المملكة العربية السعودية
المؤسسة العامة للتدريب التقني والمهني
الإدارة العامة لتصميم وتطوير المناهج

الكليات التقنية

CURRICULUM
FOR
Department:
Chemical Technology
Major:
Chemical Production

Program Description:

This curriculum was designed as to match the local labor markets needs and it is based on the National Professional Standards for Chemical Production Technicians. The curriculum includes training on the general skills in English, mathematics, and computer and human communication methods and dealing with others. It also includes training in basic skills in computers and operating systems and awareness of the trainee on the importance of safety tools and how to apply them, in addition to specialized skills in the field of chemical production such as those related to the chemical industry and energy. The curriculum also keeps pace with the rapid development in the field of chemical production and the needs of the industrial market. The focus during training will be on the practical side and link it to theoretical information in most of the specialized courses through intensive basic practical training and the application of a cooperative training program with sectors related to the trainee's field of study. The duration of the program is 1534 hours of training in addition to 420 hours of training in the labor market. The graduate of this department is awarded the Intermediate University Degree in the field of chemical production. The graduate is expected to work in areas related to chemical production as chemical equipment operator.

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Seventh Trimester								
	Course Code	Course Name	Prereq	No. of Units				
				CRH	L	P	T	CTH
1	IC 305	Islamic studies (3)		2	2	0	0	2
2	MATH 325	Mathematics (3)		4	3	2	1	6
3	PHYS 325	Physics (2)		4	3	2	0	5
4	CMT 385	Advanced Computer Applications		2	0	4	0	4
5	ENG 305	English language (1)		2	2	0	2	4
6	CHE 315	Chemical engineering calculations		3	3	0	1	4
Total				17	13	8	4	25
L = Lecture Hours, P = Workshop/Laboratory Hours, T = Tutorial Hours								

Eighth Trimester								
	Course Code	Course Name	Prereq	No. of Units				
				CRH	L	P	T	CTH
1	ARAB 305	Arabic (2)		2	2	0	0	2
2	MATH 326	Mathematics (4)		4	3	2	1	6
3	ENG 306	English language (2)		2	2	0	2	4
4	CMT 325	Computer Programming		3	2	2	0	4
5	CHE 375	Applied mass transfer	CHE 315	4	3	2	0	5
6	CHE 355	Thermodynamics	CHE 315	3	3	0	0	3
Total				18	15	6	3	24
L = Lecture Hours, P = Workshop/Laboratory Hours, T = Tutorial Hours								

Ninth Trimester								
	Course Code	Course Name	Prereq	No. of Units				
				CRH	L	P	T	CTH
1	ENG 307	English language (3)		2	2	0	2	4
2	GS 335	Introduction to Management & Leadership		2	2	0	2	4
3	GS 336	Communication Skills		2	2	0	2	4
4	CHE 377	Chemical reaction engineering		3	2	2	0	4
5	CHE 357	Petrochemicals industries		3	3	0	0	3
6	CHE 365	Applied materials science& corrosion		3	3	0	0	3
Total				15	14	2	6	22
L = Lecture Hours, P = Workshop/Laboratory Hours, T = Tutorial Hours								

Tenth Trimester								
	Course Code	Course Name	Prereq	No. of Units				
				CRH	L	P	T	CTH
1	ENG 308	English language (4)		2	2	0	2	4
2	GS 437	Management of Engineering Projects		3	3	0	2	5
3	STAT 425	Statistics & Engineering Probabilities		4	3	2	1	6
4	CHE 475	Polymer engineering		3	2	2	0	4
5	CHE 468	Water treatment		2	2	0	0	2
6	CHE 495	Project (1)		2	0	4	0	4
Total				16	12	8	5	25
L = Lecture Hours, P = Workshop/Laboratory Hours, T = Tutorial Hours								

Eleventh Trimester								
	Course Code	Course Name	Prereq	No. of Units				
				CRH	L	P	T	CTH
1	ENG 309	English language (5)		2	2	0	2	4
2	GS 438	Quality Tools & Applications		3	3	0	2	5
3	GS 439	Engineering Economy		2	2	0	0	2
4	CHE 476	Process control		3	2	2	0	4
5	CHE 467	Plant design& Economics		3	3	0	0	3
6	CHE 496	Project (2)	CHE 495	2	0	4	0	4
Total				15	12	6	4	22
L = Lecture Hours, P = Workshop/Laboratory Hours, T = Tutorial Hours								

Twelfth Trimester								
	Course Code	Course Name	Prereq	No. of Units				
				CRH	L	P	T	CTH
1	CHE 499	Co-operating Training	Pass all Courses	4				
Total				85	66	30	22	118
The total training hours (118X13) + 420				1954				
L = Lecture Hours, P = Workshop/Laboratory Hours, T = Tutorial Hours								

Brief description

CHE 315 Chemical Engineering Calculations:

The course aims toacquiretraineebasicskillstodoprinciplestechnicalchemicalcalculations. The coursesubmits detailed explanation of theunits of measurementsystemsanddimensionsused in industrial processes. In addition, itgivesthetraineetheabilitytodealwithprocesses variablesandhowtocalculatethechemicalcompositionofthemixturesandsolutions.Also it provides afullexplanationof the laws ofmaterial and energybalanceanditsapplicationsonindustrial units whether singleormultiple. Thecoursealsohelpsthetraineetounderstandandaccommodateotherspecialized courses.

CHE 355 Thermodynamics:

This course aims toprovidethetraineewiththe basic conceptsofthermodynamicsanditsapplications. It explainsconceptofheat,work,andinternalenergyandshowstherelationshipbetweenthem. In addition, itprovidesthetraineeadetailedexplanationofthe first law ofthermodynamicsanditsapplicationsondifferentsystems. Alsoexplains the second law ofthermodynamicsanditsapplicationsanditsrelationshipwiththefirstlawof thermodynamics. It discusses alsosomesteamcyclesanditsindustrialapplications.

CHE 377 Chemical Reaction Engineering:

This course includes the following: Mole Balances, Conversion and Reactor Sizing, Rate laws and Stoichiometry, Isothermal Reactor Design, Collection and Analysis of Rate data, Nonisothermal Reactor Design, Catalysis and catalytic reaction.

CHE 357 Petrochemicals Engineering:

This course introduces the student to the various processes involved in the technology of petrochemicals production, the raw materials used, their composition, and processing. It also deals with chemical reactions and conversion processes that produce the precursors, and intermediates needed for further processing into petrochemicals. The production of selected petrochemicals, along with a local case study, will be covered with emphasis on unit processes and operations employed. The course is supported by laboratory experiments.

CHE 365 Applied Materials science & Corrosion:

This course focuses on basic elements of materials science which relate the materials properties and types to the microscopic behavior atoms .

CHE 375 Applied Mass Transfer:

This course introduces the student to basic principles of mass transfer operations and their applications in the chemical industry, such as diffusion, absorption, extraction, distillation, evaporation, drying, fluidization, size reduction, and mechanical separations. Description of the equipments used for the above operations, is also dealt with. This course is supported by laboratory experiments and exercise.

CHE 475 Polymer Engineering:

Polymer science is considered in present-day an important science in the engineering and chemical fields, due to their economic impact and various applications. This course provides the trainee with the basic topics of polymer engineering at the rate of two hours per week. The trainee is introduced through this course on the chemistry of polymers and polymer molecules and the mechanism of their reactions, and also studies their method of manufacture and their finished products. Also through the study of physical, chemical and mechanical properties, the trainee cancompare the different types of polymers and their industrial applications.

CHE 468 Water Treatment:

This course aims to give the trainee the basic skills for the treatment of wastewaters. In this course training will be carried through theoretical information by two lectures per week in addition to training on the following subjects:introduction to pollution, water pollution, wastewater treatment and uses of treated waters.

CHE 476 Process Control:

The aim of this course is to expose students to the concepts of dynamic behavior, physical and empirical modeling, computer simulation, measurement and control technology, basic control concepts, feedback, feed-forward and stability. These are important for understanding of many complex systems of interest in chemical engineering and also to be able to design and operate modem plants. It includes an overview of process control system design with some illustrative examples and theoretical models of chemical processes. Dynamic behavior of processes and feedback control strategies are also dealt with. Furthermore, frequency response methods also covered. Performance of laboratory experiments is a component of this course to reinforce the students understanding of fundamental principles of process dynamics and control.

CHE 495 Project(1):

CHE 467 Plant design & Economics:

The course aims at giving the trainee the basic skills to deal with the economics of optimal chemical processes where they will be trained on the steps for project design and industrial development. The trainee will learn the general points that he should take into account when designing any project such as security, safety and environmental protection from pollution and provide the necessary services for the project and other considerations. Training will be performed on the estimate of the cost of the project at all stages after taking a general idea of accounting. This course will present a comprehensive study on the process profitability in general and investment costs and appropriate alternatives. The trainee will also have a clear and enough view for optimal design of equipment used in the factory and find the optimum method to choose necessary materials for manufacturing.

Courses description

Department	General Study	**Major**	All Majors
Course Name	Arabic 2	**Course Code**	ARB 305
Prerequisites		**Credit Hours *(L,W,T)***	2 (2,0,0)

Course description :

This course concentrates on improving the advance skills of arabic composition of technical colleges students according to their needs and knowledge. It enables them to acquire enough knowledge of types of writing in Arabic. It also gives the theoretical description and practical training of the basic types : summarizing, report, and adminstrative message,..etc. The course also intends to introduce dictative and grammatic subjects to solve the problems of writing and the common mistakes in composition with training on them to change them to acquired linguistic experiences.

Topics :

- Building elements of the text.
- Types of functional writing.
- Types of technical writing.
- Writing mistakes.

Textbook :

كتاب: " التحرير الكتابي" للمؤلفين : د. حمدان الزهراني، د. فهد اللهيبي، د. سعد المطرفي . دار النشر :دار حافظ بجدة

Department	General Study	**Major**	All Majors
Course Name	Islamic Culture 3	**Course Code**	ISL 305
Prerequisites		**Credit Hours** *(L,W,T)*	2 (2,0,0)

Course description :

This course covers principle areas of Islam and Contemporary Issues such as islam systems (the aims of Islam, profession in Islam , and human right) considering to the determination of the general objectives of profession conception , the purposes, and the principles that islam brought, concentrating on what distinguishes islam in its organization with respect to its completeness, its detailing, and its linking between the purposes of sharia and what it brought as a social and economic system

Topics :

- Introduction to assets approach Sunnis.
- profession in Islam.
- Human Right in Islam.
- Suspicious cases in Human Right and response.

Textbook :

المدخل الى الثقافة الإسلامية – جامعة الملك سعود

Department	General Study	**Major**	All Majors
Course Name	Advance Computer Applications	**Course Code**	CMT 385
Prerequisites		**Credit Hours** *(L,W,T)*	2 (0,4,0)

Course description :

This course designed to give the student an advance skill of the Microsoft Word, Microsoft Excel and Microsoft Project. The student has to know how to use the advance option and create a professional document.

Topics :

- Microsoft Word : Use advance option and inset it inside the document
- Microsoft Excel : Use the high level option with workbooks
- Microsoft Project : Give a brief knowledge about how the student use the Microsoft Project

Experiments: if applicable it will support the theoretical topics.

References :

- Microsoft MOS

Detailed of practicals Contents			
Week No	**Contents**	**material**	**Hours**
1	Create new documents apply templates	Microsoft Word	**4**
2	Inserting special characters (©, ™, £) Configure AutoCorrect Options Inserting Special Characters Using AutoCorrect Disabling AutoCorrect		**4**
3	Record simple macros Assign shortcut keys Manage macro security		**4**
4	Create new workbooks using templates Select a Template from the New Tab Search for Additional Templates	Microsoft Excel	**4**
5	Display dates and times with functions Summarize data with functions Use a financial function Use formulas to create subtotals Uncover formula errors		**4**
6	Demonstrate how to apply the SUM function Demonstrate how to apply the COUNT function Demonstrate how to apply the AVERAGE function Demonstrate how to apply the MIN and MAX functions		**4**
7	Import files Set data validation Create outlines Collapse groups of data in outlines Filter records Change the sort order Remove duplicates Manage macro security		**4**
8	Navigate in Microsoft Project Create a Project Schedule Define Project Calendars Enter Tasks and Task Details Organize Tasks into Phases Link Tasks Document Tasks	Microsoft Project	**4**

	Review the Project Schedule's Duration		
9	Establish people resources Establish equipment resources Establish material resources Establish cost resources Establish resource pay rates Adjust resource working times Add resource notes	Microsoft Project	**4**
10	Assign work resources to tasks Add more work resource assignments to tasks Assign material resources to tasks Assign cost resources to tasks		**4**
11	Apply a task calendar to an individual task Change task types Split a task Establish recurring tasks Apply task constraints Review the project's critical path View resource allocations over time		**4**

Department	General Study	**Major**	All Majors
Course Name	Computer Programming	**Course Code**	CMT 325
Prerequisites		**Credit Hours** *(L,W,T)*	3 (2,2,0)

Course description :

The main purpose of this course is to help the trainees increase their programming and problem solving skills.

This course should provide trainees with basic Knowledge of C++-Programming, regarding syntax and applied practice, with a focus on object-oriented design principles.

Topics :

- Problem-Solving and Introduction programs and C++.
- Elementary programming.
- Selections.
- Mathematical Functions, Characters, and Strings.
- Loops.
- Functions.
- Arrays.
- Objects and classes.

Experiments: if applicable it will support the theoretical topics.

References :

- Y. Daniel Liang, Introduction to Programming with C++, 3/E.
- Gary J. Bronson, C++ for Engineers and Scientists, 3/E.

Detailed of Theoretical Contents			
	Contents	**Week no.**	**Hours**
1	**Problem-Solving and Introduction programs and C++:** - Algorithms and Flowchart. - Understand software development cycle. - Realize the fundamental of C ++.	**1**	**2**
2	**Elementary programming :** - Study basic data types, their declarations and initializations. - Characters, and Strings. - Use variables to store data.	**2**	**4**
3	**Selections :** - Implement selection control using if and switch statements - Combine conditions using logical operators - Write expressions using the conditional operator. - Format output using stream manipulators. - Examine the rules governing operator precedence and operator associativity .	**1**	**2**
4	**Loops:** - Write loops using do-while, while and for statements. - Control a loop with the user confirmation or a sentinel value. - Write nested loops. - Learn the techniques for minimizing numerical errors. - Implement program control with break and continue .	**1**	**2**
5	**Function basics:** - Mathematical Functions. - Define and invoke different types of functions. - Use function prototypes for function headers. - Know how to pass arguments. - Create header files for reusing functions. - Develop functions for various tasks - Develop applications using C++ functions .	**2**	**4**
6	**Advanced function feature:** - Experience advanced topics on pass-by-value, pass-by-reference. - Understand the difference between them. - Determine the scope of local and global variables. - Define functions with default arguments. - Improve runtime efficiency by using inline functions .	**1**	**2**
7	**Arrays** : - Understand the necessity of an array in programming. - Know how to declare and initialize an array.	**2**	**4**

	- Program common array operations. - Develop and invoke functions with array arguments. - Process string using C-strings .		
8	**Objects and classes:** - Describe objects and classes. - Create objects using constructors. - Distinguish between instance and static variables and functions. - Access data fields and invoke functions using the object member access operator. - Declare private data fields for data field encapsulation and make classes easy to maintain .	**2**	**4**
9	**Files and streams:** - Learn ifstream, ofstream, and fstream classes for processing and manipulating files. - Read and write data using the getline, get and put functions. - Study functions to test file existence and the end of a file. - Open a file for both input and output to update files .	**1**	**2**
Textbook:	Y. Daniel Liang, Introduction to Programming with C++, 3/E**.** Gary J. Bronson, C++ for Engineers and Scientists, 3/E.		

Detailed of practical Contents			
	Contents	**Week no.**	**Hours**
1	Algorithms and draw flowchart exercises.	**1**	**2**
2	Develop a simple C++ program for console output using Visual C++. Read input from keyboard. Program with assignment statements and expressions familiar with C++ documentation, programming style. Experience various errors and debug logic errors .	**2**	**4**
3	Training on Selections statements.	**1**	**2**
4	Training on looping statements.	**1**	**2**
5	Training on functions.	**3**	**6**
6	Training on Arrays .	**2**	**4**
8	Training on Objects and classes.	**2**	**4**
9	Training on Files and streams.	**1**	**2**
Textbook:	Y. Daniel Liang, Introduction to Programming with C++, 3/E.		

Department	All Departments	**Major**	All Majors
Course Name	English 1	**Course Code**	ENG 305
Prerequisites		**Credit Hours** *(L,W,T)*	2 (2,0,2)

Course description :

English 1 is reading course. It is about improving and empowering Student's reading. Through exposure to different types of reading and approach to reading, the learners learn the strategies and practice for strengthening comprehension skills, building vocabulary, and test preparation.

Topics :

- Reading for Pleasure:

lets students select their own reading materials to practice new strategies and broaden their vocabulary.

- Reading Comprehension Skills:

covers skimming, scanning, recognizing topics and main ideas, understanding sentences, and making inferences.

- Thinking Skills:

involves targeted practice in inference and analytic skills.

- Reading Faster:

helps students develop speed and flexibility in reading with high interest, short fiction and non-fiction selections.

- Reading Faster texts (which includes different types of reading) Fiction, Biography, Non-fiction

Experiments :if applicable it will support the theoretical topics.

References :

- Skillful Reading: A Text and Workbook for Students of English as a Second Language

by Amy L. Sonka , Elizabeth Whalley.

- Practice Makes Perfect Intermediate English Reading and Comprehension

byDiane Engelhardt

- NorthStar: Reading and Writing, Level 2, 3rd Edition

by Natasha Haugnes, Beth Maher

Detailed of Theoretical Contents			
	Contents	**Week no.**	**Hours**
1	Part 1- Extensive Reading	1	2
2	Part 2- Vocabulary Learning and Building	2-3	4
3	Part 3- Comprehension Skills	4	2
4	Previewing	5	2
5	Scanning	6	2
6	Making Inferences	7	2
7	Focusing on the Topic	8	2
8	Understanding Paragraphs	9	2
9	Identifying the Pattern	10	2
10	Thinking in English	11	2
11	Summarizing	12	2
12	Final Assessment	13	2
Textbook:	Reading Power 2 (4th Edition) [Paperback] Linda Jeffries, Beatrice S. Mikulecky Pearson Education ESL; •ISBN-10: 0138143889 •ISBN-13: 978-0138143886		

Department	All Departments	**Major**	All Majors
Course Name	English 2	**Course Code**	ENG 306
Prerequisites	English 1	**Credit Hours** *(L,W,T)*	2 (2,0,2)

Course description :

English 2 *is a reading course for intermediate students of English. It builds on high-interest, authentic reading passages that serve as springboards for reading skills development, vocabulary building, Language analysis, and thought-provoking discussions and writing.*

Topics :

- Usingcontext
- Skimming
- Topicvs.Mainidea
- Inferencing
- Using headings
- Usingheadings
- Usingcontext
- Reading Instructionalmaterials
- Findingdetails
- Main ideas
- Usingexamples

Experiments: if applicable it will support the theoretical topics.

References :

- Select Readings: Student Book Upper-Intermediate
by Linda Lee

- Academic Reading
by Kathleen T. McWhorter, Brette M Sember

Detailed of Theoretical Contents			
	Content	**Week no.**	**Hours**
1	Father teaches son a lesson	1	4
2	How to work In groups with classmates	2	4
3	An exchange student in the US	3	4
4	Disability leads to Success	4	4
5	The art of good speech making	5	4
6	The art of good speech making	6	4
7	An interview with Bill Gates about the future	7	4
8	Applying for effectively in	8	4
9	Spanish siesta tradition	9	4
10	How can the public be 'helped to understand I science?	10	4
11	Ways that geniuses think	11	4
Textbook:	Select readings intermediate by Linda Lee and Erik Gundersen. OXTORD UNIVERSITY PRESS ISBN 0-19-437475-0		

Department	All Departments	**Major**	All Majors
Course Name	English 3	**Course Code**	ELC 307
Prerequisites	English 2	**Credit Hours** *(L,W,T)*	2 (2,0,2)

Course description :

English 3 *is writing course. Itis an intermediate course for English language. It helps students to master the standard organisational patterns of the paragraph and the basic concepts of essay writing. It integrates the study of rhetorical patterns and the writing process with extensive practice in sentence structure and mechanics.*

Topics :

- Paragraph Format
- Narrative Paragraphs
- Paragraph Structure
- Descriptive Paragraphs
- logical Division of ideas
- ProcessParagraphs
- Comparison/ContrastParagraphs
- DefinitionParagraphs
- EssayOrganization
- Opinion Essays

Experiments: if applicable it will support the theoretical topics.

References :

- First Steps in Academic Writing , by Ann Hogue
- Academic Writing Student's Book , by Dorothy Zemach and Lisa Rumisek

Detailed of Theoretical Contents			
	Content	**Week**	**Hours**
1	Definition Paragraphs Paragraph 1: Paragraph 2: Sentence Structure Appositives and Adjective Clauses Appositives Adjective Clauses Complex Sentences with Adjective Clauses Subject Pronouns: who, which, that Object Pronouns: whom, which, that, and 0 (no pronoun) Clauses with when	1	4
2	Tim order Time Order Signal Sentence Structure Compound Sentences Coordinating Conjunctions Punctuation Three Comma Rules The Writing Process Freewriting Model: Freewriting	1	4
3	Three Parts of a Paragraph A Hawaiian Wedding The Topic Sentence Supporting Sentences The Concluding Sentence Punctuation Apostrophes The Writing Process Outlining Detailed Outlining	2	8
4	Model: Descriptive Paragraph Spatial Order Spatial Order Signals Topic Sentences for Descriptive Paragraphs Supporting Sentences for Descriptive Paragraphs Model: Descriptive Details Paragraph Unity Sentence Structure Model: Compound Sentences Compound Sentences Varying Sentence Openings Clustering	1	4

5	Logical Division of Ideas Paragraph Logical Division of Ideas Coherence Using Nouns and Pronouns Consistently Transition Signals Run-Ons and Comma Splices	1	4
6	Process Paragraph Time Order Time Order Signals Clauses and Complex Sentences Clauses Complex Sentences Subordinators	2	8
7	Comparison/Contrast Paragraphs Paragraph 1: Right Brain/Left Brain Paragraph 2: Two Job Applicants Block Organization Point-by-Point Organization Comparison/Contrast Signals Comparison Signals Contrast Signals	1	4
8	Definition Paragraphs Paragraph 1: Paragraph 2: Sentence Structure Appositives and Adjective Clauses Appositives Adjective Clauses Complex Sentences with Adjective Clauses Subject Pronouns: who, which, that Object Pronouns: whom, which, that, and 0 (no pronoun) Clauses with when	1	4
9	Three Parts of an Essay Essay Structure The Introductory Paragraph Body Paragraphs The Concluding Paragraph Transitions Between Paragraphs Essay Outlining Essay Outline Planning an Essay		

	Step 1 Prewriting 162 Step 2 Organizing Step 2A Group Ideas Logically Step 2B Make an Outline	2	8
10	Opinion Essay The Right to Die Organization The Introductory Paragraph Bogy Paragraphs The Concluding Paragraph Developing Supporting Details Quotations Rules for Using and Punctuating Quotations Statistics	1	4

Department	All Departments	**Major**	All Majors
Course Name	English 4	**Course Code**	ENG 308
Prerequisites	English 3	**Credit Hours** *(L,W,T)*	2 (2,0,2)

Course description :

English 4 *is a writing course .It* covers transactional writing versus academic writing, producing informative and persuasive documents through process writing, developing analytical writing techniques, constructing technical reports, and writing letters, memos, email and related forms. In addition, it addresses the task of formulating resumes and cover letters for employment.

Topics :

- Description of a mechanism
- Description of a process
- Proposals
- Feasibility report
- Laboratory report
- Business communications
- Resume and coverletters

References :

- Writing Academic English

by Alice Oshima, Ann Hogue

- Cambridge Academic English

By Martin Hewings, Michael McCarthy

Detailed of Theoretical Contents			
	Contents	**Week**	**Hours**
1	Ethical Considerations	1	2
2	Technical Definition		2
3	Descriptions of a Mechanism	2	2
4	Descriptions of a Process		2
5	Proposals	3	4
6	Progress Reports	4	4
7	Feasibility and Recommendation Reports	5	4
8	Laboratory and Project Reports	6	2
9	Instructions and Manuals		2
10	Research Reports	7	4
11	Abstracts and Summaries	8	2
12	Grammar, Style, and Punctuation		2
13	Documentation	9	4
14	Visuals	10	2
15	Electronic Publishing		2
16	Presentations and Briefings	11	4
17	Business Communications	12	4
18	Resumes, Cover Letters, and Interviews	13	2
Textbook:	Pocket Book of Technical Writing, 3rd,By Finkelstein, L., McGraw Hill, USA, 2008		

Department	All Departments	**Major**	All Majors
Course Name	English 5	**Course Code**	ENG 309
Prerequisites	English 4	**Credit Hours** *(L,W,T)*	2 (2,0,2)

Course description :

English 5 is a communication skill course. It is a course designed to develop students' oral, written, and interpersonal communication skills essential for life and work. Students will learn communication principles, strategies, and methods through discussions, exercises, and examples. They will be trained in how to communicate clearly and effectively in various social, business, and intercultural situations. In addition, they will learn and practice verbal, nonverbal, and electronic communication.

Topics :

- Whatis Communication؟
- Effective ListeningSkills
- Verbal Communication
- Communicating Over the Phone
- Nonverbal Communication
- Written Communication
- CommunicatingElectronically

Experiments: if applicable it will support the theoretical topics.

References :

- Guide to Presentations , by Lynn Russell, Mary Munter
- Technical Communication , by Mike Markel

Detailed of Theoretical Contents			
	Content	**Week**	**Hours**
1	Good Communication Skills Lead to Success Different Forms of Communication Communication Is a Learned Activity Communication in the Workplace	1	4
2	What Is Listening? Listening to Learn Listening to Evaluate Listening Effectively Listening at Work	1	4
3	Your Voice Is a Tool Good Grammar Counts Starting a Conversation Ending a Conversation Speaking to Different Audiences Verbal Communication in the Workplace	2	8
4	Effective Phone Communication Using the Telephone Directory Long-Distance, Toll-Free, and Other Calls Phone Communication in the Workplace Using a Cell Phone	1	4
5	Body Action Body Language How Culture Affects Nonverbal Communication	2	8
6	Why Is Writing Important? Personal Letters Business Letters Business Memos Thank-You Notes Invitations	2	8
7	Communicating with E-mail Just Fax It to Me Instant Messaging Text Messaging How Technology Is Changing Workplace Communication	3	12

Department	General Study	**Major**	All Majors
Course Name	Physics (2)	**Course Code**	PHY325
Prerequisites	General physics	**Credit Hours** *(L,W,T)*	4(3,2,0)

Course description :

The course enables students to gain theoretical and practical background in physics. The course includes the development of skills and understanding of basic principles of Physical measurements .The student has to know the basic notions of the electric circuits and basic electronic devices like resistors and transistors, the measurement of characteristics of electric signals and the use of basic instrumentation and to know how to analyze any electric circuit using the different methods of analysis.. Also this course is designed to give the student a basic knowledgein the theory of electricity, electrostatics and magnetism.

Topics :

- PhysicalMeasurements
- Direct-Current Circuits and Resistance
- AlternatingCurrent Circuit (AC Circuit)
- Electrostatics
- The magnetic field
- Faraday'slow of electromagnetic induction

Experiments: if applicable it will support the theoretical topics.

References :

- Microelectronics Digital and Analog Circuits and Systems – Jacob mill man- ISPN 0-07-042327. Update edition.
- Physics Principal and Problems- Robert B. Clark, Patrick Kenealy> ISBN 0-02826721-4.

Detailed of Theoretical Contents			
Chapter	**Contents**	**Week no.**	**Hours**
1	**Physical Measurements :** International System of Units, Base units, Derived Quantities, Derived units, Systems of units, Prefixes, Conversion between units, Fundamental Dimension, Derived dimension Dimensional Analysis, Dimensionally Homogeneous Equations, Examples and Problems.	**1-2**	**6**
2	**Direct-Current Circuits and Resistance:** Electric Current, Resistance and Ohm's Law, Energy and Power in Electric Circuits, Joule's Low, Resistors in Series and Parallel Kirchhoff's Rules, Circuits Containing Capacitors, Capacitors connected in series, Capacitors connected in parallel, RC Circuits, RC charging circuit, RC discharging circuit, Ammeters and Voltmeters, Examples and Problems	**3- 4 - 5**	**9**
3	**Alternating Current Circuit (AC Circuit):** AC source, Resistors in an AC circuit, rms current, rms voltage, Capacitors in an AC circuit, The capacitive reactance $X_{C,}$ Inductors in an AC circuit, The inductive reactance $X_{L,}$ The RLC series circuit, The impedance Z, The phase angle, The maximum voltages across the elements, Power in an AC circuit, Resonance in a series RLC circuit, The resonance frequency, The transformer, Examples and Problems	**6- 7 - 8**	**9**
4	**Electrostatics:** electric charge, Coulomb's low, The electric field due to a point charge, The electric potential due to a point charge, stored energy in a capacitor, dielectric materiel in capacitor, examples and problems	**9- 10**	**6**

5	**The magnetic field:** Magnetic field and magnetic field lines, Ampere's low: magnetic field due to a long straight wire, a circular conductor, a solenoid, Hall effect, Discovering of the electron and measuring e/m, The magnetic force, Examples and Problems **Faraday's low of electromagnetic induction**	**11- 12- 13**	**9**
Textbook:	1- Fundamentals of physics (extended edition) David Halliday Robert Resnick Gearal Walker John Wiley and Son , INC , ISBN -0 -471 – 57578-x. Fifth edition -1997 2- Foundations Of Physics for Technology Colleges and universities freshmen . Dr. Marwan A. Alfahha Third edition 2012		

Detailed of practicals Contents			
	Contents	**Week no.**	**Hours**
1	Electric Components/Measurements and Instruments	**1**	**2**
		2	**2**
2	Current-Voltage (I-V) characteristics Evaluation of two unknown resistances R_1 and R_2	**3**	**2**
		4	**2**
3	Evaluate the equivalent resistance of some resistors connected in series and in parallel.	**5**	**2**
		6	**2**
4	RC circuit :Charging and discharging a capacitor when switching DC on and off	**7**	**2**
		8	**2**
5	Oscillator and oscilloscope	**9**	**2**
		10	**2**
6	Determination of the specific charge of the electron	**11**	**2**
		12	**2**
7	Study of the deflection of electron in a magnetic field into a circular orbit	**13**	**2**
Textbook:			

Department	General Study	**Major**	All Majors
Course Name	Mathematics (3) Linear Algebra	**Course Code**	MAT 325
Prerequisites	General Math	**Credit Hours** *(L,W,T)*	4 (3,2,1)

Course description :

This course is designed to give the student a basic knowledge of the Complex numbers and its operations. The student has to know the basic notions of vector spaces and how to solve any linear systems of equations using Gauss-Jordan Elimination. Also this course is designed to give the student an introduction to the first and second order linear differential equations and to solve initial value problem by Laplace Transforms.

Topics :

- ComplexNumber
- Vectorsspaces
- Linearsystems of equations
- Introduction to differentialequation
- Laplace Transform

Experiments: if applicable it will support the theoretical topics.

References :

- C. Edward and D.Penny, Elementary Linear Algebra.
- John Auer, Linear Algebra with application
- Albert L.Rabenstion, elementarydifferentialequationwithLinearAlgebra

Detailed of Theoretical Contents			
	Contents	**Week no.**	**Hours**
1	Complex Number: Operation on complex number- Demoiver theorem- Solution of a quadratic equation	**1-2-3**	**18**
2	Vector spaces: Basic notions of vectors spaces- subspaces- Linear combination, linear independent, basis and dimension of vector spaces	**4-5-6**	**18**
3	Linear systems of equations: Gauss-Jordan elimination- Elementary row operations- reduced row echelon form- Solution of linear system by gauss- Jordan elimination	**7-8**	**12**
4	Introduction to differential equations: Some first order of differential equation-Second order linear differential equation	**9-10-11**	**18**
5	Laplace transforms: Solving initial value problem by Laplace transform	**12-13**	**12**
Textbook:	**C.Edward and D. penny, Elementary Linear Algebra**		

Department	General Study	**Major**	All Majors
Course Name	Mathematics (4) Discrete and Numerical Analysis	**Course Code**	MAT 326
Prerequisites	General Math	**Credit Hours** *(L,W,T)*	4 (3,2,1)

Course description :

This course is designed to give the student a basic knowledge of the Sequences and the Numerical series. The student has to know the basic notions of the numerical method and how to solve any linear or non linear equations using Newton-Raphson method . Also this course is designed to learning the student how to apply the Linear and Quadratic Lagrange interpolation and the Rectangular and Trapezoidal method for numerical integration. Further,this course gives to the students an introduction to Fourier series and Fourier transform.

Topics :

- Sequences
- NumericalSeries
- NumericalMethod
- Computer compilation
- Fourier Analysis

Experiments: if applicable it will support the theoretical topics.

References :

- C. Woodford,Chris Phillips, Numerical Methods with Worked Examples.
- T. W. Körner, Fourier analysis
    - PremKythe,Dongming Wei, An Introduction to Linear and Nonlinear Finite Element Analysis

Detailed of Theoretical Contents			
	Contents	**Week no.**	**Hours**
1	Sequences: Some important limits-Convergence and divergence - Monotonocity and boundedness of sequences.	**1-2-3**	**18**
2	Numerical Series: Convergence and divergence series- some usual series (Harmonic, Geometric and P-series)- Positive series (integral, ratio tests)- Positive series: Integral, ratio, root and comparison tests. Power series: Interval of convergence- representation of function. Maclaurin and Taylor series.	**4-5-6**	**18**
3	Numerical Method: Newton-Raphson method for solving linear or nonlinear equations. Interpolation: Linear and quadratic Lagrange interpolation. Numerical integration: Rectangular and Trapezoidal method. Some Application on MATLAB	**7-8-9-10**	**18**
4	Fourier Analysis: Fourier seris- Fourier transform	**11-12-13**	**9**
Textbook:	Keith E. Hirst,Keith Edwin Hirst, Numbers, Sequences and Series		

Department	General Study	**Major**	All Majors
Course Name	Engineering statistics and probability	**Course Code**	STA 425
Prerequisites	General Math	**Credit Hours** *(L,W,T)*	4 (3,2,1)

Course description :

This course is designed for students majoring in engineering of technology. Topics include: probability, random variables, discrete and continuous probability distributions, statistical process control, and parameters estimation.

Topics :

- Introduction to ProbabilityVectorsspaces
- Random variable and Probability Distributions
- SomeDiscreteProbability Distribution
- SomeContinuousProbability Distribution
- Introduction to statistics
- Parameter Estimation

Experiments: if applicable it will support the theoretical topics.

References :

- Ross, S. ,*A First Course in Probability*, Fifth Edition
- Devore, Jay L., *Probability and Statistics for Engineering and the Sciences*, Eighth Edition

Detailed of Theoretical Contents			
	Contents	**Week no.**	**Hours**
1	Introduction to Probability: Random Experiment - Sample space – Event – Counting Sample space – Probability of an Event - The Axioms of Probability – Conditional Probability – Independent Events	**1-2-3**	**18**
2	Random variable and Probability Distributions: Concept of a Random Variable - Discrete Probability Distribution-Continuous Probability Distribution - Mean and Variance of a Random Variable	**4-5-6**	**18**
3	Some Discrete Probability Distribution: Bernoulli Trials – Binomial Distribution – Poisson Distribution	**7-8**	**12**
4	Some Continuous Probability Distribution: Continuous Uniform Distribution – Normal Distribution – Exponential Distribution	**9-10-11**	**18**
5	Introduction to statistics and Parameter Estimation: Sampling Theory – Sample Distribution Function – Samples and Statistics – Methods of Estimation (Point , Interval) – Confidence Interval	**12-13**	**12**
Textbook:			

Department	General Study	**Major**	All Majors
Course Name	Introduction to management & leadership	**Course Code**	GMS 335
Prerequisites		**Credit Hours** *(L,W,T)*	2 (2,0,2)

Course description :

This course prepares students with a comprehensive introduction to effective management principles and conduct. It aims at providing students with an introduction to contemporary management concepts and skills, and encourages students to put these concepts and skills into practice. This course is an introduction to the management function. It will focus on the theory and fundamental concepts of management including planning, organization, leadership, and control. This class will review the evolution of management thought, function and practice and will stress current approaches and emerging concepts.

Topics :

- introduction to management
- integrativemanagerial issues
- Planning
- Organizing
- Leading
- controlling

Experiments : if applicable it will support the theoretical topics.

References :

- Robbins, Stephen P, and Coulter, Mary. (2012) Management, 11th Edition, Prentice Hall

Detailed of Theoretical Contents			
	Contents	**Week no.**	**Hours**
1	Effective Management for Managers Today - Introduction to Management and Organizations. Management Yesterday and Today. Organizational Culture and Environment: The Constraints. Social Responsibility and Managerial Ethics.	**4**	**8**
2	Management Functions and Techniques - Decision-Making: The Essence of the Manager's Job. Foundations of Planning, planning tools and techniques. Organizational Structure and Design. Human.	**3**	**6**
3	Resource Management. Managing Change and Innovation. Understanding Groups and Teams. Leadership skills. Foundations of Control. Operations and Supply Chain Management.	**2**	**4**
4	Contemporary Management Competencies - Time Management Skills. Effective Communication Skills. Problem Solving Skills. Crisis Management	**4**	**8**
Textbook:	Robbins, Stephen P, and Coulter, Mary. (2012) Management, 11th Edition, Prentice Hall		

Department	General Study	**Major**	All Majors
Course Name	Communication Skills	**Course Code**	GMS 336
Prerequisites		**Credit Hours** *(L,W,T)*	2 (2,0,2)

Course description :

This course is intended to provide the studentswithplainunderstandingofthekeysubjects, matters andideaseducativein the field of communication studies.

Topics :

- Communication Today.
- Reports and proposals.
- Nonverbal communication.
- Interpersonalskills
- Interpersonalskills
- Negotiationskills
- Conflict management
- Intercultural communication
- Organizational communication
- Public communication
- Team communication

Experiments: if applicable it will support the theoretical topics.

References:

- Communicating in the 21st Century, 3rd edition By Baden Eunson 2011 1149 pages ISBN: 978-1-742- 16617-9 John Wiley & Sons Limited Inc.

Detailed of practical's Contents			
	Contents	**Week no.**	**Hours**
1	Communication Today. Letters, emails and memos.	**1**	**2**
2	Reports and proposals. Academic writing the essay.	**2**	**2**
3	Nonverbal communication.	**3**	**2**
4	Interpersonal skills: 1- Emotional intelligence , Self- talk and	**4**	**2**
5	Interpersonal skills: 2- Listening, questioning and feed-back.	**5**	**2**
6	Negotiation skills	**6**	**2**
7	Conflict management *** Mid-term Exam	**7**	**2**
8	Intercultural communication	**8**	**2**
9	Organizational communication	**9**	**2**
10	Public communication	**10**	**2**
11	Team communication	**11**	**2**
Textbook:	Communicating in the 21st Century, 3rd edition By Baden Eunson 2011 1149 pages ISBN: 978-1-742- 16617-9 John Wiley & Sons Limited Inc.		

Detailed of Theoretical Contents			
	Contents	**Week no.**	**Hours**
1	Communicating in meetings	**12**	**2**
2	Employment communication and social media. *** Final Exam.	**13**	**2**
Textbook:	Communicating in the 21st Century, 3rd edition By Baden Eunson 2011 1149 pages ISBN: 978-1-742- 16617-9 John Wiley & Sons Limited Inc.		

Department	General Study	**Major**	All Majors
Course Name	Engineering Project Management	**Course Code**	GMS 437
Prerequisites		**Credit Hours** *(L,W,T)*	(3,0,2)3

Course description :

The Engineering Project Management Course is intended to help meet the requirements of industry by educating undergraduate engineering students to understand engineering projects, project organizations and project management methods. Students completing this course will be able to work effectively in multidisciplinary engineering projects immediately after completion and to advance more rapidly within the project management organization and profession. The management of projects entails technical knowledge, engineering skills and management skills.

Topics :

- Introduction to project management
- Organizational influences and project life cycle.
- Project management processes
- Project integration management
- Project scope management.
- Project time management
- Project cost management.
- Project quality management
- Project humanresource management.
- Project communications management.
- Project risk management
- Project procurement management.
- Project stakeholder management

Experiments: if applicable it will support the theoretical topics.

References :

- A Guide to the Project Management Body of Knowledge (PMBOK® Guide), Fifth Edition, Project Management Institute , Project Management Institute © 2013

Detailed of Theoretical Contents			
	Contents	**Week no.**	**Hours**
1	1. Introduction to Project Management 1.1 History of Project Management 1.2 What is a Project? 1.2.1. The Relationships among Portfolios, Programs, and Projects. 1.3 What is Project Management? 1.4 Relationships among Portfolio Management, Program Management, Project Management, and Organizational Project Management 1.4.1 Program Management 1.4.2 Portfolio Management 1.4.3 Projects and Strategic Planning. 1.4.4 Project Management Office 1.5 Relationship between Project Management, Operations Management, and Organizational Strategy. 1.5.1 Operations and Project Management 1.5.2 Organizations and Project Management 1.6 Business Value 1.7 Role of the Project Manager 1.7.1 Responsibilities and Competencies of the Project Manager. 1.7.2 Interpersonal Skills of a Project Manager 1.8 Project Management Body of Knowledge	**1**	**3**

2	2. ORGANIZATIONAL INFLUENCES AND PROJECT LIFE CYCLE. 2.1 Organizational Influences on Project Management. 2.1.1 Organizational Cultures and Styles 2.1.2 Organizational Communications 2.1.3 Organizational Structures. 2.1.4 Organizational Process Assets. 2.1.5 Enterprise Environmental Factors 2.2 Project Stakeholders and Governance. 2.2.1 Project Stakeholders. 2.2.2 Project Governance. 2.2.3 Project Success. 2.3 Project Team 2.3.1 Composition of Project Teams 2.4 Project Life Cycle. 2.4.1 Characteristics of the Project Life Cycle 2.4.2 Project Phases.	**2**	**3**
3	3. PROJECT MANAGEMENT PROCESSES 3.1 Common Project Management Process Interactions. 3.2 Project Management Process Groups 3.3 Initiating Process Group 3.4 Planning Process Group 3.5 Executing Process Group 3.6 Monitoring and Controlling Process Group 3.7 Closing Process Group 3.8 Project Information	**3**	**3**

	3.9 Role of the Knowledge Areas		
4	4. PROJECT INTEGRATION MANAGEMENT 4.1 Develop Project Charter 4.2 Develop Project Management Plan. 4.3 Direct and Manage Project Work 4.4 Monitor and Control Project Work 4.5 Perform Integrated Change Control 4.6 Close Project or Phase	**4**	**3**
5	5. PROJECT SCOPE MANAGEMENT. 5.1 Plan Scope Management. 5.2 Collect Requirements 5.3 Define Scope 5.4 Create WBS 5.5 Validate Scope. 5.6 Control Scope	**5**	**3**
6	6. PROJECT TIME MANAGEMENT 6.1 Plan Schedule Management 6.2 Define Activities. 6.3 Sequence Activities. 6.4 Estimate Activity Resources. 6.5 Estimate Activity Durations. 6.6 Develop Schedule 6.7 Control Schedule.	**6**	**3**
7	7. PROJECT COST MANAGEMENT. 7.1 Plan Cost Management. 7.2 Estimate Costs.	**7**	**3**

	7.3 Determine Budget 7.4 Control Costs.		
8	8. PROJECT QUALITY MANAGEMENT 8.1 Plan Quality Management. 8.2 Perform Quality Assurance. 8.3 Control Quality.	**8**	**3**
9	9. PROJECT HUMAN RESOURCE MANAGEMENT. 9.1 Plan Human Resource Management. 9.2 Acquire Project Team 9.3 Develop Project Team 9.4 Manage Project Team	**9**	**3**
10	10. PROJECT COMMUNICATIONS MANAGEMENT. 10.1 Plan Communications Management. 10.2 Manage Communications. 10.3 Control Communications.	**10**	**3**
11	11. PROJECT RISK MANAGEMENT 11.1 Plan Risk Management. 11.2 Identify Risks. 11.3 Perform Qualitative Risk Analysis 11.4 Perform Quantitative Risk Analysis 11.5 Plan Risk Responses. 11.6 Control Risks.	**11**	**3**
12	12. PROJECT PROCUREMENT MANAGEMENT. 12.1 Plan Procurement Management. 12.2 Conduct Procurements	**12**	**3**

	12.3 Control Procurements. 12.4 Close Procurements		
13	13. PROJECT STAKEHOLDER MANAGEMENT 13.1 Identify Stakeholders 13.2 Plan Stakeholder Management. 13.3 Manage Stakeholder Engagement 13.4 Control Stakeholder Engagement.	**13**	**3**
Textbook:	A Guide to the Project Management Body of Knowledge (PMBOK® Guide), Fifth Edition, Project Management Institute, Project Management Institute © 2013.		

Detailed of Tatorial Contents			
	Contents	**Week no.**	**Hours**
1	Workshop: Forming Project Team and Project Selection	**1**	**2**
2	Workshop: Defining Project Business Case	**2**	**2**
3	Workshop: Developing Project Charter	**3**	**2**
4	Workshop: Project Configuration & Integration	**4**	**2**
5	Workshop: Collect Project Requirements, Creating Project Scope Statement, and Developing Project WBS	**5**	**2**
6	Workshop: Developing Project Schedule Using Project Management Tools	**6**	**2**
7	Workshop: Developing Project Budget and Cash flow	**7**	**2**
8	Workshop: Developing Project Quality Management Plan	**8**	**2**
9	Workshop: Developing Project HR Management Plan	**9**	**2**
10	Workshop: Developing Project Communications Management Plan	**10**	**2**
11	Workshop: Developing Project Risk Management Plan	**11**	**2**
12	Workshop: Developing Project Procurement Management Plan	**12**	**2**
13	Workshop: Developing Project Stakeholders Management Plan	**13**	**2**
Textbook:	A guide to the project management body of knowledge (pmbok® guide), fifth edition, project management institute, project management institute © 2013.		

Department	General Study	**Major**	All Majors
Course Name	Quality Tools and Applications	**Course Code**	GMS 438
Prerequisites		**Credit Hours** *(L,W,T)*	3 (3,0,2)

Course description :

This course gives the student basic foundation knowledge on Quality Management and its Tools and Applications, this course has been design to help the student to understand the quality concept as a major successful factor for the competitiveness at any sector.

By the end of this course, the student should know when, why and how to apply the quality concepts and tools successfully on his workplace.

Topics :

- Quality Management as a Concept
- Quality Management as a Culture
- Quality Management as a Strategic Planning
- Overview on Quality Management Tools
- ProblemsSolving and DecisionsMaking
- Optimizing and ControllingProcesses
- Implementing the Quality Management

Experiments:if applicable it will support the theoretical topics.

References :

- Introduction to Total Quality Management for Production, Processing and Services. (Sixth Edition)
- By David L. Goetsch and Stanley B. Davis

Detailed of Theoretical Contents			
	Contents	**Week no.**	**Hours**
1	Quality Management as a Concept: - How Quality is defined. - 8 principles of Total Quality Management. - Customer Satisfaction.	**1-3**	**15**
2	Quality Management as a Culture: - Understanding the quality culture VS. the traditional culture - Change management	**4-5**	**10**
3	Quality Management as a Strategic Planning: - Developing Plan (vision, mission and objectives) - Execution Plan (action plan, operations, KPIs)	**6-7**	**10**
4	Overview on Quality Management Tools: - The basic 7 tools for quality management	**8**	**5**
5	Problems Solving and Decisions Making: - Root Cause analysis techniques. - Decision making support techniques.	**9-10**	**10**
6	Optimizing and Controlling Processes: - Statistical Process Control (SPC) applications. - Control Charts.	**11-12**	**10**
7	Implementing the Quality Management: - Plan, Do, Check, Act (implementation project)	**13**	**5**
Textbook:	Quality Management Introduction to Total Quality Management for Production, Processing and Services. (Sixth Edition) By David L. Goetsch and Stanley B. Davis		

Department	General Study	**Major**	All Majors
Course Name	Engineering Economy	**Course Code**	GMS 439
Prerequisites		**Credit Hours** *(L,W,T)*	(2,0,2)2

Course description :

This course covers the basics of economic analysis from an engineering perspective. The concepts and techniques required to facilitate the evaluation and comparison of investment opportunities on an economic basis are presented, along with the corresponding Excel spreadsheet functions. Topics include: foundations of engineering economy, nominal and effective interest rates, engineering economy factors, present worth analysis, annual worth analysis, rate of return analysis, benefit/cost analysis and public sector economics, breakeven and payback analysis, and depreciation methods.

Topics:

- Foundations of Engineering Economy
- Engineering Economy Factor
- Nominal and Effective Interest Rates
- Present Worth (PW) Analysis
- Annual Worth (AW) Analysis
- Rate of Return (ROR) Analysis
- Benefit /Cost (B/C) Analysis and Public Sector Economics
- Breakeven and PaybackAnalysis

Experiments: if applicable it will support the theoretical topics.

References :

- William G. Sullivan, Elin M. Wicks, and C. Patrick Koelling, "Engineering Economy", 15th Edition, Printice Hall, ISBN 978-0132554909.
- Jerald J. Thuesen and W. J. Fabrycky, " Engineering Economy", 9th Edition, Printice Hall, ISBN 978-0130281289.

Details of Theoretical Contents			
	Contents	**Week no.**	**Hours**
1	**Foundations of Engineering Economy**: - Engineering economics: description and role in decision making process. - How to perform an Engineering Economy study. - Interest rate and rate of return. - Engineering economy terminology and symbols. - Cash flows: estimation and diagramming. - Economic Equivalence. - Simple and compound interests. - Meaning and use of Minimum Attractive Rate of Return (MARR). - Spreadsheets use in engineering economy.	**1-2**	**4**
2	**Engineering Economy Factors**: - Deriving and using the following factors: F/P, P/F, P/A, A/P, F/A, A/F, P/G, and A/G. - Linear interpolation of factors values. - Combining factors (Calculations pertaining to Shifted uniform series and randomly placed single amounts).	**3-4**	**4**
3	**Nominal and Effective Interest Rates**: - Difference between nominal and effective interest rates. - Calculating the effective interest rate. - Equivalence calculations under single and series cash flows in the case where payment and compounding periods are unequal.	**5**	**2**
4	**Present Worth (PW) Analysis**: - Formulating alternatives. - PW analysis of equal- life alternatives. - PW analysis of different- life alternatives. - Future worth analysis.	**6-7**	**3**
5	**Annual Worth (AW) Analysis**: - Advantages and uses of AW analysis. - Calculation of Capital Recovery (CR) and AW values. - Evaluating alternatives by AW analysis.	**8**	**2**

6	**Rate of Return (ROR) Analysis**: - Interpretation of a ROR value. - ROR calculation using a PW or AW relation. - Using ROR analysis to evaluate a single project. - Special considerations when using the ROR method. - Incremental ROR analysis and the issue of inconsistent rankings. - Using incremental ROR analysis to compare two alternatives. - Using incremental ROR analysis to compare several alternatives .	**9-10**	**5**
7	**Benefit /Cost (B/C) Analysis and Public Sector Economics**: - The fundamental differences between public and private sector projects. - B/C analysis for a single project.	**11**	**2**
8	**Breakeven and Payback Analysis**: - Breakeven analysis for a single project. - Payback analysis.	**12**	**2**
9	**Depreciation Methods**: - Definition of asset depreciation. - The Straight Line (SL) method. - The Declining Balance (DB) method. - The unit-of -production (UOP) method.	**13**	**2**

Textbook:	Leland Blank and Anthony Tarquin.," Engineering Economy", **7**th Edition, McGraw-Hill , ISBN 978 – 0073376301.

Department	Chemical Technology	**Major**	Chemical Production
Course Name	Chemical Engineering Calculations	**Course Code**	CHE 315
Prerequisites		**Credit Hours** (L,W,T)	3 (3,0,1)

Course description :

The course aims toacquiretrainee basicskillsto doprinciplestechnicalchemicalcalculations. The coursesubmits detailed explanation of theunits of measurementsystemsanddimensionsused in industrial processes. In addition, itgivesthetraineetheabilitytodealwithprocesses variablesandhowtocalculatethechemicalcompositionofthemixturesandsolutions. Alsoit provides a fullexplanationof the laws ofmaterial and energybalanceanditsapplicationsonindustrial units whether singleormultiple. Thecoursealsohelpsthetraineeto understandandaccommodateotherspecialized courses.

Topics:

- Units and dimensions
- Chemical compassion
- Material balances without chemical reaction
- Material balances with chemical reaction
- Energy balances

Experiments: if applicable it will support the course topics.

References :

- Richard M. Felder and Ronald W. Rousseau; "Elementary principle of chemical processes", John Wiley, 3th Edition, 2005
- David M. Himmelblau; "Basic Principles and Calculations in Chemical Engineering", McGraw-Hill, 7th Edition, 2004

Details of Theoretical Contents			
	Contents	**Week no.**	**Hours**
1	Basic chemical calculations: Units and Dimensions: Introduction – Systems of units – Conversion of units – Dimensional homogeneity Chemical Composition: Mole and molecular weight – Mass fraction and mass percent – Mole fraction and mole percent – Molecular weight of mixture	**1**	**4**
2	Material Balance: Material balance without chemical reaction: General concept of material balance – General low of material balance – Material balance in continuous processes at steady state for one unit - Material balance in continuous processes at steady state for multiple- units – Recycle and bypass calculations Material balance with chemical reaction: Stoichiometry – Limiting reactant – Excess reactants – Conversion – Multiple reactions – Yield – Selectivity – Recycle and purge	**2-7**	**24**
3	Energy balance: Types of energy – General low of energy balance – Energy balance on closed systems without chemical reaction – Energy balance on open systems without chemical reaction – Enthalpy calculation – Simultaneous material and energy balances – Heat of reaction – Heat of formation – Heat of combustion – Material balance with chemical reaction	**8-13**	**24**
Textbook:	Richard M. Felder and Ronald W. Rousseau; "Elementary principle of chemical processes", John Wiley, 3th Edition, 2005		

Department	Chemical Technology	**Major**	Chemical Production
Course Name	Thermodynamics	**Course Code**	CHE 355
Prerequisites	CHE 315	**Credit Hours** *(L,W,T)*	3 *(3,0,0)*

Course description :

This course aims toprovidethetraineewiththe basic conceptsof thermodynamicsanditsapplications. It explainsconceptofheat,work,andinternalenergyandshows therelationshipbetweenthem. In addition, itprovidesthetrainee adetailedexplanationofthe first law ofthermodynamicsanditsapplicationsondifferentsystems. Alsoexplains the second law ofthermodynamicsanditsapplicationsanditsrelationshipwiththefirstlawof thermodynamics. It discusses alsosomesteamcyclesandits industrialapplications.

Topics:

- Basic Thermodynamics Terminologies
- First law of thermodynamics
- Gases and single phase systems
- Second law of thermodynamics
- Steam tables and vapor cycles

Experiments: if applicable it will support the course topics.

References:

- R. Joel, " Basic Engineering Thermodynamics ", Dorling Kindersley (India), 5th Ed, 2008.
- J.M. Smith and H.C. Van Ness and M.M. Abbott, " Introduction to Chemical Engineering Thermodynamics ", McGraw-Hill, 6th Ed., 2005.
- Y.A. Cengel and M.A. Boles, " Thermodynamics: An Engineering Approach ", McGraw-Hill, 25th Ed., 2006.

Details of Theoretical Contents			
	Contents	**Week no.**	**Hours**
1	Basic concepts and Terminologies of thermodynamics: Introduction – Terminologies of thermodynamics – Relation between work and the pressure-volume diagram – Relationship between work and the polytrophic process – Relationship between work and the hyperbolic process – Statement of the Zeroth law of thermodynamics	**1-2**	**4**
2	First low of thermodynamics: Definition of closed- and open-systems – Energy forms in thermodynamic systems – Statement of the First law of Thermodynamics – Applications of the first law to a closed- system and an open-system	**3-4**	**4**
3	Gases and Single-Phase Systems: The gas laws and their applications – Statement of Joule's Law for a gas – Definitions of the specific heat capacities of a gas – Application of the Non-Flow Energy Equation to a gas (Subjected to constant volume heating - Subjected to constant pressure heating – Undergoing a polytrophic process – Under adiabatic conditions – Under isothermal conditions)	**5-7**	**6**
4	Second law of thermodynamics: The principle of the thermodynamic engine and calculation of thermal efficiency – Definition of reversible and irreversible processes – Statement of the Second Law of Thermodynamics – Relationship between the first law and the second law - The concept of Entropy and the Third Law of Thermodynamics – Entropy as a function of temperature and volume – Entropy as a function of temperature and pressure	**8-9**	**4**

5	Steam tables and Vapor Cycles: Definition of steam tables – Properties of saturated steam and superheated steam – Main features of the steam power plant – The Carnot steam power cycle and efficiency – Thru Rankine steam power cycle and efficiency – Basic definitions related to refrigeration processes – Characteristics and examples of refrigerants – The vapor compression refrigeration cycle	**10-13**	**8**
Textbook:	R. Joel, "Basic Engineering Thermodynamics ", Dorling Kindersley (India), 5th Ed, 2008.		

Department	Chemical Technology	**Major**	Chemical Production
Course Name	Applied mass transfer	**Course Code**	CHE 375
Prerequisites	CHE 315	**Credit Hours** *(L,W,T)*	4 *(3,2,0)*

Course description :

This course introduces the student to basic principles of mass transfer operations and their applications in the chemical industry, such as diffusion, absorption, extraction, distillation, evaporation, drying, fluidization, size reduction, and mechanical separations. Description of the equipments used for the above operations, is also dealt with. This course is supported by laboratory experiments and exercises.

Topics:

- Principles of Mass Transfer
- Evaporation
- Drying of process Materials
- Membrane Separation Processe
- Experiments

Experiments: if applicable it will support the course topics.

References:

- Transport Processes and Separation Process Principles , C.J. Geankoplis, Prentice , Hall, 4th Edition, 2003

Details of Theoretical Contents			
	Contents	**Week no.**	**Hours**
1	• introduction to Mass Transfer and Diffusion • Molecular Diffusion in Gases • Molecular Diffusion in Liquids • Molecular Diffusion in Biological Solutions and Gels • Molecular Diffusion in Solids • Numerical Methods for Steady- State Molecular Diffusion in Two Dimensions.	**1-3**	**9**
2	• Types of Evaporation Equipment and operation Methods • Overall Heat Transfer Coefficient in evaporators • Calculation Methods for Single-Effect Evaporators • Calculation Methods for Multiple-Effect Evaporators • Condensers for Evaporators • Evaporation of Biological Materials • Evaporation using Vapor Recompression	**4-6**	**9**
3	• Introduction and Methods of Drying • Equipment for Drying • Vapor Pressure of Water and Humidity • Equilibrium Moisture Content of Materials • Rate of – Drying Curves • Calculation Methods for Constant – Rate Drying Period • Calculation Methods for Falling – Rate Drying Period • Combined Convection ,Radiation ,and Conduction Heat Transfer in Constant – Rate Period • Drying in Falling Rate Period by Diffusion and Capillary Flow • Equations for Various Types of Dryers • Freeze – Drying of Biological Materials • Unsteady – State Thermal Processing and Sterilization of Biological Materials	**7-8**	**9**

4	• Introduction of types of Membrane Separation Processes • Liquid Permeation Membrane Separation Processes • Gas Permeation Membrane Processes • Complete-Mixing Model for Gas Separation by Membranes • Complete-Mixing Model for Multicomponent Mixtures • Cross – Flow model for Gas Separation by Membranes • Derivation of Equations for Countercurrent and Cocaaurrent Flow for Gas Separation by Membranes • Derivation of Finite-Difference Numerical Method for Asymmetric membranes	**10-13**	**12**
Textbook:	Transport Processes and Separation Process Principles , C.J. Geankoplis, Prentice , Hall, 4th Edition, 2003		

Details of Practical Contents			
	Contents	**Week no.**	**Hours**
1	1st Experiment: Verification of the Diffusion Phenomena	1-2	4
2	2nd Experiment: Determination of the Diffusivity of Selected Gases	3	2
3	3rd Experiment: Determination of the Diffusivity of Liquids	4	2
4	4th Experiment: Determination of the Liquid Film Mass Transfer Coefficient	5-6	4
5	5th Experiment: Verification of the Principles of Evaporation Using Saline Water	7	2
6	6th Experiment: Verification of the Principles of Steam Distillation Process	8	2
7	7th Experiment: Calculation of Selected Parameters of Distillation	9-10	4
8	8th Experiment: Verification of the Distribution Law of a Solute between Two Immiscible liquids	11-12	4
Textbook:	Transport Processes and Separation Process Principles , C.J. Geankoplis, Prentice , Hall, 4th Edition, 2003		

Department	Chemical Technology	**Major**	Chemical Production
Course Name	Chemical Reaction Engineering	**Course Code**	CHE 377
Prerequisites	CHE 315	**Credit Hours** *(L,W,T)*	3 *(2,2,0)*

Course description :

This course includes the following: Mole Balances, Conversion and Reactor Sizing, Rate laws and Stoichiometry, Isothermal Reactor Design, Collection and Analysis of Rate data, Nonisothermal Reactor Design, Catalysis and catalytic reaction.

Topics:

- Mole Balances
- Conversion and Reactor Sizing
- Rate laws and Stoichiometry
- Isothermal Reactor Design
- Nonisothermal Reactor Design
- Catalysis and Catalytic Reaction

Experiments: if applicable it will support the course topics.

References:

- H.ScottFogler ((Elements of Chemical Reaction Engineering))Prentice-Hall International Editions,1986

Details of Theoretical Contents			
	Contents	**Week no.**	**Hours**
1	Mole Balances (Rate law Definition .and Equations ,Batch Reactors and continuous Reactor)	**1**	2
2	Conversion and Reactor Sizing (Definition,Design Equation of Batch System and Flow system,Reactor in Series)	**2-3**	**4**
3	Rate laws and Stoichiometry (Basic Definitions ,Stoichiometry table	**4-5**	**4**
4	Isothermal Reactor Design (Design structure for Isothermal reactors, Scale-up of liquid phase, Design of CSTR	**6-8**	**6**
5	Nonisothermal Reactor Design (Energy Balance,nonisothermal continuous-flow reactors at steady state,unsteady state operation,multiple steady states).	**9-11**	**4**
6	Catalysis and Catalytic Reaction (Definitions and properties, steps in a catalytic reaction, Rate law synthesis,mechanism and rate limtingstep,catalyst reactivation)	**12-13**	**4**
Textbook:	H.ScottFogler ((Elements of Chemical Reaction Engineering))Prentice-Hall International Editions,1986		

Department	Chemical Technology	**Major**	Chemical Production
Course Name	Petrochemicals industries	**Course Code**	CHE 357
Prerequisites	CHE 315	**Credit Hours** (L,W,T)	3 (3,0,0)

Course description :

This course introduces the student to the various processes involved in the technology of petrochemicals production, the raw materials used, their composition, and processing. It also deals with chemical reactions and conversion processes that produce the precursors, and intermediates needed for further processing into petrochemicals. The production of selected petrochemicals, along with a local case study, will be covered with emphasis on unit processes and operations employed. The course is supported by laboratory experiments.

Topics:

- Raw Materials for Petrochemicals
- Hydrocarbon and Non-Hydrocarbon Intermediates for Petrochemicals
- Petrochemicals from Basic Raw Materials
- Synthesis Gas
- Ammonia
- Urea
- Ethylene and Polyethylene

Experiments: if applicable it will support the course topics.

References:

- Petrochemical Process Technology, by Mall I D, Macmillan, Inc., 1st Edition, 2008

Details of Theoretical Contents			
	Contents	**Week no.**	**Hours**
1	Raw materials for petrochemical 1. Introduction 2. Natural gas 3. Properties of natural gas 4. Natural gas treatment processes a. Sweetening process b. Demethanization process c. Fractionation process d. Refrigeration process 5. Crude oils a. Composition of crude oils b. Properties of crude oils c. Crude oil classification 6. Coal, oil shale, tar sand and gas hydrates	**1-3**	**9**
2	Hydrocarbon and Non-Hydrocarbon Intermediates for Petrochemicals processes 1. Physical separation processes 2. Conversion process 3. Production of olefins 4. Production of hydrogen 5. Production of sulfur 6. Production of carbon black	**4-5**	**6**
3	Petrochemicals from Basic Raw Materials 1. Petrochemicals based on methane 2. Petrochemicals based on ethylene 3. Petrochemicals based on propylene 4. Petrochemicals based on C_4 olefins and diolefins 5. Petrochemicals based on benzene toluene and xylene	**6-7**	**6**
4	Synthesis Gas 1. Introduction 2. Production processes a. Steam reforming process b. Partial combustion process 3. Economics of synthesis gas production	**8**	**3**

5	Ammonia 1. Introduction 2. Description of the production process of ammonia 3. Reaction and equilibrium conditions in ammonia synthesis 4. Effect of catalysis on the rate of reaction in ammonia synthesis 5. Design and operation of an ammonia synthesis converter 6. Uses and economics of ammonia production	**9-10**	**6**
6	Urea 1. Introduction 2. Description of the production process of urea 3. Major engineering problems associated with urea production 4. Growth of urea production and important uses	**11**	**3**
7	Ethylene and Polyethylene 1. Ethylene properties and sources 2. Manufacture of ethylene 3. Polythylene properties and basic reactions 4. Production processes of polythylene a. High-pressure polymerization process b. Medium – pressure polymerization process c. Low – pressure polymerization process 5. Comparison of polythelene polymerization processes 6. Common uses of polyethylene	**12-13**	**6**

Textbook:	Petrochemical Process Technology, by Mall I D, Macmillan, Inc., 1st Edition, 2008

Department	Chemical Technology	**Major**	Chemical Production
Course Name	Applied Materials Science& Corrosion	**Course Code**	CHE 365
Prerequisites		**Credit Hours** *(L,W,T)*	3 *(3,0,0)*

Course description :

This course focuses on basic elements of materials science which relate the materials properties and types to the microscopic behavior atoms .

Topics:

- Atomic Structure and Interatomic Bonding
- The Structure of Crystalline Solids
- Mechanical Properties of Metals
- Phase Diagram
- Applications and Processing of Metal Alloys

Experiments: if applicable it will support the course topics.

References:

- Materials Science and Engineering An Introduction, W.D. Jhon Wiley&Sons.2007

Details of Theoretical Contents			
	Contents	**Week no.**	**Hours**
1	Introduction Historical Perspective Materials Science and Engineering Why Study Materials Science and Engineering? Classification of Materials Advanced Materials Modern Materials' Needs	1	3
2	Atomic Structure and Interatomic Bonding Introduction ATOMIC STRUCTURE Fundamental Concepts Electrons in Atoms ATOMIC BONDING IN SOLIDS Bonding Forces and Energies Primary Interatomic Bonds Secondary Bonding or van der Waals Bonding Molecules	2-3	6
3	The Structure of Crystalline Solids Introduction CRYSTAL STRUCTURES Fundamental Concepts Metallic Crystal Structures Density Computations	4-5	6
4	Mechanical Properties of Metals Introduction Concepts of Stress and Strain ELASTIC DEFORMATION Stress-Strain Behavior Anelasticity Elastic Properties of Materials PLASTIC DEFORMATION Tensile Properties True Stress and Strain Elastic Recovery after Plastic Deformation Compressive, Shear, and Torsional Deformation Hardnessormation	6-7	6

5	Phase Diagram Introduction DEFINITIONS AND BASIC CONCEPTS Solubility Limit Phases Microstructure Phase Equilibria One-Component (or Unary) Phase Diagrams Equilibrium Diagrams Having Intermediate Phases or Compounds Eutectic and Peritectic Reactions Transformations The Gibbs Phase Rule THE IRON–CARBON SYSTEM The Iron–Iron Carbide (Fe–Fe3C) Phase Diagram Development of Microstructure in Iron–Carbon Alloys The Influence of Other Alloying Elements	8-10	9
6	Applications and Processing of Metal Alloys Introduction TYPES OF METAL ALLOYS Ferrous Alloys Nonferrous Alloys FABRICATION OF METALS Forming Operations Miscellaneous Techniques THERMAL PROCESSING OF METALS Heat Treatment of Steels	11-13	9
Textbook:	Materials Science and Engineering An Introduction, W.D. Jhon Wiley&Sons.2007		

Department	Chemical Technology	**Major**	Chemical Production
Course Name	Polymer Engineering	**Course Code**	CHE 475
Prerequisites		**Credit Hours** *(L,W,T)*	3 *(2,2,0)*

Course description :

Polymer science is considered in present-day an important science in the engineering and chemical fields, due to their economic impact and various applications. This course provides the trainee with the basic topics of polymer engineering at the rate of two hours per week. The trainee is introduced through this course on the chemistry of polymers and polymer molecules and the mechanism of their reactions, and also studies their method of manufacture and their finished products. Also through the study of physical, chemical and mechanical properties, the trainee cancompare the different types of polymers and their industrial applications.

Topics:

- Introduction to polymer science
- Molecular weight of polymers
- Polymers reactions
- Thermal transition in polymers
- Polymerization
- Polymers properties and their applications

Experiments: if applicable it will support the course topics.

References:

- Ebewele, R., " Polymer Science and Technology", CRC Press, Florida, 2000.

Details of Theoretical Contents			
	Contents	**Week no.**	**Hours**
1	Introduction to polymers • Importance of polymers • Definitions • Degree of polymerization • Copolymers • Types of polymers (thermoplastics, thermosets, elastomers)	1	2
2	Molecular weight of polymers • Effect of molecular weight • Calculation of molecular weight average • Practical measurement of molecular weight	2-3	4
3	Polymerization reactions • Step-growth reaction • Chain reaction • Copolymers reactions and factors affecting them • Homogeneous and heterogeneous polymerization	4-6	6
4	Thermal transitions in polymers • Glass transition temperature • Factors affecting glass transition temperature • Boiling point	7	2
5	Polymer processing • Injection molding • Blow molding • Rotational molding • Forming	8-10	6
6	Polymer properties and applications • Properties of thermoplastic • Examples and applications • Thermosets properties • Examples and applications • Elastomers properties • Examples and applications	11-13	6
Textbook:	Ebewele, R., " Polymer Science and Technology", CRC Press, Florida, 2000.		

Department	Chemical Technology	**Major**	Chemical Production
Course Name	Water Treatment	**Course Code**	CHE 368
Prerequisites		**Credit Hours** *(L,W,T)*	2 *(2,0,0)*

Course description :

This course aims to give the trainee the basic skills for the treatment of wastewaters. In this course training will be carried through theoretical information by two lectures per week in addition to training on the following subjects:introduction to pollution, water pollution, wastewater treatment and uses of treated waters.

Topics:

- Water pollution
- Wastewater treatment
- Design of wastewater station
- Disposal of the products of treatment
- Uses of treated water

Experiments: if applicable it will support the course topics.

References:

- Wastewater Engineering: Treatment and Reuse by George Tchobanoglous, Franklin L. Burton, and H. David Stensel, 2002

Details of Theoretical Contents			
	Contents	**Week no.**	**Hours**
1	**Water pollution** • Sources of water pollution • Wastewaters	**1**	**2**
2	**Philosophy of wastewater collection and treatment** • Planning and design of sewage • Philosophy of sewage treatment	**2-3**	**4**
3	**Primary treatment of wastewater** • Sedimentation	**4**	**2**
4	**Secondary treatment of wastewater** • Fundamentals of applied microbiology • Description of the activated sludge process • Design of activated sludge systems • The design of the aerator to the activated sludge process • Filtration by distillation and design fundamentals • Other air treatment systems • Fundamentals of anaerobic treatment • Design of anaerobic reactors • Design of UASB reactors	**5-7**	**6**
5	**Advanced treatment of wastewater** • Nitrification: Description of the process and design • Denitrification: Description of the process and design • Removal of phosphorus and other advanced treatment	**8-9**	**4**
6	**Residuals Management** • Management basics of remaining • Design of residual management operation	**10**	**2**
7	• **Design of wastewater treatment plant** • **Disposal of treatment products** • **Uses of treated wastewater**	**11-13**	**6**
Textbook:	Wastewater Engineering: Treatment and Reuse by George Tchobanoglous, Franklin L. Burton, and H. David Stensel, 2002		

Department	Chemical Technology	**Major**	Chemical Production
Course Name	Process control	**Course Code**	CHE 476
Prerequisites		**Credit Hours** (L,W,T)	3 (2,2,0)

Course description :

The aim of this course is to expose students to the concepts of dynamic behavior, physical and empirical modeling, computer simulation, measurement and control technology, basic control concepts, feedback, feed-forward and stability. These are important for understanding of many complex systems of interest in chemical engineering and also to be able to design and operate modem plants. It includes an overview of process control system design with some illustrative examples and theoretical models of chemical processes. Dynamic behavior of processes and feedback control strategies are also dealt with. Furthermore, frequency response methods also covered. Performance of laboratory experiments is a component of this course to reinforce the students understanding of fundamental principles of process dynamics and control.

Topics

- Introduction to Process Control
- Theoretical Models of Chemical Processes
- Laplace Transforms
- The Transfer Function and state-space models
- Dynamic Behavior of First-Order and Second-Order processes
- Dynamic Behavior and Stability of Closed-Loop Control Systems
- PID Controller Design, Tuning, and Troubleshooting
- Frequency Response Methods
- Control System Design Based on Frequency Response Analysis

Experiments: if applicable it will support the course topics.

References:

- Instrumentation for Process Measurement and Control, Norman A. Anderson, 3rd Ed., CRC Press LLC, 1998.
- Modern control Engineering, K. Ogata, 4th Edition, Prentice-Hall, Inc., 2002
- Design of Feedback Control Systems, R. T. Stefani, B. Shahian, and G. H. Hostetter, 4th Edition, Oxford Univ. Press. Inc., 2002

Details of Theoretical Contents			
	Contents	**Week no.**	**Hours**
1	**Introduction to Process Control** **1.** Representative process control problems **2.** Illustrative example of a blending process **3.** Classification of process control strategies **4.** Illustrative example of a distillation column **5.** The hierarchy of process control activities **6.** An overview of control system design	**1**	**2**
2	**Theoretical Models of Chemical Processes** **1.** The rationale for dynamic process models **2.** General modeling principles **3.** Degrees of freedom in modeling **4.** Dynamic models of representative processes **5.** Solution of dynamic models and the use of digital simulators	**2**	**2**
3	**Laplace Transforms** **1.** The Laplace transform of representative functions **2.** Solution of differential equations by Laplace transform techniques **3.** Partial fraction expansion **4.** Other Laplace transform properties 5. A transient response example	**3**	**2**
4	**The Transfer Function and state-space models** **1.** Development of transfer functions **1.** Properties of transfer functions **2.** Linearization of nonlinear models **3.** State-space and transfer function matrix models	**4-5**	**4**
5	**Dynamic Behavior of First-Order and Second-Order processes** **1.** Standard process inputs **2.** Response of first - order processes **3.** Response of integrating processes **4.** Response of second - order processes	**6**	**2**
6	**Dynamic Behavior and Stability of Closed-Loop Control Systems** **1.** Block diagram representation **2.** Closed-loop transfer functions **3.** Closed-loop responses of simple control systems	**7**	**2**

	4. Stability of closed-loop control systems **5.** Root locus diagrams		
7	**PID Controller Design, Tuning, and Troubleshooting** **1.** Performance criteria for closed-loop systems **2.** Model-based design methods **3.** Controller tuning relations **4.** Controllers with two degrees of freedom **5.** On-line controller tuning **6.** Guidelines for common control loops **7.** Troubleshooting control loops	**8-9**	**4**
8	**Frequency Response Methods** **1.** Sinusoidal forcing of a first-order process **2.** Sinusoidal forcing of an nth-order process **3.** Bode diagrams **4.** Frequency response characteristics of feedback controllers	**10**	**2**
9	**Control System Design Based on Frequency Response Analysis** **1.** Closed-loop behavior **2.** Bode stability criterion **3.** Nyquist stability criterion **4.** Gain and phase margins **5.** Closed-loop frequency response and sensitivity functions **6.** Robustness anaylsis of control systems	**11**	**2**
Textbook:	Instrumentation for Process Measurement and Control, Norman A. Anderson, 3rd Ed., CRC Press LLC, 1998.		

Details of Practical Contents			
	Contents	**Week no.**	**Hours**
1	Operation of the control manual valve and knowledge of its properties	**1**	**2**
2	Operation of an electric control valve	**2**	**2**
3	Determination of *Cv* flow coefficient of valves	**3**	**2**
4	Operation of engine valves and the study of its properties	**4**	**2**
5	Control of the liquid level in a tank using the two-mode gauging level (Control of pump work)	**5**	**2**
6	Control of the liquid level in a tank using the two-mode level gauge (Control in the work of input and output valves)	**6**	**2**
7	Study of the properties of the two-mode controller	**7-8**	**4**
8	Study of the properties of the proportional controller	**9-10**	**4**
9	Study of the properties of the proportional-differential controller	**11-12**	**4**
Textbook:			

Department	Chemical Technology	**Major**	Chemical Production
Course Name	Plant Design & Economics	**Course Code**	CHE 467
Prerequisites		**Credit Hours** (L,W,T)	3 (3,0,0)

Course description :

The course aims at giving the trainee the basic skills to deal with the economics of optimal chemical processes where they will be trained on the steps for project design and industrial development. The trainee will learn the general points that he should take into account when designing any project such as security, safety and environmental protection from pollution and provide the necessary services for the project and other considerations. Training will be performed on the estimate of the cost of the project at all stages after taking a general idea of accounting. This course will present a comprehensive study on the process profitability in general and investment costs and appropriate alternatives. The trainee will also have a clear and enough view for optimal design of equipment used in the factory and find the optimum method to choose necessary materials for manufacturing.

Topics:

- Process design development
- General design considerations
- Cost and asset accounting
- Cost estimation
- Interest and investment cost
- Depreciation
- Profitability, alternative investments and replacements
- Optimum design
- Materials and fabrication selection

Experiments: if applicable it will support the course topics.

References:

•Max S. Peters and Klaus D. Timmerhaus, "Plant Design and Economics for Chemical Engineers", 4th edition, McGraw – Hill, Inc., 1991.
•F. C. Jelen and J. H. Black, "Cost and Optimization Engineering", 3th edition, McGraw Hill, Inc., 1992.

Details of Theoretical Contents			
	Contents	**Week no.**	**Hours**
1	**Process design development** • Introduction • Design information from the literature • Flow diagrams • The preliminary design • Comparison of different processes • Equipment design and specifications	**1**	**3**
2	**General design considerations** • Health and safety hazards • Loss prevention • Environmental protection • Plant location • Plant layout • Plant operation and control • Utilities • Structural design • Storage • Materials handling	**2-3**	**6**
3	**Cost and asset accounting** • Outline of accounting procedure • Basic relationships in accounting • The balance sheet • The income statement • Maintaining accounting records • Cost accounting methods	**4**	**3**
4	**Cost estimation** • Cash flow for industrial operations • Factors affecting investment and production cost • Capital investments • Estimation of capital investment • Cost indexes • Cost factors in capital investments • Estimation of total production cost	**5**	**3**
5	**Interest and investment cost** • Types of interest • Nominal and effective interest rates • Continuous interest • Present worth and discount	**6**	**3**

	• Annuities • Relationships for continuous cash flow and continuous interest of importance for profitability analyses • Costs due on interest on investment		
6	**Depreciation** • Types of depreciation • Service life • Salvage value • Present value • Methods for determining depreciation	**7**	**3**
7	**Profitability, Alternative investments and replacements** • Profitability standards • Alternative investments • Replacements • Practical factors in alternative investment and replacement studies	**8-9**	**6**
8	**Optimum design** • Incremental costs • General procedure for determining optimum conditions • Comparison of graphical and analytical methods • The break-even chart for production schedule and its significance for optimum analysis • Optimum production rates in plant operations • Optimum conditions in cyclic operations • Fluid dynamics (optimum economic pipe diameter) • Heat transfer (optimum flow rate of cooling water in condenser) • Mass transfer (optimum reflux ratio)	**10-11**	**6**
9	**Materials and fabrication selection** • Materials of construction • Low and high temperature materials • Fabrication of equipment	**12-13**	**6**
Textbook:	Max S. Peters and Klaus D. Timmerhaus, "Plant Design and Economics for Chemical Engineers", 4th edition, McGraw – Hill, Inc., 1991.		