بسم الله الرحمن الرحيم

King Khalid University

College of Engineering

Department of Industrial Engineering

Summary of the study plan

For

Bachelor of Science in Industrial Engineering

1440/1439

Summary of the study plan
For
Bachelor of Science in Industrial Engineering

The Bachelor of Science program in Industrial Engineering is well equipped with distinguished faculty from the kingdom and internationally. The faculties are pioneers in the field of industrial engineering and are globally recognized to deliver technical expertise to the students. It also provides excellent preparation for working in a wide range of professional environments and economic activities such as manufacturing, logistics, economic and financial modeling, transportation, engineering consultancy, health, services, aviation, and military sectors.

Industrial engineering is generally aimed at "managing the engineering discipline", an engineering specialization that applies mathematics to various aspects of industrial, economic and commercial processes to improve efficiency and productivity. Industrial engineering uses technology to manage all types of resources correctly to achieve optimal productivity and high quality with minimal costs. It is also used to design and analyze complex systems taking into consideration the integration of technical, economic and social factors of all types of organizations.

The methodologies used by industrial engineering to solve problems are engineering statistics and probability, simulation, continuous improvement, economic decision analysis, computer science, manufacturing systems to reduce wastes, total quality management, production planning and maintenance processes, occupational safety and health systems. Their key areas of application are safety systems, supply chains, manufacturing, quality control, economic and financial systems, energy systems, health care systems, aviation systems, decision making, military planning and many more.

Bachelor of Science in Industrial Engineering (BSc) is a five-year engineering program that prepares our students in an integrated range of knowledge and skills of intermediate and advanced industrial engineering. The program has a unique discipline that allows students to obtain BSc in three disciplines in the fields of occupational safety and health engineering, supply chain engineering, and general industrial engineering. This combination produces the inherent flexibility of industrial engineering, which offers program graduates a wide range of professional options for future career.

The program plan consists of 166 accredited academic hours; field training and fulfill the requirements of ABET (USA) and is fully consistent with the learning outcomes of the National Qualifications Framework (NQF) and the National Commission for Academic Accreditation and Assessment (NCAAA).

BSc in Industrial Engineering Study Plan

First Year: Level One

Course Code	Course Name	Credit hours			Contact hours	Pre-requisite	Co-requisite
		Theoretical	Practical /Tutorial	Total			
011-ENG-6	Intensive English Program I	--	6	6	12	--	--
107-CHEM-4	General Chemistry	3	1	4	5	--	--
119-MATH-3	Calculus I	3	--	3	3	--	--
111-ISLAM-2	Islamic Culture (1)	2	--	2	2	--	--
201-ARAB-2	Language Skills	2	--	2	2	--	--
	Total	10	7	17	24		

First Year: Second Level

Course Code	Course Name	Credit hours			Contact hours	Pre-requisite	Co-requisite
		Theoretical	Practical /Tutorial	Total			
012-ENG-6	Intensive English Program II	--	6	6	12	011-ENG-6	--
104-CMS-2	Computer Science	1	1	2	3	--	--
219-MATH-3	Calculus II	3	--	3	3	119-MATH-3	--
129-PHYS-4	Physics I	3	1	4	5	--	--
112-ISLAM-2	Islamic Culture (2)	2	--	2	2	--	--
	Total	9	8	17	25		

The Second Year: Level Three

Course Code	Course Code	Credit hours			Contact hours	Pre-requisite	Co-requisite
		Theoretical	Practical /Tutorial	Total			
231-INE-2	Probability with Applications	2	1	3	4	129-PHYS-4	--
261-INE-2	Introduction to Industrial Engineering	2	--	2	2	--	--
229-MATH-3	Calculus III	3	--	3	3	219-MATH-3	--
219-PHYS-4	Physics II	3	1	4	5	129-PHYS-4	--
113-ISLAM-2	Islamic Culture (3)	2	--	2	2	--	--
111 -GE-3	Engineering Drawing	--	3	3	6	--	--
	Total	12	5	17	22		

The Second Year: Level Four

Course Code	Course Name	Credit hours			Contact hours	Pre-requisite	Co-requisite
		Theoretical	Practical /Tutorial	Total			
200-INE-2	Data Input and Manipulation	1	1	2	3	--	--
232-INE-2	Basics Statistical Methods	2	1	3	4	231-INE-2	--
211-GE-2	Learning Skills	2	--	2	2	--	--
212-MEC-2	Statics	2	--	2	2	129-PHYS-4	--
218-ELEC-3	Electrical Engineering I	2	1	3	4	،129-PHYS-4 119-MATH-3	--
221-MEC-3	Production Technology and Workshop	1	2	3	5	GE-3-111	--
	Total	10	5	15	20		

The Third Year: Level Five

Course Code	Course Name	Credit hours			Contact hours	Pre-requisite	Co-requisite
		Theoretical	Practical /Tutorial	Total			
361-INE-2	Applied Statistics in Industrial Engineering	1	1	2	3	232 -INE-3	--
329-MATH-3	Linear Algebra	3	--	3	3	--	--
311-INE-2	Engineering Economy	2	--	2	2	--	--
313-MEC-2	Dynamics	2	--	2	2	--	--
211-MEC-3	Material Science	2	1	3	4	129—PHYS-4, 107-CHEM-4	--
221-GE-2	Creativity and Innovation	2	--	2	2	--	--
301-ENG-2	Technical Report Writing	2	--	2	2	012-ENG-6	
	Total	14	2	16	18		

The Third Year: Level Six

Course Code	Course Name	Credit hours			Contact hours	Pre-requisite	Co-requisite
		Theoretical	Practical /Tutorial	Total			
331-INE-3	Simulation Analysis & Design	2	1	3	4	232-INE-3	--
319-MATH-3	Differential Equations	3	--	3	3	219-MATH-3	--
321-INE-3	Operations Research I	2	1	3	4	232-INE-3	--
xxx	Free Elective I	3	--	3	3	--	--
114-ISLAM-2	Islamic Culture (4)	2	--	2	2	--	--
32X-INE-2	Elective I	2	--	2	2	--	--
	Total	14	2	16	18		

Free Elective I: The student chooses a course from the university's Courses

Summer Training

Course Code	Course Name	Credit hours			Contact hours	Pre-requisite	Co-requisite
		Theoretical	Practical /Tutorial	Total			
400 -INE-0	Summer Training	0	--	0	0	**Pass 95 credit hours**	--

Fourth Year : Level Seven

Course Code	Course Name	Credit hours			Contact hours	Pre-requisite	Co-requisite
		Theoretical	Practical /Tutorial	Total			
431-INE-2	Work Design and Measurement	1	1	2	3	232-INE-3	--
420-INE-2	Management Information Systems	2	--	2	2	--	--
451-INE-3	Production Planning and Control	2	1	3	4	231-INE-3	--
461-INE-3	Human Factors Engineering	2	1	3	4	--	--
411-INE-2	Professional Ethics and Practice	2	--	2	2	--	--
202-ARAB-2	Arabic Writing	2	--	2	2	--	--

451-INE-2	Reliability and Maintenance Planning	2	--	2	2	--	--
Total		13	3	16	19		

Fourth Year : Level Eight

Course Code	Course Name	Credit hours			Contact hours	Pre-requisite	Co-requisite
		Theoretical	Practical /Tutorial	Total			
432-INE-3	Quality Control	2	1	3	4	231-INE-3	--
437-INE-3	Regression and Forecasting	2	1	3	4	232-INE-3	--
411-INE-2	Engineering Management	2	--	2	2	--	--
452-INE-3	Supply Chain Planning, and Design	2	1	3	4	321 -INE-3	--
453-INE-3	Product Design & Development	2	--	2	2	--	--
419-MATH-3	Numerical Methods	3	--	3	3	MATH-3-319	--
Total		13	3	16	19		

Fifth Year :Level Nine

Course Code	Course Name	Credit hours			Contact hours	Pre-requisite	Co-requisites
		Theoretical	Practical /Tutorial	Total			
521-INE-3	Operations Research II	2	1	3	4	321 -INE-3	--
5XX-GE-3	Elective II	2	1	3	4	--	--
541-INE-3	Supply Chain Modeling	2	1	3	4	--	--
xxx	Free Elective II	2	--	2	2	--	--
554-INE-3	Senior Design I	2	--	2	2	**Pass 125 credit hours**	--
511-GE-2	Entrepreneurship and Venture Engineering	2	--	2	2	--	--
566-INE-3	Facilities Planning, Design and Engineering	2	1	3	4	321 -INE-3	--
Total		14	4	18	22		

Free Elective II: The student chooses a course from the University's Courses

Fifth Year : Level Ten

Course Code	Course Name	Credit hours			Contact hours	Pre-requisite	Co-requisite
		Theoretical	Practical /Tutorial	Total			
5XX-GE-3	Elective III	2	1	3	4	--	--
5XX-GE-3	Elective IV	2	1	3	4	--	--
531-INE-2	Design & Analysis of Experiments	1	1	2	3	232 -INE-3	--
551-INE-3	Computer Aided Design & Manufacturing	2	1	3	4	--	--
555-INE-2	Senior Design II	2	--	2	2	554 -INE-3	--
564 -INE-2	Safety & Environmental Engineering	2	--	2	2	232-INE-2	--
544-INE-3	Queuing Systems	2	1	3	4	--	--

Total	13	5	18	23		

List of Elective I

Course Code	Course Name	Credit hours			Contact hours	Pre-requisite	Co-requisite
		Theoretical	Practical/Tutorial	Total			
321 -GE-2	Knowledge Management	2	--	2	2	--	--
322 -GE-2	Design Thinking	2	--	2	2	--	--
323-GE-2	System Dynamics & Control	2	--	2	2	--	--

Elective Courses

Elective courses selected for specialization / track are selected according to the following rules:

1. **Supply Chain engineering specialization: The student chooses elective courses in supply chain engineering elective courses.**
2. **Occupational Safety and Health Engineering Specialization: The student chooses elective courses from occupational safety and health engineering elective courses.**
3. **General industrial engineering specialization: The student chooses from elective courses without any specialization.**

List of elective courses II,III,IV

المسار (التخصص)	Course Code	Course Name	Contact hours			Contact hours	Pre-requisite	Co-requisite
			Theoretical	Practical /Tutorial	Total			
Supply Chain Engineering	552 -INE-3	Advanced Logistics	2	1	3	4	--	--
	542 -INE-3	Supply Chains Economics	2	1	3	4	--	--
	539 -INE-3	Advanced Stochastic	2	1	3	4	232-INE-3	--
	534 -INE-3	Designing and improving energy systems	2	1	3	4	--	--
	520 -INE-3	Management of manufacturing systems	2	1	3	4	--	--
	542 -INE-3	Supply Chain Analysis	2	1	3	4	--	--
Occupational Safety and Health Engineering	562 -INE-3	Professional and Health Law	2	1	3	4	--	--
	565 -INE-3	Safety Systems	2	1	3	4	--	--
	526 -INE-3	Crisis and disaster management	2	1	3	4	--	--
	525 -INE-3	Fire and explosion prevention	2	1	3	4	--	--
	527 -INE-3	Occupational Health	2	1	3	4	--	--
	563 -INE-3	Advanced Ergonomics	2	1	3	4	--	--

Course Requirements:

University Requirements

Sl.No.	Course Code & No.	Course Title	Credit /Contact hrs
1	111-IC1-2	The Entrance to the Islamic Culture	2/2
2	112-IC1-2	Islamic Culture - 2	2/2
3	113-IC1-2	Islamic Culture - 3	2/2
4	114-IC1-2	Islamic Culture - 4	2/2
5	201-ARAB-2	Language Skills	2/2
6	202-ARAB-2	Arabic Writing	2/2
Total			**12/12**

College Requirements

Sl.No.	Course Code & No.	Course Title	Credit /Contact hrs
1	011-ENG-6	Intensive English Program - 1	6/12
2	012-ENG-6	Intensive English Program - 2	6/12
3	301-ENG-2	Technical Report Writing	2/2
Total			**14/26**

Math & Basic Sciences

Sl. No.	Course Code & No.	Course Title	Credit /Contact hrs
1	107-CHEM-4	General Chemistry	4/5
2	119-MATH-3	Differentiation and Integration - 1	3/3
3	219-MATH-3	Differentiation and Integration - 2	3/3
4	129-PHYS-4	Physics - 1	4/5
5	229-MATH-3	Differentiation and Integration - 3	3/3
6	219-PHYS-4	Physics - 2	4/5
7	319-MATH-3	Differential Equations	3/3
8	329-MATH-3	Linear Algebra	3/3
9	329-STAT-2	Principals of Statistics & Probability	2/2
10	419-MATH-3	Numerical Analysis	3/3
Total			**32/35**

Soft Skills

Sl. No.	Course Code & No.	Course Title	Credit /Contact hrs
1	211-GE-2	Learning Skills	2/2
2	221-GE-2	Creativity and Innovation	2/2

3		Elective Soft skills*	2/2
4	411-GE-2	Professional Ethics and Practices	2/2
Total			**8/8**

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Choose any Elective Soft skills from below mentioned

321-GE-2 Knowledge Management
322-GE-2 Design Thinking
323-GE-2 System Dynamics

Total Non- Engineering Courses

Sl. No.	Course Title	Credit /Contact hrs
1	University Requirements	12/12
2	College Requirements	14/26
3	Math & Basic Sciences	32/35
4	Soft Skills	8/8
5	Free courses	5/5
Total		**71/86**

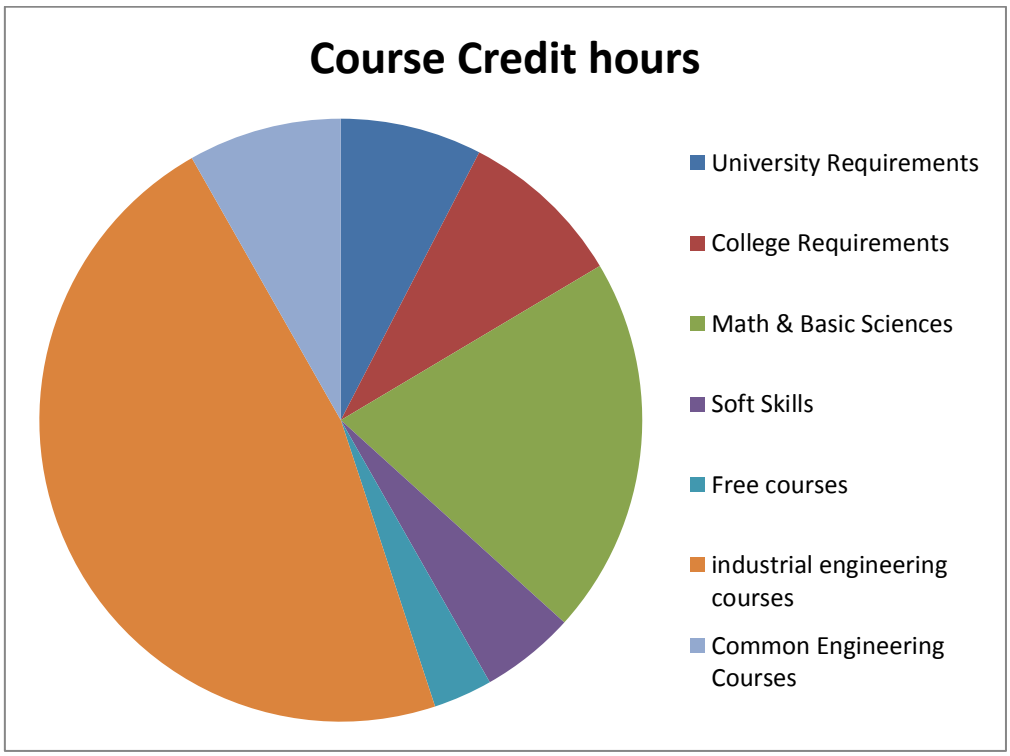
Common Engineering Courses

Sl. No.	Course Code & No.	Course Title	Credit /Contact hrs
1	111-GE-3	Engineering Drawing	3/6
2	104-CMS-2	Programming for Engineering	2/3
3	221-ME-3	Production Technology and Workshop	3/5
4	218-EE-3	Electric Engineering - 1	3/4
5	311-IE-2	Engineering Economy	2/2
		Total	**13/20**

Industrial Engineering Courses

Sl. No.	Course Code & No.	Course Title	Credit /Contact hrs
1	231-INE-2	Probability with Applications	2/2
2	261-INE-2	Introduction to Industrial Engineering	2/2
3	200-INE-2	Data Input and Manipulation	2/2
4	232-INE-2	Basics Statistical Methods	2/2
5	361-INE-2	Applied Statistics in Industrial Engineering	2/2
6	321-INE-3	Operations Research I	3/3
7	32X-INE-2	Elective I	2/2

8	400 -INE-0	Summer Training	0/0
9	431-INE-2	Work Design and Measurement	2/3
10	420-INE-2	Management Information Systems	2/2
11	451-INE-3	Production Planning and Control	3/4
12	461-INE-3	Human Factors Engineering	3/4
13	411-INE-2	Professional Ethics and Practice	2/2
14	451-INE-2	Reliability and Maintenance Planning	2/2
15	432-INE-3	Quality Control	3/4
16	437-INE-3	Regression and Forecasting	3/4
17	411-INE-2	Engineering Management	2/2
18	452-INE-3	Supply Chain Planning, and Design	3/3
19	453-INE-3	Product Design & Development	3/5
20	521-INE-3	Operations Research II	3/3
21	5XX-GE-3	Elective II	3/4
22	541-INE-3	Supply Chain Modeling	3/4
23	xxx	Free Elective I	2/2
24	xxx	Free Elective II	2/2
25	554-INE-3	Senior Design I	3/6
26	566-INE-3	Facilities Planning, Design and Engineering	3/5
27	531--INE-2	Design & Analysis of Experiments	2/2
28	551-INE-3	Computer Aided Design & Manufacturing	3/5
29	555-INE-3	Senior Design II	2/6
30	564 -INE-2	Safety & Environmental Engineering	2/2
31	544-INE-3	Queuing Systems	3/3
		Total	74/91



Total credit hours =162 hrs

Descriptions of B.Sc. Industrial Engineering Core Courses:

Course Title	Data Input & Manipulation	**Coordinator**			
Course Code	200-INE-2	**Credit Hrs.**	2	**Contact Hrs.**	3
Prerequisite	-	**Level/Year**	4/2		

Course Objectives:
This course will provide background and experience in reading, manipulating, and exporting data for engineering, business and scientific applications. Students will learn to build programs controlled by basic graphical user interfaces. Assignments will be modeled after business, engineering, and scientific problems.

Teaching Method:
Lectures, and Training exercises

Expected learning outcomes

- CLO 1: Write programs using various data types, and using basic techniques such as assignment, method calls, while loops, for loops, and conditionals.
- CLO2: Use and manipulate several language provided data structures such as: Lists, Dictionaries, and Strings.
- CLO 3: Read and write data to and from text files, both as plain text and in structured formats (such as CSV).
- CLO 4: Read a textual representation of numerical data and convert it to the appropriate (integer/floating point) data type.
- CLO 5: Load HTML pages with a program, and extract specific pieces of information from the HTML.
- CLO 6: Write a program that can generate a report in text or HTML format which includes elements under program control.
- CLO 7: Connect to existing SQL databases and insert and retrieve data from the database.
- CLO 8: Program interactive graphical user interfaces consisting of a graphically organized set of widgets, including a minimum of one from each of the following classes (Label, Button, Text Field).
- CLO 9: Implement simple business or mathematical algorithms (calculating interest payments, averaging a row of data, calculating standard deviation) into a program.
- CLO 10: Use compound data structures provided by the programming language such as lists, arrays, and dictionaries to hold sequences or sets of data, including two-dimensional (tabular) data.

Week	Course Contents
	Fundamentals of programming languages, general structure of C programming language/Python
	File I/O, string processing, Variables and operators, Basic I/O functions, Sequences

	If statement, Switch statement, Loops, Nested loops, Functions, Arrays, HTML, CSS
	Web scraping, writing HTML and basic interfacing with SQL databases (reading / writing data in pre-existing tables). Software for Commercial application, Small projects
Text book(s) • Mark Summerfield, Programming in Python 3 (2nd edition) : - Addison Wesley, ISBN: 0-321-68056-1	
Reference Book(s): • Python in a Nutshell: http://shop.oreilly.com/product/0636920012610.do • Fluent Python (Advanced): http://shop.oreilly.com/product/0636920032519.do	
Mode of Evaluation: • Mid-Term Tests (Not less than two Exams) …… (40 %) • Assignments + E-Learning…… (10 %) • Final Exam. …….. (50 %)	

Course Title	Statics	**Coordinator**			
Course Code	212-MEC-2	**Credit Hrs.**	2	**Contact Hrs.**	2
Prerequisite	129-PHYS-4	**Level/Year**	4/2		

Course Objectives:
To impart knowledge about the basic principles of engineering mechanics with emphasis on their analysis and application to practical engineering problems.

Teaching Method:
Lectures, and Training exercises

Expected learning outcomes

- CLO-1: To define the fundamentals of forces in plane or in space and equivalent force systems as well as the equations of equilibrium of particles and rigid bodies.
- CLO-2: To design and analyze trusses and beams.
- CLO-3: To solve friction problems under realistic constraints and interpret results.
- CLO-4: To apply integration methods to determine the centroid and moments of Inertia
- CLO-5: To define the professional and ethical responsibility in the design of trusses and beams

Week	Course Contents
	Introduction to solid mechanics: What is mechanics? , History of , mechanics, Fundamental Concepts, Fundamental Principles, Systems of Units
	Statics of Particles : of Two Forces, Vectors, Addition of Vectors , Resultant of Several Concurrent Forces, Rectangular Components of a Force: Unit Vectors, Addition of Forces by Summing Components Equilibrium of a Particle, Free-Body Diagrams, Rectangular Components in Space
	Rigid Bodies: Equivalent Systems of Forces and equilibrium , Principle of Transmissibility: Equivalent Forces, Vector Products of Two Vectors Moment of a Force About a Point , Rectangular Components of the Moment of a Force, Scalar Product of Two Vectors, Moment of a Couple, Addition of Couples, Resolution of a Force Into a Force at O and a Couple, System of Forces: Reduction to a Force and a Couple , Reactions at Supports and Connections for a 2D Structure , Equilibrium of a Rigid Body in Two Dimensions, Statically Indeterminate Reactions Equilibrium of a Two-Force Body, Equilibrium of a Three-Force Body Equilibrium of a Rigid Body in Three Dimensions, Reactions at Supports and Connections for a Three-Dimensional Structure
	Moment of inertia, Centroids and Centers of gravity; Moments of Inertia of an Area by Integration, Polar Moment of Inertia ,Radius of Gyration of an Area , Parallel Axis Theorem , Moments of Inertia of Composite Areas, Product of Inertia , Moment of Inertia of: a Mass, Thin Plates, a 3D Body by Integration and Common Geometric Shapes Center of Gravity of a 2D Body, Centroid of a Line, Centroids and First Moments of Areas , Determination of Centroids by Integration

Text book(s)

• R.C. Hibbler, Engineering Mechanics: Statics, 12th Edition, Pearson Prentice Hall, 2010. • R.C. Hibbler, Engineering Mechanics- Statics and Dynamics, 11th Edition, Pearson, 2010
Reference Book(s): • Meriam and Kraige, Engineering Mechanics: Statics Vol. 1, 7th Ed, Wiley, 2013. • Bedford, A, Engineering mechanics. Statics 5th ed. in SI units, 2008
Mode of Evaluation: • Mid-Term Tests (Not less than two Exams) …… (40 %) • Assignments + E-Learning…… (10 %) • Final Exam. ……..…….. (50 %)

Course Title	Probability with Applications	**Coordinator**			
Course Code	231-INE-3	**Credit Hrs.**	3	**Contact Hrs.**	4
Prerequisite	129-PHYS-4	**Level/Year**	3/2		

Course Objectives:
To impart knowledge about the basic principles of engineering Probability applications

Teaching Method:
Lectures, and Training exercises

Expected learning outcomes

- CLO-1: Understand measures of distribution's location and spread
- CLO-2: Model and analyze problems as newsvendor problem or the travel times
- CLO-3: Understand the role of probability in decision making
- CLO-4: Understand how randomness affects system behavior and performance
- CLO-5: Be able to use the central limit theorem to approximate probabilities

Week	**Course Contents**
	Introduction; Basic Definitions and Properties: Sample spaces, events, and the axioms of probability. Basic relationships involving the probability of complements and unions of events. Finite sample spaces with equally likely outcomes. Counting techniques including the multiplication principle, permutations, combinations, and the binomial theorem.. Conditional probabilities and independent events. The birthday problem. The law of total probability and Baye's Theorem
	Random numbers, random variates and random operations: Random Variables: Definition of a random variable. Discrete random variables and probability mass functions. Continuous random variables and probability density functions. Cumulative distribution functions. Important discrete distributions including Bernoulli, binomial, geometric and Poisson. Important continuous distributions including uniform, exponential, and normal. Expectation of a random variable. Uses and shortcomings of the mean in decision making. Markov's inequality. The Poisson approximation to the Binomial. Functions of a random variable. Expectations of functions of random variables and the law of the unconscious statistician. The variance of a random variable. Chebyshev's inequality. Selected applications such as insurance, the newsvendor problem, and travel times in order picking and carousels.

Text book(s)

- Dekking, F. M. C. Kraaikamp, H. P. Lopuhaa, and L. E. Meester, A Modern Introduction to Probability and Statistics: Understanding Why and How, Springer, London, 2005.
- Hajek, B. Probability with Engineering Applications, Course Notes, available at http://www.ifp.illinois.edu/~hajek/Papers/probability.html, free.

Reference Book(s):

• Wessa P., (2017), Multiple Regression (v1.0.48) in Free Statistics Software (v1.2.1), Office for Research Development and Education
Mode of Evaluation: • Mid-Term Tests (Not less than two Exams) …… (40 %) • Assignments + E-Learning…… (10 %) • Final Exam. ……..…….. (50 %)

Course Title	Basic Statistical Methods	**Coordinator**			
Course Code	232-INE-3	**Credit Hrs.**	3	**Contact Hrs.**	4
Prerequisite	231-INE-3	**Level/Year**	4/2		

Course Objectives:

- Demonstrate understanding hypothesis
- Perform linear and multiple linear regression analyses**.**

Teaching Method:
Lectures, and Training exercises

Expected learning outcomes

- CLO-1: Estimate parameters of distributions
- CLO-2: Perform statistical analysis and decision making using statistical inference.
- CLO-3: Use statistical software to conduct analyses and interpret output
- CLO-4: Draw sound statistical conclusions from experiments and observational studies

Week	**Course Contents**
	Introduction statistics: Data Description: Random Sampling; Data Displays; Sampling Distributions include t-Distribution and F-Distribution
	Descriptive statistics: Point and Interval Estimation: Estimating the Mean; Estimating the Differences between Means; Proportions, and Variances; Methods of Moments; Maximum Likelihood Estimation; Properties of Estimators.
	Tests of Hypotheses: Tests of Hypothesis: One-and Two-Sided Tests; Single Sample Tests; Two Sample Tests; Use of p-Values; Goodness-of-Fit Test; Test for Independence; Test for Homogeneity
	Regression and correlation: Linear Regression and Correlation: Least Squares and the Fitted Model; Properties of the Least Squares Estimators

Text book(s)

- Douglas C. Montgomery, George C. Runger, Applied Statistics and Probability for Engineers, 5th Edition, Wiley, 2010. eText: http://www.coursesmart.com/9780470053041
- Mason, L.R., Gunst, F.R. and Hess, L.J. (2003) Statistical design and analysis of experiments with applications to engineering and science, 2nd edition, Wiley-Interscience.

Reference Book(s):

- Hair, Black, Babin, Anderson, and Tatham. Multivariate Data Analysis, 6th Edition. Prentice Hall.2010

Mode of Evaluation:

• Mid-Term Tests (Not less than two Exams) …… (40 %) • Assignments + E-Learning…… (10 %) • Final Exam. ……..…….. (50 %)

Course Title	Applied Statistics in Industrial Engineering	**Coordinator**			
Course Code	361-INE-2	**Credit Hrs.**	2	**Contact Hrs.**	3
Prerequisite	232 -INE-3	**Level/Year**	5/3		

Course Objectives:

- Understanding the responsibilities of employers in health and safety.
- Intended learning outcomes
- Understanding the origins of Industrial-Organizational (I-O) Psychology and what I-O Psychologists do.
- understand the building blocks of a job and learn a methodology to study jobs
- learn how the science of human behavior is used to select, develop, and manage employees
- learn how organizations can create a supportive work environment
- develop an understanding of how theory and research are applied to work settings
- begin to think and write critically about I-O psychology theory, research, and application begin to apply what you've learned about I-O psychology to your own and others' work

Teaching Method:

- Mid-Term Exam
- Computer Based Presentation
- Short Exam
- Presentation of Report
- Homework Assessment
- Oral Exam

Expected learning outcomes

- CLO-1: Knowledge
- CLO-2: Cognitive Skills
- CLO-3: Interpersonal Skills & Responsibility
- CLO-4: Communication, Information Technology, Numerical
- CLO-5: Psychomotor

Week	Course Contents
	Job Analysis; Talent Acquisition
	Employee selection
	Learning and Development (Training)
	Performance Management
	Leadership

	Employee Engagement
	Work Motivation
	Workplace Psychological Health

Text book(s):
Muchinsky, P. M. and Culbertson, S. S. (2015). *Psychology applied to work* (11th Edition). Hypergraphic Press.

Reference Book(s):
https://www.youtube.com/watch?v=3j4HRaDOksI

Mode of Evaluation:

1. e-learning Class activities (On-line Quizzes, Assignments)
2. Major Exam- I
3. Major Exam- II
4. Discussions / Attendance / Participation
5. Final exam

Course Title	Linear Algebra	**Coordinator**			
Course Code	329-MATH-3	**Credit Hrs.**	3	**Contact Hrs.**	3
Prerequisite	NIL	**Level/Year**	5/3		

Course Objectives:
Calculus is taught in a traditional lecture format or in laboratories with individual and group learning focusing on numerical and graphical experimentations. Give an ability to apply knowledge of mathematics on engineering problems. Provide the evaluation of integrals by using integral techniques. Give the basic concepts of analytic geometry. Give a broad knowledge and basic understanding of sequences and series. Provide the limit, continuity and integral of vector-valued functions in application.

Teaching Method:
- Mid-Term Exam
- Computer Based Presentation
- Short Exam
- Presentation of Report
- Homework Assessment
- Oral Exam

Expected learning outcomes
- CLO-1: Knowledge
- CLO-2: Cognitive Skills
- CLO-3: Interpersonal Skills & Responsibility
- CLO-4: Communication, Information Technology, Numerical

Week	Course Contents
	Matrices: Definition and Notations, Matrix Algebra
	Systems of Linear Algebraic Equations; Terminology and Notations
	Systems of Linear Algebraic Equations; Gaussian Elimination, The Inverse of a Square Matrix
	Determinants
	Cofactor Expansions and The Adjoint Method and Cramer's Rule
	Vector Spaces, Subspaces
	Spanning Sets, Linear Dependence and Linear Independence, Bases and Dimensions
	Inner Product Spaces and Orthogonal Sets of Vector and the Gram-Schmidt Procedure
	Linear Transformations
	The Kernel and Range of a Linear Transformations
	The Algebraic Eigenvalue / Eigenvectors

Text book(s):
- W. Kernighan, Dennis M. Ritchie , C Programming Language, Prentice Hall
- Lecture notes and online resources

Reference Book(s):

Introducing Python, by Bill Lubanovic, O'Reilly Media, November 2014.
Mode of Evaluation: 1. e-learning Class activities (On-line Quizzes, Assignments) 2. Major Exam- I 3. Major Exam- II 4. Discussions / Attendance / Participation 5. Final exam

Course Title	Engineering Economy	**Coordinator**			
Course Code	311-INE-2	**Credit Hrs.**	2	**Contact Hrs.**	2
Prerequisite	NIL	**Level/Year**	5/3		

Course Objectives:

- Demonstrate Evaluation of alternatives.
- Recognize and conduct retention analysis
- Perform Break even analysis.

Teaching Method:

- Midterm 1
- Midterm 2
- Homework and group discussions
- Final exam

Expected learning outcomes
CLO-1: Knowledge
CLO-2: Cognitive Skills
CLO-3: Interpersonal Skills & Responsibility
CLO-4: Communication, Information Technology, Numerical
CLO-5: Psychomotor

Week	Course Contents
	Foundations of Engineering Economy
	How Time and Interest Affect Money
	Nominal and Effective Interest Rate.
	Present Worth Analysis
	Annual Worth Analysis
	ROR Analysis
	Benefit/Cost Analysis
	Breakeven and Payback Analysis
	Replacement Decisions
	Inflation Impacts
	Cost Estimation
	Depreciation

Text book(s):
Blank, Leland T. and Tarquin, Anthony J., Basics of Engineering Economy, 1ST Ed., McGraw-Hill, 2008, ISBN 9780071287623.

Reference Book(s):
William G. Sullivan. Elin M. Wicks and James Luxhoj "Engineering Economy" 13th ed., Prentice Hall, 2005.

Mode of Evaluation:

1. e-learning Class activities (On-line Quizzes, Assignments)
2. Major Exam- I
3. Major Exam- II
4. Discussions / Attendance / Participation
5. Final exam

Course Title	Dynamics	**Coordinator**			
Course Code	313-MEC-2	**Credit Hrs.**	2	**Contact Hrs.**	2
Prerequisite	NIL	**Level/Year**	5/3		

Course Objectives:

- Identify stresses, strains and deformation due to internal actions
- Determine Forces and Moments Transmitted by Slender Members
- Deflection using Strain Energy Method

Teaching Method:

- Mid-Term Exam
- Short Exam
- Presentation of Report
- Homework Assessment
- Oral Exam

Expected learning outcomes

CLO- 1:Knowledge
CLO-2: Cognitive Skills
CLO-3: Interpersonal Skills & Responsibility
CLO-4: Communication, Information Technology, Numerical
CLO-5: Psychomotor

Week	Course Contents
	Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion - Newton's laws of motion – Work Energy Equation– Impulse and Momentum – Impact of elastic bodies.
	Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction – wedge friction- Rolling resistance -Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion of simple rigid bodies such as cylinder, disc/wheel and sphere

Text book(s):

- Meriam J.L. and Kraige L.G., " Engineering Mechanics- Statics - Volume 1, Dynamics- Volume 2", Third Edition, John Wiley & Sons,(1993)
- Vela Murali, "Engineering Mechanics", Oxford University Press (2010)

Reference Book(s):

- Hibbeller, R.C and Ashok Gupta, "Engineering Mechanics: Statics and Dynamics", 11th Edition, Pearson Education (2010)
- Irving H. Shames and Krishna Mohana Rao. G., "Engineering Mechanics – Statics and Dynamics", 4th Edition, Pearson Education (2006)

Mode of Evaluation:

1. e-learning Class activities (On-line Quizzes, Assignments)
2. Major Exam- I
3. Major Exam- II
4. Discussions / Attendance / Participation
5. Final exam

Course Title	Simulation Analysis & Design	**Coordinator**			
Course Code	331-INE-3	**Credit Hrs.**	3	**Contact Hrs.**	4
Prerequisite	232-INE-3	**Level/Year**	6/3		

Course Objectives:

- Identify target area is the design of industrial logistics systems.
- Determine Important areas within industrial logistics are transportation

Teaching Method:

- Mid-Term Exam
- Computer Based Presentation
- Short Exam
- Presentation of Report
- Homework Assessment
- Oral Exam

Expected learning outcomes

- CLO-1: Knowledge
- CLO-2: Cognitive Skills
- CLO-3: Interpersonal Skills & Responsibility
- CLO-4: Communication, Information Technology, Numerical

Week	Course Contents
	General principles and simulation languages
	Statistical models in simulation
	Queueing models Random number generation
	Random variate generation Input modeling
	Verification and validation Output analysis for a single model
	Comparison and evaluation of alternative
	system designs Introduction to Simio
	Serial Manufacturing Systems Animation in Simio
	Entity Routing Advanced Modeling Techniques: Simio Processes

Text book(s):

- Banks, J., Carson, J. S., Nelson, B. L., and Nikol, D. M. Discrete-Event System Simulation, 4th edition, Prentice-Hall, 2010.
- Pegden, C. D., and Sturrock, D. T. Rapid Modeling Solutions: Introduction to Simulation and Simio, Simio LLC (included with software).

Reference Book(s):

Joines, J. A. and S. D. Roberts, Simulation Modeling with SIMIO: A Workbook. Available online at www.simio.com/academics/workbook/index.html (optional).

Mode of Evaluation:

6. e-learning Class activities (On-line Quizzes, Assignments)
7. Major Exam- I
8. Major Exam- II
9. Discussions / Attendance / Participation
10. Final exam

Course Title	Work Design and Measurement	Coordinator			
Course Code	431INE-3	Credit Hrs.	3	Contact Hrs.	3
Prerequisite	232INE-3	Level/Year	7/4		

Course Objectives:

- Study work design areas
- Apply and measure productivity improvement methods

Teaching Method:

- Lectures, Training exercises (Tutorial + Labs, Reports for different subjects in this field

Expected learning outcomes

- CLO-1Evaluate the Students should be able to measure productivity of a work system through work system design
- CLO-2 Apply various above mentioned techniques

Week	Course Contents
	Total time for a job or operation, total work content and ineffective time, – Production and Productivity - Productivity and standard of living, Factors affecting Productivity, Introduction to Productivity measurement Models
	Methods Engineering-Steps -Tools and techniques, Motion study.
	Stop watch time study, performance rating, allowances, Development of Standard data, learning effect. Work measurement in Automated Processes. Computerized Labor standards
	Work sampling, Group Timing Technique (GTT), predetermined time systems, types, Methods Time Measurement (MTM), Introduction to MOST standard, Wage incentive plans.
	Organization and methods (O & M), Work measurement of office work, Work Analysis techniques applied to support staff, Form design and control

Text book(s)

- Barnes, R.M, "Motion and Time Study, Design and measurement of work", John Wiley sons (Asia), 7t^{H} ed.,2003.

Reference Book(s):

- Benjamin W.Niebel, Andris Freivalds, "Methods, standards and Work Design", McGraw hill, Eleventh edition, 2002.
- ILO, "Introduction to Work Study", Oxford and IBH publishing , 2008

Mode of Evaluation:

- Course evaluation by the students "Course Evaluation Survey (CES)" at the conclusion of every course.
- Student verbal & written or via the Blackboard feedback are encouraged.
- Students provide written feedback on tutorials.
- Randomly evaluation focusing on effectiveness of some sessions across modules.

- Program Evaluation Survey (PES): at the conclusion of the program (end of sixth year).
- Student Experience Survey (SES): to gather student's opinion about their experiences HALF WAY through their programs, in the KKU University.
- Students' Survey on Lecturing Skills: Feedback from students about the quality of faculty lecturing.
- Mid-course evaluation at week 8 (verbal & written).

Course Title	Management Information System	**Coordinator**			
Course Code	**420 INE-3**	**Credit Hrs.**	2	**Contact Hrs.**	2
Prerequisite		**Level/Year**	7/4		

Course Objectives:

- Use a professional relational database management system such as MySQL, SQL queries that are compatible with the RDMBS system, and write database access programs in an application programming language such as PHP
- Explain internal database level storage structures, files and indexing

Teaching Method:

- Lectures, Training exercises (Tutorial + Labs, Reports for different subjects in this field

Expected learning outcomes

- List and explain basic concepts - data independence, 3 level database architecture, database system components
- Explain conceptual database level and the Entity-Relationship Model
- Design a database using DBMS Design Methodology
- Identify model data using the Relational Data Model, relational Algebra and relational Calculus
- Write correct data definition and data manipulation queries in SQL Query Language
- Map concepts from ER Model to Relational Model

Week	Course Contents
	DB Concepts & ER/EER Model
	Relations, Algebra & Calculus, and QBE
	SQL and ER to Relational Mapping
	Normalization and Physical Design
	DB Concepts & ER/EER Model

Text book(s)

- Elmasri & Navathe, Addison-Wesley, Fundamentals of Database Systems, 7th edition, 2015

Reference Book(s):

- Jeffrey D. Ullman and Jennifer Widom, A First Course in Database Systems," Prentice Hall, Second Edition or Higher, 2002.

Mode of Evaluation:

- Course evaluation by the students "Course Evaluation Survey (CES)" at the conclusion of every course.
- Student verbal & written or via the Blackboard feedback are encouraged.
- Students provide written feedback on tutorials.
- Randomly evaluation focusing on effectiveness of some sessions across modules.
- Program Evaluation Survey (PES): at the conclusion of the program (end of sixth year).
- Student Experience Survey (SES): to gather student's opinion about their experiences HALF WAY through their programs, in the KKU University.
- Students' Survey on Lecturing Skills: Feedback from students about the quality of faculty lecturing.
- Mid-course evaluation at week 8 (verbal & written).

Course Title	Production Planning and Control	**Coordinator**			
Course Code	**451-INE-3**	**Credit Hrs.**	3	**Contact Hrs.**	4
Prerequisite	231-INE-3	**Level/Year**	7/4		

Course Objectives:

- To understand the various components and functions of production planning and control such as work study

Teaching Method:

- Lectures, Training exercises (Tutorial + Labs, Reports for different subjects in this field

Expected learning outcomes

- Evaluate the effects of product planning, Develop credible and valid simulation models.
- Analyze output data process planning, production scheduling
- Identify Inventory Control.

Week	Course Contents
	Objectives and benefits of planning and control-Functions of production control-Types of production-job- batch and continuous-Product development and design-Marketing aspect – Functional aspects-Operational aspect-Durability and dependability aspect aesthetic aspect. Profit consideration-Standardization, Simplification & specialization- Break even analysis-Economics of a new design.
	Method study, basic procedure-Selection-Recording of process – Critical analysis, Development – Implementation – Micro motion and memo motion study – work measurement – Techniques of work measurement – Time study – Production study – Work sampling – Synthesis from standard data – Predetermined motion time standards
	Product planning-Extending the original product information-Value analysis-Problems in lack of product planning-Process planning and routing-Pre requisite information needed for process planning-Steps in process planning-Quantity determination in batch production-Machine capacity, balancing-Analysis of process capabilities in a multi-product system
	Production Control Systems-Loading and scheduling-Master Scheduling-Scheduling rules-Gantt charts-Perpetual loading-Basic scheduling problems – Line of balance – Flow production scheduling-Batch production scheduling-Product sequencing – Production Control systems-Periodic batch control-Material requirement planning kanban – Dispatching-Progress reporting and expediting-Manufacturing lead time-Techniques for aligning completion times and due dates.

	Inventory control-Purpose of holding stock-Effect of demand on inventories-Ordering procedures. Two bin system-Ordering cycle system-Determination of Economic order quantity and economic lot size-ABC analysis-Recorder procedure-Introduction to computer integrated production planning systems-elements of Just-in-Time system-Fundamentals of MRP II and ERP.

Text book(s)

- Martand Telsang, "Industrial Engineering and Production Management", First edition, S. Chand and Company, 2000.
- James.B.Dilworth,"Operations management – Design, Planning and Control for manufacturing and services" Mcgraw Hill International edition 1992.

Reference Book(s):

- Samson Eilon, "Elements of Production Planning and Control", Universal Book Corpn.1984
- Elwood S.Buffa, and Rakesh K.Sarin, "Modern Production / Operations Management", 8th Edition, John Wiley and Sons, 2000.
- Kanishka Bedi, " Production and Operations management", 2nd Edition, Oxford university press, 2007

Mode of Evaluation:

- Course evaluation by the students "Course Evaluation Survey (CES)" at the conclusion of every course.
- Student verbal & written or via the Blackboard feedback are encouraged.
- Students provide written feedback on tutorials.
- Randomly evaluation focusing on effectiveness of some sessions across modules.
- Program Evaluation Survey (PES): at the conclusion of the program (end of sixth year).
- Student Experience Survey (SES): to gather student's opinion about their experiences HALF WAY through their programs, in the KKU University.
- Students' Survey on Lecturing Skills: Feedback from students about the quality of faculty lecturing.
- Mid-course evaluation at week 8 (verbal & written).

Course Title	Human Factor Engineering	**Coordinator**			
Course Code	461-INE-3	**Credit Hrs.**	3	**Contact Hrs.**	4
Prerequisite	-	**Level/Year**	7/4		

Course Objectives:

- Identify Muscle types and joints structures to study their pain and stress formation
- Awareness of functional anatomy of the human body.
- Understanding to carry out the calculation for Engineering anthropometry

Teaching Method:

- Lectures, Training exercises (Tutorial + Labs, Reports for different subjects in this field

Expected learning outcomes

- Understand work place design
- Identify design aspects of work place
- Describe variety of tools evaluating methodologies for design

Week	**Course Contents**
	Study of Human body, Mind, Senses
	Study of effective and non-effective ergonomic models.
	Study of ergonomic principles with reference to the workplace.
	Comprehensive study of ergonomics in workplace
	Design and evaluation of ergonomic systems in Industrial environment, Study of Biomechanics and Psychophysics of Manual Strength Design

Text book(s)

- Kroemer, K., Kroemer, H., and Kroemer-Elbert, K. (2001). Ergonomics: How to design for ease and efficiency (2nd ed.).Upper Saddle River, NJ: Prentice Hall,[ISBN-13: 978-0137524785,ISBN-10: 0137524781]
- Stephan A. Konz and Steven Johnson (2000),Work Design: Industrial Ergonomics 5th Edition,[ISBN-13: 978-1890871079,ISBN-10: 1890871079]

Reference Book(s):

- Kroemer, K., Kroemer, H., and Kroemer-Elbert, K. (2001). Ergonomics: How to design for ease and efficiency (2nd ed.).Upper Saddle River, NJ: Prentice Hall,[ISBN-13: 978-0137524785,ISBN-10: 0137524781]
- Stephan A. Konz and Steven Johnson (2000),Work Design: Industrial Ergonomics 5th Edition,[ISBN-13: 978-1890871079,ISBN-10: 1890871079]

Mode of Evaluation:

- Course evaluation by the students "Course Evaluation Survey (CES)" at the conclusion of every course.
- Student verbal & written or via the Blackboard feedback are encouraged.
- Students provide written feedback on tutorials.
- Program Evaluation Survey (PES): at the conclusion of the program (end of sixth year).

• Student Experience Survey (SES): to gather student's opinion about their experiences HALF WAY through their programs, in the KKU University. • Students' Survey on Lecturing Skills: Feedback from students about the quality of faculty lecturing. • Mid-course evaluation at week 8 (verbal & written).	

Course Title	Professional Ethics and Practice	**Coordinator**			
Course Code	411-INE-2	**Credit Hrs.**	2	**Contact Hrs.**	2
Prerequisite	-	**Level/Year**	7/4		

Course Objectives:

- To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

Teaching Method:

- Lectures, Training exercises (Tutorial + Labs, Reports for different subjects in this field

Expected learning outcomes

- Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society

Week	Course Contents
	Human Values: Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self-confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.
	Engineering Ethics: Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles – Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories
	Engineering as Social Experimentation:Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.
	Safety, Responsibilities And Rights: Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination
	Global Issues: Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility
Text book(s)	

- Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.
- Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 200

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Reference Book(s):

- Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
- Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009

Mode of Evaluation:

- Course evaluation by the students "Course Evaluation Survey (CES)" at the conclusion of every course.
- Student verbal & written or via the Blackboard feedback are encouraged.
- Students provide written feedback on tutorials.
- Randomly evaluation focusing on effectiveness of some sessions across modules.
- Program Evaluation Survey (PES): at the conclusion of the program (end of sixth year).
- Student Experience Survey (SES): to gather student's opinion about their experiences HALF WAY through their programs, in the KKU University.
- Students' Survey on Lecturing Skills: Feedback from students about the quality of faculty lecturing.
- Mid-course evaluation at week 8 (verbal & written).

Course Title	Reliability and Maintenance Planning	**Coordinator**			
Course Code	451-INE-2	**Credit Hrs.**	2	**Contact Hrs.**	2
Prerequisite	-	**Level/Year**	7/4		

Course Objectives:

- To stress the importance of reliability in Engineering and products also the concept of maintainability, failure modes and testing methods.

Teaching Method:

- Lectures, Training exercises (Tutorial + Labs, Reports for different subjects in this field

Expected learning outcomes

- The Student must apply and optimize reliability for time independent and time dependent failure models through various testing methods for various manufacturing amnesty process

Week	Course Contents
	Definition of reliability – reliability Vs quality-reliability function-MTTF – hazard rate function- bathtub curve – derivation of the reliability function-constant failure rate model – time dependent failure models. Weibull distribution – normal distribution – the lognormal distribution. Serial configuration – parallel configuration – combined series parallel systems – system structure function, minimal cuts and minimal paths –
	Reliability design process – system effectiveness – economic analysis and life cycle cost – reliability allocation – optimal, Arinc, Agree, – Design methods – parts and material selection, derating, stress- strength analysis – failure analysis – identification of failure mode – determination of causes –assessment of effects – classification of seventy – computation of critically index – corrective action – system safety and FTA. Analysis of downtime – the repair time distribution – stochastic point processes – system repair time – reliability under preventive maintenance – state dependent systems with repair –
	Markov analysis – load sharing systems, standby system, degraded systems, three state devices – covariate models, static models, dynamic models, physics of failure model
	proactive, preventive, predictive maintenance – maintenance and spares provisioning – maintainability prediction and demonstration – concepts and definition of availability.
	MTTR-mean system downtime – MTR – MH/OH – cost model – fault isolation and self-diagnostics – repair Vs replacement – replacement model –

Text book(s)

- Charles E. Ebling, "An introduction to Reliability and Maintainability Engineering" Tata McGraw-Hill, 2000.

Reference Book(s):

- Patrick D T O'connor, "Practical Reliability Engineering", John-Wiley and Sons Inc., 2002.
- David J Smith, "Reliability, Maintainability and Risk: Practical Methods for Engineers", Butterworth, 2002
- Way Kuo, Rajendra Prasad V, Frank A and Tillman, Ching- Lai Hwang "Optimal Reliability Design and Applications", Cambridge University Press P ltd., 2001.

Mode of Evaluation:

- Course evaluation by the students "Course Evaluation Survey (CES)" at the conclusion of every course.
- Student verbal & written or via the Blackboard feedback are encouraged.
- Students provide written feedback on tutorials.
- Randomly evaluation focusing on effectiveness of some sessions across modules.
- Program Evaluation Survey (PES): at the conclusion of the program (end of sixth year).
- Student Experience Survey (SES): to gather student's opinion about their experiences HALF WAY through their programs, in the KKU University.
- Students' Survey on Lecturing Skills: Feedback from students about the quality of faculty lecturing.
- Mid-course evaluation at week 8 (verbal & written).

Course Title	Differential Equations	**Coordinator**			
Course Code	319-MATH-3	**Credit Hrs.**	3	**Contact Hrs.**	3
Prerequisite	219-INE-3	**Level/Year**	6/3		

Course Objectives:
Calculus is taught in a traditional lecture format or in laboratories with individual and group learning focusing on numerical and graphical experimentations. Give an ability to apply knowledge of mathematics on engineering problems. Provide the evaluation of integrals by using integral techniques. Give the basic concepts of analytic geometry. Give a broad knowledge and basic understanding of sequences and series. Provide the limit, continuity and integral of vector-valued functions in application.

Teaching Method:
- Mid-Term Exam
- Computer Based Presentation
- Short Exam
- Presentation of Report
- Homework Assessment
- Oral Exam

Expected learning outcomes
- CLO-1: Knowledge
- CLO-2: Cognitive Skills
- CLO-3: Interpersonal Skills & Responsibility
- CLO-4: Communication, Information Technology, Numerical

Week	**Course Contents**
	Matrices: Definition and Notations, Matrix Algebra
	Systems of Linear Algebraic Equations; Terminology and Notations
	Systems of Linear Algebraic Equations; Gaussian Elimination, The Inverse of a Square Matrix
	Determinants
	Cofactor Expansions and The Adjoint Method and Cramer's Rule
	Vector Spaces, Subspaces
	Spanning Sets, Linear Dependence and Linear Independence, Bases and Dimensions
	Inner Product Spaces and Orthogonal Sets of Vector and the Gram-Schmidt Procedure
	Linear Transformations
	The Kernel and Range of a Linear Transformations
	The Algebraic Eigenvalue / Eigenvectors

Text book(s):
- W. Kernighan, Dennis M. Ritchie , C Programming Language, Prentice Hall
- Lecture notes and online resources

Reference Book(s):
Introducing Python, by Bill Lubanovic, O'Reilly Media, November 2014.

Mode of Evaluation:

1. e-learning Class activities (On-line Quizzes, Assignments)
2. Major Exam- I
3. Major Exam- II
4. Discussions / Attendance / Participation
5. Final exam

Course Title	Operations Research I	**Coordinator**		Dr. M S Khan	
Course Code	321-INE-3	**Credit Hrs.**	3	**Contact Hrs.**	4
Prerequisite	232 -INE-3	**Level/Year**	6/3		

Course Objectives:

- Demonstrate understanding forecasting models and their applications in various fields of science and engineering.
- Perform linear and multiple linear regression analyses.

Teaching Method:

- Mid-Term Exam
- Computer Based Presentation
- Short Exam
- Presentation of Report
- Homework Assessment
- Oral Exam

Expected learning outcomes

- CLO-1: Knowledge
- CLO-2: Cognitive Skills
- CLO-3: Interpersonal Skills & Responsibility
- CLO-4: Communication, Information Technology, Numerical
- CLO-5: Psychomotor

Week	Course Contents
	Introduction to Operations Research and Optimization;
	Optimization Models: Linear,
	Integer models
	Formulating Models: examples, applications
	Linear Optimization: simplex algorithm, sensitivity analysis, duality
	Discrete Optimization: graph and network algorithms,
	brand-and-bound, integer programming methods
	and computer modeling languages

Text book(s):

- Wayne L. Winston (2000), Operations Research: Algorithms and Applications

Reference Book(s):

- Wayne L. Winston and M.Venkataramanan (2003),Introduction to Mathematical Programming, 4th edition

Mode of Evaluation:

1. e-learning Class activities (On-line Quizzes, Assignments)
2. Major Exam- I
3. Major Exam- II
4. Discussions / Attendance / Participation
5. Final exam

Course Title	Material Science	**Coordinator**			
Course Code	211-MEC-3	**Credit Hrs.**	3	**Contact Hrs.**	4
Prerequisite	129-PHYS-4, 107-CHEM-4	**Level/Year**	5/3		

Course Objectives:

- Identify target phase diagram and heat treatment zones
- Determine Important areas, phase diagrams

Teaching Method:

- Mid-Term Exam
- Computer Based Presentation
- Short Exam
- Presentation of Report
- Homework Assessment
- Oral Exam

Expected learning outcomes

- CLO- 1:Knowledge
- CLO-2: Cognitive Skills
- CLO-3: Interpersonal Skills & Responsibility
- CLO-4: Communication, Information Technology, Numerical
- CLO-5: Psychomotor

Week	Course Contents
	Lattice, Crystal structures, Miller indices for planes and directions.
	Microscopes, microstructures and quantitative metallography.
	Defects, diffusion and phase diagram.
	Equilibrium phase diagram, lever rule, phases transformation.
	Iron-carbon phase diagram, TTT and CCT curves, heat treatments.
	Introduction to mechanical properties, cold and hot working..
	Strengthening mechanism Fracture, and Fatigue.
	Creep, ceramics and plastic, NDT techniques, alloy designation

Text book(s): Materials Science and Engineering An Introduction, W. D. Callister, Jr., John Wiley and Sons, 2006

Reference Book(s): Materials Science and Engineering A First Course 5 ed., V. Raghavan, Prentice Hall of India Pvt. Ltd.

Mode of Evaluation:

1. e-learning Class activities (On-line Quizzes, Assignments)
2. Major Exam- I
3. Major Exam- II
4. Discussions / Attendance / Participation
5. Final exam

Course Title	Quality Control	**Coordinator**			
Course Code	432-INE-3	**Credit Hrs.**	3	**Contact Hrs.**	4
Prerequisite	231-INE-3	**Level/Year**	8/4		

Course Objectives:

- To develop a deeper understanding of Quality control fundamentals and its application in Industry.
- To develop skill in employing knowledge of statistics in solving Quality related problems.
- To be aware of practical problems in industry and solve using industrial engineering tools.

Teaching Method:

- Lectures, Training exercises (Tutorial + Labs, Reports for different subjects in this field

Expected learning outcomes

- Understand Quality control fundamentals
- Solve Quality related problems using knowledge of statistics.
- Able to draw the chart for Process Control using variables, Process Control using attributes.
- Able to apply Statistics based knowledge and quality control techniques to solve the problem.
- Able to design the statistical process control system

Week	Course Contents
	Introduction to quality control
	Fundamentals of statistics for quality control
	The basic concepts for quality control
	Process Control using variables, Process Control using attributes
	Process capability, Introduction to quality management, Six-sigma process quality

Text book(s)

- Shewhart,W.A. Statistical Method from the Viewpoint of Quality Control, 2012,[9780486652320]
- Chandra,M.J,Statistical Quality Control, 2001, [978-0849323478**]**

Reference Book(s):

- Jain,P.L., Quality Control and Total Quality Management, 2001 [9780070402140]

Mode of Evaluation:

- Course evaluation by the students "Course Evaluation Survey (CES)" at the conclusion of every course.
- Student verbal & written or via the Blackboard feedback are encouraged.
- Students provide written feedback on tutorials.
- Randomly evaluation focusing on effectiveness of some sessions across modules.
- Program Evaluation Survey (PES): at the conclusion of the program (end of sixth year).
- Student Experience Survey (SES): to gather student's opinion about their experiences HALF WAY through their programs, in the KKU University.
- Students' Survey on Lecturing Skills: Feedback from students about the quality of faculty lecturing.
- Mid-course evaluation at week 8 (verbal & written).

Course Title	Regression and Forecasting	**Coordinator**			
Course Code	437-INE-3	**Credit Hrs.**	3	**Contact Hrs.**	4
Prerequisite	232-INE-3	**Level/Year**	8/4		

Course Objectives:
Time series and forecasting. Forecasting accuracy. Monitoring and controlling forecasts. Linear and multiple regression with forecasting applications. Box-Jenkins (ARIMA) methodology. Introduction to fundamental and technical analysis with applications in financial markets. Introduction to neural networks. Judgmental forecasting

Teaching Method:
- Lectures, Training exercises (Tutorial + Labs, Reports for different subjects in this field

Expected learning outcomes
- Understand the difference between time series forecasting and causal (regression) forecasting.
- Compute forecasts using the various methods and tools presented in the course outline
- Measure forecast accuracy.
- Learn how to use forecasting packages (Minitab and Excel) for various forecasting.
- Apply Box-Jenkins (ARIMA) methodology for forecasting.
- Work in a group for case studies analysis and reporting.
- Develop & use power-point for case studies oral presentation

Week	**Course Contents**
	Introduction to Forecasting
	Exploring data Patterns
	Choosing a Forecasting Technique , Measures of forecasting accuracy
	Moving averages ,Exponential smoothing ,Trend, Seasonal & cyclic variations in data , Simple Linear regression
	Multiple Regression Analysis, Introduction to Box-Jenkins (ARIMA) Methodology

Text book(s)
- Richard I. Levin, David S. Rubin, Statistics for Management, Pearson Education, 7th Edition, 2011

Reference Book(s):
- Anderson D.R., Sweeney D.J. and Williams T.A., Statistics for business and economics, 11th edition, Thomson (South – Western) Asia, Singapore, 2012

Mode of Evaluation:

- Course evaluation by the students "Course Evaluation Survey (CES)" at the conclusion of every course.
- Student verbal & written or via the Blackboard feedback are encouraged.
- Students provide written feedback on tutorials.
- Randomly evaluation focusing on effectiveness of some sessions across modules.
- Program Evaluation Survey (PES): at the conclusion of the program (end of sixth year).
- Student Experience Survey (SES): to gather student's opinion about their experiences HALF WAY through their programs, in the KKU University.
- Students' Survey on Lecturing Skills: Feedback from students about the quality of faculty lecturing.
- Mid-course evaluation at week 8 (verbal & written).

Course Title	Engineering Management	**Coordinator**			
Course Code	**411-INE-3**	**Credit Hrs.**	2	**Contact Hrs.**	2
Prerequisite	-	**Level/Year**	8/4		

Course Objectives:

- Understand the Objectives of Engineering Management-
- Importance of Project Management- resource utilization

Teaching Method:

- Lectures, Training exercises (Tutorial + Labs, Reports for different subjects in this field

Expected learning outcomes

- To apply project management principles in business situations to optimize time
- Identify Project Selection – Teamwork in Project Management
- Apply Feasibility study: Types of feasibility in project

Course Contents	UNIT I INTRODUCTION TO MANAGEMENT AND PROJECT SELECTION Objectives of Project Management- Importance of Project Management- Types of Projects
	Project Management Life Cycle- Project Selection – Feasibility study: Types of feasibility Steps in feasibility study.
	UNIT II PROJECT PLANNING AND IMPLEMENTATION Project Scope- Estimation of Project cost – Cost of Capital – Project Representation and Preliminary Manipulations
	- Basic Scheduling Concepts - Resource Levelling – Resource Allocation
	. UNIT III PROJECT MONITORING AND CONTRON Setting a base line- Project management Information System – Indices to monitor progress. Importance of Contracts in projects-
	SPECIAL TOPICS IN PROJECT MANAGEMENT Computers, e-market sand their role in Project management- Risk management

Text book(s)

- Arun Kanda, "Project Management A Life Cycle Approach", Prentice Hall of India, 2011

Reference Book(s):

- R.B.Khanna, "Project Management", Prentice Hall of India, 2011.

Mode of Evaluation:

- Course evaluation by the students "Course Evaluation Survey (CES)" at the conclusion of every course.
- Student verbal & written or via the Blackboard feedback are encouraged.
- Students provide written feedback on tutorials.
- Randomly evaluation focusing on effectiveness of some sessions across modules.
- Program Evaluation Survey (PES): at the conclusion of the program (end of sixth year).
- Student Experience Survey (SES): to gather student's opinion about their experiences HALF WAY through their programs, in the KKU University.
- Students' Survey on Lecturing Skills: Feedback from students about the quality of faculty lecturing.

- Mid-course evaluation at week 8 (verbal & written).

Course Title	Supply chain Planning and Design	**Coordinator**			
Course Code	452-INE-3	**Credit Hrs.**	3	**Contact Hrs.**	4
Prerequisite	321-INE -3	**Level/Year**	8/4		

Course Objectives:

- To develop a deeper understanding of logistics problems, including design and operational problems;
- To develop skill in employing tools such as statistics, optimization, and probability models to address logistics problems;

Teaching Method:

- Lectures, Training exercises (Tutorial + Labs, Reports for different subjects in this field

Expected learning outcomes

- Able to Logistics network design.
- Able to apply logistics solution carious are like disaster management, military logistics, human logics etc.
- Able to define the security in the logic

Course Contents	Introduction to supply chain management
	Global supply chain operations
	Supply chain design and planning
	Lean supply management
	Agile supply management
	Purchasing and suppliers selection

Text book(s)

- Lu "Fundamentals of Supply Chain Management", 2nd ed. Prentice Hall, Eaglewood Cliffs, ISBN 9788776817985.

Reference Book(s):

- Schönsleben, P., Integral Logistics Management: Operations and Supply Chain Management Within and Across Companies, 5th Edition, Auerbach Publications,2016

Mode of Evaluation:

- Course evaluation by the students "Course Evaluation Survey (CES)" at the conclusion of every course.
- Student verbal & written or via the Blackboard feedback are encouraged.
- Students provide written feedback on tutorials.
- Randomly evaluation focusing on effectiveness of some sessions across modules.
- Program Evaluation Survey (PES): at the conclusion of the program (end of sixth year).
- Student Experience Survey (SES): to gather student's opinion about their experiences HALF WAY through their programs, in the KKU University.

- Students' Survey on Lecturing Skills: Feedback from students about the quality of faculty lecturing.
- Mid-course evaluation at week 8 (verbal & written).

Course Title	Product Design and Development	**Coordinator**			
Course Code	453-INE-3	**Credit Hrs.**	2	**Contact Hrs.**	2
Prerequisite	-	**Level/Year**	8/4		

Course Objectives:

- To understand basic knowledge in the common features a product
- To identify and incorporate product economic analysis

Teaching Method:

- Lectures, Training exercises (Tutorial + Labs, Reports for different subjects in this field

Expected learning outcomes

- Understand the integration of customer requirements in product design
- Apply structural approach to concept generation, selection and testing
- Understand various aspects of design such as industrial design , design for
- manufacture , and product architecture

Week	Course Contents
	Meaning of product liability. Definition of defective product.
	Management strategy in product safety. Reducing product design risks through design reviewing systems. Personal and environmental risk identification of the whole product life from manufacturing to end of services disposal.
	The consumer Product Safety Acts. The safety standards used in different countries such as Underwriters Laboratories Inc.
	Fault Tree Analysis (FTA). Failure Mode and Effect Analysis (FMEA). Hazard and Operability
	Product Risk Management - Product Risk transfer through insurance and contract conditions
	The use of quantitative and statistical methods in assessing product risks and design optimization
	Overview of the application and testing procedures in obtaining product safety markings for new products. Planning, implementation and control in product test and assurance.
	Study (HAZOP) and Hazard Analysis Critical Control Point (HACCP).

Text book(s)

- Karl T.Ulrich and Steven D.Eppinger, Product Design and Development, McGraw –Hill International Edns.1999
- Orwin, Homewood,, Effective Product Design and Development, Stephen Rosenthal, Business One 1992,ISBN, 1-55623-603-4 3.

Reference Book(s):

- Kemnneth Crow, Concurrent Engg./Integrated Product Development. DRM Associates, 6/3,ViaOlivera, Palos Verdes, CA 90274(310) 377-569,Workshop Book
- Stuart Pugh, Addison,Tool Design – Integrated Methods for successful Product Engineering, Wesley Publishing,Neyourk,NY,1991, ISBN 0-202-41639-5

Mode of Evaluation:

- Course evaluation by the students "Course Evaluation Survey (CES)" at the conclusion of every course.
- Student verbal & written or via the Blackboard feedback are encouraged.
- Students provide written feedback on tutorials.
- Randomly evaluation focusing on effectiveness of some sessions across modules.
- Program Evaluation Survey (PES): at the conclusion of the program (end of sixth year).
- Student Experience Survey (SES): to gather student's opinion about their experiences HALF WAY through their programs, in the KKU University.
- Students' Survey on Lecturing Skills: Feedback from students about the quality of faculty lecturing.
- Mid-course evaluation at week 8 (verbal & written).

Course Title	Numerical Methods	**Coordinator**			
Course Code	419-MATH-3	**Credit Hrs.**	3	**Contact Hrs.**	3
Prerequisite	319-MATH-3	**Level/Year**	8/4		

Course Objectives:

- To introduce the basic concepts of solving algebraic and transcendental equations.
- To introduce the numerical techniques of interpolation in various intervals in real life situations.
- To acquaint the student with understanding of numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
- To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.
- To understand the knowledge of various techniques and methods of solving various types of partial differential equations.

Teaching Method:

- Lectures, Training exercises (Tutorial + Labs, Reports for different subjects in this field

Expected learning outcomes

- Understand the basic concepts and techniques of solving algebraic and transcendental equations.
- Appreciate the numerical techniques of interpolation and error approximations in various intervals in real life situations
- Apply the numerical techniques of differentiation and integration for engineering problems.
- Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
- Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.

Week	**Course Content**
	Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method - Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Eigenvalues of a matrix by Power method and Jacobi's method for symmetric matrices.
	Interpolation with unequal intervals - Lagrange's interpolation – Newton's divided difference interpolation – Cubic Splines - Difference operators and relations - Interpolation with equal intervals - Newton's forward and backward difference formulae.
	Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 rule –

	Romberg's Method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.
	Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 rule – Romberg's Method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.

Text book(s)

- Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
- Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.

Reference Book(s):

- Sankara Rao. K., "Numerical Methods for Scientists and Engineers", Prentice Hall of India Pvt. Ltd, 3rd Edition, New Delhi, 2007.
- Sastry, S.S, "Introductory Methods of Numerical Analysis", PHI Learning Pvt. Ltd, 5th Edition, 2015.

Mode of Evaluation:

- Course evaluation by the students "Course Evaluation Survey (CES)" at the conclusion of every course.
- Student verbal & written or via the Blackboard feedback are encouraged.
- Students provide written feedback on tutorials.
- Randomly evaluation focusing on effectiveness of some sessions across modules.
- Program Evaluation Survey (PES): at the conclusion of the program (end of sixth year).
- Student Experience Survey (SES): to gather student's opinion about their experiences HALF WAY through their programs, in the KKU University.
- Students' Survey on Lecturing Skills: Feedback from students about the quality of faculty lecturing.
- Mid-course evaluation at week 8 (verbal & written).

Course Title	Advanced Optimization	**Coordinator**			
Course Code	521-INE-3	**Credit Hrs.**	3	**Contact Hrs.**	4
Prerequisite	321-INE-3	**Level/Year**	9/5		

Course Objectives:

- Develop a deeper understanding of the key concepts, theory, and algorithms of linear optimization, integer optimization, and some modern convex optimization
- Identify more advanced modeling techniques,
- Learn ways of solving optimization problems that are too hard, too large for direction solution,

Teaching Method:

- Lectures, Training exercises (Tutorial + Labs, Reports for different subjects in this field

Expected learning outcomes

- To define knowledge optimization, modeling
- To understand correct procedure solution techniques for very large
- An ability to apply knowledge of mathematics, science and engineering and facility planning; An ability to critically analyze modeling and analysis of complex problems
- An ability to critically understand algorithmic solution methods and an ability to identify and heuristics,
- An ability to understand optimization software
- An ability to understand and Analysis and Design
- Able to apply the safety concept and develop an ability to engage in lifelong learning
- The ability to function on multidisciplinary teams and understand the concepts
- An understanding of professional and ethical responsibility in safety
- A knowledge of contemporary issues Contingencies Extension of the results to multi-stage and Batching schemes and their complications

Course Contents

	Linear Optimization: a. Modeling using linear optimization b. Geometry of LP c. Revised simplex method d. Duality theory e. Large scale optimization: i. Column generation ii. Constraint generation iii.
	Dantzig-Wolfe decomposition iv. Benders decomposition Discrete Optimization: a. Application and formulation techniques of discrete optimization b. Branch-bound and cutting plane methods

	Convex Optimization: a. Applications of convex optimization b. Modeling and fast prototyping using convex optimization

Text book(s)

- Wayne L. Winston, Introduction to Mathematical Programming: Applications and Algorithms by Duxbury Press, 2002 (advanced chapters)

Reference Book(s)

- **Ronald L. Rardin, Optimization in Operations Research, Prentice Hall, 1997 (advanced chapters), or equivalent.**

Mode of Evaluation:

	Assessment task (e.g. essay, test, group project, examination, speech, oral presentation, etc.)	Week Due	Proportion of Total Assessment
1	e-learning Class activities (On-line Quizzes, Assignments)	Every Week	15%
2	Major Exam- I	5th Week	15%
3	Major Exam- II	10th Week	15%
4	Discussions / Attendance / Participation	All Week	05%
5	Final exam	15th Week	50%

Course Title	Facilities Planning, Design and Engineering	**Coordinator**		Dr.	
Course Code	566-INE-3	**Credit Hrs.**	3	**Contact Hrs.**	4
Prerequisite	321-INE-3	**Level/Year**	9/5		

Course Objectives:

- Understanding material flow analysis techniques, capability to design facility layout
- Understanding the various facility departments (services and production) relationship
- Capably to develop space determination and area allocation
- Capability to carry evaluation techniques
- Understanding facility layout planning methods and computerized layout planning
- Capability to construct layout and use CAD as facility design tool
- Analyze location problems and site selection, to work within facility design team, communicate with industry , reporting and evaluating industrial facility

Teaching Method:

- Lectures, Training exercises (Tutorial + Labs, Reports for different subjects in this field

Expected learning outcomes

- CLO-1 Identifying the facility design phases, facility strategic planning, and facility design procedure
- CLO-2 Ability to carry out data collection and analysis to estimate production volume and product specifications
- CLO-3 Ability to design manufacturing process, specify technologies
- CLO-4 Ability to find the capacity (machines and labors)
- CLO-5 Understanding material handling and flow methods and equipment and the MH selection process

Week	Course Contents
	Introduction: Production cycle and facility design; facility planning; facility design phases
	Product Analysis: Market and product requirements; Product design process
	Production Analysis: Product-Process relations; industrial decisions (make or buy, technology select, production method); Production method-layout relation; Process design and planning charts.
	Production Analysis: Capacity requirements calculation for production line and assembly line (machines and work stations Labors, assembly line and raw material)
	Production Analysis: Material handling analysis (principles, unit load, equipment's types, selection and cost, ,handling system design,
	Factory Analysis : Area allocation and space determination of production, warehousing, management departments, physical

	services departments
	Factory Analysis : Flow Analysis
	Factory Analysis : Relationship analysis and Layout design; graphical, quantitative, qualitative methods, layout evaluation
	Factory Analysis : Computerized layout, **Location Analysis:** Discrete and continuous location problems; **Location Analysis:** Site selection problems
Text book(s) • F.E.Mayer, M.P. Stephen, Manufacturing Facility Design and material handling, Prentice Hall. • Tompkins, J & White J., Facility Planning, John, Wiley & Sons. • Francis, R., McGinnisl, and White J. (1992) Facility Layout and Location: Analytical approach, Prentice-Hall.	
Reference Book(s): • Sule, D.R, Manufacturing Facility: Location, Planning and Design, PWS –Kent • Apple, J.M.,Plant Layout and Material Handling, John Wiley & Sons.	
Mode of Evaluation: E-learning Class activities (On-line Quizzes, Assignments), MID - I, MID - II, Discussions / Attendance / Participation, Final Exam	

Course Title	Operation research II	**Coordinator**			
Course Code	521-INE-3	**Credit Hrs.**	3	**Contact Hrs.**	4
Prerequisite	321 -INE-3	**Level/Year**	9/5		

Course Objectives:

- Develop a deeper understanding of topics in review in networks and project management, goal programming, theory of games, Integer programming, stochastic models, Markovian decision process.
- Identify more advanced modeling techniques,
- Learn ways of solving optimization problems that are too hard, too large for direction solution using computer applications of software TORA, LINGO, LINDO

Teaching Method:

- Lectures, Training exercises (Tutorial + Labs, Reports for different subjects in this field

Expected learning outcomes

- To define knowledge optimization, modeling
- An ability to apply knowledge of mathematics, science and engineering and facility planning; An ability to critically analyze modeling and analysis of complex problems
- An ability to critically understand algorithmic solution methods and an ability to identify and heuristics,
- An ability to understand optimization software
- An ability to understand and Analysis and Design
- Solve networks dynamic programming, Theory of games, stochastic models
- Able to apply the safety concept and develop an ability to engage in lifelong learning
- The ability to function on multidisciplinary teams and understand the concepts
- Computer applications using TORA, LINGO, LINDO

Course Contents

- Integer Programming: a. Application and formulation techniques of discrete optimization b. Branch-bound and cutting plane methods
- Solve networks and project management
- Integer programming, dynamic programming,
- Theory of games,
- Stochastic models, Markovian decision process.
- Computer applications using TORA, LINGO, LINDO.

Text book(s)

- Taha, H.,Operations Research: An Introduction, 2017, 10thEdition, Prentice-Hall.

Reference Book(s):

- Jim Hefferon, Linear Algebra, 2017, 3rdEdition, Orthogonal Publishing l3c, ISBN-13: 9781944325039, ISBN-10: 1944325034.
- Hillier and Lieberman, Introduction to Operations Research, 2005, 8thEdition, ISBN 978-0073211145.

Mode of Evaluation:

	Assessment task (e.g. essay, test, group project, examination, speech, oral presentation, etc.)	Week Due	Proportion of Total Assessment
1	e-learning Class activities (On-line Quizzes, Assignments)	Every Week	15%
2	Major Exam- I	5th Week	15%
3	Major Exam- II	10th Week	15%
4	Discussions / Attendance / Participation	All Week	05%
5	Final exam	15th Week	50%

Course Title	Senior Design I/	**Coordinator**			
Course Code	554-INE-2	**Credit Hrs.**	4	**Contact Hrs.**	2
Prerequisite	**Pass 125 credit hours**	**Level/Year**	9/5		

Course Objectives:

- To acquire job skills programs on the system using the computer in the lab.
- Using a practical model of the system in the lab if possible.
- Apply skills in writing the final report of the project in the form of integrated business.

Teaching Method:

- Lectures, Training exercises (Tutorial + Labs, Reports for different subjects in this field)

Expected learning outcomes

- CLO-1 Identify analysis and design of engineering integrated (a)
- CLO-2 Train students to work in computer applications of mathematical simulation of the system designer and laboratory tests if necessary. (b)
- CLO-3 Develop the skill to have it on the future application in the field of engineering work (c)

Week	Course Contents
	Students have to learn how to analyze and design an engineering integrated system using the principles and foundations
	Using engineering skills by the Capacitated during the years of study.
	The project report submitted in details for the steps of the student analysis and design achieved.
	Maps, graphics and engineering necessary to implement the system engineering designer.
	The student must demonstrate in the main subject when discussing the project a
	Foundations and architectural elements based upon his ability to work in the field of applied engineering in the future.
	Students have to learn how to analyze and design an engineering integrated system using the principles and foundations
	Using engineering skills apply and understand and fully absorb the principles.

Text book(s)

- Stephan A. Konz and Steven Johnson (2000),Work Design: Industrial Ergonomics 5th Edition,[ISBN-13: 978-1890871079,ISBN-10: 1890871079]

Reference Book(s):

- Ergonomic engineering journals, safety and design Analysis Journal

Mode of Evaluation:

E-learning Class activities (On-line Quizzes, Assignments), MID - I, MID - II, Discussions / Attendance / Participation, Final Exam

Course Title	Computer Aided Design & Manufacturing	**Coordinator**		Dr.	
Course Code	551-INE-3	**Credit Hrs.**	3	**Contact Hrs.**	4
Prerequisite	-	**Level/Year**	10/5		

Course Objectives:

- To give an ability to understand, CNC programming using manual method, generation of CNC codes using CAM software.
- Identify Tooling and work holding devices.
- To give an ability CNC machine tool building.

Teaching Method:

- Lectures, Training exercises (Tutorial + Labs, Reports for different subjects in this field)

Expected learning outcomes

- CLO-1 Apply knowledge in various fields of Computer Aided Manufacturing (a)
- CLO-2 Understand Computer Aided Machining (i)
- CLO-3 Define application to Computer in Manufacturing (j)
- CLO-4 Describe Machining of Various parts (k)

Week	Course Contents
	The evolution of product realization, CAM and its historical development, Engineering product specification– Engineering design, design drafting, tolerance graph analysis, relationship between product and process tolerance, statistical quality control, manufacturing reliability. Geometric tolerancing- ASME standard, interpreting geometric specifications, multiple part features and datum.
	Networking- networking techniques, LAN, components, wiring methods, network interface cards, network standards, Graphics standards – Data exchange format, evolution- features of various interfaces GKS, IGES, DXF, PDES, STEP etc., Process planning, Computer Aided Process Planning(CAPP) - variant, generative approaches.
	Machine building, structural details, guide ways –Friction, Anti friction and other types of guide ways, elements used to convert the rotary motion to a linear motion – Screw and nut, recirculating ball screw, planetary roller screw, recirculating roller screw, rack and pinion, spindle assembly, torque transmission elements – gears, timing belts, flexible couplings, Bearings, Spindle drives and feed drives, open loop and closed loop control, Axis measuring system - Turn Mill Center - CNC VTL - Multi Axis (5 And 6 Axis) Machines With Live Tools - Axes & Spindle Cooling System - Through Coolant & Shower Coolant - Integral Spindle With HSK & Big Plus Spindle - Double Ball Screws - Linear Motors - Grease Lubricating System - Probing For Zero Offsets and First Off Inspection - Tool Breakage Detecting System - In Process Gauging System

	Structure of CNC program, Coordinate system, G & M codes, cutter radius compensation, tool nose radius compensation, tool wear compensation, canned cycles, sub routines, do loop, mirroring features, Manual part programming for CNC turning and machining centre for popular controllers like Fanuc, Siemens, Generation of CNC program using CAM software.
	Introduction to cutting tool materials – HSS, Carbides, Ceramics, CBN, PCD, classification of inserts- PMK, NSH, qualified, semi qualified and preset tooling, tooling system for CNC Machining centre and Turning centre, Automatic Tool changers, work holding devices for rotating and fixed work parts, Automatic Pallet changer, economics of CNC, maintenance of CNC machines. Feedback devices - Principles of Operation - Robots for loading jobs & material handling - Multi Pallets - Hydraulic and Pneumatic Fixtures - Anti Vibration Boring Bars - Hydro Gripping & Shrink Fit Adaptors for Drills and Reamers

Text book(s)

- Zeid,I., "CAD - CAM Theory and Practice ", Tata McGraw-Hill Publishing Co. Ltd., 2007.
- "Mechatronics", HMT, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2005.
- Chang,T.C., Wysk, R.A. and Wang,H.P., "Computer Aided Manufacturing", Pearson Prentice Hall, 2009. 4. Rao, P.N., "CAD/CAM", Tata McGraw-Hill Publishing Company Limited, New Delhi, 2010.

Reference Book(s):

- Jones, B.L., "Introduction to Computer Numerical Control", Pitman, London, 1987.
- Seamers, W.S., "Computer Numeric Control", Fourth Edition – Thomson Delmar, 2002.

Mode of Evaluation:

E-learning Class activities (On-line Quizzes, Assignments), MID - I, MID - II, Discussions / Attendance / Participation, Final Exam

Course Title	Design & Analysis of Experiments	**Coordinator**		Dr.	
Course Code	531-INE-2	**Credit Hrs.**	2	**Contact Hrs.**	3
Prerequisite	232-INE-3	**Level/Year**	10/5		

Course Objectives:

- Demonstrate understanding of hypotheses testing for a single sample.
- Recognize and conduct statistical inference for two samples to solve engineering problems.
- Perform linear and multiple linear regression analyses.

Teaching Method:

- Lectures, Training exercises (Tutorial + Labs, Reports for different subjects in this field)

Expected learning outcomes

- CLO-1 Understand modern quality improvement statistics methods (h)
- CLO-2 Understand probability, statistical inference (i)
- CLO-3 Define application to factorial design, building models, and implementation (j)
- CLO-4 Describe statistical experimental design (k)

Week	Course Contents
	Principles and techniques
	Planning experiments
	Design with one source of variation
	Inference for contrasts and treatment means
	Experiments with two crossed treatment factors
	Several crossed treatment factors
	Complete block designs
	Incomplete block designs
	Confounded two-level factorial experiments
	Fractional factorial experiments Response surface methodology

Text book(s)

- Dean, Angela M., and Daniel Voss. 2000. Design and Analysis of Experiments. Corrected. Springer
- Montero (2002) Introduction to Design of Experiments Part 3

Reference Book(s):

- NIST Engineering Statistics Handbook Section
- Choosing an experimental design http://www.itl.nist.gov/div898/handbook/pri/section3/pri3.htm and Section
- Analysis of DoE data http://www.itl.nist.gov/div898/handbook/pri/section4/pri4.htm

Mode of Evaluation:

E-learning Class activities (On-line Quizzes, Assignments), MID - I, MID - II, Discussions / Attendance / Participation, Final Exam

Course Title	Advanced Ergonomics	**Coordinator**			
Course Code	461-INE-3	**Credit Hrs.**	3	**Contact Hrs.**	3
Prerequisite	-	**Level/Year**	9/5		

Course Objectives:

- Identify Muscle types and joints structures to study their pain and stress formation
- Awareness of functional anatomy of the human body.
- Understanding to carry out the calculation for Engineering anthropometry

Teaching Method:

- Lectures, Training exercises (Tutorial + Labs, Reports for different subjects in this field)

Expected learning outcomes

- CLO-1 Understand work place design (a)
- CLO-2 Identify design aspects of work place (b)
- CLO-3 Describe variety of tools evaluating methodologies for design (c)

Week	Course Contents
	Study of Human body, Mind, Senses
	Study of effective and non-effective ergonomic models.
	Study of ergonomic principles with reference to the workplace.
	Comprehensive study of ergonomics in workplace
	Design and evaluation of ergonomic systems in Industrial environment
	Study of environmental factors that affect the human body,
	Study of Biomechanics and Psychophysics of Manual Strength Design
	Study human interaction and relationships.

Text book(s)

- Kroemer, K., Kroemer, H., and Kroemer-Elbert, K. (2001). Ergonomics: How to design for ease and efficiency (2nd ed.).Upper Saddle River, NJ: Prentice Hall,[ISBN-13: 978-0137524785,ISBN-10: 0137524781]
- Stephan A. Konz and Steven Johnson (2000),Work Design: Industrial Ergonomics 5th Edition,[ISBN-13: 978-1890871079,ISBN-10: 1890871079]

Reference Book(s):

- Karwowski,W. and Marras,W.S.(2003),Occupational Ergonomics: Design and Management of Work Systems [9780849318016]
- Konz,S. and Johnson,S. (2008),Work Design: Occupational Ergonomics,7th Edition[ISBN-13: 978-1890871796,ISBN-10: 1890871796]

Mode of Evaluation:

E-learning Class activities (On-line Quizzes, Assignments), MID - I, MID - II, Discussions / Attendance / Participation, Final Exam

Course Title	Safety & Environmental Engineering	**Coordinator**			
Course Code	564-INE-2	**Credit Hrs.**	2	**Contact Hrs.**	2
Prerequisite	232-INE-3	**Level/Year**	9/5		

Course Objectives:

- Demonstrate understanding of hypotheses testing for a single sample.
- Recognize and conduct statistical inference for two samples to solve engineering problems.
- Perform linear and multiple linear regression analyses.

Teaching Method:

- Lectures, Training exercises (Tutorial + Labs, Reports for different subjects in this field)

Expected learning outcomes

- CLO-1 Understanding Occupational Safety Management, and occupational safety management program (a)
- CLO-2 Developing policies and procedures for occupational safety management (b)
- CLO-3 Understanding enterprise risk management and occupational safety (cj)
- CLO-4 Understanding Comprehensive risk assessment for the occupational safety manager (d)
- CLO-4 Analyses the Occupational Safety Investigation (e)
- CLO-5 Describe the Safety and Security management for chemical facilities (f)

Week	Course Contents
	Introduction to quality control
	Fundamentals of statistics for quality control
	The basic concepts for quality control
	Process Control using variables
	Process Control using attributes
	Process capability
	Designing the statistical process control system
	Quality improvement
	Quality costs
	Introduction to quality management
	Six-sigma process quality

Text book(s)

- Brauer, Roger (2006). Safety and Health for Engineers, 2nd Edition. New York: John Wiley & Sons. ISBN-13: 978-1118959459

Reference Book(s):

- Gayle Woodside and Dianna Kocurek, Environmental, Safety, and Health Engineering 1st Edition

Mode of Evaluation:

E-learning Class activities (On-line Quizzes, Assignments), MID - I, MID - II, Discussions / Attendance / Participation, Final Exam

Course Title	Senior Design II	**Coordinator**		Dr.	
Course Code	555-INE-2	**Credit Hrs.**	2	**Contact Hrs.**	2
Prerequisite	554-INE-2	**Level/Year**	9/5		

Course Objectives:

- To acquire job skills programs on the system using the computer in the lab.
- Using a practical model of the system in the lab if possible.
- Apply skills in writing the final report of the project in the form of integrated business

Teaching Method:

- Lectures, Training exercises (Tutorial + Labs, Reports for different subjects in this field)

Expected learning outcomes

CLO-1 Identify analysis and design of engineering integrated (a)
CLO-2 Train students to work in computer applications of mathematical simulation of the system designer and laboratory tests if necessary. (b)
CLO-3 Develop the skill to have it on the future application in the field of engineering work (c)

Week	Course Contents
	Students have to learn how to analyze and design an engineering integrated system using the principles and foundations
	Using engineering skills by the Capacitated during the years of study.
	The project report submitted in details for the steps of the student analysis and design achieved.
	Maps, graphics and engineering necessary to implement the system engineering designer.
	The student must demonstrate in the main subject when discussing the project a
	Foundations and architectural elements based upon his ability to work in the field of applied engineering in the future.
	Students have to learn how to analyze and design an engineering integrated system using the principles and foundations
	Using engineering skills apply and understand and fully absorb the principles.

Text book(s)

• No specific Books

Reference Book(s):

- No specific Books

Mode of Evaluation:

E-learning Class activities (On-line Quizzes, Assignments), MID - I, MID - II, Discussions / Attendance / Participation, Final Exam

Course Title	Professional and Health Law	**Coordinator**			
Course Code	562- INE-3	**Credit Hrs.**	3	**Contact Hrs.**	4
Prerequisite	NIL	**Level/Year**	10/5		

Course Objectives:

- Describe the History of Occupational Health, Field of Occupational and Environmental Engineering
- Explain the occupational safety and health, Occupational injuries, Occupational health disparities Workers' Compensation
- Able to define and understand the Workers' Compensation, Non-Occupational Disability Management, Ergonomics and Occupational Exposure Limits

Teaching Method:

- Mid-Term Exam
- Computer Based Presentation
- Short Exam
- Presentation of Report
- Homework Assessment
- Oral Exam

Expected learning outcomes

- CLO-1: Knowledge
- CLO-2: Cognitive Skills
- CLO-3: Interpersonal Skills & Responsibility
- CLO-4: Communication, Information Technology, Numerical
- CLO-5: Psychomotor

Week No.	Course Contents
	History of Occupational Health, Field of Occupational and Environmental Engineering,
	Introduction to the occupational safety and health, Occupational injuries
	Evaluation of Occupational health disparities Workers' Compensation, Workers' Compensation
	Non-Occupational Disability Management
	Ergonomics and Occupational Exposure Limits
	Physical/Energy Hazards (mechanical, noise, radiation, temperature, light, structures, electrical, fire, explosion, confined space)
	Laws of insurance and use of work equipment - Laws of personal protective equipment -
	Workplace, health, safety and welfare laws - Fire safety - first aids - Incident reports -

Text book(s):

- Cherilyn Tillman (2007), Principles of Occupational Health and Hygiene: An Introduction,1st Edition,[ISBN-13: 978-1741750584]
- Friend, M.A. and Kohn, J.P. (2016), Fundamentals of Occupational Safety and Health,5th Edition,[ISBN-13: 978-1605907062, ISBN-10: 1605907065]

Reference Book(s): • Marcelo M. Soares and Francisco Rebelo (2016),Ergonomics in Design: Methods and Techniques,[ISBN 9781498760706] • International Commission on Occupational Health l http://www.icoh.org.sg/ • American College of Occupational and Environmental Engineering l http://www.acoem.org/
Mode of Evaluation: 1. e-learning Class activities (On-line Quizzes, Assignments) 2. Major Exam- I 3. Major Exam- II 4. Discussions / Attendance / Participation 5. Final exam

Course Title	Advanced Logistics	**Coordinator**		Dr. M. S. Khan	
Course Code	552 -INE-3	**Credit Hrs.**	3	**Contact Hrs.**	4
Prerequisite	NIL	**Level/Year**	10/5		

Course Objectives:

- To develop a deeper understanding of logistics problems, including design and operational problems;
- To develop skill in employing tools such as statistics, optimization, and probability models to address logistics problems;
- To be aware of practical problems in logistics management and its probable solution using industrial engineering tools.

Teaching Method:

- Mid-Term Exam
- Computer Based Presentation
- Short Exam
- Presentation of Report
- Homework Assessment
- Oral Exam

Expected learning outcomes

- CLO-1: Knowledge
- CLO-2: Cognitive Skills
- CLO-3: Interpersonal Skills & Responsibility
- CLO-4: Communication, Information Technology, Numerical
- CLO-5: Psychomotor

Week No.	**Course Contents**
	Less-than-truckload transportation (a) Traveling salesman, (b) Node routing, (c) Arc routing, (d) Inventory routing, (e) Terminal design and operations
	Truckload transportation, Network flow applications and Logistics network design
	Various modes of transportations i.e. Water transportation, Rail transportation, Air Transportation
	Logistics Applications for instance Humanitarian logistics, Disaster management logistics, International logistics
	Regulation and other legal issues and Closed-loop supply chains
	Outsourcing and its management
	Procurement and auctions
	Revenue management

Text book(s):

- Schönsleben, P. (2011), Integral Logistics Management: Operations and Supply Chain Management Within and Across Companies, 4th Edition, Auerbach Publications.

Reference Book(s):

- Wood,D.F.,Barone,A.,Murphy,P. and Wardlow,D.L.(2002) International Logistics 2nd Edition, ISBN-13: 978-0814406663

Mode of Evaluation:

6. e-learning Class activities (On-line Quizzes, Assignments) 7. Major Exam- I 8. Major Exam- II 9. Discussions / Attendance / Participation 10. Final exam

Advanced Course Title	Advanced Ergonomics	**Coordinator**			
Course Code	461-INE-3	**Credit Hrs.**	3	**Contact Hrs.**	3
Prerequisite	-	**Level/Year**	9/5		

Course Objectives:

- Identify Muscle types and joints structures to study their pain and stress formation
- Awareness of functional anatomy of the human body.
- Understanding to carry out the calculation for Engineering anthropometry

Teaching Method:

- Lectures, Training exercises (Tutorial + Labs, Reports for different subjects in this field)

Expected learning outcomes

- CLO-1 Understand safety and planning (a)
- CLO-2 Awareness of functional anatomy of the human body (b)
- CLO-3 Understanding to carry out the calculation for Engineering anthropometry (c)

Week	Course Contents
	Study of Human body, Mind, Senses
	Study of effective and non-effective ergonomic models.
	Study of ergonomic principles with reference to the workplace.
	Comprehensive study of ergonomics in workplace
	Design and evaluation of ergonomic systems in Industrial environment
	Study of environmental factors that affect the human body,
	Study of Biomechanics and Psychophysics of Manual Strength Design
	Study human interaction and relationships.

Text book(s)

- Kroemer, K., Kroemer, H., and Kroemer-Elbert, K. (2001). Ergonomics: How to design for ease and efficiency (2nd ed.).Upper Saddle River, NJ: Prentice Hall,[ISBN-13: 978-0137524785,ISBN-10: 0137524781]
- Stephan A. Konz and Steven Johnson (2000),Work Design: Industrial Ergonomics 5th Edition,[ISBN-13: 978-1890871079,ISBN-10: 1890871079]

Reference Book(s):

- Kroemer, K., Kroemer, H., and Kroemer-Elbert, K. (2001). Ergonomics: How to design for ease and efficiency (2nd ed.).Upper Saddle River, NJ: Prentice Hall,[ISBN-13: 978-0137524785,ISBN-10: 0137524781]
- Stephan A. Konz and Steven Johnson (2000),Work Design: Industrial Ergonomics 5th Edition,[ISBN-13: 978-1890871079,ISBN-10: 1890871079]

Mode of Evaluation:

E-learning Class activities (On-line Quizzes, Assignments), MID - I, MID - II, Discussions / Attendance / Participation, Final Exam

Course Title	Safety Systems	**Coordinator**			
Course Code	565-INE-3	**Credit Hrs.**	3	**Contact Hrs.**	3
Prerequisite	-	**Level/Year**	9/5		

Course Objectives:

- Managing safety in work place
- Proper planning of safety programs
- Theoretical knowledge to understand worker health and exposure to hazards

Teaching Method:

- Lectures, Training exercises (Tutorial + Labs, Reports for different subjects in this field)

Expected learning outcomes

- CLO-1 Understand safety and planning (a)
- CLO-2 Understand Student awareness of safety in industries (b)
- CLO-3 Describe the need of safety programs (c)

Week	Course Contents
	Studying the safety at work, Application of Ergonomics to safety, and analyze industrial hazards
	Studying the various safety measures, industrial accidents, environmental factors
	Studying various industrial waste and treatment
	Studying the Occupational health, Occupational Health problems
	Studying the Industrial Fatigue, Job safety Analysis, Promoting a positive health and safety culture
	Studying the ergonomics and its importance in system design
	Job safety Analysis, Promoting a positive health and safety culture
	Studying the safety at work, Application of Ergonomics to safety, and analyze industrial hazards

Text book(s)

- Hughes,P. and Ferrett,Ed, Introduction to Health and Safety at Work : For the NEBOSH National General Certificate in Occupational Health and Safety,6th Edition,2015, ,[ISBN13 9780415723084]
- Ed Ferrett, International Health & Safety at Work Revision Guide : For the NEBOSH International General Certificate in Occupational Health and Safety,2015 [ISBN13 9781138916760]

Reference Book(s):

- Barbara A. Plog, Patricia J. Quinlan, Fundamental of industrial hygiene, occupational health and safety,2002

Mode of Evaluation:

E-learning Class activities (On-line Quizzes, Assignments), MID - I, MID - II, Discussions / Attendance / Participation, Final Exam