KING SAUD UNIVERSITY
COLLEGE OF ENGINEERING
CIVIL ENGINEERING DEPARTMENT
SURVEYING ENGINEERING PROGRAM

BACHELOR OF SCIENCE IN

SURVEYING ENGINEERING

Academic Plan

1439 H
2018 G

1. INTRODUCTION

The Civil Engineering Department is one of the earliest departments established in the Kingdom's universities. The department was established in 1382H.

There is no doubt that civil engineering plays a considerable role in driving urban development in the Kingdom of Saudi Arabia (KSA). The effect of the tasks done by civil engineers appear in various growth plans and engineering projects like design and construction of bridges roads, railways, airports, buildings, dams and drinking water, irrigation and drainage network systems. In addition to that the civil engineer plays role in engineering project managements and projects cost analysis.

On the other hand all these projects are related to earth surface and hence comes the role of the surveying engineer.

The Department of Civil Engineering offers two undergraduate programs, the civil engineering program and the surveying engineering program.

The B.Sc. Surveying Engineering program started in the academic year 1408/1409H as the unique program of its kind in the GCC universities. That is because the gulf region is passing a period of urban development which really needs the service of the surveying engineers that include planning, topographic studies and engineering projects layout on the earth surface.

Surveying engineers are needed in both government and private sectors. Governmental units include such Ministry of Municipality and Rural Affairs (MOMRA), Military Survey Department at the Ministry of Defense and Aviation, National Commission of surveying, General Commission for Survey as an example, while private sector include all those companies working in the field of cadastral, ground or aerial surveying, remote sensing and geographic information systems (GIS).

The program includes, in addition to the general courses shared with other engineering programs in the college of engineering, a number of special courses covering the following surveying specializations: Spatial Measurements, Geodesy, Photogrammetry and Remote Sensing, Development and Production of Maps, Geographic and Land Information Systems.

2. BACHELOR OF SCIENCE IN SURVEYING ENGINEERING PROGRAM

The B.Sc. in Surveying Engineering Program aims to prepare students to satisfy needs of the Kingdom of Saudi Arabia in executing the current huge urban development. The program covers courses related to spatial data collection such as remote sensing, GPS and GIS and those needed for execution of engineering projects like land surveying, geodesy and aerial surveying.

The Surveying engineering program is a five-year program (10 semesters) including a two-semester common first year.

Approved by: Chairman: ……………………………… Dean: ………………………………

2.1 Course Requirements (165 credit hours)

To complete the graduation requirements for a B.Sc. in Surveying Engineering, the students are required to successfully pass a total of **165** credit hours (Table 1) with a minimum GPA of 2.75 out of 5. These hours are divided into:

- **32** credit hours of the common first year (Table 2)

- **8** credit hours of University requirements (Table 3) of which:
    - 2 credit hours are compulsory (Table 3A);
    - 6 credit hours are elective to be taken from IC courses (Table 3B).

- **51** credit hours of college requirements (Table 4) of which:
    - 40 credit hours are compulsory courses for all engineering programs (Table 4A);
    - 9 credit hours of complementary courses for SEP (Table 4B);
    - 2 credit hours of free courses to be taken by the student from any college but not from his program (Table 4C).

- **74** credit hours of program requirements (Table 5) of which:
    - 46 credit hours are core courses (Table 5A),
    - 4 credit hours of graduation project (Table 5B),
    - 17 credit hours of courses from other programs (Table 5C),
    - 6 credit hours are program electives (Table 5D) which can be selected from the list of elective courses in (Table 5E).
    - 1 credit hour (NP, no-grade pass or fail) of practical training (Table 5F).
    - The program provides its students with a chance to register a zero credit hour course in research project (Table 5G). This course is NOT required for graduation.

2.2 Senior Graduation Project Requirements

The design project is divided into two parts (2 credit hours each). The student is eligible to register for Graduation Project-1 if he completes successfully at least 129 credit hours including CFY (or 97 credit hours excluding the CFY) and passes successfully all courses in levels 1-7. The Graduation Projects (1 and 2) can only be taken during the first and second semesters (not during summer semester).

2.3 Practical Training Requirements

Students in the program are required to complete 10 weeks of practical training in an area related to Surveying Engineering. Prior to undertaking the practical training program, the student must obtain the approval of the department and he must have completed, successfully, at least 110 credit hours including CFY (or 78 credit hours excluding the CFY). Students enrolling in the practical training program are not allowed to take simultaneously any course or the graduation project.

A typical plan of study for a B.Sc. in Surveying Engineering is presented in Table 6.

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Table 1: SUMMARY OF B.S. DEGREE REQUIREMENTS IN SURVEYING ENGINEERING

Requirements	Cr. Hr.	Description
Common First Year	**32**	General Chemistry (4) Differential Calculus (3) Statistics (3) English (12) Writing Skills (2) University Skills (3) IT Skills (3) Entrepreneurship (1) Health and Fitness (1)
University	**8**	**Islamic Studies**: Compulsory (2) Complementary (6)
College	**51**	Common (40) Complementary (6) free course (2)
Department	**74**	Core courses (46) Projects (4) SE Electives (6) Courses from other Programs (17) Practical training (1, NP) Research Project (0, NP)
Total	**165**	

Table 2: Common First Year (32 credit hours)

Level 1					Level 2			
Course Code	**Course Title**	**Cr. Hr. (X,Y,L)**	**Pre-requisite**		**Course Code**	**Course Title**	**Cr. Hr. (X,Y,L)**	**Pre-requisite**
ENGS 100	English language	6(6,9,0)			ENGS 110	English	6(6,9,0)	
MATH 101	Differential Calculus	3(3,1,0)			CUR 101	University Skills	3(3,0,0)	
ENT 101	Entrepreneurship	1(1,0,0)			CT 101	IT skills	3(0,0,6)	
CHEM 101	General Chemistry	4(3,0,2)			STAT 101	Introduction to Statistics	3(2,2,0)	
ARAB 100	Writing Skills	2(2,0,0)			EPH 101	Health Education & fitness	1(1,1,0)	
Total		**16**			**Total**		**16**	

(X,Y,L) X = Lectures; Y = Tutorials; L = Lab.

Table 3: UNIVERSITY REQUIREMENTS (TOTAL 8 CREDIT HOURS)

TABLE 3-A: COMPULSORY COURSES (2 CREDIT HOURS)

Course Code	Course Title	Cr. Hr.	Nature
IC 107	Ethics of the Profession	2	Compulsory
Total		**2**	

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TABLE 3-B: OPTIONAL COURSES (The student must choose 3 courses (6 hours) from the list below)

Course Code	Course Title	Cr. Hr.	Nature
IC 100	Studies in Prophet Biography	2	Optional
IC 101	Origins of Islamic Culture	2	Optional
IC 102	Family in Islam	2	Optional
IC 103	The Economic System in Islam	2	Optional
IC 104	The Political System in Islam	2	Optional
IC 105	Human Rights	2	Optional
IC 106	Medical Jurisprudence	2	Optional
IC 108	Contemporary Issues	2	Optional
IC 109	Role of Women in Development	2	Optional
	Total	**6**	

TABLE 4: COLLEGE REQUIREMENTS (51 CREDIT HOURS)

Table 4-A: COLLEGE COMPULSORY COURSES (40 CREDIT HOURS)

Course Code	Course Title	Cr. hr. (X,Y,L)	Pre-requisites
MATH 106	Integral Calculus	3 (3,2,0)	MATH 101
MATH 107	Vectors and Matrices	3 (3,2,0)	MATH 101
MATH 203	Calculus for Engineering Students	3 (3,2,0)	MATH 106; MATH 107
MATH 204	Differential Equations	3 (3,2,0)	MATH 203
PHYS 103	General Physics (1)	4 (3,0,2)	
PHYS 104	General Physics (2)	4 (3,0,2)	PHYS 103
ENGL 109	Language and Communication	2 (2,1,0)	
ENGL 110	Technical Writing	2 (2,1,0)	ENGL 109
GE 201	Statics	3 (3,1,0)	MATH 106; MATH 107
GE 104	Basics of Engineering Drawing	3 (2,0,2)	
GE 106	Introduction to Engineering Design	3 (2,1,2)	GE 104
GE 203	Engineering and Environment	2 (2,0,0)	CHEM 101; MATH 101
GE 402	Engineering Projects Management	3 (3,1,0)	
GE 403	Engineering Economy	2 (2,1,0)	
	Total	**40**	

(X,Y,L) X = Lectures;   Y = Tutorials;   L = Lab.

Table 4-B COLLEGE ADDITIONAL COURSES FOR SEP (9 CREDIT HOURS)

Course Code	Course Title	Cr. hr. (X,Y,L)	Pre-requisites
GE 209	Computer Programming	3 (2,0,2)	
MATH 254	Numerical Methods	3 (3,2,0)	MATH 107
GE 202	Dynamics	3(3,1,0)	GE 201, PHYS 103
	Total	**9**	

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Table 4-C COLLEGE FREE COURSE FOR SEP (2 CREDIT HOURS)

Course Code	Course Title	Cr. Hr. (X,Y,L)	Pre-requisites
xxxxxx	xxx Free Course	2	
	Total	2	

TABLE 5 SEP REQUIREMENTS (74 CREDIT HOURS)

Table 5-A CORE COURSES (46 CREDIT HOURS)

Code & Number	Course Title	Cr. Hr. (X,Y,L)	Requisites Pre-	Co-
SE 212	Spatial Measurements	3(2,1,2)	MATH 107	
SE 312	Introduction to Geomatics Engineering.	3(2,1,2)	SE 212	
SE 314	Geodesy	**4**(3,0,2)	SE 212	
SE 315	Map Projections	3(2,1,2)	SE 314	
SE 321	Photogrammetry	3(2,0,2)	SE 212	
SE 331	Adjustment Computations	3(2,0,2)	SE 312 STAT 101	
SE 365	Principles of Remote Sensing & Image Interpretation	3(2,0,2)	SE 321	
SE 413	Satellite Geodesy & Geopositioning	3(2,1,2)	SE 314	
SE 422	Advanced Photogrammetry	3(2,0,2)	SE 321 SE 331	
SE 423	Digital Image Processing	3(2,1,2)	SE 365	
SE 453	Cartography and Geographic Information Systems	3(2,0,2)	SE 315	
SE 464	Introduction to Digital Photogrammetry	2(2,1,0)	SE 422	
SE 466	Spatial Analysis in Geographic Information Systems	**4**(3,0,2)	SE 423 SE 453	
SE 471	Survey Camp	**3**(2,0,2)	SE 413	
SE 473	Professional & Legal Aspects of Surveying	3(2,0,2)	SE 315	
	Total	46		

Table 5-B SENIOR GRADUATION PROJECTS (4 CREDIT HOURS)

Code & Number	Course Title	Cr. Hr. (X,Y,L)	Requisites Pre-	Co-
SE 496	Graduation Project -1	2(2,0,0)	Complete successfully 129 credits hours and passing all courses in levels 1-7.	
SE 497	Graduation Project -2	2(2,0,0)	SE 496	
	Total	4		

(X,Y,L) X = Lectures;   Y = Tutorials;   L = Lab.

Table 5 - C COURSES FROM OTHER PROGRAMS (17 CREDIT HOURS)

Code & Number	Course Title	Cr. Hr. (X,Y,L)	Requisites Pre-	Co-
CE 302	Mechanics of. Materials	3(3,1,0)	GE 201	
GEO 281	Geology for Engineers	2(2,1,0)		
CE 323	Water Engineering for Surveying Students	3(3,1,0)	GE 202	
CE 334	Highway Engineering for Surveying Students	3(2,1,2)	SE 312, STAT 101	
CE 363	Basics of Concrete Structures for Surveying Students	3(3,1,0)	CE 302	
EE 329	Signal analysis for Surveying Students	3(3,1,0)		
	Total	17		

(X,Y,L) X = Lectures;   Y = Tutorials;   L = Lab.

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Table 5-D   ELECTIVE COURSES (6 CREDIT HOURS)
(Each student is required to take 6 cr. hr. from the list of SE elective courses)

Course Code	Course Title	Cr. Hr. (X,Y,L)	Pre-requisites
---- xxx	Elective (1)	3	xxxx
---- xxx	Elective (2)	3	xxxx
	Total	6	

Table 5-E   LIST OF SE ELECTIVE COURSES
(Each student is required to take 6 cr. hr. from the following list of SE elective courses)

Course Code	Course Title	Cr. Hr. (X,Y,L)	Pre-requisites
SE 418	Hydrographic Surveying	3(3,1,0)	SE 312
SE 467	Web GIS	3(3,1,0)	SE 453
SE 419	Advanced Geodesy	3(3,1,0)	SE 315
SE 431	Computer Applications in Surveying Engineering	3(2,0,2)	GE 209 SE 331
GEO 301	Geomorphology	3(2,0,2)	GEO 281
PL442	Urban Strategic Planning	3(3,0,0)	-
CE 411	Introduction to Construction Contracts	3(3,1,0)	Successful completion of 110 cr. hr.
CE 412	Estimating Construction Cost	3(3,1,0)	. Successful completion of 110 cr. hr.-
	Total	6	

Table 5-F   SEP PRACTICAL TRAINING - COMPULSORY - (1 CREDIT HOUR NP)

Course Code	Course Title	Cr. Hr. (X,Y,L)	Pre-requisites
SE 999	Practical Training	(1 NP)	Successful completion of 110 cr. hr.

Table 5-G   SEP ELECTIVE COURSE WITHOUT CREDIT HOURS (0 NP)
(This is an optional elective course with no credit hours; no required for the B.S. degree in CHE)

Course Code	Course Title	Cr. Hr. (X,Y,L)	Pre-requisites
SE 998	Research Project	(0 NP)	Successful completion of 129 cr. hr.

(X,Y,L) X = Lectures;   Y = Tutorials;   L = Lab;   NP=No grade (Pass or Fail)

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Table 6 RECOMMENDED SEMESTER SCHEDULE -SURVEYING ENGINEERING PROGRAM

Level 1			
Course Code	Course Title	Cr. Hr. (X,Y,L)	Pre-requisite
ENGS100	English language	6(6,9,0)	
MATH 101	Differential Calculus	3(3,1,0)	
ENT 101	Entrepreneurship	1(1,0,0)	
CHEM 101	General Chemistry	4(3,0,2)	
ARAB 100	Writing Skills	2(2,0,0)	
Total		**16**	

Level 2			
Course Code	Course Title	Cr. Hr. (X,Y,L)	Pre-requisite
ENGS 110	English	6(6,9,0)	
CUR 101	University Skills	3(3,0,0)	
CT 101	IT skills	3(0,0,6)	
STAT 101	Introduction to Statistics	3(2,2,0)	
EPH 101	Health Education & fitness	1(1,1,0)	
Total		**16**	

Level 3			
Course Code	Course Title	Cr. Hr. (X,Y,L)	Pre-requisite
IC 1xx	Islamic Elective	2(2,0,0)	
PHYS 103	General Physics (1)	4(3,0,2)	
MATH 106	Integral Calculus	3(3,2,0)	*MATH 101*
MATH 107	Vectors & Matrices	3(3,2,0)	*MATH 101*
ENGL 109	Language and Communication	2(2,1,0)	
GE 104	Basics of Engineering Drawing	3(2,0,2)	
Total		**17**	

Level 4			
Course Code	Course Title	Cr. Hr. (X,Y,L)	Pre-requisite
PHYS 104	General Physics (2)	4(3,0,2)	PHYS 103
ENGL 110	Technical Writing	2(2,1,0)	*ENGL 109*
MATH 203	Differential and Integral Calculus	3(3,2,0)	*MATH 106 MATH 107*
GE 106	Introduction to Engineering Design	3(2,1,2)	*GE 104*
GE 201	Statics	3(3,1,0)	*MATH 106 MATH 107*
GE 203	Engineering and Environment	2(2,0,0)	*CHEM 101 MATH 101*
Total		**17**	

Level 5			
Course #	Course	Cr. Hr. (X,Y,L)	Pre-requisite
CE 302	Mechanics of Materials	3(3,1,0)	GE 201
GE 209	Computer Programming	3(2,0,2)	
MATH 204	Differential Equations	3(3,2,0)	MATH 203
IC xxx	Islamic Elective	2(2,0,0)	
SE 212	Spatial Measurements	3(2,1,2)	MATH 107
GE 202	Dynamics	3(3,1,0)	GE 201 PHYS 103
Total		**17**	

Level 6			
Course #	Course	Cr. Hr. (X,Y,L)	Pre-requisite
CE 323	Water Engineering for Surveying Students	3(3,1,0)	GE 202
EE 329	Signal analysis for Surveying Students	3(3,1,0)	
GEO 281	Geology for Engineers	2(2,1,0)	
SE 312	Introduction to Geomatics Engineering	3(2,1,2)	SE 212
SE 314	Geodesy	4(3,0,2)	SE 212
SE 321	Photogrammetry	3(2,0,2)	SE 212
Total		**18**	

(X, Y, L): X = Lectures;   Y = Tutorials;   L = Lab.

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Level 7			
Course #	Course	Cr. Hr. (X,Y,L)	Pre-requisite
CE 334	Highway Engineering for Surveying Students	3(2,1,2)	STAT 101 SE 312
SE 315	Map Projections	3(2,1,2)	SE 314
SE 331	Adjustment Computations	3(2,0,2)	SE 312 STAT 101
SE 365	Principles of Remote Sensing & Image Interpretation	3(2,0,2)	SE 321
IC xxx	Islamic Elective	2(2,0,0)	
CE 363	Basics of Concrete Structures for Surveying Students	3(3,1,0)	CE 302
Total		**17**	

Level 8			
Course #	Course	Cr. Hr. (X,Y,L)	Pre-requisite
-------------	College Free Course	2	
MATH 254	Numerical Methods	3(3,2,0)	MATH 107
SE 413	Satellite Geodesy	3(2,1,2)	SE 314
SE 422	Advanced Photogrammetry	3(2,0,2)	SE 321 SE 331
SE 423	Digital Image Processing	3(2,1,2)	SE 365
SE 453	Cartography and GIS	3(2,0,2)	SE 315
Total		**17**	

Level 9			
Course #	Course	Cr. Hr. (X,Y,L)	Pre-requisite
IC xxx	Islamic Elective	2(2,0,0)	
GE 403	Engineering Economy	2(2,1,0)	
---- xxx	Program Elective - 1	3	
SE 466	Spatial Analysis in Geographic Information Systems	4(3,0,2)	SE 423 SE 453
SE 471	Survey Camp	**3(2,0,2)**	SE 413
SE 496	Graduation Project-1	2(2,0,0)	Completion of 129 credit hrs.& Levels 1 to 7
Total		**16**	

Level 10			
Course #	Course	Cr. Hr. (X,Y,L)	Pre-requisite
---- xxxx	Program Elective -2	3	
GE 402	Engineering Projects Management	3(3,1,0)	
SE 464	Introduction to Digital Photogrammetry	2(2,1,0)	SE 422
SE 473	Professional & Legal Aspects of Surveying	3(2,0,2)	SE 315
SE 497	Graduation Project -2	2(2,0,0)	SE 496
SE 999	Practical Training	1^{NP}	Successful completion of 110 credit hrs
SE 998	Research Project	0^{NP}	Completion of 129 credit hrs.
Total		**14**	

* CO-REQUISITE

NP: NO-GRADE-PASS

(X, Y, L) X = Lectures;   Y = Tutorials;   L = Lab.

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3. COURSE DESCRIPTION

3.1 Common First Year

ENGS 100 - English Language   *6(6,9,0)*
This initial stage of the course is designed to give the students a strong foundation in the language, improving their command of English as well as improving their vocabulary, reading, writing and communication skills. In the process of improving these skills, students will also develop their confidence in the language and also their presentation skills. These all contribute to the life skills of the student and help to prepare them for their future studies and careers beyond KSU. As the course progresses, and students reach a higher level of English, the focus will switch to the academic side of the language. This will involve preparing students for the style of language they will need for their future studies.

Pre-requisites: None.

ENGS 110 –English   *6(6,9,0)*
The final assessment for the course is the highly regarded International English Language Testing System (IELTS), which is used as a qualifying test for students wishing to attend university in many countries including the UK and Australia. Specialist material will be used to prepare students for this test with the aim of reaching an IELTS score of 5.0 by the end of the year.

Pre-requisites: None.

MATH 101 - Differential Calculus   *3(3,1,0)*
Limits and Continuity: The Concept of Limit, Computation of Limits, Continuity and its Consequences, Limits Involving Infinity, Formal Definition of the Limit. Differentiation: The Concept of Derivative, Computation of Derivatives (The Power Rule, Higher Order Derivatives, and Acceleration), the Product and Quotient Rules, The Chain Rule, Derivatives of Exponential and Logarithmic Functions, Implicit Differentiation and Inverse Trigonometric Functions, the Mean Value Theorem. Applications of Differentiation: Indeterminate Forms and L'Hopital's rule, Maximum and Minimum Values, Increasing and Decreasing Functions, Concavity and the Second Derivative Test, Optimization, Related Rates.

Textbook: Robert T. Smith, and Roland R. Minton, "Calculus, early Transcendental functions", Third Edition, 2007.
Pre-requisite: None

ENT 101 Entrepreneurship   *1(1,0,0)*

Pre-requisites: None.

ARAB 100 - Writing Skills   *2(2,0,0)*
Pre-requisites: None.

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CHEM 101 - General Chemistry   4(3,0,2)

Stoichiometry: SI Units, chemical formulas, the mole, methods of expressing concentration, Calculations based on chemical equations. Gases: laws, kinetic theory, deviation and van der Waals equation. Thermochemistry: Types of enthalpy changes, Hess Law and its applications,, first law of thermodynamics. Solutions: Type of solutions and laws related, colligative properties. Chemical kinetics: Law of reaction rate, reaction order, factors affecting the rates. Chemical Equilibrium: Relation between Kc & Kp, Le Chatelier's principle and factor affecting equilibrium. Ionic equilibrium: Acid and base concepts, pH calculations of acid, base and buffer solutions. Atomic Structure: emission spectrum, Bohr's theory de Broglre's hypothesis, quantum numbers, electronic configuration of elements, consequences of the periodic table.

Pre-requisites: *None*.

CUR 101 - University Skills   3(3,0,0)
Learning skills**:** Self-management for learning, Learning tools, Reading strategies, Second language learning skills, Test administration. Thinking skills: Theory Of Inventive Problem Solving (TRIZ), Rounding Thinking, Expanding perception, Creative thinking. Research skills: Problem determining, Search for information strategies, Sites of sources, access this information, using thin formation, Information construction, Information evaluation.

Pre-requisites: None

CT 101 - IT Skills   3(0,0,6)

Basic Concepts of Information Technology, Using a computer and Managing Files, Word Processing, Spreadsheets, Databases, Presentation.
Pre-requisites: None.
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Pre-requisites: None.

STAT 101: Introduction to Statistics   3(2,2,0)
Descriptive statistics; Probability; Random variables and probability distribution functions; Statistical inference; Correlation and simple linear regression.
Pre-requisites: None.

EPH 101 - Health Education and Fitness   1(1-1-0)

Subjects about general health and body and brain fitness.

Pre-requisites: None.

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3.2 University Requirements

IC 100- Studies in Prophet Biography   **2(2,0,0)**

IC 101- Introduction to Islamic Culture   *2(2-0-0)*
This subject aims to introduce the student to the Islamic culture; manifestation of the Muslims attitude towards other cultures; explaining the characteristics of Islam, such as: Universality, Comprehensibility, integrity, consistency with human nature (instinct), reason, and science. This subject also explains the Islamic tenet and its fundamentals, such as: To believe in Allah, the Hereafter, the Angles, the Holy Books, the Messengers, and Divine Destiny.
Pre-requisite: ---

IC 102   Islam and Society Building   *2(2-0-0)*
This course studies the following: The concept of the Muslim society; its basics, its method and characteristics, means of consolidating its social ties; the most important social problems, the Islamic philosophy of family affairs, marriage: its introductory formalities, aims and effects. It also deals with ways of strengthening the family bonds.
Pre-requisite: ---

IC 103   The Islamic Economic System   *2(2-0-0)*
This course depicts the Islamic concept of life, the nature of man, the basic constituents of the Islamic economics and its objectives; it studies as well the legal evidences of these topics. It also explains the opinion of Islam toward finance, ownership, production, maintenance, conception, distribution of wealth, and the exchange in the Islamic Economic system.
Pre-requisite: ---

IC 104   Fundamentals of Islamic Political System   *2(2-0-0)*
This subject contains the following: Introduction to the Political System and its fundamentals; the Islamic Political System is the best system for human societies to follow and apply; the rise up of Islamic State during the Prophet's lifetime, Caliphate, and the fundamentals of State.

IC 105 Human Rights   2(2,0,0)

IC 106 Medical Jurisprudence   2(2,0,0)

IC 107 Ethics of the Profession   2(2,0,0)

IC 108 Contemporary Issues   2(2,0,0)

IC 109 Role of Women in Development   2(2,0,0)

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3.3 College Requirements

A- Compulsory Courses

MATH 106 - Integral Calculus   *3(3,2,0)*

The definite integral, fundamental theorem of calculus, the indefinite integral, change of variable, numerical integration. Area, volume of revolution, work, arc length. Differentiation and integration of inverse trigonometric functions. The logarithmic, exponential, hyperbolic and inverse hyperbolic functions. Techniques of integration: substitution, by parts, trigonometric substitutions, partial fractions, miscellaneous substitutions. Indeterminate forms, improper integrals. Polar coordinates.

Textbooks: 1- Robert T. Smith, and Roland R. Minton, "Calculus, Early Transcendental Functions", 3rd Edition.
2- Earl W. Swokowski, Michael Olinick, Dennis Pence, and Jeffery A. Cole "Calculus", 6th Edition.

Pre-requisite: MATH 101

MATH 107 – Vectors and Matrices   *3(3,2,0)*

Vectors in two and three dimensions, scalar and vector products, equations of lines and planes in space, surfaces, cylindrical and spherical coordinates. Vector valued functions, their limits, continuity, derivatives and integrals. Motion of a particle in space, tangential and normal components of acceleration. Functions in two or three variables, their limits, continuity, partial derivatives, differentials, chain rule, directional derivatives, tangent planes and normal lines to surfaces. Extreme of functions of several variables, Lagrange multipliers. Systems of linear equations, matrices, determinants, inverse of a matrix, Cramer's rule.

Textbook: Edward and Penny, "Calculus", international edition.
Pre-requisite: *MATH 101*.

MATH 203 - Differential & Integral Calculus   *3(3,2,0)*

Infinite series, convergence and divergence of infinite series, integral test, ratio test, root test and comparison test. Conditional convergence and absolute convergence, alternating series test. Power series, Taylor and Maclaurin series. Double integral and its applications to area, volume, moments and centre of mass. Double integrals in polar coordinates. Triple integral in rectangular, cylindrical and spherical coordinates and applications to volume moment and centre of mass. Vector fields, line integrals, surface integrals, Green's theorem, the divergence theorem, Stoke' theorem.

Textbook: 1- Robert T. Smith, and Roland R. Minton, "Calculus, Early Transcendental Functions", 3rd Edition.
2- Earl W. Swokowski, Michael Olinick, Dennis Pence, and Jeffery A. Cole "Calculus", 6th Edition.

Pre-requisite: *MATH 106* and *MATH 107*.

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MATH 204 - Differential Equations   *3(3,2,0)*

Various types of first order equations and their applications. Linear equations of higher order. Systems of linear equations with constant coefficients, reduction of order. Power series methods for solving second order equations with polynomial coefficients. Fourier series, Fourier series for even and odd functions. Complex Fourier series. The Fourier integral.

Textbook: Dennis G. Zill and Michael R Cullen, "Differential equations with boundary value problems", 6th edition
Pre-requisite: *MATH 203*.

PHYS 103 - General Physics (1)   *4(3,0,2)*

Introduction (Vectors), Motion in one dimension with constant acceleration, Motion in two dimension with application to projectile motion and circular motion, Newton's Laws of Motion, Work and Energy, Potential Energy and conservation of Energy, Linear Momentum and Collisions, Rotation of rigid object about a fix axis.

Pre-requisites: *None*.

PHYS 104 - General Physics (2)   *4(3,0,2)*

Electricity and Magnetism: Coulomb's law, electric fields, Gauss' Law, electric potential, potential energy, capacitance and dielectric, currents and resistance, electrical energy and power, direct current circuits, Kirchhoffs rules, magnetic fields, motion of charged particle in a magnetic field, sources of the magnetic field, Ampere's law, Faraday's law of induction, self inductance, energy in a magnetic field, mutual inductance, alternating current circuits, the RLC series circuit, power in an A.C. circuit, resonance in RLC services circuit.

Pre-requisites: *PHYS 103*

ENGL 109 - Language and Communication   *2(2,1,0)*

ENGL 109 includes *English for Specific Purpose* (ESP) units that cover terminology and expressions, in various engineering disciplines. The course is designed to improve the communication and reading skills of engineering students. It equips the student with essential linguistic expertise for his engineering study and prospective professional career.

Textbook: Eric H. Glendinning & Norman Glendinning, "Oxford English for Electrical and Mechanical Engineering", Oxford University Press (2000).
Pre-requisites: None.

ENGL 110 – Technical Writing   *2(2,1,0)*

English 110 is intended to enhance technical writing skills. It equips students with writing basics and techniques required for constructing clear and persuasive presentation of their ideas, on various forms including reports, presentations, worksheets, CVs' and memos. The course highlights effective writing features including: focus, organization, support & elaboration, style, and conventions. It emphasizes on observing ethical norms in writing.
Textbook: Daphne Mackey, "Send me a Message: *A step-by-step approach to business and professional writing*", McGraw Hill (2006)

Approved by: Chairman: …………………………… Dean: ……………………………

Pre-requisites: ENGL 109.

GE 104 - Basics of Engineering Drawing   *3(2,0,2)*

The course includes the drawing of Orthographic and isometric projections. Other topics include scaling, sectioning, dimensioning and blue print reading. The course is taught using free hand, AutoCAD and Auto-Desk Inventor

Textbook: Fundamentals of Graphics Communication, Bertoline, G.R., And Weibe, E.N.,
           Mc Grew-Hill Inc., New York, 5th edition, 2007
References: A Manual of Engineering Drawing Practice, C.H. Simons and D.E. Maguire,
           Hodder & Stoughton.
           Engineering Drawing and Graphic Technology, French T. E., Charles J. V.
           and Foster R.J., 14th Edition, McGraw-Hill,1993.
Pre-requisites: *None*.

GE 106 - Introduction to Engineering Design   *3(2,1,2)*

Engineering profession, jobs, and disciplines; Elements of engineering analysis; Introduction to engineering design and team formation; Engineering problem definition; Engineering system Architecture and physical function decomposition; human factor, environment, and safety issues in design; Generation of alternative concepts; Evaluation of alternatives and selection of a concept, Design defense, performance evaluation, and reporting; Engineering ethics.

Textbook: Philip Kosky, Robert T. Balmer, William D. Keat, George Wise. 2015.
Exploring Engineering: An Introduction to Engineering and design. Elsevier.

Prerequisite: *GE 104*.

GE 201 - Statics   *3(3,1,0)*

Force systems; vector analysis, moments and couples in 2D and 3D. Equilibrium of force systems. Analysis of structures; plane trusses and frames. Distributed force system; centroids and composite bodies. Area moments of inertia. Analysis of beams. Friction.

Textbook: Meriam, J. L. and Kraige, L. G. "Engineering Mechanics, Volume 1, Statics",
           SI units Version

Pre-requisite: *MATH 106* and *MATH 107*.

GE 203: Engineering and Environment   *2(2,0,0)*

This course introduces the impact of engineering and industrial activities on the environment. The lectures cover basics of ecosystems, environmental balance, types of pollution, and types, sources, and limits of pollutants; in addition to fundamentals of Environmental Impact Assessment (EIA). Pollution control technologies and examples of pollution from various engineering and industrial sectors are also covered.

Textbook: G. Tyler Miller, Scott Spoolman. Living in the Environment, 17th edition.
          Cengage Learning (2014)
          Jerry A. Nathanson, Richard A. Schneider. Basic Environmental Technology:
          Water Supply, Waste Management, and Pollution Control, 6th edition. Pearson
          Education, Limited (2014)
Pre-requisite: *CHEM 101* and *MATH 101*.

Approved by: Chairman: …………………………… Dean: ……………………………

GE 402 –Engineering Projects Management   *3(3,1,0)*

This course introduces techniques that provide rational solutions to a range of project management decisions encountered in engineering projects. Students are expected to gain a detailed understanding of some of the techniques, tools and processes available and their application in starting, planning, managing and finishing engineering projects; The course covers project management fundamentals including projects life cycle, project planning and scheduling techniques, cash flow forecasting, performance evaluations, estimating and cost control; project organizations; Introduction to risk management.

Textbook: Meredith, J. R., Mantel Jr, S. J., & Shafer, S. M. (2013). Project management in practice. Wiley Global Education

Pre-requisites: *None*.

GE 403 - Engineering Economy   *2(2,1,0)*

This course is being offered to the students who enrol in the College of Engineering to give them fundamental knowledge and understandings on Cost concepts, Time value of money operations, Measuring the worth of investments, Comparison of alternatives, Depreciation, and Economic analysis of public projects

Textbook: John A. White, Kenneth E. Case and David B. Pratt, "Principles of engineering economic analyses", 5th edition.

Pre-requisites: *None*.

B- College Additional Courses

GE 202 – Dynamics   *3(3,1,0)*

Kinematics of a particle: curvilinear motion and relative motion; Kinematics of a rigid body in plane motion: relative velocity relative acceleration, and rotating axes; Kinetics of particles: Newton's 2nd law, work and energy, impulse and momentum, and impact; Kinetics of a rigid body in plane motion: translation, fixed axis rotation, general motion, work and energy, and impulse and momentum.

Textbook：J. L. Meriam and L. G. Kraige, "Engineering Mechanics, Volume 2, Statics, SI units Version", Fifth edition.

Pre-requisites*: GE 201, PHYS 103*

GE 209: Computer Programming   *3(2,0,2)*

To introduce computer programming for solving engineering problems in MATLAB environment

Textbook: MATLAB for Engineers by Holly Moore, Pearson; 5th edition (2017).

Pre-requisites: None.

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MATH 254: Numerical Methods *3(3,2,0)*

Various numerical methods for solving nonlinear equations. Direct and iterative methods for solving systems of linear equations along with error estimate. Polynomial interpolation with error formula. Numerical differentiation and integration with error terms. An introduction to numerical solution of ordinary differential equations.

Textbook: Rizwan Butt and Yacine Benhadid, "An Introduction to Numerical Analysis"
Pre-requisite: *MATH 107*

3.4 Program Core Courses

SE 212 Spatial Measurements *3 (2,1,2)*
Prerequisite: Math 107
Introduction & definitions; surveying types & importance, measurements units; basics of Linear Measurements (tape, optical & electronic); theodolites & angular measurements; levels & leveling operations; applications of leveling (contouring); planimetric (cross-sectional area & volume determination); introduction to total station; setting out; introduction to underground surveying; introduction to photogrammetry & remote sensing.

Textbook: Paul, R. Wolf & Charles D. Ghilani, "Elementary Surveying: An Introduction to Geomatics" 14th Ed. 2014. Pearson.

SE 312 Introduction to Geomatics Engineering *3(2,1,2)*
Prerequisite: SE 212.
Electromagnetic distance measurement & electronic theodolites; total station; control fixing (traversing, triangulation: resection & intersection); map compilation using electronic surveying instruments & computer; precise levelling; introduction to hydrographic surveying; setting out; horizontal & vertical curves & rout location.

Textbook: Paul, R. Wolf & Charles D. Ghilani, "Elementary Surveying: An Introduction to Geomatics" 14th Ed. 2014. Pearson.

SE 314 Geodesy *4(3,1,0)*
Prerequisite: SE 212.
Spherical trigonometry; solution of geodetic problems on the spherical surface; introduction to spherical astronomy; spheroidal trigonometry; solution of geodetic problems on the spheroidal surface; geodetic networks; computer applications; transformation of coordinate systems.

Textbook: Timothy, G. Freeman, "Portraits of the Earth", 1st Ed. 2002. Walter de Gruyter

SE 315 Map Projections *3(2,1,2)*
Prerequisite: SE 314.
General theory of map projection; study of some famous map projections; map projections applied in KSA; map projections transformation (plans, map, image); computer applications.

Textbook: Erik W. Grafarend, "Map Projections", 2008. John Wiley.

   Approved by: Chairman: ……………………………… Dean: ………………………………

SE 321 Photogrammetry *3(2,0,2)*

Prerequisite: SE 212.

Definitions & basic concepts; geometry of aerial photos; theory & procedure of stereoscopy; analogue stereoploters; orientation (inner, relative, absolute); flight planning; map compilation.

Textbook: P. R. Wolf, B. A. Dewitt and B. Wilkinson "Elements of Photogrammetry with Applications in GIS", 4th Ed. 2014. McGraw Hill.

SE 331 Adjustment Computations *3(2,0,2)*

Prerequisite: SE 312 & STAT 101.

Basic definitions; the frequency curve & the accidental error; the variance, covariance & weight of a measured quantity; principles of correlation; least squares method; adjustment by conditions; adjustment by variation of coordinates; computer applications.

Textbook: P. Wolf and Charles Ghilani. "Adjustment Computations: Spatial Data Analysis", 4th edition, 2006. John Wiley, USA.

SE 365 Principles of Remote Sensing & Image Interpretation *3(2,0,2)*

Prerequisite: SE 321.

Concepts & definition of remote sensing; properties of electro-magnetic waves & the environment; ground truth; spectral signature & target identification; remote sensors (types & comparison); techniques utilized to interpret remote sensing imagery visually; emphasis on airphoto interpretation in a range of application areas; visual analysis of non-photographic remote sensing data; introduction to computer-assisted image interpretation & GIS.

Textbook: Lillisand, Keifer and Chipman "Remote Sensing and Image Interpretation", 6th ed. 2008, John Wiley.

SE 413 Satellite Geodesy and Geopositioning *3 (2,1,2)*

Prerequisite: SE 314.

Introduction to positioning systems by satellites; satellite orbit motion; signal propagation & errors; surveying by satellite geodesy; GNSS data processing & transformation; application of satellite geodesy; computer applications.

Textbook: B. Hofmann-Wellenhof, "GPS Theory and Practice", 5th ED. 2008. Springer.

SE 422 Advanced Photogrammetry *3(2,0,2)*

Prerequisite: SE 321 & SE 331.

Coordinates systems in photogrammetry; coordinates transformation; measured photo coordinates refinements; mathematical models used in analytical photogrammetry; analytical relative & absolute orientations; analytical stereoplotters & map production; Introduction to terrestrial photogrammetry; mathematical models in terrestrial photogrammetry; automatic terrestrial photogrammetry; computer applications.

Textbook: P. R. Wolf, B. A. Dewitt and B. Wilkinson "Elements of Photogrammetry with Applications in GIS", 4th Ed. 2014. McGraw Hill.

Approved by: Chairman: …………………………… Dean: ………………………….

SE 423 Digital Image Processing *3(2,1,2)*
Prerequisite: SE 365.
Introductions; data acquisition; computer techniques to manipulate & interpret digital images; overview of formats of digital image data & procedures used in image rectification & registration; image enhancement; image classification; & digital image data merger;

Textbook: Lillisand, Keifer and Chipman "Remote Sensing and Image Interpretation", 6th Ed. 2007, John Wiley.

SE 453 Cartography and GIS *3(2,0,2)*
Prerequisite: SE 315.
Introduction; map classification; map use; sources of spatial information; introduction to GIS; data coding using GIS; layers concept and data modelling; cartographic generalisation; map production and printing using GIS.

Textbook: Gretchen N. Peterson. "GIS Cartography: A Guide to Effective Map Design". CRC Press (April 6, 2009). ISBN-10: 1420082132, ISBN-13: 978-1420082135

SE 464 Introduction to Digital Photogrammetry *2(2,1,0)*
Prerequisite: SE 422.
Definitions; digital photogrammetry evolution; data collection procedures; stereoviewing of digital images; digital images matching techniques; DEM & features extraction; digital orthophoto production; digital photogrammetric workstations; applications using computer.

Textbook: P. R. Wolf, B. A. Dewitt and B. Wilkinson "Elements of Photogrammetry with Applications in GIS", 4th Ed. 2014. McGraw Hill.

SE 466 Spatial Analysis in Geographic Information Systems *4(3,0,2)*
Prerequisite: SE 423, SE 453.
Definitions; queries in GIS; relation between GIS and other sciences; projection systems and mutual transformation using GIS; concept of data base; methods of tables connection and spatial analysis in GIS; DEM production using GIS; Selective applications in GIS.

Textbook: P. Longley, Micheal, F. Goodchid, David J. Maguire and David W. Rhind, 2015. "Geographic Information Systems and Science", 4th edition 2015, John Wiley.

SE 472 Surveying Camp *3(1,0,2)*
Prerequisite: SE 413.
Introduction; practical training on precise leveling & trigonometry; measuring distances using electronic distances measurements instrument; measurement of vertical & horizontal angles; GNSS observation & processing, observation treatment and electronic map drawings; computer applications.

SE 473 Professional & Legal Aspects of Surveying *3(2,0,2)*
Prerequisite: SE 315.
Introduction to real state registration & its systems; real state registration surveying; special law principals related to transfer & endorsing real state ownership procedures in the Kingdom of Saudi Arabia; managing of land information & its systems; needs & surveying practicing in the Kingdom of Saudi Arabia; planning & cost estimation for surveying projects; preparation of specifications & special technical conditions for carrying out surveying projects; managing surveying projects; advanced topics.

Approved by: Chairman: …………………………… Dean: ……………………………

SE 496 Graduation Project-1 *2(2,0,0)*

Pre-requisite: Successful completion of 129 cr. Hr and passing all courses in levels 1-7

The student must accomplish a 2-semester-project in any major fields of surveying (the project must include field work &/or field data in addition to associated computations & assessment); an integrated report detailing each step of the project must be provided by the student & approved by the project supervisor & the examiners after presentation of the project.

SE 497 Graduation Project-2 *2(2,0,0)*

Prerequisite: SE 496

The student must accomplish a 2-semester-project in any major fields of surveying (the project must include field work &/or field data in addition to associated computations & assessment); an integrated report detailing each step of the project must be provided by the student & approved by the project supervisor & the examiners after presentation of the project.

SE 998: Research Project *0 (NP)*

The course is designed to serve the research needs of the students. The course **is not required for graduation**; so students may opt to register it or otherwise. The consent of the faculty member with whom the student might work is essential.

It provides the student with the principles of conducting a comprehensive introduction to research proposal writing, research methodologies, and foundational research theories and protocols.

Prerequisite: Successful completion of 129 credit hours.

SE 999 Practical Training *1(Nograde-Pass)*

Prerequisite: Successful Completion of 110 credit hrs

Students in the program are required to complete a 10 weeks summer training requirement in an area related to Surveying Engineering. Prior to undertaking the summer training program, the student must obtain the approval of the department and he must have completed, successfully, at least 110 credit hours including the CFY (or 78 credit hours excluding the CFY). Students enrolling in the summer training program are not allowed to take simultaneously any course or projects.

3.5 Courses from other Programs

GEO 281 Geology for Engineers *2(2,1,0)*

Prerequisites: None

Introduction. Structure of Earth. Minerals and Rocks. Igneous Rocks and Volcano. Weathering, erosion and soil formation. Sedimentary Rocks. Metamorphic Rocks. Geology and Water Supply; Geology of Saudi Arabia

Textbook: McLean, A.C. and Gribble, C.D., *Geology for Civil Engineering*, 2nd Edition, George Allen & UNWIN.

Tarbuck, E.J. and Lutgens, F.K., 2002, *The Earth*, Ninth Edition, Prentice Hall, New Jersey, 670 p. with accompanying GEODe III CD-ROM bound into book inside back cover**.**

Approved by: Chairman: ……………………………… Dean: …………………………….…

CE 302 Mechanics of Materials *3(3,1,0)*
Prerequisites: GE 201
Introduction and fundamentals of mechanics of deformable materials. Concept of stress and strain and Hook's law. Concept of failure, yield and allowable stresses. Factor of safety and allowable stress design. Normal stress under axial loading and bending. Shear stress under shear force and torsion. Shear force and bending moment diagrams. Transformation of stress and strain and Mohr's circle. Buckling of columns.
Textbook: Ferdinand P. Beer & E.R. Johnson, "Mechanics of Materials" SI, Ed., McGraw-Hill.

CE 323 Water Engineering for Surveying Students *3(3,1,0)*
Prerequisites: GE 202
Introduction to fluid properties, hydrostatics, motion of fluids, closed conduit flow and open channel flow. Introduction to hydrology and ground water.

EE 329 Signal Analysis for Surveying Students *3(3,1,0)*
Prerequisites: None
Motivation and Applications, Signal Classifications, Signal Operations, Singularity Functions; Linear time-Invariant Systems and Convolution; Correlation; Fourier Series and Transform for continuous and discrete time signals. Introduction to z-transform.

Textbook:
1- Oppenheim, Willsky and Nawab, "Signals and Systems", Prentice-Hall, 1997.
2- Haykin and Veen, "Signals and Systems", John Wiley, 1998.

CE 334 Highway Engineering for Surveying Students *3(2,1,2)*
Prerequisites: STAT 101, SE 312
Introduction to Transportation Systems, Economic Analysis of Highways, Highway Surveys and Plans, Geometric Design of Highway, Intersections and Interchanges, Introduction to Pavement types and layers.

Textbook: P. H. Wright & Karen K. Dixon, "Highway Engineering", 7th ed. 2009, John Wiley and Sons.

CE 363 Basics of Concrete Structures for Surveying Students *3(3,1,0)*
Prerequisites: CE 302
Introduction to concrete technology; composition and properties of concrete; tests of fresh and hardened concrete, analysis of simple and continuous beams, design of bending and shear. Design of short columns, bond strength and development length;

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3.6 Elective Courses
Program Courses:

SE 418 Hydrographic Surveying   3(2, 1, 0)
Prerequisites: SE 312

Introduction; Hydrographic project planning, Coastline Survey; hydrographic survey datum, tidal theory, sea level measurement techniques, water depth determination techniques, horizontal position determination and errors estimation and analysis.

Textbook:
George Wood Logan, 2015. Elements of Hydrographic Surveying. Andesite Press, Annapolis, US Naval Institute, ID-13 9781230343303

SE 419 Advanced Geodesy   3(3, 1, 0)
Prerequisites: SE 315

Basic definitions and concepts (Geoid and ellipsoid); Ellipsoid and ellipsoidal references; systems; Geometric calculations on the ellipsoid surface; Datums and datums transformations Geodetic networks

SE 431 Computer Applications in Surveying Engineering   3(2, 0, 2)
Prerequisites: SE 331 and GE 209

Introduction; Programming computations and adjustments of triangulation nets and traverses; Adjustment of levelling nets; Programs for coordinates transformations. Applications on Map Projection problems; Using software for DEMs; Applications of AUTOCAD in surveying engineering

SE 467 Web GIS   3(3, 1, 0)
Prerequisites: SE 453

Web based GIS concept, Fundamentals and Evolution. Instruction on the Web interface design, networking fundamentals, geographic mark-up language, service and security in Web based GIS, Web mapping software and Web based GIS applications including voluntary geographic information. Mobile GIS technology. Geoportals. Future trends.

Textbook:
Fu, P & Sun, J. 2010, Web GIS: principles and applications, ESRI Press, Redlands, Calif.

Elective Courses from other programs:

GEO 301 Geomorphology   3(2, 0, 2)
Prerequisites: GEO 281

Natural processes that create landforms and landscapes - physics and chemistry of weathering and soil formation - dynamics of mass wasting - streams and glaciers - karst processes - topographic response to tectonic and climatic forces - terrain analysis utilizing geomorphic field data, remote sensing imagery,

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and numerical models - natural hazards.
(Two days field trip).

PL 442: Urban Strategic Planning   3(3, 0, 0)
Prerequisites: none
The course will help students to understand the objectives, methodological and conceptual issues of
Urban Strategic Planning. Types of Strategic Urban Planning and Urban Policy will be discussed in
addition to Urban Planning Schemes and the Role of Urban Planner in Riyadh city and other Saudi and
World cities.

CE 411 Introduction to Construction Contracts   *3 (3, 1, 0)*
Pre-requisite: Successful completion of 110 cr. hr.
Basics of construction law. Types and selection of construction contracts. Essentials of plans
and specifications. Bidding.   Awarding and administration of contracts. Liability. Bonding
claims. Construction contracts in Saudi Arabia. Introduction to computer applications. Group
project.

Textbook: Keith Collier, "Construction Contracts", Prentice Hall.

CE 412 Estimating Construction Costs   3(3, 1, 0)
Prerequisites: Successful completion of 110 cr. hr.

The estimating process. Conceptual estimation. Range estimation. Detailed estimate.
Earthwork. Concrete. Masonry. Carpentry and steel. Mechanical and Electrical
estimating. Heavy construction. Profit and bonds. Labor productivity. Computers in
estimating. Bidding strategy, Group Project.

Textbook: Stephen and Roger W. Liska, "Building Construction Estimation", McGraw-
     Hill.

3.6 Courses Offered to other Programs

SE 251 Surveying for non-Engineers   2(1,0,2)
Prerequisites: MATH 107
Definitions and concepts with a brief description of historical development of surveying.
Principles of survey observations. Distance measurements. Detailed mapping. Area
determination. Levelling. Applications of levelling. Earthwork computations. Introduction
to electronic equipments: EDM, total station

Textbook:
Paul, R. Wolf & Charles D. Ghilani, "Elementary Surveying: An Introduction to
Geomatics" 14th Ed. 2014. Pearson.

Approved by: Chairman: ……………………………… Dean: ………………………………