engineering, business, and industry processes.

PEO 2: Engage in life-long learning and career development.

PEO 3: Demonstrate professional, ethical, and leadership qualities in engineering practice.

University of Tabuk Admission Guidelines

https://www.ut.edu.sa/ar/Deanship/dar/Documents/1444.pdf

Program Admission Requirements

1. Pass all preparatory year courses.
2. After completing 78 credit hours (completing the Level 5-second year), the student can choose from the four engineering programs offered (Civil, Mechanical, Electrical, and Industrial).
3. Applications are submitted electronically through the student's academic portal.
4. Admissions are based on students' GPA, selections, and the program's capacity, as approved by the Faculty of Engineering Council for that academic year.
5. Dean Approval.

Faculty of Engineering Admission Process Video

https://shorturl.at/hlHL6

Student Academic Guide

https://www.ut.edu.sa/ar/Deanship/dar/Documents/Student%20Guide%20443.pdf

Study and Tests Regulations

https://www.ut.edu.sa/ar/Deanship/dar/Documents/S.R.444.pdf

Organizational Structure

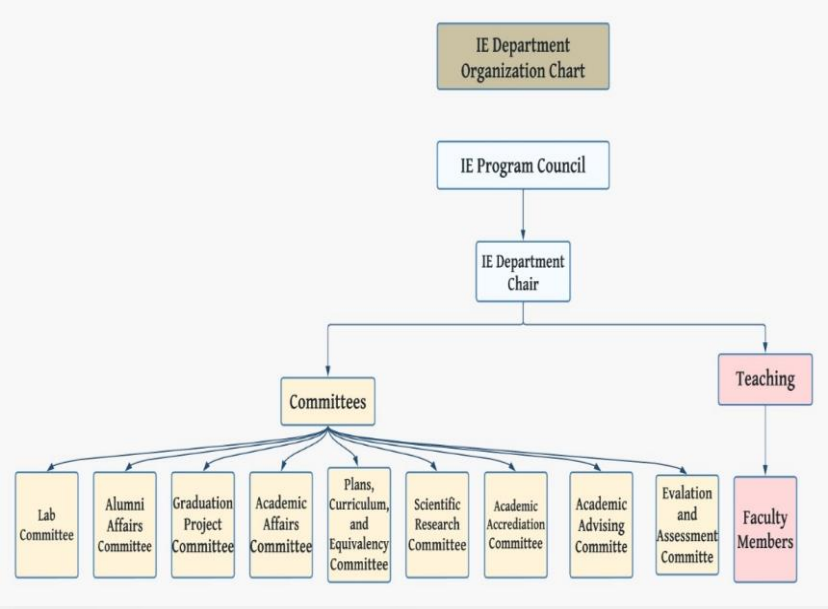


Fig1: Organizational Structure

Degree Requirements

The Department of Industrial Engineering awards the B.Sc. degree in Industrial Engineering. The curriculum within the Department of Industrial Engineering is structured in such a way as to provide its graduates with the technical and professional expertise necessary for serving and developing the society and for conducting scientific research within the Islamic and Engineering Ethical framework. To obtain the B.Sc. degree in Industrial engineering, the student must successfully complete 165 credit hours which are split over 10 levels of studying. In addition, the students are required to complete one practical summer training sessions (8 - weeks) in the industrial field. Towards the total of 165 credit hours, 20 credit hours represent the university requirements and 60 credit hours represent the faculty requirements whereas 85 credit hours represent the department requirements. The tables below shows overall summary of requirements to obtain degree.

IE Study Plan

Table 1: IE Study Plan

	Course Title	Course Code	Credit
1	University Requirements	Compulsory	20
2	Faculty of Engineering Requirements	Compulsory	60
3	Industrial Engineering Department Requirements	Compulsory	73
		Elective	12
Total			**165**

University Requirements

The university requirements in the UT consist of 20 credits covering a wide spectrum of subject areas including communication skills, computer skills, learning and thinking skills, Arabic language, Islamic studies, English language, basic sciences, biology, and mathematics. The table below shows the set of courses in the university requirements.

Table 2: University Requirements

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Communication Skills	COMM001	2	0	0	2	
2	Computer Skills	CSC001	4	0	0	3	
3	Learning, Thinking, &Research Skills	LTS001	4	0	0	3	

4	Language Skills	ARAB101	2	0	0	2	ARAB101
5	Writing Skills	ARA201	2	0	0	2	
6	Islamic Culture I	ISLS101	2	0	0	2	ISLS101
7	Islamic Culture II	ISLS201	2	0	0	2	ISLS201
8	Islamic Culture III	ISLS301	2	0	0	2	ISLS301
9	Islamic Culture IV	ISLS401	2	0	0	2	
Total			**22**	**0**	**0**	**20**	

Faculty Requirements

The Faculty of Engineering requirements consist of 62 credits. The tables below show the set of courses in the faculty requirements.

Table 3: Faculty Requirements (Preparatory Year)

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	English Language I	ELS001	15	0	0	5	
2	English Language II	ELS002	15	0	0	5	ELS001
3	Mathematics I	MATH100	3	0	0	3	
4	Mathematics II	MATH101	3	0	0	3	MATH100
5	General Physics	PHYS101	3	0	0	3	
6	General Biology	BIO101	3	0	0	3	
7	General Chemistry	CHEM101	3	0	0	3	
Total			**45**	**0**	**0**	**25**	

Table 4: Faculty Requirements (Additional Courses)

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Mathematical Geometry	MATH284	3	0	1	3	MATH101
2	Statistics&Probability	MATH325	3	0	1	3	MATH284
3	Differential Equations	MATH383	3	0	1	3	MATH284
4	Linear Algebra	MATH241	3	0	1	3	MATH284
5	Physics	PHYS205	3	2	0	4	PHYS101
6	General Physics Lab	PHYS281	0	2	0	1	PHYS101
7	GeneralChemistryLab	CHEM203	0	2	0	1	CHEM101

8	Engineering Drawing and Graphics	ENG201	1	4	0	3	
9	Production Tech. and Workshops	ENG202	1	4	0	3	ENG201
10	Engineering Mechanics I	ENG203	2	0	1	2	PHYS101
11	Engineering Mechanics II	ENG204	2	0	1	2	ENG203
12	Engineering Design I	ENG205	3	3	0	3	ELS002-MATH101
13	Engineering Design II	ENG213	2	2	0	2	ENG205
14	Engineering Economy	ENG214	2	0	0	2	ENG213
Total			**73**	**19**	**6**	**35**	

Departmental Course Requirements (Compulsory)

The table below shows the set of compulsory courses in the Industrial engineering department.

Table 5: Set of compulsory courses in the Industrial engineering department.

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Introduction to Industrial Engineering	INEN 210	2	0	0	2	
2	Engineering Materials	ME201	2	2	0	3	CHEM101
3	Operations Research I	INEN221	2	2	0	3	MATH241
4	Fundamentals of Computer Systems	INEN231	2	2	0	3	CSC001
5	Project Management	INEN261	3	0	0	3	ENG214
6	Manufacturing Processes I	INEN212	2	2	0	3	ENG202 ME 201
7	Mechanics of Materials	ME213	2	2	0	3	ENG203
8	Fundamentals of Electrical Engineering	INEN214	2	2	0	3	PHYS205
9	Thermo-Fluid Engineering	INEN216	2	2	0	3	CHEM101 ENG 204
10	Production Planning and Control	INEN301	3	0	0	3	INEN221 INEN261
11	Work Study	INEN305	2	2	0	3	MATH383 INEN210

12	Operations Research II	INEN445	3	0	0	3	INEN221
13	Control Systems	INEN311	2	2	0	3	INEN214 INEN216
14	Engineering Statistics	INEN320	3	0	0	3	MATH325
15	Computer Applications in Industrial Engineering	INEN302	2	2	0	3	INEN231
16	Human Factors Engineering	INEN321	2	2	0	3	INEN305
17	Manufacturing Processes II	INEN331	2	2	0	3	INEN212 ME213
18	Safety Engineering	INEN400	3	0	0	3	INEN212
19	Statistical Quality Control	INEN302	3	0	0	3	INEN320
20	Summer Training	INEN321	0	4	0	2	Department Approval
21	Design and Analysis of Experiments	INEN331	3	0	0	3	INEN320
22	Facilities Planning and Material Handling	INEN400	3	0	0	3	INEN301
23	Industrial Systems Simulation	INEN444	3	0	0	3	INEN445
24	Senior Design Project (1)	INEN350	0	0	0	1	Department Approval
25	Industrial Automation	INEN546	2	2	0	2	INEN311
26	Senior Design Project (2)	INEN522	0	0	0	3	INEN592
Total			55	30	0	**73**	

Departmental Course Requirements (Elective Courses)

The students have to choose four courses (12 credit hrs.). The name of these courses depends on the specialty area as follows:

Table 6: Set of Elective Courses in the Industrial Engineering Department.

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Computer Integrated Manufacturing	INEN536	3	0	0	3	INEN331

2	Special Topics in Industrial Engineering	INEN594	3	0	0	3	INEN301 INEN210
3	Maintenance Engineering	INEN527	3	0	0	3	INEN261
4	Supply Chain Management	INEN523	3	0	0	3	INEN301
5	Design and Analysis of Production Systems	INEN524	3	0	0	3	INEN301
6	Production Economics and Cost Analysis	INEN525	3	0	0	3	ENG214
7	Lean and Agile Manufacturing	INEN526	3	0	0	3	INEN301
8	Total Quality Management	INEN548	3	0	0	3	INEN444
9	Special Topics in Engineering Management	INEN595	3	0	0	3	INEN261
10	Decision-Making and Analysis	INEN549	3	0	0	3	INEN221
Total			30	0	0	**30**	

Industrial Engineering Program Study Plan

Preparatory Year/First Year

The preparatory year aims at enhancing the skills of the students through intense English courses and courses that improve their communication and computer skills. It also provides foundation courses in IT, mathematics, and basic sciences. The tables below illustrate the modules studied during the preparatory year.

1. 1st Level/ Preparatory Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	English Language Skills I	ELS001	15	0	0	5	
2	Mathematics I	MATH100	3	0	2	3	
3	Learning & Thinking Skills	LTS001	3	0	0	3	
4	General Biology	BIO101	3	0	0	3	
5	Chemistry	CHEM101	3	0	0	3	
Total			**27**	**0**	**2**	**17**	

2. 2nd Level/ Preparatory Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	English Language Skills (2)	ELS002	15	0	0	5	ELS001
2	Mathematics II	MATH101	3	0	2	3	MATH100
3	Communication Skills	COMM001	2	0	0	2	
4	General Physics	PHYS101	3	0	0	3	
5	Computer Skills & Applications	CSC001	4	0	0	3	
Total			**27**	**0**	**2**	**16**	

Degree Curriculum

1. 3rd Level / Second Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Theoretical	Practical (Lab)	Tutorial		
1	Engineering Drawing and Graphics	ENG 201	1	4	0	3	-
2	Engineering Mechanics (1)	ENG 203	2	0	1	2	PHYS 101
3	Introduction to Engineering Design (1)	ENG 205	2	2	0	3	MATH 101 ELS 002
4	Islamic Culture I	ISLS 101	2	0	0	2	-
5	Mathematical Geometry (3)	MATH 284	3	0	1	3	MATH 101
6	Physics	PHYS 205	3	2	0	4	PHYS 101
7	General Physics Lab	PHYS 281	0	2	0	1	PHYS 101
Total			13	8	2	**17**	

2. 4th Level / Second Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	General Chemistry Lab	CHEM 203	0	2	0	1	CHEM 101

2	Introduction to Engineering Design (2)	ENG 213	2	2	0	2	ENG 205
3	Linear Algebra	MATH 241	3	0	1	3	MATH 284
4	Production Technology and Workshops	ENG 202	1	4	0	3	ENG 201
5	Introduction to Industrial Engineering	INEN210	2	0	0	2	
6	Islamic Culture (2)	ISLS 201	2	0	0	2	ISLS 101
7	Differential Equations	MATH 383	3	0	1	3	MATH 284
Total			13	4	2	16	

3. 5th Level / Third Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Engineering Materials	ME201	2	2	0	3	CHEM101
2	Engineering Economy	ENG 214	2	0	0	2	ENG 213
3	Operations Research I	INEN221	2	2	0	3	MATH241
4	Fundamentals of Computer Systems	INEN231	2	2	0	3	CSC001
5	Engineering Mechanics (2)	ENG 204	2	0	1	2	ENG 203
6	Statistics & Probabilities	MATH 325	3	0	1	3	MATH 284
Total			13	6	1	16	

4. 6th Level / 3rd Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Manufacturing Processes I	INEN212	2	2	0	3	ENG202 ME201
2	Mechanics of Materials	ME 213	2	2	0	3	ENG 205
3	Fundamentals of Electrical Engineering	INEN214	2	2	0	3	PHYS205
4	Thermo-Fluid Engineering	INEN216	2	2	0	3	CHEM101 ENG204
5	Project Management	INEN261	2	0	0	2	ENG214
6	Islamic Culture (3)	ISLS 301	2	0	0	2	ISLS 201
Total			**12**	**8**	**0**	**16**	

5. 7th Level / 4th Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Production Planning and Control	INEN301	3	0	0	3	INEN221 INEN261
2	Work Study	INEN305	2	2	0	3	MATH383 INEN210
3	Control Systems	INEN311	2	2	0	3	INEN214 INEN216
4	Engineering Statistics	INEN320	3	0	0	3	MATH325
5	Operations Research II	INEN445	3	0	0	3	INEN221
6	Language Skills	ARB101	2	0	0	2	ISLS101
Total			**15**	**4**		**17**	

6. 8th Level / 4th Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Islamic Culture (IV)	ISLS401	2	0	0	2	ISLS301
2	Human Factors Engineering	INEN321	2	2	0	3	INEN305
3	Manufacturing Processes II	INEN331	2	2	0	3	INEN212 + ME213
4	Computer Applications in Industrial Engineering	INEN302	2	2	0	3	INEN231
5	Statistical Quality Control	INEN444	3	0	0	3	INEN320
6	Safety Engineering	INEN400	3	0	0	3	INEN212
Total			**14**	**6**	**0**	**17**	

7. Field Training / Fourth Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Summer Training	INEN350	0	4	0	2	Department approval

Total				2	

8. 9th Level / 5th Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Design and Analysis of Experiments	INEN546	3	0	0	3	INEN320
2	Facilities Planning and Material Handling	INEN522	3	0	0	3	INEN301
3	Industrial Systems Simulation	INEN547	1	2	0	3	INEN445
4	Senior Design Project (1)	INEN592	0	3	0	1	Dep. Approval
5	Elective I	INENxxx	3	0	0	3	-
6	Elective II	INENxxx	3	0	0	3	
Total			16	2		16	

9. 10th Level / 5th Year

	Course Title	Course Code	Contact Hours			Credit	Prerequisites
			Lecture	Lab	Tutorial		
1	Industrial Automation	INEN535	2	2	0	3	INEN311
2	Graduation Project (2)	INEN593	2	0	0	3	INEN592
3	Arabic Language (II)	ARB201	2	0	0	2	ARB101
4	Elective III	INENxxx	3	0	0	3	
5	Elective IV	INENxxx	3	0	0	3	-
Total			13	2	0	14	

Senior Design Project

The senior design project (SDP) is an emulation of real-life engineering projects where students develop their technical and professional skills and apply their knowledge to solve a complicated engineering problem. The project is designed to enable the students

to practice their research and problem-solving skills and enhance their communication, teamwork, time management and project planning skills. Furthermore, it emphasizes students' understanding of safety polices, ethical issues, conflict of interest as well as social and environmental impacts of engineering solutions.

Students undertaking senior design project work under the direct supervision of a faculty advisor. The students are expected to work on a team on an engineering problem, conduct sufficient literature survey, recognize the objectives of their work and identify any relevant constraints, perform experiments, build prototypes and/or produce simulations as appropriate to their problem, analyze the results and present their work in the form of a report and a presentation.

Steps to Assign Senior Project

Students registered for the course apply for available projects individually or as a team. Students interested in a specific problem may approach a faculty member whose specialty is compatible with the proposed project before the beginning of the term for approval.

The process for project proposals and registration are as follows:

1. Supervisors submit the senior project proposal (SDP Proposal Form).

2. Proposals are presented in a department meeting for approval.

3. Approved proposals are announced to the students for the selection process.

4. Students may apply for one or more of the approved projects (SDP Application Form).

5. If the number of students apply for a project exceeds five, the five students with highest GPAs will be selected.

6. Students are registered with the designated faculty member

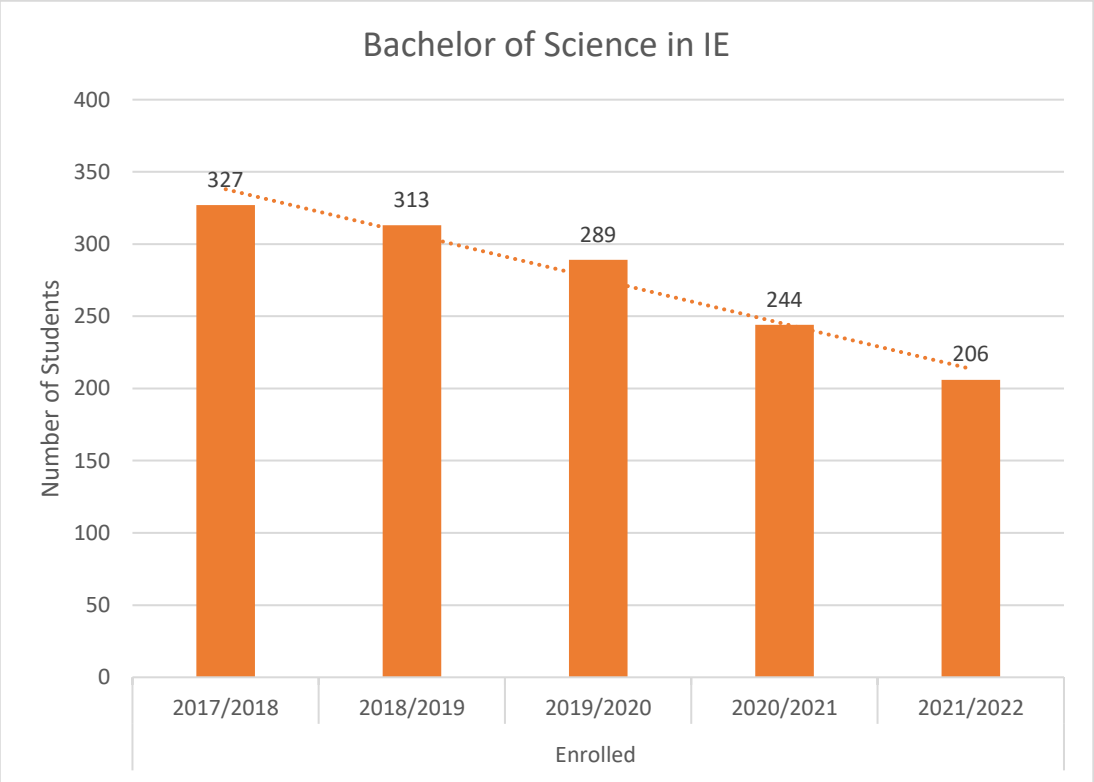
Senior Design Project Perquisites and Duration

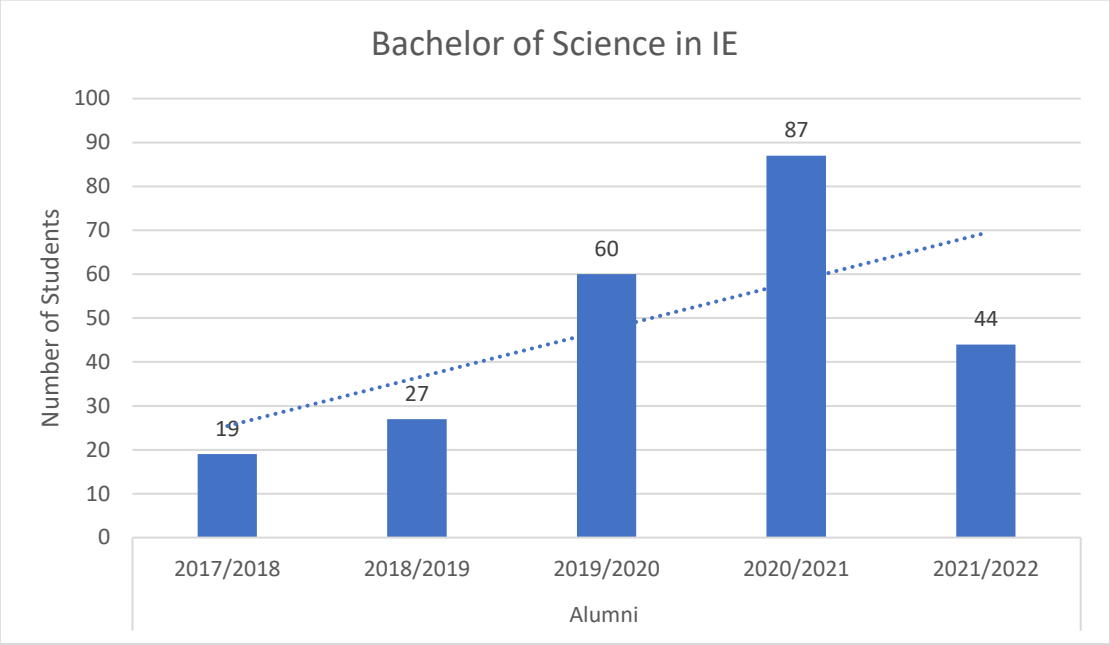
Students must complete at least 120 credit hours as well as certain courses depending on the field of study prior registering for Senior Design Project I. Then, the student continues their project in Senior Design Project II. The completion of senior design project requires two semesters (1 academic year).

Senior Design Project Guide

https://www.ut.edu.sa/ar/Faculties/engineering/civil/Documents/Senior%20Design%20Project%20Guide.pdf

Students Enrollment and Graduation Statistics





Faculty Members

Faculty Name	Rank	Area of Expertise	Email
Dr. Jaism Alnahas	Assistant Professor	Industrial and System Engineering	jalnahas @ut.edu.sa
Dr. Hassan Hijry	Assistant Professor	Systems Engineering	hhegri@ut.edu.sa
Dr. Abdullah Alghuried	Assistant Professor	Industrial Engineering	aalghuried@ut.edu.sa
Dr. Moahd Alghuson	Assistant Professor	Transportation Systems Management	malghuson@ut.edu.sa
Dr. Omar Albalawi	Assistant Professor	Industrial Engineering	oalbalawi@ut.edu.sa
Dr. Abdulaziz Alotaibi	Assistant Professor	Manufacturing Engineering	A.Aldalbahi@ut.edu.sa
Dr. Muidh Algahtani	Assistant Professor	Industrial Engineering	maalgahtani@ut.edu.sa
Dr. Ahmed Hassan	Assistant Professor	Manufacturing and Automation	a.yassin@ut.edu.sa
Eng. Muhammad AlAtawi	Lecturer	Engineering Management	msalatawi@ut.edu.sa
Eng. Abdullah Al Masoudi	Lecturer	Structural Engineering	at_almasoudi@ut.edu.sa

Laboratories

The laboratories used by the IE Department are located in the Laboratories Buildings (Buildings-11 and 12). The laboratories have adequate equipment for carrying out experimental work for courses, senior projects and community service. The laboratories are well maintained and regularly upgraded. The laboratories thus adequately support the curriculum delivery. These include the following laboratories:

A. Engineering Workshop
B. Mechanics of materials and engineering materials laboratory
C. Fluid Mechanics and Hydraulic Lab.
D. Work Study Lab
E. Human Factors Lab.
F. Manufacturing Processes and CIM Lab.
G. Electrical Circuits Lab.
H. Control Systems and Automation Lab.
I. Computer Lab

A. Engineering Workshop

The IE workshop is equipped with machines and apparatus for training the students in the fields of casting, metal forming, and machining processes. This Engineering Workshop covers the experimental work associated with the ENG 202, ENG 205, ENG 213, INEN 212, and INEN 331 courses.

B. Mechanics of materials and engineering materials laboratory

This lab actively contributes to teaching activities in the IE Department. Its enables faculty and students are to provide tests such as tension, compression, shear, buckling, hardness, bending, deep drawing, impact and metallurgical observations, and used in determining the mechanical properties and characterization of materials and testing for students. It provides educational facilities at different levels to undergraduate students. The lab used in the graduation projects related to mechanical testing of materials and the graduation projects related to material science. The mechanics of materials and engineering materials laboratory, which covers the experimental work associated with ME 201 and ME 213 courses.

C. Fluid Mechanics and Hydraulic Lab.

The Fluid Mechanics and Hydraulic laboratory provides a “hands on” environment that is crucial for developing students understanding of theoretical concepts. The laboratory contains equipment for the measurement of various fluid properties and flow characteristics. Facilities are available for investigating the fundamentals of fluid statics as well as kinematics and kinetics of fluid flow to enhance the hands-on experience of our students. The lab is equipped with test rigs for experiments pertinent to fluid mechanics, pumping machinery, and hydraulic turbines. The pumping machinery and hydraulic turbines devices aim to give students hands-on experience at conducting experiments and analyzing the data to obtain the performance characteristics of various types of pumps, fans and compressors. Many experiments are conducting in the lab such as Performance characteristics of a centrifugal radial flow pump, Effect of impeller size on the performance of a centrifugal

pump, Performance characteristics of an axial flow pump, Performance of centrifugal fans, Performance characteristics of a jet pump, Performance characteristics of a multi-stage centrifugal compressor. The Fluid Mechanics and Hydraulic lab covers the experimental work associated with the INEN 216 course. The lab has an essential and effective role enabling industrial engineering students to gain educational understanding and experimental information in the field of fluid mechanics and hydraulics, turbomachines and projects.

D. Work Study Laboratory

The Work Study laboratory is equipped with a wide variety of instructional facilities in work study. The laboratory contains modern instruments which are used to train students in the practical aspect of the work study. This laboratory class aims to provide students with a general knowledge of work study and methods engineering. Also, the laboratory session is an introductory laboratory in which students obtain general knowledge of human factor engineering as well as the nature of experiments and laboratory exercises that are covered throughout the semester. Safety instructions that must be followed during each laboratory session will be explained and discussed with students in the first day of lab. The work study laboratory covers the experimental work associated with the INEN 305, course.

E. Human Factors Laboratory

Human Factors Engineering (Ergonomics) is the study, design and integration of human capabilities and limitations into the workplace. The Human Factors Engineering Lab provides undergraduate students with the tools and measurement to collect data, analyze and provide recommendations for improved human effectiveness and productivity in the workplace. The lab covers the experimental work associated with the INEN 321 course.

F. Manufacturing Processes and CIM Laboratory

This laboratory is aiming to providing an introduction of Know-how of common processes used in industries for manufacturing parts by removal of material in a controlled manner. Auxiliary methods for machining to desired accuracy and quality will also be covered. The emphasis throughout the laboratory course will be on understanding the basic features of the processes rather than details of constructions of machine, or common practices in manufacturing or acquiring skill in the operation of machines. The Manufacturing Processes and CIM Lab covers the experimental work associated with the INEN 212, INEN 331and INEN 536 courses.

G. Electrical Circuits Lab

This lab is designed to give the student an overview of the electrical and electronic engineering lab instruments, such as Digital Multi-Meters (DMM), Power supply Oscilloscopes and the Training Electronic Boards (prototype boards) and to practice the use of these lab instruments. In the Electrical Circuit Lab. students can create their own electrical circuits and do measurements on it. The laboratory emphasizes the practical, hands-on component of Electrical circuit's course. It complements the theoretical material presented in lectures. The lab demonstrates DC circuits, KVL, Network theorems, Transient analysis in RL, RC, and RLC circuits, and Power measurements. Students can analyze the collected data by creating graphs of the data and use the graphs in the conclusion. The lab covers the experimental work associated with the INEN 214 course.

H. Control Systems and Automation Laboratory

This lab consists of appropriate training kits and equipment to investigate the implementation of control systems principles on various applications and to explore the effect of tuning the control gains on the system responses. This lab provides students an overall background in the applications of engineering control for industrial uses. This laboratory covers the experimental work associated with the INEN 311and INEN 535 courses.

I. Computer Laboratory

The students of the IE department have access to computer lab provided by the FAO. The complete description of the FAO computer center is shown in Table 7-2. The systems are supplied with all necessary software for the students to carry out their tasks like: MS-Office (complete), AUTOCAD, MATLAB and other software. Total Number of PCs is 30 with total capacity of the laboratory maximum of 30 students. It is used for teaching different courses like Engineering Drawing, Supply chain Management, Computer Application in IE, Engineering Simulation, etc.,

Useful Links:

1. UT Deanship of Students Affairs

https://www.ut.edu.sa/en/Deanship/student-affairs/Pages/default.aspx

2. Institute of Industrial and Systems Engineers

Institute of Industrial and Systems Engineers (iise.org)

3. Saudi Council of Engineers

https://www.saudieng.sa/English/Pages/default.aspx

4. American Society for Quality

https://asq.org/

5. Project Management Institute

https://www.pmi.org/

6. Occupational Safety and Health Administration

https://www.osha.gov/

Appendix A

Course Description

General Courses

PHYS0205 Physics

Geometrical Optics: Nature and propagation of light; Refraction of light, Prisms, Reflection of light, Lenses, Lens aberration, image formation-paraxial approximation; optical instruments; superposition of waves; standing waves beats; Wave motion and sound; two-beam and multiple-beam interference; polarization; Fraunhofer and Fresnel diffraction; holography; lasers; Selected Topics in Modern Physics; nuclear physics; Experiments.

Prerequisite: PHYS0101

PHYS0281 General Physics Lab

Determination of thermal conductivity of a bad conductor; Determination of the coefficient of surface tension of a liquid; Determination of Young›s modulus; Determination of the coefficient of viscosity of a viscous liquid; Determination of shear modulus; Comparison and determination of an EMF and R using potentiometer and meter – bridge; Determination of the resistivity of a material (metal wire).

Prerequisite: PHYS0101

CHEM0101 General Chemistry

Physical chemistry: Matter, atomic structure and the periodic table, chemical bonding, stoichiometry of pure substances, reaction in aqueous solutions, states of matter, gases, liquid state; Chemical equilibria; Chemical kinetics; Nuclear chemistry; Thermo- chemistry; Electrochemistry: corrosion of metals; Water treatment; Chemistry of cements; Chemistry of polymers; Fuels combustion; Pollution and its control; Experiments.

Prerequisite: None

MATH0284 Mathematical Geometry

Definite and indefinite integrals of functions of single variable; Applications of the definite integral; Fundamental theorem of calculus; Techniques of integration; Mean value theorems and Hospital›s rule; Integration and its applications in parametric and polar coordinates; Hyperbolic functions; Improper integrals; Sequences and series; Alternating series; Absolute and conditional convergence; Power series; Laplace transform.

Prerequisite: MATH0101

MATH0383 Differential Equations

Differential equations of the first order including basic concepts; Solving methods of differential equations; Differential equations of higher orders and their solutions; Euler›s equations and systems of linear equations; Solution by matrices: some applications; Fourier series; Partial differential equations including Alembert›s equations and separation of variables methods for solving heat; Wave and Laplace equations.

Prerequisite: MATH0284

MATH0325 Probability and Statistics

Descriptive statistics; Axiomatic probability; Random variables and their moments; Special discrete and continuous distributions; Sampling distributions; Estimation; Hypothesis testing; Linear regression; Analysis of variance; Analysis of categorical data.

Prerequisite: MATH0284

MATH0241 Linear Algebra

Systems of linear equations: matrices, determinants, inverse of a matrix, Cramer's rule. Vector spaces and subspaces; linear transformations; Determinants; Vectors in two and three dimensions: scalar and vector products; Equations of lines and planes in space, surfaces, cylindrical and spherical coordinates. Vector valued functions; Functions in two and three variables; Chain rule; Tangent planes and normal lines to surfaces; Extreme of functions of several variables, Lagrange multipliers.

Prerequisite: MATH0284

ENG0201 Engineering Drawing and Graphics

Engineering drawing techniques and skills; Orthographic projection of engineering bodies: points, lines, surfaces and bodies; Derivation of views from isometric drawings and vice versa; Derivation of views and sections from given views; Intersection of bodies and surfaces; Assembly drawings for some mechanical components; Introduction to Computer Aided Drawing (CAD); Fundamentals of engineering graphics in 2D and 3D drawings.

Prerequisite: None

ENG0202 Production Technology and Workshops

Introduction; Function and planning of workshops; Properties of engineering materials and their applications; Workshop metrology; Basic bench work operations; Machining operations; Tools; Equipment and machinery used in basic workshop processes: turning, milling, grinding, forging, sheet metal-work; Measurements: standardization, international measuring systems; Cost analysis and estimation of maintenance; Welding processes; Casting processes; Industrial safety; Workshops.

Prerequisite: ENG0201

ENG0203 Engineering Mechanics I

Basic concepts and principles of engineering mechanics; Vector analysis of forces; Moment and reduction of forces: moment and couples, reduction of a system force, equivalent system forces, equivalent couples; Equilibrium of particles in two and three dimensions; Equilibrium of rigid bodies; Friction and its applications; Analysis of trusses; Center of gravity and moment of inertia.

Prerequisite: PHYS0101

ENG0204 Engineering Mechanics II

Kinematics of a particle: rectilinear and curvilinear motion, and relative motion of a particles, plane motion of a rigid body; Dynamics of systems of particles: Newton›s laws of motion,

equations of motion for rectilinear and curvilinear motion; Kinetics of particles: work and energy, impulse and momentum, and impact; Kinetics of a rigid body in plane motion: translation, fixed axis rotation, work and energy, impulse and momentum.

Prerequisite: ENG0203

ENG0205 Engineering Design I

Introduction to active learning: working in teams, team dynamic, team norms and communication, conducting effective meetings and quality assessment; Problem solving: problem definition, generation of solutions, selection methodology, solution implementation, assessment of implementation; Levels of learning and degrees of internalization; Ethical decision; Organization of the work and design notebook; Engineering history; Technology and environment; Engineering Professions.

Prerequisite: ECE0002-MATH0101

ENG0213 Engineering Design II

Engineering design process; Computer modeling of processes and products; Presentation, organization, and assessment of technical or Engineering work and the preparation of brief reports; quality principles; and self- regulation or the behaviors associated with taking personal responsibility for time management, learning new material, setting goals; Basic elements of technical report; Types of technical reports.

Prerequisite: ENG0205

ENG0214 Engineering Economy

Principles of engineering economy, Design and manufacturing processes, Cost terminology and estimation, Accounting, Balance sheet, Profit loss statement, Money time relationships, Simple and compound interest rates, Single amounts and uniform series, Increasing and decreasing gradient, Application of money, Time relationships, Present value, Internal and External rate of return, Payback period, Evaluation of alternatives for different useful life and study period, Depreciation methods, Replacement analysis, Determination of the economic life of challenger and defender, Engineering economy techniques for evaluation of public projects; Requires final project and presentation.

Prerequisite: ENG0213

ENG0215 Engineering Management

Introduction to engineering management, Types and characteristics of production systems, Forecasting methods and techniques, Product design, Capacity planning, Aggregate planning, Inventory planning and materials management, Short term scheduling, Quality management and quality control, Job design and work methods, Project planning and scheduling.

Prerequisite: ENG0214- MATH0325

Industrial Engineering Courses

INEN210 Introduction to Industrial Engineering

An introduction to and overview of the profession, including career planning, professionalism, ethics and teamwork Nature of the Industrial Engineer job, Selected areas of IE such as quality, optimization, productivity, process improvement. Industry site visits, industrial speakers, Case studies from IE applications.

Prerequisite: None

ME210 Engineering Materials

Introduction and classification of materials, Modern Material needs, Mechanical behaviors and testing of materials, Atomic structure, Atomic Bonding in solids; the structure of crystalline solids, properties and performance, Crystalline and non-crystalline materials, Imperfections in solids; Reaction rates and diffusion. Phase transformations in metals; Phase diagrams; Carbon-iron phase diagrams; Mechanical properties of metals, Heat treatment, Deformation and fracture, Metal alloys, Materials selection, Metals, Ceramics and Polymers. Introduction to failure analysis. Case studies. Use of computers in materials science.

Prerequisite: CHEM101

INEN221 Operations Research I

Modeling in Operations Research. Linear Programming: Simplex Method, Duality, Sensitivity Analysis. Network Models; Shortest-Route Problem, PERT/CPM, Maximum Flow Problem, Minimal Spanning Tree Problem, Transportation and Assignment Problems. Goal Programming.

Prerequisite: MATH241

INEN231 Fundamentals of Computer Systems

Fundamentals of computers; hardware, software and computer systems concepts. Introduction to operating systems and data processing. Overview of programming languages. Internet and computer security. Introduction to software packages for Industrial Engineering applications.

Prerequisite: CSC001

INEN214 Fundamentals of Electrical Engineering

Basic electrical concepts: Electrical symbols, Ohm's Law, Kirchoff's Law, DC and AC, resistance, inductance, capacitance and three-phase system. Power computation of DC and AC, circuit theorems, Diode & Transistor and its applications, Ohms, concepts of AC and DC machines.

Prerequisite: PHYS205

INEN216 Thermo-Fluid Engineering

Introduction to thermo-fluid sciences: Introduction to modes of heat transfer. One-dimensional heat conduction. Heat transfer from surfaces. Introduction to fluid mechanics. Fluid properties. Fluid statics. Use of control volumes. Internal flows.

Prerequisite: CHEM101, ENG204

INEN261 Project Management

Principles of industrial management, Principles of industrial system and industrial institutions management, Principles of scientific management and Management functions, Management of Engineering professions, personnel's management, and industrial organization, Energy and water resource management and raw materials management, Time management and work analysis, Industrial project management, Computer applications in management.

Prerequisite: ENG214

ME213 Mechanics of Materials

Types of loads, Axial loads (centric for tension and compression), Definition of stress and strain. Stress and strain relation (Hook's Law), Types of stresses, Normal stress due to axial load, Stress-Strain Diagram, Statically determinate problems, Statically indeterminate problems, Thermal stresses, Shear force, Bending moment diagrams, Normal stress due to bending, Shear stresses, Direct shear, Torsion, Combined stresses, (Eccentric Loading), Principle stresses, and Mohr's circle. Deflection of beams, Buckling, Thin and thick cylinders, Yield criteria, Lab work.

Prerequisite: ENG203

INEN212 Manufacturing Processes I

Casting technology, sand casting methods, and mold materials and properties, Casting equipment and alloy solidification, Castings defects, inspection methods, and die casting technology, Welding technology, hot and cold forming, Forging processes, Sheet forming and calculations, Rolling and drawing processes, Deep drawing and wire drawing, Hot and cold extrusion, and applications on force and power calculations.

Prerequisite: ENG202, ME201

INEN301 Production Planning and Control

Basic concepts of Production and Operations Management (POM). Design of products and services. Processes and technologies. Inventory management. Forecasting. Material Requirements Planning (MRP). Introduction to Enterprise Requirement Planning (ERP). Capacity and Aggregate planning. Scheduling.

Prerequisite: INEN221, INEN261

INEN305 Work Study

History of Methods Design & Work Measurement Methods design. Process analysis. Operation analysis. Introduction to human engineering. Standardization. Work measurement Predetermined motion-time systems. Standard data. Work sampling. Term project

Prerequisite: MATH383, INEN210

INEN445 Operations Research II

Integer programming – Branch and Bound Algorithm, Integer programming – Cutting Plane Algorithm, Travelling Salesman Problem, Dynamic Programming (DP) –Forward and backward recursion methods, Selected DP applications, Applications in industrial, service and public sector.

Prerequisite: INEN221

INEN311 Control Systems

Introduction to dynamic and modeling control systems (open loop and closed control of system). Block diagram and Transformation function, SFG. Time response of systems. System stability. Design and analysis of closed- loop control systems using locus techniques. Control by microprocessors. System characteristics. ID controllers.

Prerequisite: INEN214, INEN216

INEN320 Engineering Statistics

Review for estimation. Test of hypothesis for single and two samples. Applications of test of hypothesis in engineering. Simple and multiple linear regression, and their applications. Design and analysis of single-factor experiments: analysis of variance. Design of experiments with several factors. Case studies in engineering statistics.

Prerequisite: MATH325

INEN302 Computer Applications in Industrial Engineering

Introduction to Industrial Engineering and basic of computers, Introduction to modeling, Enterprise modeling, IDEF0 modeling, IDEF3 modeling, Object oriented modeling, Microsoft Excel, Databases

Prerequisite: IENN231

INEN444 Statistical Quality Control

Introduction to quality control and process improvement. Cost of quality and the effects of quality on productivity. Concepts of variation. Statistical process control (SPC tools). Control charts for variables, attributes and their applications in process control. Process capability studies. Acceptance sampling. Case studies in applied quality control.

Prerequisite: INEN320

INEN321 Human Factors Engineering

Study of human response into man-machine systems. Study of visual displays as a medium of input. Auditory and tactual displays. Human control of systems. Control tools and related devices. Applied anthropometry and workplace design. Physical space arrangement, Environment, Illumination, Atmospheric conditions and noise.

Prerequisite: INEN305

INEN331 Manufacturing Processes II

Introduction to metal cutting and forming principles. Metal cutting processes, metal cutting theories, and chip removal process. Cutting tools and tool geometry, The effect of cutting process variables on manufacturing processes and machines classification. Metal turning, drilling, shaping, grinding, milling and gear manufacturing, surface and cylindrical grinding, Conventional machining processes (turning, drilling, shaping, milling, surface and cylindrical grinding, and shaping), Nonconventional machining processes, design and selection of machining processes, Case studies (turning, drilling, milling, shaping, grinding).

Prerequisite: INEN212, ME213

INEN400 Safety Engineering

Accident: causes and costs. Appraising safety performance and risk assessment. Analysis of accident causes. Accident reports and records. Job safety analysis. Plant inspection. Accident investigation. Plant layout and arrangement. Plant housekeeping. Maintenance and safety. Material handling and safety. Machine guarding. Explosion and fire prevention. Personal protection. First aid. Planning for emergencies.

Prerequisite: INEN212

INEN350 Summer Training

Eight weeks of supervised hands-on work experience at a recognized firm in a capacity, which ensures that the student applies his engineering knowledge and acquires professional experience in his field of study at KAU. The student is required to communicate, clearly and concisely, training details and gained experience both orally and in writing. The student is evaluating based on his abilities to perform professionally, demonstrate technical competence, work efficiently, and to remain business focused, quality oriented, and committed to personal professional development.

Prerequisite: Department Approval

INEN546 Design and Analysis of Experiments

Introduction to design of experiments and its application in industrial engineering, Hypothesis tests, Fixed effect models, Random effect models, Hybrid models, Block designs, Error analysis, Model building and practical applications..

Prerequisite: INEN320

INEN522 Facilities Planning and Material Handling

Introduction to facility planning issues. Material handling. Facility location and layout, computer-aided techniques and packages. Storage and warehousing functions, emphasizing quantitative and simulation techniques.

Prerequisite: INEN301

INEN54 Systems Simulation

Basic principles for building simulation models, Introduction to probability distributions, Simulation systems and software, Random numbers generators and varieties, Data analysis, Simulation models in service and industrial systems, Queuing systems, Queuing systems design and analysis, Steady state equations, performance measures, and service rates, Simulation and analysis techniques, Using Statistica SLAMII, GPSS, AWESIM, Pro-Model

Prerequisite: INEN445

INEN592 Senior Design Project (1)

Choosing the topic, establishing the project, literature review, preparing for/or preliminary conducting the experiments, collecting the field data and developing the mathematical/ computer model if applicable, writing the first two chapters along with any preliminary findings.

Prerequisite: Department Approval

INEN593 Senior Design Project (2)

Continuation of Part-I of the project including: running and finalizing the experimental program or the mathematical/computer model, analyzing the results and findings and drawing the conclusion, writing the complete project report, presenting and defending the project.

Prerequisite: INEN592

INEN221 Improvement of Soil Properties

Soil and rocks cycle; Analysis of Stress and Strain: Mohr›s circle, shear stress, strain tensor; Deformation and failure of rocks: stress-strain curve, axial stress; Engineering properties of rocks: compressive strength, tensile strength, shear strength, permeability; Methods of rock classification; Rocks as a construction material; Bearing capacity of rocks.

Prerequisite: CE0432

INEN535 Industrial Automation

Basic production concepts, analysis of serial production lines, assembly line balancing, computer numerical control, industrial robots, Piece position (forward and inverse kinematics, sensors and actuators, automated material handling, CNC systems, automated storage and retrieval systems PLC.

Prerequisite: INEN311

INEN523 Supply Chain Management

The course covers the design, planning, and operational control of manufacturing supply chain systems. Models of the supply chain at the strategic, tactical and operational levels examined as well as the incorporation of these models in a variety of decision support systems. Understand the role of transportation and evaluate the different types of transportation. The role of information technology is study in the supply chain context.

Prerequisite: INEN301

INEN527 Maintenance Engineering

Maintenance systems. Maintenance operation and control. Preventive Maintenance: concepts, modeling, and analysis. Maintenance planning and scheduling. Maintenance material control. Computerized Maintenance Management Systems. Replacement studies. Case studies.

Prerequisite: INEN261

INEN548 Total Quality Management

Introduction to TQM, Leadership, Customer satisfaction, Continuous process improvement, Benchmarking, Quality function deployment, Management Tools, Statistical process control. Prerequisite: INEN444

INEN549 Decision Making and Analysis

Basic theory and methods on individual or group decision making, problem analysis, problem solving and decision making method, decision making meaning, decision problem, decision tree, sensitivity analysis, the information role on decision making, utility concept, preference, group decision making. Borda method, Delphi, NGT, AHP decision-making techniques that can be use to assist the design, improvement and operation of integrated system

Prerequisite: INEN221

INEN526 Lean and Agile Manufacturing

Introduction, Lean manufacturing through waste elimination, Value stream mapping, Concepts, Kaizen in lean manufacturing paradigm, Single minute exchange of die, Pull production through Kanban card systems, One piece flow production system, Visual management, The fundamental structure of Agile manufacturing paradigm, Implementation of Agile paradigm in moderate and smart organizations.

Prerequisite: INEN301

INEN524 Design and Analysis of Production Systems

This course deals with the analysis, planning and control of production system for the optimum design of production system. This course provides the student with an introduction to issues in planning and control of production systems and scheduling techniques used in production environments. Topics include assembly line balancing models, performance measurement, materials requirements planning (MRP), production lot-size, just-in-time (JIT) models and other push v pull control systems, and job shop/flow shop scheduling and sequencing. Other set of programs currently practiced in industry to improve production systems, such as Lean Manufacturing and Six-Sigma, are also covered.

Prerequisite: INEN301

INEN524 Special Topics in Industrial Engineering

In-depth study of relevant Industrial Engineering topics not covered in other courses of the program in order to enhance students' knowledge in the field of Industrial Engineering Prerequisite: INEN301, INEN210

INEN595 Special Topics in Engineering Management

In-depth study of relevant Engineering Management topics not covered in other courses of the program in order to enhance students' knowledge in the field of Engineering Management.

Prerequisite: INEN261

INEN525 Production Economics and Cost Analysis

Importance of cost analysis in engineering. Cost terms and concepts. Cost estimation for decision-making: cost volume-profit analysis, measuring relevant costs and revenues, cost assignment, and activity-based costing. Cost evaluation of engineering alternatives. Case studies.

Prerequisite: ENG214

INEN536 Computer Integrated Manufacturing

Introduction to production systems. Introduction to Material Handling. Storage Systems, Automatic Data Capture, Introduction to Manufacturing Systems, Single Station Manufacturing Cells, Group Technology and Cellular Manufacturing, Manual Assembly Lines, Automated Assembly Lines, Product Design and CAD/CAM in production systems, Process Planning and Concurrent Engineering.

Prerequisite: INEN331