KING SAUD UNIVERSITY

COLLEGE OF ENGINEERING

PETROLEUM AND NATURAL GAS ENGINEERING DEPARTMENT

BACHELOR OF SCIENCE IN
PETROLEUM AND NATURAL GAS ENGINEERING

ACADEMIC PLAN

1439 H

2018 G

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1. INTRODUCTION

The Department of Petroleum and Natural Gas Engineering (PGED) was established in 1973 to become the first Petroleum and Natural Gas Engineering Department in the Kingdom and the entire Gulf region. Its establishment was a national response to the increasing demand for petroleum engineers in a country that has more than 25% of the total world oil reserves. This is the largest reserve in any single country in the worldwide. A simple calculation shows that with the prevailing current oil production rate, this reserve will last more than 100 years. This indicates that the oil industry will continue to play a leading role and to have the largest contribution to the economy. Based on these facts, it seems that, among other engineering and scientific disciplines, the petroleum engineers will have the most secure jobs in the future.

Whenever an exploration team becomes confident about the existence of certain geological formations which may contain oil or natural gas, petroleum engineers start designing and setting up a general plan for the drilling programs. Then they study the amount of oil and natural gas reserves and the optimum methods for oil and gas production at the minimum cost, and the best methods for preserving the energy of the reservoir, keeping in mind the special conditions of each reservoir. This requires the collaboration of drilling, reservoir, and production engineers. Because of the need to acquire all these skills, basic sciences are interconnected with the specialized engineering sciences in an integrated program leading to B.Sc. degree in petroleum and natural gas engineering. Both fundamental and applied courses are included in the curriculum, relating to the engineering areas of exploration, reservoir, drilling, production, transportation, economics, and natural gas. It is stressed on computer applications in petroleum engineering in order to better prepare the graduate engineer to work in the complex world of modern technology. In a developing country, more emphasis is needed on practical training, whether in the laboratory or in the field.

The department has well-equipped laboratories in different disciplines. Oil and natural gas companies working in the Kingdom attract and employ the largest number of the petroleum and natural gas engineering graduates where they have good opportunities to practice and apply the knowledge they have acquired during their academic study. They enjoy attractive financial benefits as well as chances for studying and training missions inside and outside the Kingdom. Other governmental agencies such as the Ministry of Petroleum and Minerals, SABIC, KACST, etc. employ a large number of petroleum and natural gas engineering graduates. Service companies which are an integral part of the oil industry also present attractive job opportunities.

Bachelor Program objectives are:

- Graduates will perform as highly skilled engineers in the local and international petroleum and natural gas industry,
- Graduates will continue to learn, improve and evolve in their jobs, and
- Graduates may pursue higher education to participate in academia and involve in research.

The courses in the petroleum and natural gas engineering major cover both basic and applied subjects in oil and gas reservoir engineering. The program learning outcomes are designed based on:

1) National Qualification Framework (NQF).
2) ABET and NCAAA requirements.
3) SPE Competency Matrices Satisfaction.

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4) University, and College Visions and Missions.
5) Department Vision, Mission, Goals, Educational Objectives, and Learning Outcomes.
6) Kingdom of Saudi Arabia Oil and Gas Industry Needs.

2. BACHELOR OF SCIENCE IN PGE PROGRAM

The courses required by the department towards the fulfillment of such a degree include all the following extensive aspects in petroleum and natural gas engineering:

Exploration Engineering	Drilling Engineering	Reservoir Evaluation:
Reservoir Engineering	Production Engineering	Natural Gas Technology

2.1 Courses Requirements (165 credit hours)

To complete the graduation requirements for a B. S. in Petroleum and Natural Gas Engineering, the students are required to successfully pass a total of 165 credit hours (32 credit hours from the common first year, CFY 132 credit hours and 1 (no-grade) credit hour of practical training as shown in Table 1) with a minimum GPA of 2.75 out of 5.

The program is divided into:

- 32 credit hours of Common First Year Requirements. The breakdown is shown in 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)..
- 48 credit hours of College requirements (Table 4) of which:
  - 40 credit hours are compulsory courses for all departments (Table 4A)
  - 6 credit hours of additional courses from a list of optional courses offered by the College of Engineering (Table 4B)
  - 2 credit hours of free courses to be taken by the student from any college but not from his department (Table 4C)
- 77 credit hours of departmental requirements (Table 5) of which:
  - 64 credit hours are core courses (Table 5A),
  - 4 credit hours of graduation project (Table 5B),
  - 8 credit hours from Other Engineering Departments (Table 5C)
  - 1 credit hour (NP, no-grade pass or fail) of practical training (Table 5A).
  - The department provides its students with a chance to register a zero credit hour, no-grade course in research project (Table 5D); this course is NOT required for graduation.

2.2 Senior Graduation Project Requirements (4 credit hours)

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

2.3 Practical Training Requirements (1 no-grade credit hour)

Students in the department are required to complete a 10 weeks practical training requirement in an area related to Petroleum and Natural Gas 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 the 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. S. in Petroleum and Natural Gas Engineering is presented in Table 6.

Table 1: SUMMARY OF B.SC DEGREE REQUIREMENTS IN PETROLEUM AND NATURAL GAS 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	**48**	Common (40) Complementary (6) free course (2)
Department	**77**	Core (64) Graduation Projects (4) Chemical and Mechanical Engineering (8) Research Project (0, NP) Practical training (1,NP)
Total	**165**	

Table 2: Common First Year (32 credit hours)

Level 1			
Course Code	**Course Title**	**Cr. Hr. (X,Y,L)**	**Pre-requisite**
ENGS 100	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 & fitness	1(1,1,0)	
	Total	**16**	

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

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Table3: 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**	

TABLE 3-B: ELECTIVE 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 (48 CREDIT HOURS)

TABLE 4A: 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 & 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 (2,1,0)	CHEM 101; MATH 101
GE 402	Engineering Projects Management	3 (3,1,0)	
GE 403	Engineering Economy	2 (2,1,0)	
Total		**40**	

H(X-Y-L) H=Total Credit Hours X = Lectures; Y = Tutorials; L = Laboratory

Table 4B COLLEGE COMPLEMENTARY COURSES FOR PGE PROGRAM (6 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
Total		**6**	

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TABLE 4C: COLLEGE FREE COURSE FOR PGE PROGRAM (2 CREDIT HOURS

Course Code	Course Title	Cr. Hr. (X,Y,L)	Pre-requisites
PGE xxx	xxxx	2	
Total		**2**	

Table 5: Petroleum and Natural gas Engineering Requirements

Table 5A: Core Courses (65 CREDIT HOURS)

Code & Number	Course Title	Cr. Hrs. (X-Y-L)	Requisites	
			Pre-	Co-
PGE 251	Introduction to Petroleum and Natural Gas Engineering	2(2-1-0)	---	--
PGE 361	Reservoir Rocks and Fluid Flow	2(2-1-0)	PGE 251	---
PGE 362	Reservoir Fluid Properties	2(2-1-0)	PGE 251	---
PGE 363	Reservoir Engineering Laboratory	2(1-0-2)		PGE 362 PGE 361
PGE 366	Natural Gas Reservoir Engineering	2(2-1-0)	PGE 362 PGE 363	---
PGE 391	Principles of Petroleum Geology	3(3-1-0)	PGE 251	---
PGE 450	Seminar	2(1-2-0)	---	PGE 496
PGE 455	Transportation & Storage of Petroleum and Natural Gas	2(2-1-0)	PGE 481	---
PGE 457	Computer Applications in Petroleum and Natural Gas Engineering	2(1-2-0)	PGE 460	PGE 366
PGE 460	Petroleum Reservoir Engineering	3(3-1-0)	PGE 362 PGE 363	---
PGE 464	Improved Oil Recovery	3(3-1-0)	PGE 460	---
PGE 467	Reservoir Simulation	3(3-1-0)	MATH 204 PGE 460	---
PGE 471	Drilling Engineering-1-	2(2-1-0)	---	PGE 490
PGE 474	Drilling Engineering-2-	3(3-1-0)	PGE 471	PGE 494
PGE 476	Drilling Engineering Laboratory	2(1-0-2)	PGE 474	---
PGE 478	Directional and Horizontal Drilling and Well Control	3(3-1-0)	PGE 474	---
PGE 481	Production of Naturally Flowing Wells	3(3-1-0)	PGE 471	---
PGE 482	Artificial Lift Methods and Surface Operations	2(2-1-0)	PGE 481	---
PGE 484	Natural Gas Production Engineering	3(3-1-0)	PGE 366	---
PGE 485	Petroleum Production Engineering Laboratory	2(1-0-2)	---	PGE 481
PGE 486	Stimulation and Sand Production Management	3(3-1-0)	PGE 482	---
PGE 490	Petroleum and Natural Gas Exploration -1-	3(3-1-0)	PGE 391	---
PGE 491	Petroleum and Natural Gas Economics	2(2-1-0)	---	PGE 496
PGE 492	Well Logging	3(3-1-0)	PGE 474	---
PGE 493	Well Test Analysis	3(3-1-0)	PGE 460	---
PGE 494	Petroleum and Natural Gas Exploration -2-	2(2-1-0)	PGE 490	---
Total	**64**			

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Table 5B: Senior Design Projects (4 credit hours)

Code & Number	Course Title	Hours (X-Y-L)	Pre-requisites
PGE 496	Graduation Project - 1	2(2-0-0)	Complete 129 credits and pass all Levels 1-7
PGE 497	Graduation Project - 2	2(2-0-0)	PGE 496
Total		**4**	

H(X-Y-L) H=Total Credit Hours X = Lectures; Y = Tutorials; L = Laboratory

Table 5C: Courses from Other Engineering Departments (8 credit hours)

Code & Number	Course Title	Hours (X-Y-L)	Requisites	
			Pre-	Co-
CHE 304	Thermodynamics for Petroleum and Natural Gas Engineering Students	2(2-1-0)	---	---
CHE 312	Momentum Transport Operations for Petroleum and Natural Gas Engineering Students	3(3-1-0)	---	---
ME 340	Mechanical Engineering for Petroleum and Natural Gas Students	3(3-1-0)	GE 201	---
Total		**8**		

H(X-Y-L) H=Total Credit Hours X = Lectures; Y = Tutorials; L = Laboratory

Table 5D: PGE Practical Training Requirement (Compulsory: 1 NP)

Code & Number	Course Title	Hours (X-Y-L)	Requisites	
			Pre-	Co-
PGE 999	Practical Training	1 (NP)	Successful completion of 110 credit hours	
Total		**1**		

Table 5E: PGE ELECTIVE COURSE WITHOUT CREDIT HOUR (0 NP)

(THIS IS AN OPTIONAL ELECTIVE COURSE WITH NO CREDIT HOURS: NOT REQUIRED FOR THE B.S DEGREE IN PGE)

Code & Number	Course Title	Hours (X-Y-L)	Requisites	
			Pre-	Co-
PGE 998	Research Project	0 (NP)	Successful completion of 129 cr. hr.	

Table 6: Typical Plan for B.Sc. Program in Petroleum and Natural Gas Engineering

Level 1			
Code & Number	**Course Title**	**Cr. Hrs. (X-Y-L)**	**Requisites**
ENGS 100	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**	

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Level 2			
Code & Number	**Course Title**	**Cr. Hrs. (X-Y-L)**	**Requisites**
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 & fitness	1(1,1,0)	
Total		**16**	

Level 3			
Code & Number	**Course Title**	**Cr. Hrs. (X-Y-L)**	**Requisites**
IC 1xx	Optional IC course	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 & Communication	2(2,1,0)	
GE 104	Basics of Engineering Drawing	3(2,0,2)	
Total		**17**	

Level 4			
Code & Number	**Course Title**	**Cr. Hrs. (X-Y-L)**	**Requisites**
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**	

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Level 5			
Code & Number	**Course Title**	**Cr. Hrs. (X-Y-L)**	**Requisites**
IC 1XX	Optional IC Course	2(2,0,0)	---
MATH 204	Differential Equations	3(3-2-0)	MATH 203 (Pre-)
ME 340	Mechanical Engineering for Petroleum Students	3(3-1-0)	GE 201 (Pre-)
CHE 312	Momentum Transport Operations for Petroleum and Natural Gas Engineering Students	3(3-1-0)	---
GE 209	Computer Programming	3(2-0-2)	---
PGE 251	Introduction to Petroleum & Natural Gas Engineering	2(2-1-0)	---
Total		**16**	

Level 6			
Code & Number	**Course Title**	**Cr. Hrs. (X-Y-L)**	**Requisites**
PGE 361	Reservoir Rock Properties and Fluid Flow	2(2-1-0)	PGE 251 (Pre-)
CHE 304	Thermodynamics for Petroleum and Natural Gas Engineering Students	2(2-1-0)	---
PGE 362	Reservoir Fluid Properties	2(2-1-0)	PGE 251 (Pre-)
PGE 363	Reservoir Engineering Laboratory	2(1-0-2)	PGE 361 (Co-) PGE 362 (Co-)
PGE 391	Principles of Petroleum Geology	3(3-1-0)	PGE 251 (Pre-)
IC 1XX	Optional IC Course	2(2,0,0)	---
MATH 254	Numerical Methods	3(3-2-0)	MATH 107 (Pre-)
GE 403	Engineering Economics	2(2,1,0)	
Total		**18**	

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Level 7			
Code & Number	**Course Title**	**Cr. Hrs. (X-Y-L)**	**Requisites**
IC 1XX	Optional IC Course	2(2,0,0)	---
GE 402	Engineering Projects Management	3(3-1-0)	---
PGE 490	Petroleum & Natural Gas Exploration -1-	3(3-1-0)	PGE 391 (Pre-)
PGE 460	Petroleum Reservoir Engineering	3(3-1-0)	PGE 362 (Pre-) PGE 363(Pre-)
PGE 366	Natural Gas Reservoir Engineering	2(2-1-0)	PGE 362 (Pre-) PGE 363 (Pre-)
PGE 471	Drilling Engineering -1-	2(2-1-0)	PGE 490 (Co-)
Total		**15**	

Level 8			
Code & Number	**Course Title**	**Cr. Hrs. (X-Y-L)**	**Requisites**
PGE 492	Well Logging	3(3-1-0)	PGE 471 (Pre-)
PGE 474	Drilling Engineering –2-	3(3-1-0)	PGE 471 (Pre-) PGE 494 (Co-)
PGE 481	Production of Naturally Flowing Wells	3(3-1-0)	PGE 471 (Pre-)
PGE 464	Improved Oil Recovery	3(3-1-0)	PGE 460 (Pre-)
PGE 485	Petroleum Production Engineering Laboratory	2(1-0-2)	PGE 481 (Co-)
PGE 494	Petroleum & Natural Gas Exploration -2-	2(2-1-0)	PGE 490 (Pre-)
PGE 457	Computer Applications in Petroleum and Natural Gas Engineering	2(1-2-0)	PGE 460 (Pre-) PGE 366 (Pre-)
Total		**18**	

Level 9			
Code & Number	**Course Title**	**Cr. Hrs. (X-Y-L)**	**Requisites**
PGE 455	Transportation & Storage of Petroleum and Natural Gas	2(2-1-0)	PGE 481 (Pre-)
PGE 476	Drilling Engineering Laboratory	2(1-0-2)	PGE 474 (Pre-)
PGE 493	Well Test Analysis	3(3-1-0)	PGE 460 (Pre-)
PGE 484	Natural Gas Production Engineering	3(3-1-0)	PGE 366 (Pre-)
PGE 482	Artificial Lift Methods and Surface Operations	2(2-1-0)	PGE 481 (Pre-)
PGE 450	Seminar	2(1-2-0)	PGE 496 (Co-)
PGE 496	Graduation Project - 1	2(2-0-0)	Complete successfully 129 credits hours and passing all courses in levels 1-7.
Total		**16**	

Level 10			
Code & Number	**Course Title**	**Cr. Hrs. (X-Y-L)**	**Requisites**
PGE 491	Petroleum and Natural Gas Economics	2(2-1-0)	PGE 496 (co-)
PGE 486	Well Stimulation and Sand Production Management	3(3-1-0)	PGE 482 (Pre-)
PGE 478	Directional & Horizontal Drillin Control	3(3-1-0)	PGE 474 (Pre-)
PGE 467	Reservoir Simulation	3(3-1-0)	PGE 460 (Pre-) MATH 204 (Pre-)
SC 1XX	Free College Course	2(2-x-0)	
PGE 497	Graduation Project -2	2(2-0-0)	PGE 496
PGE 999	Practical Training	1 (NP)	Complete successfully 110 credits hours
PGE 998	Research Project	0 (NP)	Successful completion of 129 cr. hr
Total		**16**	

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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.

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.

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.

ARAB 100: Writing Skills ***2(2,0,0)***

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.

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.

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

EPH 101: Health and Fitness ***1(1-1-0)***
Subjects about general health and body and brain fitness.

Pre-requisites: None.

3.2 University Requirements

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

IC 101 - Origins of Islamic Culture 2(2,0,0)

IC 102 - Family in Islam 2(2,0,0)

IC 103 - The Economic System in Islam 2(2,0,0)

IC 104 - The Political System in Islam 2(2,0,0)

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)

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. 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. Extrema 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

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

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

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

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

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 AutoDesk Invetor

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, Exploring Engineering: An Introduction to Engineering and design, 4th ed.

Pre-requisite: 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; centroid of simple 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 & 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, MATH 101

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

Prerequisite:

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

This course is being offered to the students who enroll 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- Additional courses

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.

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 Department Requirements

A-CORE COURSES

PGE 251 - Introduction to Petroleum and Natural Gas Engineering ***2(2-1-0)***

The importance and history of petroleum and natural gas. Origin, formation, migration and accumulation of petroleum and natural gas. Introduction to chemistry of petroleum. Classification of petroleum and natural gas. Introduction to petroleum and natural gas reservoirs geology, rocks and fluids properties. Introduction to petroleum and natural gas exploration and well drilling engineering. Introduction to natural gas engineering. Petroleum and natural gas reserves estimation. Introduction to petroleum production engineering, transportation and refining of petroleum. Offshore pollution by petroleum.

Pre-requisites: None

PGE 361 - Reservoir Rock Properties and Fluid Flow ***2(2-1-0)***

Porosity, Permeability, Fluid flow in porous media, Fluid saturations, Capillary pressure, Wettability, surface tension, Relative permabilities.

Pre-requisites: PGE251

PGE 362 - Reservoir Fluid Properties ***2(2-1-0)***

Properties of gases, Phase behavior of liquids, Qualitative phase behavior of hydrocarbon systems, Quantitative phase behavior, Reservoir fluid characteristics.

Pre-requisites: PGE251

PGE 363 - Reservoir Engineering Laboratory ***2(1-0-2)***

Firstly: Determinations of physical properties of reservoir rock: absolute and effective porosity, gas and liquid permeability and Klinkenberg effect, capillary pressure curves and pore size distribution, fluid saturation. Secondly: measurements of PVT characteristics of reservoir fluids: bubble-point pressure, oil formation volume factor, gas solubility, gas formation volume factor and compressibility factor, oil, gas and water viscosities.

Co-requisites: PGE361 and PGE362

PGE 366 - Natural Gas Reservoir Engineering ***2(2-1-0)***

Introduction to natural gas. Physical properties of natural gases. Types of natural gas. Characteristics of gas and gas-condensate reservoirs. Estimation of gas reserves (for normally and abnormally pressured) using different forms of the general material balance equation. Prediction of gas reservoir performance subjected to water drive. Derivation of the basic flow equations for real gas and their solutions in terms of pressure, pressure squared and pseudo function and applications for analyzing gas well testing design and analysis. Production forecasting and decline curve analysis. Gas field development including reservoir deliverability.

Pre-requisites: PGE362 and PGE363

PGE 391 - Principles of Petroleum Geology ***3(3-1-0)***

Structure of the earth: (plate tectonics, depositional basins). Geological time (relative time, absolute time, stratigraphic classifications). Rocks and minerals: (minerals identification, rocks classification, rock cycle). Land and marine erosion and deposition. The subsurface environment: (subsurface waters, earth pressures, earth temperatures, impact on hydrocarbon exploration). Structural geology: (factors controlling behavior of materials, reservoir traps, folds: types, recognition and causes, faults: types and recognition, salt domes: origin and structural evolution). Examples of Saudi Aramco oil field geology: (introduction, total petroleum systems in Ghawwar field). Geological maps: (structure contours, isopach maps, cross-sections, measurements of strike and dip).

Pre-requisites: PGE251

PGE 450 – Seminar ***2(1-2-0)***

This course provides assistance to students to improve their oral presentation skills through, material preparation, proper training, and sufficient presentation practice. The students will attend professional seminars delivered by the department staff and distinguished speakers for the oil industry. Also, in this course students will learn the guidelines of technical reports writing in the field of petroleum engineering.

Co-requisites: PGE496

PGE 455 - Transportation & Storage of Petroleum and Natural Gas ***2(2-1-0)***

Single phase flow equations, friction factor, increasing the capacity of the pipelines, hydraulic gradient for pipelines, selecting the booster pump stations, storage tanks (types, design calculations, testing, gauging, and corrosion control), the components of underground gas storage, characteristics of underground storage..

Pre-requisites: PGE481

PGE 457 - Computer Applications in Petroleum and Natural Gas Engineering ***2(1-2-0)***

Computing techniques emphasizing solution to problems encountered in higher-level courses of petroleum and natural gas engineering.

Pre-requisites: PGE460 and PGE366

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

PGE 460 - Petroleum Reservoir Engineering ***3(3-1-0)***

Classification of reservoirs, oil in place, recovery factor, the material balance equation for oil reservoirs, performance prediction techniques, water influx calculations.

Pre-requisites: PGE362 and PGE363

PGE 464- Improved Oil Recovery ***3(3-1-0)***

Fractional flow, displacement mechanisms, flood patterns, displacement and areal sweep efficiency, peripheral and all pattern flooding, the effect of gas saturation on flooding performance, calculation of injection rate at the water flooding stages, displacement in stratified reservoirs, calculation of the vertical sweep efficiency by different models, calculations of the reservoir performance by using Dykstra-Parsons model, CGM model, water treatment and preparation for water-flooding applications, improved water flooding by chemical and thermal methods.

Pre-requisites: PGE460

PGE 467 - Reservoir Simulation ***3(3-1-0)***

Overview of reservoir simulation. Introduction to elementary mathematics. Properties of reservoir rocks and fluids, Rock-Fluid interaction properties. Reservoir Flow Equations: Single phase and multi-phase flow in porous media (incompressible and compressible). Finite Difference Approximations for one, two and three-dimensional reservoirs, Crank-Nicholson method, Thomas' algorithm. Solutions of systems of linear equations. Applications using a black oil simulator.

Pre-requisites: PGE460 and Math 204

PGE 471 - Drilling Engineering -1- ***2 (2-1-0)***

System of units, calculation of pressure and temperature gradients. Rotary drilling, rig components, well planning, Drill string design of conventional drilling, stress analyses (yield strength, collapse and burst calculations and biaxial stresses. Hoisting system, draw-works, blocks, drilling lines, ton-mile calculation and design factor. Drilling tools, Bit design and selection. Drilling fluids, mud types, functions, Circulating system hydraulics, pressure losses and optimization of bit hydraulics.

Co-requisites: PGE490

PGE 474 - Drilling Engineering -2- ***3(3-1-0)***

Types, origins and methods of estimating pore pressure, formation fracture pressure and methods of its calculations, types, selection, and calculations of drilling fluids, casing seat selection, casing design, cementing, well completion, factors affecting rate of penetration, hole problems, fishing, basics of directional drilling, rig contracts.

Pre-requisites: PGE471 and Co-requisites: PGE494

PGE 476- Drilling Engineering Laboratory ***2(1-0-2)***

For Drilling Fluids: density, viscosity, gel strength, filtration, HPHT filter loss, lubricity, solids content, oil content, sand content, pH and filtrate chemical analysis. For Cement: density, viscosity, filtration, thickening time, setting time, and compressive strength.

Pre-requisites: PGE474

PGE 478 - Directional and Horizontal Drilling and Well Control ***3(3-1-0)***

Introduction to directional drilling. Steps in designing well profile (kick-off point and build-up rate), Directional planning (purpose, considerations and calculations). Kick-off tools (purposes and functions), Horizontal drilling (design of BHA, max. dog-leg severity, fatigue, pipe sticking, miss target, etc.), Survey tools (MWD) and practices, well profile calculations, Well control, hydrostatic pressure vs. formation pressure, formation integrity test, and causes of underbalanced situations, Kick causes, detection and warning signs, shut-In procedures and collection of data, Calculating drillstring and annular volume, kill methods, Well control equipment, Ram-type blowout preventer.

Pre-requisites: PGE474

PGE 481 - Production of Naturally Flowing Wells ***3(3-1-0)***

The performance of production formations. Factors influencing shape of IPR, Vertical lift performance, Flow of single and multiphase fluid flow in vertical pipes (Poettman, Gilbert, Hagedorn and Brown), Choke performance, The principles of gas lift, Production decline analysis using exponential, harmonic, and hyperbolic decline curves, Well-head equipment.

Pre-requisites: PGE471

PGE 482 - Artificial Lift Methods and Surface Operations ***2(2-1-0)***

Surface operations: Oil and gas gathering at oil fields, Oil and gas separators, Dehydration, desalting and stabilization, Heater theater design, Artificial lift methods: introduction, sucker rod pumping, Hydraulic pumping, Electric submergible centrifugal pumps, Gas lift valves and string design, Introduction to other artificial lift methods.

Pre-requisites: PGE481

PGE 484 - Natural Gas Production Engineering ***3(3-1-0)***

Introduction to gas properties. Gas reservoir performance: well deliverability tests, transient testing, and reservoir limit test, well completion effect on gas reservoir performance. Piping system performance: flow equations, and flow in pipelines. Gas compression: types and design of compressors. Total system analysis: tubing and flow line size, separator pressure effect, subsurface safety valve selection, separator pressure effect, and gas condensate reservoir. Field operation problems and gas processing. Gas measurement systems.

Pre-requisites: PGE366

PGE 485 - Petroleum Production Engineering Laboratory ***2(1-0-2)***

A laboratory study of certain basic ASTM petroleum tests; distillation, flash point, pour point, vapor pressure, cloud point, viscosity, specific gravity, water content and sediments, and salt content of crude oil.

Co-requisites: PGE481

PGE 486 - Stimulation and Sand Production Management ***3(3-1-0)***

Well stimulation by hydraulic fracturing: mechanics of fracturing, fracturing fluids and additives. Frac job design, Propping the fracture, Acidizing: acid types and reactions, Carbonate and sandstone acidizing techniques, Causes of sand production and methods of control, Gravel-pack design criteria, Nodal analysis applied to gravel-packed wells, Production of horizontal wells.

Pre-requisites: PGE482

PGE 490 - Petroleum and Natural Gas Exploration -1- ***3(3-1-0)***

Origin of petroleum: (source rocks, kerogen formation and maturation, estimation of generated petroleum), Petroleum migration: (expulsion and accumulation, different concepts), Petroleum reservoirs: (reservoir characteristics, parameters controlling the petroleum reservoirs), Oil in place and reserve calculation.

Pre-requisites: PGE391

PGE 491 - Petroleum and Natural Gas Economics ***2(2-1-0)***

History and legislations of oil in Saudi Arabia, Oil pricing methods, Economical resources, Swing producer, inflation, cartel and market clearing price, Historical data for oil prices development, OPEC, OAPEC and International Energy Agency, Basic engineering economy terms, Simple and Complex interests, Nominal and Effective and combined interest rates, Deterioration and sinking fund factor, Screening yardsticks for economical projects: Formulas for continuous and lump sum flow of fund, Net present value, Rate of return, Accounting rate of return, Growth rate of return, Discounted and undiscounted Payout time, Profit-to-Investment ratio, Benefit-Cost ratio.

Co-requisites: PGE 496

PGE 492 - Well Logging ***3(3-1-0)***

Fundamentals, SP-log, electric resistivity logs, sonic log, density log, neutron log, radioactivity logs (natural and induced gamma ray, neutron), production logs (TDT, Temp., RFT), log interpretation.

Pre-requisites: PGE471

PGE 493 - Well Test Analysis ***3(3-1-0)***

Diffusivity equations, derivation and solutions, superposition pressure drawdown test analysis, transient and semi-steady state, variable rate tests, pressure buildup test analysis, average reservoir pressure, finite and infinite reservoirs, flow barriers, well interference, pulse testing, pressure analysis in anisotropic and fractured reservoirs.

Pre-requisites: PGE460

PGE 494 - Petroleum and Natural Gas Exploration -2- ***2(2-1-0)***

Geophysical methods: (surface and subsurface prospecting for oil and gas, geo-electrical surveying, seismic surveying, gravity surveying, basic principles, equipment, data processing, analysis, geological interpretation and hydrocarbon traps detection). Remote sensing and geographic information systems: basic principles.

Pre-requisites: PGE490

PGE 496 - Graduation Project -1 ***2(2-0-0)***

A research project in which the student uses his gained skills to study a specific point in the field of petroleum and natural gas engineering.

Pre-request: Complete successfully 129 credits hours and passing all courses in levels 1-7.

PGE 497 - Graduation Project -2 ***2(2-0-0)***

A capstone design project in which the student start a comprehensive design in the field of petroleum and natural gas engineering. The group of students will develop oil or gas field from A to Z.

Pre-request: PGE 496

PGE 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.

(THIS IS AN OPTIONAL ELECTIVE COURSE WITH NO CREDIT HOURS: NOT REQUIRED FOR THE B.S DEGREE IN PGE)

Prerequisite: Successful completion of 129 credit hours.

PGE 999: Practical Training ***1 (NP)***

Students in the department are required to complete a 10 weeks summer training requirement in an area related to Petroleum and Natural Gas 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.

Prerequisite: Successful completion of 110 credit hours

B- Courses from Other Engineering Departments

CHE 304 - Thermodynamics for Petroleum and Natural Gas Engineering Students ***2(2-1-0)***

Basic concepts of thermodynamics. Properties of pure substances. First law of thermodynamics for closed systems and for open systems. Second law of thermodynamics. Power cycles. Refrigeration.

Pre-requisites: None

CHE 312 - Momentum Transport Operations for Petro. and N. Gas Eng. Students ***3(3-1-0)***

Fluid statics. Fluid dynamics. Flow around submerged bodies. Flow through porous media. Flow in Fluidized beds. Flow metering devices. Pumps and Fluid moving machinery. Non-Newtonian fluids. Dimensional analysis. Piping design.

Pre-requisites: None

ME 340 - Mechanical Engineering for Petroleum and N. Gas Eng. Students ***3(3-1-0)***

Stress and strain; compatibility of displacement; mechanical properties of materials; generalized Hook's law; torsion of circular cross-sectional beams; the relation between load, shear force and bending moment; pure bending of beams; transverse shear; shear flow; combined loadings; analysis of plane stresses; stress transformation, Mohr's circle-plane stress; thin and thick walled pressure vessels; deflection of beams; buckling.

Pre-requisites: GE 201