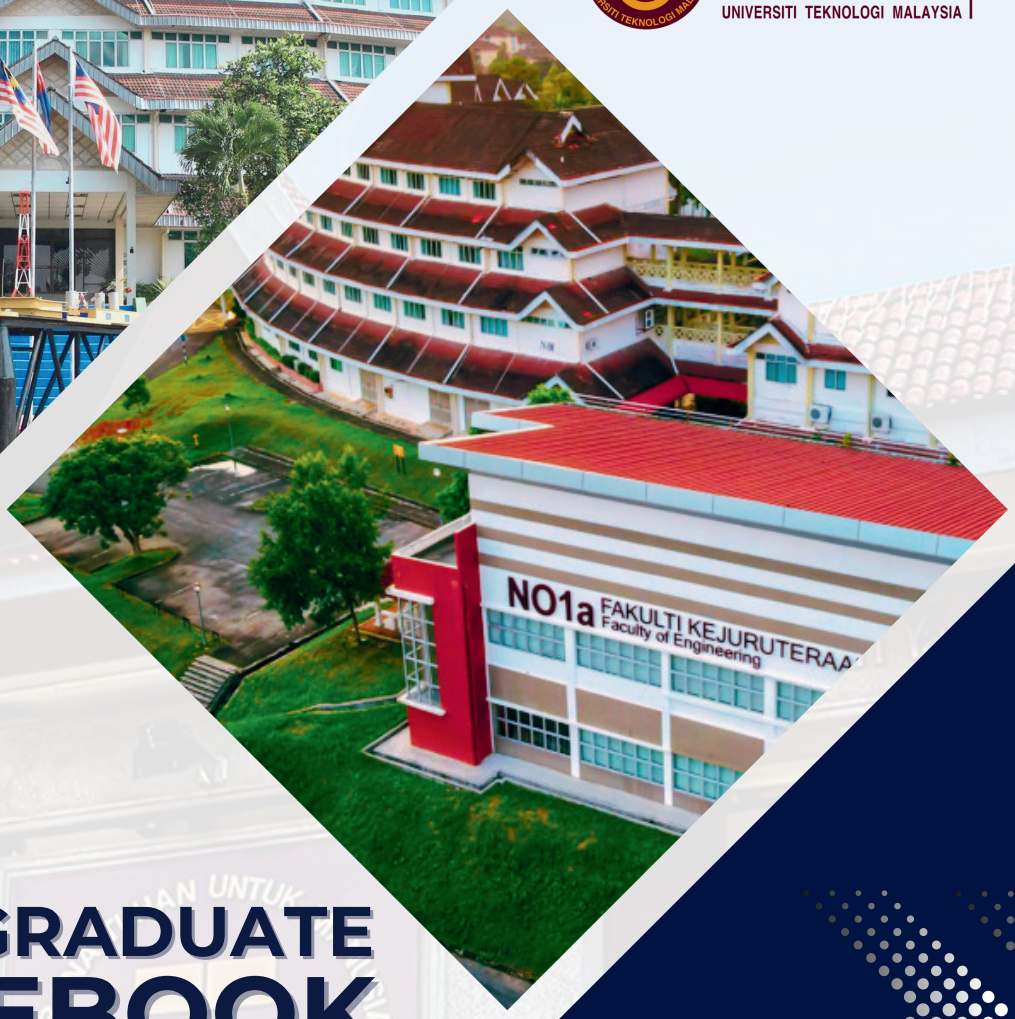

UTM
UNIVERSITI TEKNOLOGI MALAYSIA
Faculty of Chemical and Energy Engineering

UNDERGRADUATE GUIDEBOOK

Academic Session 2023/2024

FACULTY OF CHEMICAL AND ENERGY ENGINEERING

https://fkt.utm.my

QS STARS RATING SYSTEM

QS WORLD UNIVERSITY RANKINGS ASIA TOP 40

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Universiti Teknologi Malaysia
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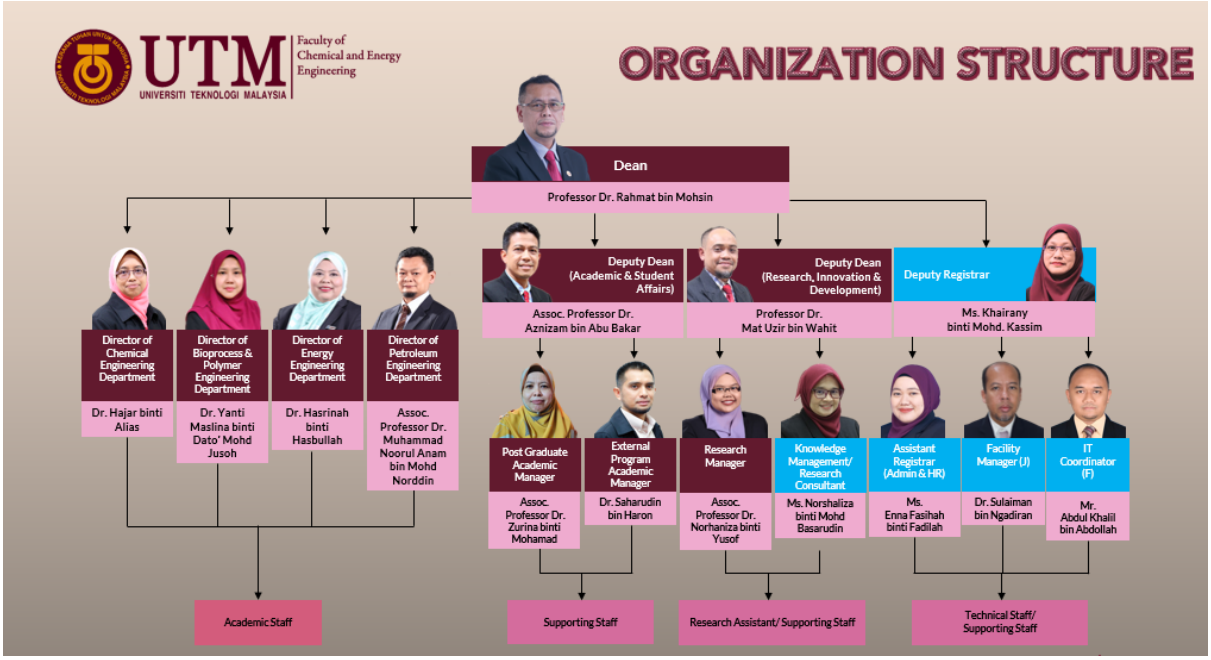
MARKETABLE | EMPLOYABLE | SUSTAINABLE | ENTREPRENEURIAL

MANAGEMENT TEAM



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Director of Petroleum Engineering Department	Associate Prof. Dr. Muhammad Noorul Anam Mohd Norddin anam@utm.my 07-5535514

Programme Educational Objectives (PEO)

Code	Intended Educational Objectives
PEO1	Perform competently in chemical/ bioprocess/ gas/ petroleum/ nuclear industries and become important contributors to national development.
PEO2	Become creative, innovative and adaptable engineers as leaders or team members in their organizations and society.
PEO3	Contribute professionally towards the environmental well-being and sustainable development

Programme Learning Outcomes (PLO)

After having completed the programme, graduates should be able to demonstrate the following competencies:

Code	Intended Learning Outcomes
PLO1	Ability to apply knowledge of mathematics, natural science, engineering fundamentals, chemical/ petroleum/ bioprocess/ gas/ nuclear engineering principles to the solution of complex engineering problems. (WK1-WK4)
PLO2	Ability to identify, formulate, conduct research literature, and analyze complex chemical/ petroleum/ bioprocess/ gas/ nuclear engineering problems using first principles of mathematics and engineering sciences. (WK1-WK4)
PLO3	Ability to design solutions for complex chemical/ petroleum/ bioprocess/ gas/ nuclear engineering problems and design systems or processes to meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations. (WK5)
PLO4	Ability to conduct investigation of complex chemical/ petroleum/ bioprocess/ gas/ nuclear engineering problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions. (WK8)
PLO5	Ability to inculcate modern computational techniques and tools complex chemical/ petroleum/ bioprocess/ gas/ nuclear which include prediction and modeling to solve complex engineering problems with an understanding of the limitations. (WK6)
PLO6	Ability to responsibly act as well as respond to the societal health, safety, environment, legal and cultural issues that are relevant to the professional engineering practice. (WK7)
PLO7	Ability to explain and evaluate the sustainability and impact of professional engineering work in the solution of complex chemical/ petroleum/ bioprocess/ gas/ nuclear engineering problems in societal and environmental contexts. (WK7)
PLO8	Ability to apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice. (WK7)
PLO9	Ability to communicate effectively through written and oral modes to all levels of society. (EA1-EA5)
PLO10	Ability to work independently, and as a member or a leader in a team to manage project in a multi disciplinary environment.
PLO11	Ability to acquire knowledge and engage in independent and life-long learning.
PLO12	Ability to demonstrate knowledge of engineering management principles and entrepreneurial mindset to manage projects in multi-disciplinary environments.

BACHELOR OF CHEMICAL ENGINEERING WITH HONOURS

PROGRAMME SPECIFICATIONS

The Bachelor of Chemical Engineering with Honours is offered either on a full-time or part-time basis. The full-time programme is offered only at the UTM Main Campus in Johor Bahru while the part-time programme is offered at various learning centres throughout Malaysia. The duration of study for the full-time programme is subject to the student's entry qualifications and lasts between four (4) years to a maximum of six (6) years.

The programme is offered on full-time basis and is based on a two-semester per academic session. Generally, students are expected to undertake courses equivalent to between twelve (12) to eighteen (18) credit hours per semester. Assessment is based on coursework and final examination given throughout the semester.

General Information

1. Awarding Institution			Universiti Teknologi Malaysia	
2. Teaching Institution			Universiti Teknologi Malaysia	
3. Programme Name			Bachelor of Chemical Engineering with Honours	
4. Final Award			Bachelor of Chemical Engineering with Honours	
5. National Education Code (NEC)			0711 (Chemical Engineering & Processes)	
6. Programme Code			SETKH	
7. Professional or Statutory Body of Accreditation			Board of Engineers Malaysia (BEM)	
8. Language(s) of Instruction			English and Bahasa Melayu	
9. Mode of Study			Conventional	
10. Mode of Operation			Self-govern	
11. Study Scheme			Full Time and Part Time	
12. Study Duration			Full Time: Minimum : 4 years Maximum : 6 years	
			Part Time: Minimum : 5 years Maximum : 10 years	
Type of Semester	No. of Semesters		No of Weeks/Semester	
	Full Time	Part Time	Full Time	Part Time
Normal	8	10	14	14
Short	4	5	8	8

Course Classification

No.	Classification	Credit Hours	Percentage
i.	University Courses (a) General (b) Language (c) Entrepreneurship (d) Co-Curriculum (e) Free Electives	 6 6 2 2 3	14.0 %
ii.	Faculty/Programme Core	107	79.3 %
iii.	Programme Electives	9	6.7 %
	Total	**135**	**100%**
A	Engineering Courses (a)Lectures (b)Laboratory/ Workshop (c) Industrial Training (d)Final Year Project (e)Integrated Design Project	 78 6 5 6 4	73.3 %
Total Credit Hours for Part A		**99**	
B	Related Courses Applied Science/Mathematics/ Computer Management/Law/ Humanities/Ethics/Entrepreneur Language Co-Curriculum Free Electives	 17 8 6 2 3	26.7 %
Total Credit Hours for Part B		**36**	
Total Credit Hours for Part A and B		**135**	**100%**
Total Credit Hours to Graduate		**135 credit hours**	

Award Requirements

To graduate, students must:

- Attain a total of not less than 135 credit hours with a minimum CGPA of 2.0.
- Pass Industrial Training
- Complete Five (5) Professional Skills Certificates (PSC)

CROSS-CAMPUS PROGRAMME

Students are given the opportunity to enroll in a few courses in participating universities. The grades and credits obtained during this period are transferable (up to 1/3 of the total credits of the curriculum). Currently, there are four participating universities i.e. Universiti Teknologi Malaysia, Universiti Sains Malaysia, Universiti Malaya and Universiti Malaysia Sarawak.

The programme is open to undergraduates who have undergone a minimum of two semesters of their studies with the following conditions:

(i) The total number of credits allowed to be taken is between twelve (12) and sixteen (16) credits only.
(ii) The student should hold a minimum CGPA of 3.00 at the time of application.
(iii) The student is not a residence of or originated from the state where the university that he/she intends to attend is located.

The student will not be charged tuition fees by the participating university but shall pay the regular tuition fees at UTM. However, should the participating university provide accommodation, the student will need to pay accommodation fees.

COURSE MENU

YEAR 1: SEMESTER 1			
Code	**Course**	**Credit**	**Prerequisite**
SETK 1511	Industrial Seminar & Profession	1	
SETK 1523	Introduction to Engineering	3	
SETK 1533	Introduction to Computer Programming	3	
SETK 1213	Statics @	3	
SETK 1111	Engineering Drawings	1	
SSCE 1693	Engineering Mathematics I@	3	
ULRS 1012	Value and Identity	2	
	TOTAL CREDIT	**16**	
	CUMULATIVE CREDITS	**16**	

YEAR 1: SEMESTER 2			
Code	**Course**	**Credit**	**Prerequisite**
SETK 1123	Mass Balance*@	3	
SETK 1223	Thermodynamics@	3	
SSCE 1993	Engineering Mathematics II@	3	
SSCK 1623	Organic Chemistry for Engineering	3	
SSCK 1831	Organic Chemistry Practical	1	
ULRS 1182	Appreciation of Ethics and Civilization (for Local Students Only)	2	
UHLM 1012	Malay Language for Communication 2 (for International Students)		
	TOTAL CREDIT	**15**	
	CUMULATIVE CREDITS	**31**	

YEAR 2: SEMESTER 1			
Code	**Course**	**Credit**	**Prerequisite**
SEEU 2003	Electrical Technology	3	
SSCE 1793	Differential Equations	3	
SETK 2133	Energy Balance*@	3	SETK 1123#
SETK 2233	Fluid Mechanics	3	
SETK 2243	Materials Engineering	3	
SETK 2711	Thermodynamics and Material Eng. Laboratory	1	
ULRF 2**2	Service Learning and Community Engagement Elective	2	
	TOTAL CREDIT	**18**	
	CUMULATIVE CREDITS	**49**	

YEAR 2: SEMESTER 2			
Code	**Course**	**Credit**	**Prerequisite**
SETK 2253	Chemical Engineering Thermodynamics	3	SETK 1223
SETK 2313	Transport Processes*	3	SETK 2133#
SETK 2721	Fluid Mechanics Laboratory	1	
SETK 2543	Numerical Method & Optimization*	3	SETK 1533
UHLB 2122	Professional Communication Skills 1	2	Refer to English Pre-requisite
ULRS 1022	Philosophy and Current Issues	2	
**** ***3	Free Elective	3	
	TOTAL CREDIT	**17**	
	CUMULATIVE CREDITS	**66**	

YEAR 3: SEMESTER 1			
Code	**Course**	**Credit**	**Pre-requisite**
SSCK 1203	Analytical Chemistry for Engineering	3	
SSCK 1891	Analytical Chemistry Practical	1	
SETK 3263	Chemical Reaction Engineering	3	
SETK 3323	Separation Processes*	3	SETK 2313#
SETK 3413	Pollution Control Engineering	3	
SETK 3731	Pollution Control and Reaction Laboratory	1	
UHL* 1112	Communication in Foreign Language Elective	2	
UHLB 3132	Professional Communication Skills 2	2	UHLB 2122
	TOTAL CREDIT	**18**	
	CUMULATIVE CREDITS	**84**	

YEAR 3: SEMESTER 2			
Code	**Course**	**Credit**	**Pre-requisite**
SETK 3564	Process Control & Instrumentation*	4	SSCE 1793# SETK 3323 SETK 3263
SETK 3334	Unit Operation & Industrial Processes	4	SETK 2313#
SETK 3741	Separation Processes Laboratory I	1	SETK 3323
SETK 3812	Undergraduate Project I**	2	
SETK 3343	Engineering Economics and Project Management	3	
ULRS 3032	Entrepreneurship and Innovation	2	
	TOTAL CREDIT	**16**	
	CUMULATIVE CREDITS	**100**	

YEAR 3: SEMESTER 3			
Code	**Course**	**Credit**	**Pre-requisite**
SETK 3915	Industrial Training	5	
	TOTAL CREDIT	**5**	
	CUMULATIVE CREDITS	**105**	

YEAR 4: SEMESTER 1			
Code	**Course**	**Credit**	**Pre-requisite**
SETK 4143	Chemical Product Design	3	
SETK 4751	Process Control Laboratory	1	SETK 3564
SETK 4761	Separation Processes Laboratory II	1	SETK 3334
SETK 4153	Plant Design*	3	SETK 3564
SETK 3552	Occupational Safety and Health in Industry	2	
SETK 4824	Undergraduate Project II**	4	SETK 3812#
SETK 4**3	Elective 1	3	
SET* 5**3	PRISMS Elective 1		
	TOTAL CREDIT	**17**	
	CUMULATIVE CREDITS	**122**	

YEAR 4: SEMESTER 2			
Code	**Course**	**Credit**	**Pre-requisite**
SETK 4573	Process Safety & Operability	3	
SETK 4834	Plant Design Project**	4	SETK 4153
SETK 4**3	Elective 2	3	
SET* 5**3	PRISMS Elective 2		
SETK 4**3	Elective 3	3	
SET* 5**3	PRISMS Elective 3		
	TOTAL CREDIT	**13**	
	CUMULATIVE CREDITS	**135**	

Note: * - cornerstone course; ** - capstone course; @ - with tutorial
- must pass (at least with grade D+) for prerequisite course

English Prerequisite

Students must register and pass the UHLB 1112 course if the English prerequisite is not fulfilled.

ENGLISH PRE-REQUISITE
a) MUET : ≥ Band 4
b) IELTS : ≥ Band 5.5
c) TOEFL: ≥ 525
d) TOEFL iBT : ≥ 60
e) CEFR : ≥ B2

Elective Courses-Streaming (Choose ONE Stream only)

Apart from the core course, students must also take 9 credits of elective course. Students are advised to choose one stream and take 3 courses from the same stream.

1. Energy Management
    - SETK 4113 Sustainable Energy Management
    - SETK 4123 Thermal Energy Management
    - SETK 4133 Energy Planning for Sustainable Development

2. Environment
    - SETK 4413 Waste Management
    - SETK 4423 Environmental Management
    - SETK 4433 Environmental Sustainability

3. Occupational Safety and Health
    - SETK 4513 OSH Legislations and Management
    - SETK 4523 Industrial Hygiene
    - SETK 4533 Human Factors in Process Industry

4. Polymer Science and Technology
    - SETK 4613 Fundamentals of Polymer
    - SETK 4623 Polymer Physics and Properties
    - SETK 4633 Polymer Rheology and Processing

5. Bioprocess Engineering
    - SETK 4643 Downstream Bioprocessing
    - SETK 4653 Pharma and Nutraceutical Engineering
    - SETK 4663 Food Process Engineering

PRISMS ELECTIVE COURSES

For students who intend to enroll in PRISMS, refer to the PRISMS Section for a list of related elective courses associated with the Postgraduate Programme.

Minor in Chemical Engineering

For students from different approved programmes who wish to have a Minor in the Chemical Engineering Programme, they must complete and pass 15 credit hours of the following courses.

No.	Code	Course Name	Credit
1	SETK 1123	Mass Balance	3
2	SETK 2133	Energy Balance	3
3	SETK 3263	Chemical Reaction Engineering	3
4	SETK 3323	Separation Processes	3
5	SETK 4573	Process Safety and Operability	3
Total Credit for Minor			**15**

GRADUATION CHECKLIST

To graduate, students must pass all the stated courses in this checklist. It is the responsibility of the students to ensure that all courses are taken and passed. Students who do not complete any of the courses are not allowed to graduate.

NO.	CODE	COURSE	CREDIT EARNED (JKD)	CREDIT COUNTED (JKK)	TICK (√) IF PASSED
CHEMICAL ENGINEERING COURSES					
1	SETK 1111	Engineering Drawing	1	1	
2	SETK 1213	Statics	3	3	
3	SETK 1511	Industrial Seminar & Profession	1	1	
4	SETK 1523	Introduction to Engineering	3	3	
5	SETK 1533	Introduction to Computer Programming	3	3	
6	SETK 1123	Mass Balance	3	3	
7	SETK 1223	Thermodynamics	3	3	
8	SETK 2133	Energy Balance	3	3	
9	SETK 2233	Fluid Mechanics	3	3	
10	SETK 2243	Material Engineering	3	3	
11	SETK 2711	Thermodynamics and Material Eng. Laboratory	1	1	
12	SETK 2253	Chemical Engineering Thermodynamics	3	3	
13	SETK 2313	Transport Processes	3	3	
14	SETK 2721	Fluid Mechanics Laboratory	1	1	
15	SETK 2543	Numerical Method & Optimization	3	3	
16	SEEU 2003	Electrical Technology	3	3	
17	SETK 3263	Chemical Reaction Engineering	3	3	
18	SETK 3323	Separation Processes	3	3	
19	SETK 3413	Pollution Control Engineering	3	3	
20	SETK 3731	Pollution Control and Reaction Laboratory	1	1	
21	SETK 3552	Occupational Safety and Health in Industry	2	2	
22	SETK 3334	Unit Operation & Industrial Processes	4	4	
23	SETK 3343	Engineering Economics and Project Management	3	3	
24	SETK 3564	Process Control & Instrumentation	4	4	
25	SETK 3741	Separation Process Laboratory I	1	1	
26	SETK 3812	Undergraduate Project I	2	2	
27	SETK 3915	Industrial Training	5	HL	
28	SETK 4143	Chemical Product Design	3	3	
29	SETK 4153	Plant Design	3	3	

30	SETK 4751	Process Control Laboratory	1	1	
31	SETK 4761	Separation Processes Laboratory II	1	1	
32	SETK 4824	Undergraduate Project II	4	4	
33	SETK 4573	Process Safety & Operability	3	3	
34	SETK 4834	Plant Design Project	4	4	
35	SETK 4**3	Elective 1	3	3	
	SET* 5**3	PRISMS Elective 1			
36	SETK 4**3	Elective 2	3	3	
	SET* 5**3	PRISMS Elective 2			
37	SETK 4**3	Elective 3	3	3	
	SET* 5**3	PRISMS Elective 3			
		TOTAL CREDIT OF CHEMICAL ENGINEERING COURSES (a)	99	94	
MATHEMATICS AND SCIENCE COURSES (Faculty of Science)					
1	SSCE 1693	Engineering Mathematics I	3	3	
2	SSCE 1793	Differential Equations	3	3	
3	SSCE 1993	Engineering Mathematics II	3	3	
4	SSCK 1623	Organic Chemistry for Engineering	3	3	
5	SSCK 1831	Organic Chemistry Practical	1	1	
6	SSCK 1203	Analytical Chemistry for Engineering	3	3	
7	SSCK 1891	Analytical Chemistry Practical	1	1	
		TOTAL CREDIT OF MATHEMATICS & SCIENCE COURSES (b)	17	17	
UNIVERSITY GENERAL COURSES					
Malaysia Core Value					
1	ULRS 1182	Appreciation of Ethics and Civilizations (for Local Students)	2	2	
	UHLM 1012	Malay Language Communication 2 (for International Students)			
2	ULRS 1022	Philosophy and Current Issues	2	2	
Value and Identity					
1	ULRS1012	Value and Identity	2	2	
Global Citizen					
1	ULRF2**2	Service Learning & Community Engagement Course	2	2	
Communication Skills					
1	UHLB 2122	Professional Communication Skills 1	2	2	
2	UHLB 3132	Professional Communication Skills 2	2	2	
3	UHL* 1112	Communication in Foreign Language Elective	2	2	
Entreprising Skills					

1	ULRS 3032	Entrepreneurship & Innovation	2	2	
Free Elective					
1	**** ***3	Free Elective Course	3	3	
		TOTAL CREDIT of UNIVERSITY GENERAL COURSES (c)	**19**	**19**	
		TOTAL CREDIT TO GRADUATE (a + b + c)	**135**	**130**	

OTHER COMPULSORY COURSES – PROFESSIONAL SKILLS CERTIFICATE (PSC)			
Students are required to enroll and pass FIVE (5) PSC courses, to be eligible to graduate. Enroll the PSC courses as follows:			
COMPULSORY PSC COURSES (Enroll All 3 Courses)			
1	GLRB0010	Design Thinking for Entrepreneur	
2	GLRM0010	Talent and Competency Management	
3	GLRL0010	English Communication Skills for Graduating Students (ECS)	
ELECTIVE PSC COURSES (Choose Any 2 Courses only)			
1	GLRT0010	Data Analytics for Organization	
2	GLRM0020	Professional Ethics and Integrity	
3	GLRT0020	Construction Measurement (Mechanical & Electrical)	
4	GLRT0030	OSHE for Engineering Industry and Laboratory	
5	GLRT0040	OSHE for Construction Industry and Laboratory Works	
6	GLRT0050	Quality Management for Build Environment and Engineering Professionals	
7	GLRT0060	Safety and Health Officer Introductory Course	
8	GLRT0070	Industrial Machinery and Lubrication	
Or any other elective PSC courses offered by UTM iLeague. Information on PSC Courses: https://ileague.utm.my/utm-professional-skills-certificate-utm-psc/ Online PSC Registration: https://elearnpsc.utmspace.edu.my/			

COURSE SYNOPSIS

CORE COURSES

SETK 1111 - Engineering Drawing

This course introduces students to Computer Aided Drawing tools. The topics include Computer Aided Drawing, Computer Aided Command, Geometry, Geometry, Orthographic Drawing, Isometric Drawing, Sectional Drawing and Flowchart Drawing.

SETK 1213 - Statics

This course introduces students to the basic principles and concepts in mechanics. It will deal with the resultant and resolution of force(s) acting on a particle, the equilibrium of a particle, the effect of force(s) on a rigid body, how to replace a force system with an equivalent system and the equilibrium of rigid body. This course also includes the determination of centroid, analysis of structure and friction. At the end of the course, students should be able to demonstrate and apply the knowledge for solving various engineering problems.

SETK 1511 - Industrial Seminar and Profession

This course introduces students to the basic chemical engineering knowledge and working environment through workshops and seminars by respective personnel (experts, engineers, lectures, alumni, senior students etc.) and also industrial visit to various chemical plants in Malaysia. Students need to prepare learning portfolios which contain summaries and reflections of all the seminars, workshops and industrial visit that they have attended.

SETK 1523 - Introduction to Engineering

The objective of this course is to introduce engineering and prepare students for learning engineering to become an engineer of the future. This course serves to bridge pre-university education to university life and provide support for adjusting to learning and expectations in tertiary education. This introduction is made through a mix of lectures, student-centred activities and presentations. This course employs Cooperative Problem-based Learning (CPBL). Through CPBL, students are not only exposed to frontier chemical engineering related issues, but are also equipped with other important professional skills such as communication, critical thinking, problem solving and life-long learning. CPBL is utilized to inculcate SD among the first year engineering students in order to foster environmentally responsible behaviours and provide strong foundation for more sustainable societies.

SETK 1533 - Introduction to Computer Programming

The main objective of this course is to provide the students the foundation of programming skills as a tool for solving problems in chemical engineering. It helps students to feel justifiably confident of their ability to write small programs that allow them to accomplish useful goals. This course includes the coverage of basics and application of MATLAB software for solving simple arithmetic operations with arrays, two-dimensional plotting and programming using flow control commands with conditional statements and loops. With this foundation of basic programming skills, the course provides opportunities to explore advanced topics for solving complex chemical engineering problems.

SETK 1123 - Mass Balance
This course introduces students to the chemical engineering and chemical processes, process and the fundamental operations of chemical process equipment. It also provides students with the basic principles of chemical engineering material balances as well as calculation techniques to solve material balance problems for chemical process systems and equipment.

SETK 1223 - Thermodynamics
Thermodynamics is an important basic engineering course where concepts such as systems, boundaries, mass, heat, work and energy are introduced. These concepts are then related using the 1st and 2nd Law of Thermodynamics. In this course, the properties of common substances such as water, air and general working fluids are introduced using property tables and basic state equations. These concepts are applied in many engineering equipment, basic refrigeration and power cycles. Such basic concepts are vital because they form the fundamentals for future chemical engineering subjects.

SETK 2133 - Energy Balance
Prerequisite: SETK 1123 Mass Balance (pass with at least D+)
This course introduces students to the chemical engineering profession and the fundamental operations of chemical process equipment. It also provides students with the basic principles of chemical engineering energy balances as well as calculation techniques to solve the material and energy balance problems for chemical process systems and equipment.

SETK 2233 - Fluid Mechanics
The course introduces the fundamental principles underlying fluid behaviour, hydraulics, hydrodynamics, internal and external flows and its analysis of engineering applications for the design of simple hydraulic components such as pump and turbine. The course covers the physics of fluid, classification of flow, fluid statics, fluid dynamics, the application of Bernoulli, continuity, and momentum equations, friction flow in pipes includes the use of Moody chart, flow metering, pump, dimensional analysis and similarity.

SETK 2243 - Material Engineering
The first part of this course is the introductory Materials Engineering. Topics covered include classification of materials (metals, ceramics, polymers, composites, semiconductors, smart materials, nanomaterials, and biomaterials); atomic bonds; crystal structure; crystalline defects and solid solutions; and phase diagrams. Main emphasis is on metals because metals are structurally the simplest to characterise and a sound knowledge of structure-property relation of metals can be extended to the study of ceramics and polymers. The second part of the course deals with mechanics of materials. Topics covered include stress and deformation of members under axial loading and torsion in circular shafts.

SETK 2711 - Thermodynamics and Material Engineering Laboratory
This laboratory course contains 6 experiments that cover basic concepts in Thermodynamics and Strength of Materials. Laboratory experiments are designed for hands-on experiences to understand the engineering principles. The experiments' application includes First and Second Law of Thermodynamics, Properties of Pure Substances and Properties & Strength

of Materials. This course also emphasizes the technical writing aspect where all students' observations and arguments of each experiment must be reported in proper format.

SETK 2253 - Chemical Engineering Thermodynamics
Prerequisite: SETK 1223 Thermodynamics (taken)
This course introduces students to the chemical engineering thermodynamics theory and applications in the areas of volumetric properties of fluids, heat effects, thermodynamics properties of fluids, thermodynamics of solutions, and physical and chemical equilibria.

SETK 2313 - Transport Processes
Prerequisite: SETK 2133 Energy Balance (pass with at least D+)
This course introduces students to the basic principles and application of heat and mass transfer engineering. The understanding from this course will be useful for the better understanding in distillation, absorption, liquid-liquid extraction, membrane separation, leaching, evaporation and other chemical processes.

SETK 2543 - Numerical Method & Optimization
Prerequisite: SETK 1533 Introduction to Computer Programming (taken)
This course introduces students to some numerical techniques in solving problems that could not be solved analytically. Students will be exposed to the numerical solution for roots of equation, system of linear algebraic equations, curve fitting, ordinary differential equations, differentiation and integration problem. MATLAB programming language will be implemented with the intention of illustrating the nuances of the methods, and showing more realistically how the methods are applied for problem solving.

SETK 2721 - Fluid Mechanics Laboratory
The aim of this laboratory course is for students to conduct experiments in conjunction with the theory course SETK 2233 (Fluid Mechanics). There are a total of 9 experiments for this course where two of them (Bourdoun Tube pressure gauge and Toricelli's Law), students need to construct and set up on their own based on the fundamental knowledge and literature finding. Other experiments include the operation of flow measurement equipment (Venturi nozzle, pitot tube, orifice and nozzle), flow through a piping system to determine major and minor losses. The lab runs closely with the lectures' observation in such a way that experiments support the text covered in the classroom.

SETK 3263 - Chemical Reaction Engineering
This course introduces students to chemical reactor design and theories in the area of chemical reaction engineering with emphasis on homogeneous and heterogeneous reactions. It will examine some problems related to isothermal reaction, data analysis, multiple reactions and non-isothermal operations. Students will also work cooperatively on a computer assignment to expose them to solving problems using software packages such as PolyMath.

SETK 3323 - Separation Processes
Prerequisite: SETK 2313 Transport Processes (pass with at least D+)
This course introduces different types of unit operations involved in the chemical and other physical processing industries such as humidification, absorption, distillation, liquid-liquid

extraction and solid-liquid extraction (leaching). It also deals with the design of separation operations using mass transfer principles.

SETK 3413 - Pollution Control Engineering
This course introduces the cause, effect and method to control pollution from industries. The course covers the three major categories of industrial pollution: water pollution, air pollution and industrial waste management. In the first part, the course includes the source and types of water pollutants, environmental regulations pertaining to waste water discharge, and techniques to treat wastewater before discharging to the environment. The second part of the course covers the source and effect of air pollution, regulations requirements for air pollution control, technology to control air pollution emissions from industries. The third part covers the management of industrial waste that includes definition of scheduled waste, scheduled waste regulations, and technique to manage the waste.

SETK 3552 - Occupational Safety and Health in Industry
This course presents a basic knowledge of occupational safety and health (OSH) at work. In particular, it emphasises on current issues and best practices in OSH in Malaysia and the world, OSH legislations, methods of hazard identification, accident prevention concept and its implementation at workplace. At the end of this course, it is expected that the students will be able to appreciate the legal requirements, theoretical and practical aspects of OSH in industry and its impact on the surrounding public community.

SETK 3731 - Pollution Control and Reaction Laboratory
This laboratory course contains experiments that cover basic concepts in chemical reaction engineering and pollution control such as kinetic analysis of reaction, ambient air and water quality analysis. All experiments require students to apply fundamental laboratory techniques and skills as well as communication skills. Students, in group will demonstrate a mastery of laboratory techniques and clearly describe the qualitative and quantitative aspects of the experiments performed.

SETK 3334 - Unit Operation and Industrial Processes
Prerequisite: SETK 2313 Transport Processes (pass with at least D+)
This subject introduces different types of unit operations and separation processes involved in the chemical industries such as particle technology, crystallization, solid-liquid separation, drying and evaporation. All of the topic is illustrated by detailed examples and is accompanied by homework exercises.

SETK 3343 - Engineering Economics and Project Management
This is a two-in-one course covering both Engineering Economy and Project Management topics. Engineering economy is the application of economic factors and criteria to evaluate alternatives, considering the time value of money in order to make an economic decision. The engineering economy study involves computing a specific economic measure of worth for estimated cash flows over a specific period of time. Project Management is the art of planning, scheduling, and controlling of project activities to achieve performance, cost, and time objectives, for a given scope of work, while using resources efficiently and effectively.

SETK 3564 - Process Control & Instrumentation

Prerequisite: SSCE 1793 (pass with at least D+), SETK 3323 Separation Processes & SETK 3263 (taken)

This course covers the fundamentals of dynamic process modelling, dynamic process behaviors and process control. Although more concentration is given to lumped parameter systems modelling, distributed parameter systems are introduced. Feedback control system design, analysis and tuning are dealt with in detail. Also included are model estimation techniques for first order plus dead time (FOPDT) systems. Other commonly found control structures, such as feedforward, ratio, split-range and cascade control, and plant-wide control systems design are taught qualitatively. This course employs Active Learning (AL).

SETK 3741 - Separation Processes Laboratory I

Prerequisite: SETK 3323 Separation Processes (taken)

This subject introduces students to the equipment in the separation processes discussed in the Separation Processes course. This will give a 'hands-on' experience to the students on how to handle the unit operations and to interpret the data taken from the experiments. There are also various types of packing and plate in the column (absorption and distillation) that are being used in the laboratory. Comparison can be made on the efficiency of each packing/plate after all the packing/plate types have been used. This subject also demonstrates the basic principles of different types of unit operations involved in the chemical industries such as liquid-liquid extraction and heat exchanger. Students will be assessed through instructor's observation, peer evaluation and technical report submitted.

SETK 3812 - Undergraduate Project I

This course is a first stage of the Undergraduate Project which involves preliminary studies and planning on how to carry out the study that is given to the students. It is designed to expose the students on how to write a research proposal. It will emphasize on the research philosophy and research methodology. The works include literature review, writing a problem statement, scope identification, objectives and method determination. At the end of the course, students should be able to write a research proposal in a professional practice. The students should also be able to manage and plan their research according to the time given.

SETK 3915 - Industrial Training

This course is a core course which will assign students to industries, governments or semi-governments agencies and organizations for a period of 12 weeks. The training aims to expose students to real chemical engineering practices while enhancing their knowledge and working experiences as well as improving their interpersonal skills. The students also have the opportunities to apply learned theories into real chemical engineering practices. Students are supervised by the school and industrial supervisors.

SETK 4143 - Chemical Product Design

This course offers a background understanding to design a chemical product using a computer-aided approach. This course introduces step by step in designing chemical products from market survey, problem formulation, establishing product needs, generating ideas to produce the targeted product, selecting among ideas and manufacturing of product. The lecture will apply the step by step of the product design using applicable case studies for

design of a product as well as enhance the understanding of the design process among students. The product is designed to meet the product specifications, environmental issues and also taking into consideration sustainable issues.

SETK 4153 - Plant Design

Prerequisite: SETK 3564 Process Control & Instrumentation (taken)

This course presents the principles and methodology for product and process design. In particular, it emphasizes on the key elements of process design which include process synthesis, heat integration, equipment sizing and cost estimation and process optimization in generating inherently safe, economic and environmentally friendly processes. The course features the use of process simulation tools.

SETK 4751 - Process Control Laboratory

Prerequisite: SETK 3564 Process Control & Instrumentation (taken)

This course exposes students to areas of process control systems in the chemical industry. It also teaches the students how to control the specific control variables through the use of simple PID control. Students will experience how to perform open loop and closed loop tuning methods for specific processes. Also included is the application of the PLC program to plan and control a simple process. Students will gain hands-on experience in process control through experiments that employ pilot-scale chemical processes.

SETK 4761 - Separation Processes Laboratory II

Prerequisite: SETK 3323 Separation Processes (taken)

This course introduces students to the equipment in the separation processes discussed in Separation Processes and Unit Operations and Industrial Processes courses. This will give a 'hands-on' experience to the students how to handle the unit operations and to interpret the data taken from the experiments. This laboratory covers particulate solid separation process, filtration, fluidized bed, spray drying, tray drying and evaporation experiments which will expose the students to the variety of the equipment that can be used in the chemical process industries. Students will be assessed through instructor's observation, peer evaluation and technical report submitted.

SETK 4824 - Undergraduate Project II

Prerequisite: SETK 3812 Undergraduate Project I (pass with at least D+)

This course is a second stage of the Undergraduate Project which involves doing experimental works / studies and discussing the results of the project. It is designed to expose the students to writing a research report. It will emphasize on the research philosophy and research methodology. The works include literature review, writing a problem statement, scope identification, objective, experimental work and discussing the results. At the end of the course, students should be able to write a thesis/ research report in a professional practice. The students should also be able to manage and plan their research according to the time given.

SETK 4573 - Process Safety & Operability

This course is intended to impart important insights on safety and operability of chemical plant operations. It reveals the current state of the art technology adopted by the process industries to deal with ever-increasing demand to make the plant safer, environmentally benign and

profitable. Techniques to evaluate the adequateness of the layer of protection adopted by the process plant shall be mastered. The course also offers systematic methods for troubleshooting plausible root causes of operational problems and deciding appropriate corrective actions. It also features extensive use of project-based learning, discussions and oral presentations and written reports.

SETK 4834 - Plant Design Project
Prerequisite: SETK 4513 Plant Design (taken)
This project is aimed at equipping the students with the skills and creativity in designing a process plant in the absence of complete data. In particular, it emphasizes on the key elements of process design which include process creation/synthesis, process analysis, process evaluation and process optimization in generating inherently safe, economic and environmentally friendly processes. Students will acquire the skill for hands-on application and integration of the principles of chemical engineering required to design a process plant. Students will also learn the technique of writing a comprehensive technical plant design report.

ELECTIVE COURSES (STREAMING)

1. Energy Management

SETK 4113 - Sustainable Energy Management
This course presents the principles for a holistic approach for energy management in a company setting. It provides strategies and methodologies for setting up a sustainable energy management system in a company and for implementing state-of-the-art energy conservation measures using various analysis tools, involving various processes equipment for thermal energy as well as electrical energy systems.

SETK 4123 - Thermal Energy Management
This course presents the principles and a system approach methodology to analyze thermal energy systems in the industries. The course will cover the fundamentals of a typical industrial steam system, including steam generation, steam distribution, steam end-uses, condensate recovery and cogeneration system. This course also presents the key parameters and measurements that are required to conduct the steam system evaluation. This course also introduces process integration to improve the energy efficiency of a thermal energy system.

SETK 4133 - Energy Planning for Sustainable Development
This course provides students with the ability to use EXCEL spreadsheet and Generalized Algebraic Modeling System (GAMS) as a tool for solving realistic energy issues. Students are expected to use basic and advanced features of Excel spreadsheet such as regression analysis, optimization calculations, matrix operations and more in-depth functions and techniques such as VBA (Visual Basic for Applications) and macro programming as well as Excel's statistical functions and GAMS. Emphasis will be placed on the formulation of mathematical models, solving and interpreting meaningful problems in engineering, science and business.

2. Environment

SETK 4413 - Waste Management

The course aims to analyze the components of solid and hazardous waste management. Upon completion of the course, students should be able to apply the concept of solid and hazardous waste management and identify the issue in waste management. The course covers the analysis of sources, generation and characteristics of industrial and municipal wastes, selection and evaluation of collection systems, handling and disposal practices of municipal wastes, management of scheduled wastes, the design of waste treatment systems and the pollution prevention and techniques.

SETK 4423 - Environmental Management

The course aims to provide knowledge and understanding on environmental management in Malaysia as well as to develop intellectual skills in environmental planning. In order to achieve this, the course is basically divided into two components which are the overview of environmental management in Malaysia and the sequence of environmental planning. Students will be taught on the methodology to carry out environmental impact assessment (EIA). Term projects for students to experience the stages involved in environmental planning

SETK 4433 - Environmental Sustainability

This course introduces students to issues of environmental sustainability. The course includes discussion on the fundamentals of environmental cycle, concept of sustainability, environmental consequences of coastal and inland developments. At the end of the course, students should be able to apply the knowledge by associating environmental problems that arise with poor management of environmentally sensitive areas. The students should be able to work in a team to demonstrate the project development practices related to the environmental enhancement.

3. Occupational Safety and Health

SETK 4513 - OSH Legislations and Management

This course presents the principles of OSH Legislations and Management. The course features extensive use of case studies from industry through group as well as individual project work.

SETK 4523 - Industrial Hygiene

This course covers the fundamentals of industrial hygiene, which in most countries including the UK, Commonwealth countries and Europe, is termed as occupational hygiene. Industrial hygiene is generally defined as the art and science dedicated to the anticipation, recognition, evaluation, communication and control of environmental stressors in, or arising from, the workplace that may result in injury, illness, impairment, or affect the well-being of workers and members of the community. The concept stems from construction, mining and manufacturing industries, and is particularly familiar among process industries. The course is started by introducing the students to the industrial hygiene field of the area. Then different categories of hazards are covered so that students may understand the source of problems/hazards. Fugitive emission, which is the main source of background exposure to workers in process

industries, is introduced to the students. Finally, the assessment and control measure of the hazards are also presented.

SETK 4533 - Human Factors in Process Industry
This course introduces a basic knowledge of human factors principles and the nature of human interaction with their physical work environment. The content of this course includes behaviors, cognitive, socio-technical systems, and the nature of human performance in the process industry.

4. Polymer Science and Technology

SETK 4613 - Fundamentals of Polymer
Basic terminologies, principles on polymers and structural relationship towards polymer classification are discussed. An overview on the polymer industry is elaborated together with its impact on human life. Molecular weight relationships toward polymer properties and its implication are briefly presented. This course emphasizes specifically on the advance of polymer synthesis including step-growth, chain-growth and coordination polymerizations. Kinetic for the polymerization mechanism is described and its relationship to molecular weight is explained in detail. The limitations and application for each polymerization mechanism are discussed. The polymerization systems used for the polymerization process are discussed together with their advantages and the disadvantages. Finally, this course also exposed students to the pilot scale set-up of the polymerization systems.

SETK 4623 - Polymer Physics and Properties
This course is designed to expose students to the properties of polymers which have great importance. It will emphasize on the mechanical properties, electrical properties, chemical resistance, degradation effects and flammability properties, A strong emphasis will be given on the mechanical properties which include viscoelastic behavior, tensile, flexural and impact properties. Long term test using creep deformation is also included. At the end of the course the student should be able to explain the interrelation between polymer properties, structures and applications. The students should also be able to describe the appropriate test and characterization for each property.

SETK 4633 - Polymer Rheology and Processing
This course will discuss about Newtonian and non-Newtonian flow, pseudo-plastic, Bingham, dilatant and thixotropic behavior, origin of non-Newtonian flow. Students will be able to do Modelling of polymer melt flow-isothermal flow of Newtonian and power law fluids (drag and pressure flow) through different channels of uniform cross-section. This course will also cover topics such as measurement of flow properties, melt flow indexer, capillary viscometers, and cone and plate viscometer, characteristics and Rabinowitch correction. Students should be able to explain the application of rheological studies in polymer processing-extruder screw and die, analysis of pressure, drag and leakage flow, characterization and interaction of screw and die, balanced runner molding.

5. Bioprocess Engineering

SETK 4643 - Downstream Bioprocessing

The aim of the course is to provide an overview of the various downstream processes involved in the production of bio-products such as food, beverages, antibiotics, antiferons, vitamins, insulins, citric acid and others. The unique natures of biomolecules make their separation processes different from conventional chemical processes. In addition, the application of mass transfer, mass balances, and thermodynamics principles are combined with life sciences so as to develop, impart and vary the biotechnology purification techniques. The various bioseparation techniques include centrifugation, microfiltration, ultrafiltration, adsorption, chromatography, electrophoresis, and many more. Students will be tested in their ability to understand the subject based on the ability to answer tests, quizzes, tutorials, assignments and final examination. In addition, class presentation based on the project also will be carried out during the end of semester.

SETK 4653 - Pharma and Nutraceutical Engineering

This course introduces students to some aspects of pharmaceutical and nutraceutical engineering. Students will be exposed to the fundamental elements, including physicochemical and biopharmaceutical drugs formulation, drug delivery system, pharmaceutical microbiology and nutraceutical considerations. At the end of lectures, students will be able to understand the theory aspects and some applications in pharmaceutical and nutraceutical engineering. Students will be tested in their ability to answer during lecture class, tests, tutorials, assignments and final examination.

SETK 4663 - Food Process Engineering

This course introduces students to some major principles, concepts and applications in handling, processing and packaging of foods including the design of process equipment. The course will also provide practice in case studies, carrying out an industrial visit project to observe the application of knowledge in food industries and setting informative research on the business planning of selective food processing operations.

Mapping of Courses to Programme Outcomes for
Bachelor of Chemical Engineering with Honours

		PROGRAMME LEARNING OUTCOMES (PLO)											
		Engineering Knowledge	Problem Analysis	Design/Development of Solution	Investigation	Modern Tool Usage	The Engineer and Society	Environment & Sustainability	Ethics	Communication Skills	Leadership and Teamwork	Life Long Learning	Project Management and Finance
COURSE CODE	**COURSE NAME**	**PLO1**	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**
PROGRAMME CORE COURSES													
SEEU 2003	Electrical Technology	/											
SETK 1111	Engineering Drawing					/			/			/	
SETK 1123	Mass Balance	/	/	/								/	
SETK 2133	Energy Balance	/	/	/								/	
SETK 4143	Chemical Product Design	/				/		/					/
SETK 4153	Plant Design	/		/		/		/		/			/
SETK 1213	Statics	/	/				/				/		
SETK 1223	Thermodynamics	/	/						/		/		
SETK 2233	Fluid Mechanics	/	/					/			/		
SETK 2243	Material Engineering	/	/				/				/		
SETK 2253	Chemical Engineering Thermodynamics	/	/							/	/		
SETK 3263	Chemical Reaction Engineering	/	/	/		/		/					
SETK 2313	Transport Processes	/		/				/				/	
SETK 3323	Separation Processes	/		/			/					/	
SETK 3334	Unit Operations & Industrial Processes	/	/							/	/		
SETK 3343	Engineering Economics and Project Management	/							/	/			/
SETK 3413	Pollution Control Engineering	/		/			/	/	/				
SETK 1511	Industrial Seminar & Profession	/				/	/					/	
SETK 1523	Introduction to Engineering	/			/					/		/	
SETK 1533	Introduction to Computer Programming	/				/					/	/	
SETK 2543	Numerical Methods & Optimization	/	/			/			/			/	
SETK 3552	Occupational Safety and Health in Industry	/					/	/	/				

		PROGRAMME LEARNING OUTCOMES (PLO)											
		Engineering Knowledge	Problem Analysis	Design/Development of Solution	Investigation	Modern Tool Usage	The Engineer and Society	Environment & Sustainability	Ethics	Communication Skills	Leadership and Teamwork	Life Long Learning	Project Management and Finance
COURSE CODE	**COURSE NAME**	**PLO1**	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**
SETK 3564	Process Control & Instrumentation	/		/		/				/	/		
SETK 4573	Process Safety & Operability	/	/	/						/	/		
SETK 2711	Thermodynamics and Material Eng. Laboratory		/		/					/	/		
SETK 2721	Fluid Mechanics Laboratory		/		/					/	/		
SETK 3731	Pollution Control and Reaction Laboratory		/		/					/	/		
SETK 3741	Separation Processes Laboratory I		/		/					/	/		
SETK 4751	Process Control Laboratory		/		/	/				/	/		
SETK 4761	Separation Processes Laboratory II		/		/					/	/		
SETK 3812	Undergraduate Project I	/	/	/			/	/	/	/		/	/
SETK 4824	Undergraduate Project II	/	/	/	/		/	/	/	/		/	/
SETK 4834	Plant Design Project	/	/	/		/	/	/	/	/	/	/	/
SETK 3915	Industrial Training	/	/				/		/	/			
PROGRAMME ELECTIVE COURSES (required 3 courses only)													
SETK 4113	Sustainable Energy Management	/								/		/	
SETK 4123	Thermal Energy Management	/		/						/		/	
SETK 4133	Energy Planning for Sustainable Development	/				/		/		/		/	
SETK 4413	Waste Management	/		/						/		/	
SETK 4423	Environmental Management	/								/		/	
SETK 4433	Environmental Sustainability	/								/		/	
SETK 4513	OSH Legislations and Management	/								/		/	
SETK 4523	Industrial Hygiene	/								/		/	
SETK 4533	Human Factors in Process Industry	/								/		/	
SETK 4613	Fundamentals of Polymer	/								/		/	

		PROGRAMME LEARNING OUTCOMES (PLO)											
		Engineering Knowledge	Problem Analysis	Design/Development of Solution	Investigation	Modern Tool Usage	The Engineer and Society	Environment & Sustainability	Ethics	Communication Skills	Leadership and Teamwork	Life Long Learning	Project Management and Finance
COURSE CODE	**COURSE NAME**	**PLO1**	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**
SETK 4623	Polymer Physics and Properties	/								/		/	
SETK 4633	Polymer Rheology and Processing	/								/		/	
SETK 4643	Downstream Bioprocessing	/								/		/	
SETK 4653	Pharma and Nutraceutical Engineering	/								/		/	
SETK 4663	Food Process Engineering	/								/		/	

BACHELOR OF CHEMICAL ENGINEERING (BIOPROCESS) WITH HONOURS

PROGRAMME SPECIFICATIONS

The Bachelor of Chemical Engineering (Bioprocess) with Honours is offered on a full-time basis. The full-time programme is offered only at the UTM Main Campus in Johor Bahru. The duration of study for the full-time programme is subject to the student's entry qualifications and lasts between four (4) years to a maximum of six (6) years.

The programme is offered on full-time basis and is based on a two semesters per academic session. Generally, students are expected to undertake courses equivalent to between twelve (12) to eighteen (18) credit hours per semester. Assessment is based on courseworks and final examinations given throughout the semester.

General Information

1. Awarding Institution			Universiti Teknologi Malaysia	
2. Teaching Institution			Universiti Teknologi Malaysia	
3. Programme Name			Bachelor of Chemical Engineering (Bioprocess) with Honours	
4. Final Award			Bachelor of Chemical Engineering (Bioprocess) with Honours	
5. National Education Code (NEC)			0711 (Chemical Engineering & Processes)	
6. Programme Code			SETBH	
7. Professional or Statutory Body of Accreditation			Board of Engineers Malaysia (BEM)	
8. Language(s) of Instruction			English and Bahasa Melayu	
9. Mode of Study			Conventional	
10. Mode of Operation			Self-govern	
11. Study Scheme			Full Time	
12. Study Duration			Minimum : 4 years Maximum : 6 years	
Type of Semester	No. of Semesters		No of Weeks/Semester	
	Full Time	Part Time	Full Time	Part Time
Normal	8	-	14	-
Short	4	-	8	-

Course Classification

No.	Classification	Credit Hours	Percentage
i.	University Courses (a) General (b) Language (c) Entrepreneurship (d) Co-Curriculum (e) Free Electives	 6 6 2 2 3	13.8%
ii.	Faculty/Programme Core	113	81.8%
iii.	Programme Electives	6	4.4%
	Total	**138**	**100%**
A	Engineering Courses (a) Lecture (b) Laboratory/Workshop (c) Industrial Training (d) Final Year Project (e) Integrated Design Project	 77 7 5 6 4	71.7%
Total Credit Hours for Part A		**99**	
B	Related Courses (a) Applied Science/Mathematic/ Computer (b) Management/Law/Humanities/Ethics/Entrepreneur (c) Language (d) Co-Curriculum (e) Free Electives	 20 8 6 2 3	28.3%
Total Credit Hours for Part B		**39**	
Total Credit Hours for Part A and B		**138**	**100%**
Total Credit Hours to Graduate		**138 credit hours**	

Award Requirements

To graduate, students must:

- Attain a total of not less than 138 credit hours with a minimum CGPA of 2.0
- Pass Industrial Training
- Complete Five (5) Professional Skills Certificates (PSC)

CROSS-CAMPUS PROGRAMME

Students are given the opportunity to enroll in a few courses in participating universities. The grades and credits obtained during this period are transferable (up to 1/3 of the total credits of the curriculum). Currently, there are four participating universities i.e. Universiti Teknologi Malaysia, Universiti Sains Malaysia, Universiti Malaya and Universiti Malaysia Sarawak.

The programme is open to undergraduates who have undergone a minimum of two semesters of their studies with the following conditions:

(i) The total number of credits allowed to be taken is between twelve (12) and sixteen (16) credits only.
(ii) The student should hold a minimum CGPA of 3.00 at the time of application.
(iii) The student is not a resident of or originated from the state where the university that he/she intends to attend is located.

The student will not be charged tuition fees by the participating university but shall pay the regular tuition fees at UTM. However, should the participating university provide accommodation, the student will need to pay accommodation fees.

COURSE MENU

YEAR 1: SEMESTER 1			
Code	**Course**	**Credit**	**Pre-requisite**
SETB 1011	Industrial & Career Seminar	1	
SETB 1021	Engineering Drawing	1	
SETB 1023	Introduction to Chemical & Bioprocess Engineering	3	
SETB 1123	Statics & Biomaterial@	3	
SEEU 2003	Electrical Technology	3	
SSCE 1693	Engineering Mathematics I@	3	
ULRS 1012	Value and Identity	2	
	TOTAL CREDIT	**16**	
	CUMULATIVE CREDITS	**16**	

YEAR 1: SEMESTER 2			
Code	**Course**	**Credit**	**Pre-requisite**
SETB 1113	Mass Balance*@	3	
SETB 2033	Thermodynamics@	3	
SETB 1133	Microbiology for Engineers	3	
SSCE 1993	Engineering Mathematics II@	3	SSCE 1693
ULRS 1182	Appreciation of Ethics and Civilizations (for Local Students)	2	
UHLM 1012	Malay Language Communication 2 (for International Students)		
	TOTAL CREDIT	**14**	
	CUMULATIVE CREDITS	**30**	

YEAR 2: SEMESTER 1			
Code	**Course**	**Credit**	**Pre-requisite**
SETB 2113	Introduction to Programming	3	
SETB 2123	Energy Balance*@	3	SETB 1113#
SETB 2043	Fluid Mechanics	3	
SSCK 1603	Organic Chemistry: Functional Group	3	
SSCK 1831	Organic Chemistry Practical	1	
SSCE 1793	Differential Equations	3	SSCE 1693
ULRF 2**2	Service Learning & Community Engagement Courses	2	
	TOTAL CREDIT	**18**	
	CUMULATIVE CREDITS	**48**	

YEAR 2: SEMESTER 2			
Code	**Course**	**Credit**	**Pre-requisite**
SETB 2133	Chemical Engineering Computation	3	
SETB 2213	Chemical Engineering Thermodynamics	3	SETB 2033
SETB 2313	Transport Processes*	3	SETB 2123
SETB 2711	Thermodynamics and Material Eng. Laboratory	1	SETB 2033
SSCK 1203	Analytical Chemistry for Engineering	3	
SSCK 1891	Analytical Chemistry Practical	1	
ULRS 1022	Philosophy and Current Issues	2	
UHLB 2122	Professional Communication Skills 1	2	
	TOTAL CREDIT	**18**	
	CUMULATIVE CREDITS	**66**	

YEAR 3: SEMESTER 1			
Code	**Course**	**Credit**	**Pre-requisite**
SETB 3223	Chemical Reaction Engineering	3	
SETB 3323	Separation Processes*	3	SETB 2313
SETB 3413	Environmental Eng. and Sustainability	3	
SETB 3213	Biochemistry	3	
SETB 1721	Bioprocess Engineering Laboratory: Upstream	1	
SETB 2721	Fluid Mechanics Laboratory	1	
UHLB 3132	Professional Communication Skills 2	2	UHLB 2122
UHL* 1112	Foreign Language for Communication	2	
	TOTAL CREDIT	**18**	
	CUMULATIVE CREDITS	**84**	

YEAR 3: SEMESTER 2			
Code	**Course**	**Credit**	**Pre-requisite**
SETB 3113	Bioseparation Technology	3	
SETB 3143	Process Control*	3	SSCE 1793 SETB 3323
SETB 3173	Engineering Economics and Project Management	3	
SETB 3812	Undergraduate Project I**	2	

SETB 3741	Bioprocess Engineering Laboratory: Downstream	1	
SETB 3721	Pollution Control & Reaction Laboratory	1	
ULRS 3032	Entrepreneurship & Innovation	2	
**** ***3	Free Elective	3	
	TOTAL CREDIT	**18**	
	CUMULATIVE CREDITS	**102**	

YEAR 3: SEMESTER 3			
Code	**Course**	**Credit**	**Pre-requisite**
SETB 3915	Industrial Training	5	
	TOTAL CREDIT	**5**	
	CUMULATIVE CREDITS	**107**	

YEAR 4: SEMESTER 1			
Code	**Course**	**Credit**	**Pre-requisite**
SETB 4814	Undergraduate Project II**	4	SETB 3812#
SETB 3133	Bioreactor Design & Analysis	3	
SETB 4153	Plant Design*	3	SETB 3143
SETB 4163	Safety and Health in Chemical & BioIndustry	3	
SETB 3731	Separation Processes Laboratory	1	SETB 3323
SETB 3123	Molecular Biology & Genetic Engineering	3	
	TOTAL CREDIT	**17**	
	CUMULATIVE CREDITS	**124**	

YEAR 4: SEMESTER 2			
Code	**Course**	**Credit**	**Pre-requisite**
SETB 4824	Plant Design Project**	4	SETB 4153, SETB 4163
SETB 4133	Quality Management in BioManufacturing	3	
SETB 4741	Process Control Laboratory	1	
SETB 4**3	Bioprocess Elective Course 1	3	
SET* 5**3	PRISMS Elective Course 1		
SETB 4**3	Bioprocess Elective Course 2	3	
SET* 5**3	PRISMS Elective Course 2		
	TOTAL CREDIT	**14**	
	CUMULATIVE CREDITS	**138**	

Note: * - cornerstone course; ** - capstone course; @ - with tutorial
- must pass (at least with grade D+) for pre-requisite course

English Pre-Requisite

Students must register and pass UHLB 1112 course if the English pre-requisite is not fulfilled.

ENGLISH PRE-REQUISITE
a) MUET : ≥ Band 4
b) IELTS : ≥ Band 5.5
c) TOEFL: ≥ 525
d) TOEFL iBT : ≥ 60
e) CEFR : ≥ B2

BIOPROCESS ELECTIVE COURSES

SETB 4213 Food Process Engineering
SETB 4223 Environmental Biotechnology for Engineers
SETB 4233 Bioproduct Development and Processing
SETB 4243 Biopharmaceutical Engineering
SETB 4253 Green Energy Engineering
SETB 4263 Tissue Culture and Cell Engineering

PRISMS ELECTIVE COURSES

For students who intend to enroll in PRISMS, refer to the PRISMS Section for a list of related elective courses associated with the Postgraduate Programme.

GRADUATION CHECKLIST

To graduate, students must pass all the stated courses in this checklist. It is the responsibility of the students to ensure that all courses are taken and passed. Students who do not complete any of the courses are not allowed to graduate.

NO.	CODE	COURSE	CREDIT EARNED (JKD)	CREDIT COUNTED (JKK)	TICK (√) IF PASSED
CHEMICAL-BIOPROCESS ENGINEERING COURSES					
1	SETB 1011	Industrial Career & Seminar	1	1	
2	SETB 1021	Engineering Drawing	1	1	
3	SETB 1023	Introduction to Chemical & Bioprocess Engineering	3	3	
4	SETB 1123	Statics & Biomaterial	3	3	
5	SETB 2033	Thermodynamics	3	3	
6	SETB 1113	Mass Balance	3	3	
7	SETB 1133	Microbiology for Engineers	3	3	
8	SETB 2113	Introduction to Programming	3	3	
9	SETB 2123	Energy Balance	3	3	
10	SETB 2043	Fluid Mechanics	3	3	
11	SETB 2721	Fluid Mechanics Laboratory	1	1	
12	SETB 1721	Bioprocess Engineering Laboratory: Upstream	1	1	
13	SETB 2133	Chemical Engineering Computation	3	3	
14	SETB 2213	Chemical Engineering Thermodynamics	3	3	
15	SETB 2313	Transport Processes	3	3	
16	SETB 2711	Thermodynamics and Material Eng. Laboratory	1	1	
17	SETB 3213	Biochemistry	3	3	
18	SETB 3123	Molecular Biology & Genetic Engineering	3	3	
19	SETB 3223	Chemical Reaction Engineering	3	3	
20	SETB 3323	Separation Processes	3	3	
21	SETB 3413	Environmental Eng. and Sustainability	3	3	
22	SETB 3721	Pollution Control and Reaction Laboratory	1	1	
23	SETB 3113	Bioseparation Technology	3	3	
24	SETB 3133	Bioreactor Design & Analysis	3	3	
25	SETB 3812	Undergraduate Project I	2	2	

26	SETB 3731	Separation Processes Laboratory	1	1	
27	SETB 3143	Process Control	3	3	
28	SETB 3741	Bioprocess Engineering Laboratory: Downstream	1	1	
29	SETB 3173	Engineering Economics and Project Management	3	3	
30	SETB 3915	Industrial Training (YEAR 3/SHORT SEM.) for 12 weeks/3 months	5	HL	
31	SETB 4741	Process Control Laboratory	1	1	
32	SETB 4814	Undergraduate Project II	4	4	
33	SETB 4153	Plant Design	3	3	
34	SETB 4163	Safety and Health in Chemical & BioIndustry	3	3	
35	SETB 4824	Plant Design Project	4	4	
36	SETB 4133	Quality Management in BioManufacturing	3	3	
37	SETB ***3	Bioprocess Elective Course 1	3	3	
	SET* 5**3	PRISMS Elective Course 1			
38	SETB ***3	Bioprocess Elective Course 2	3	3	
	SET* 5**3	PRISMS Elective Course 2			
		TOTAL CREDIT OF CHEMICAL-BIOPROCESS ENGINEERING COURSES (a)	**99**	**94**	
APPLIED SCIENCE/ MATHEMATICS COURSES (Faculty of Science)					
1	SSCE 1693	Engineering Mathematics I	3	3	
2	SSCE 1993	Engineering Mathematics II	3	3	
3	SSCE 1793	Differential Equations	3	3	
4	SEEU 2003	Electrical Technology	3	3	
5	SSCK 1603	Organic Chemistry: Functional Group	3	3	
6	SSCK 1831	Organic Chemistry Practical	1	1	
7	SSCK 1203	Analytical Chemistry for Engineering	3	3	
8	SSCK 1891	Analytical Chemistry Practical	1	1	
		TOTAL CREDIT OF APPLIED SCIENCE/ MATHEMATICS COURSES (b)	**20**	**20**	

UNIVERSITY GENERAL COURSES					
Malaysia Core Value					
1	ULRS 1182	Appreciation of Ethics and Civilizations (for Local Students)	2	2	
	UHLM 1012	Malay Language Communication 2 (for International Students)			
2	ULRS 1022	Philosophy and Current Issues	2	2	
Value and Identity					
1	ULRS 1012	Value and Identity	2	2	
Global Citizen					
1	ULRF 2**2	Service Learning & Community Engagement	2	2	
Communication Skills					
1	UHLB 2122	Professional Communication Skills1	2	2	
2	UHLB 3132	Professional Communication Skills2	2	2	
3	UHL* 1112	Foreign Language for Communication	2	2	
Enterprising Skills					
1	ULRS 3032	Entrepreneurship & Innovation	2	2	
Free Elective					
1	**** ***3	Free Elective	3	3	
		TOTAL CREDIT of UNIVERSITY GENERAL COURSES (c)	**19**	**19**	
		TOTAL CREDIT TO GRADUATE (a + b + c)	**138**	**133**	

OTHER COMPULSORY COURSES – PROFESSIONAL SKILLS CERTIFICATE (PSC)			
Students are required to enrol and pass FIVE (5) PSC courses, to be eligible to graduate. Enrol the PSC courses as follows:			
COMPULSORY PSC COURSES (Enrol All 3 Courses)			
1	GLRB0010	Design Thinking for Entrepreneur	
2	GLRM0010	Talent and Competency Management	
3	GLRL0010	English Communication Skills for Graduating Students (ECS)	
ELECTIVE PSC COURSES (Choose Any 2 Courses only)			
1	GLRT0010	Data Analytics for Organization	
2	GLRM0020	Professional Ethics and Integrity	
3	GLRT0020	Construction Measurement (Mechanical & Electrical)	
4	GLRT0030	OSHE for Engineering Industry and Laboratory	
5	GLRT0040	OSHE for Construction Industry and Laboratory Works	
6	GLRT0050	Quality Management for Build Environment and Engineering Professionals	
7	GLRT0060	Safety and Health Officer Introductory Course	
8	GLRT0070	Industrial Machinery and Lubrication	
Or any other elective PSC courses offered by UTM iLeague. Information on PSC Courses: https://ileague.utm.my/utm-professional-skills-certificate-utm-psc/ Online PSC Registration: https://elearnpsc.utmspace.edu.my/			

COURSE SYNOPSIS

CORE COURSES

SETB 1011 - Industrial Career & Seminar

This course introduces students to the chemical/bioprocess engineering working environment through seminars from respective personnel and industrial visit to various chemical plants in Malaysia.

SETB 1021 - Engineering Drawing

Computer Aided Drawing Computer Aided Command, , Geometry, Orthographic Drawing, Isometric Drawing, Sectional Drawing, Flowchart Drawing.

SETB 1023 - Introduction to Chemical & Bioprocess Engineering

Overview of engineering, the profession and its requirements in the Malaysian scenario. Communication (oral and written) and teamwork skills. Mind mapping, learning styles and time management. Basic calculations and unit conversions. Create an engineering graph and solving iterative problems using computer. Ethics. Seminar. Plant visits. This course employs Cooperative Learning and grooms students with skills for Problem-based Learning.

SETB 1123 - Statics & Biomaterial

This course is designed to introduce students to the basic principles and concepts in mechanics. The content will be divided into two parts which are i) statics and ii) strength of material/biomaterial. The first part will deal with the resultant and resolution of force(s) acting on a particle, the equilibrium of a particle, the effect of force(s) on a rigid body, how to replace a force system with an equivalent system and the equilibrium of rigid bodies. At the end of the course, students should be able to demonstrate and apply the knowledge by solving various problems in Statics. The second part will focus on the types of material/biomaterial (introduction, overview) and will follow with few elements that are important in understanding the material/biomaterial (atomic bonding, structures, strength analysis etc.). At the end of this part, should be able to relate material/biomaterial and its characteristics in order to choose the right material for different applications especially in medical devices etc.

SETB 1133 - Microbiology
The course aims to provide a strong background of various types of microorganisms to the engineering students. Topics include microbe diversity; metabolism type-based classification; factors that determine the growth and their control techniques; microbial ecology; fundamentals of immunology; and biotechnological aspects of microbes.

SETB 1113 - Mass Balance
Introduction to chemical engineering and chemical processes, process and process variables, material balance strategy, degree of freedom analysis, material balance with reactions, material balance with recycle, single-phase and multiphase systems. Introduction to energy balance.

SETB 1721 - Bioprocess Engineering Laboratory: Upstream
This laboratory course is designed to expose students to basic microbiology, biochemistry and genetic engineering techniques. The experiment will expose students to handling bacterial culture, analysis of biomolecules such as enzymes and carbohydrates.

SETB 2113 - Introduction to Programming
This course primarily aimed at the beginner who has no or little experience of using compiled languages. It is an introductory course to two different types of programming languages. First, is the C programming language and secondly, is the Matlab programming language. The course will cover various stages of programme development for both types of programming language. One who completed the course will have the ability to write a simple program using both C programming language and Matlab programming language.

SETB 2123 - Energy Balance
Pre-Requisite: SETB 1113 Mass Balance (passed)
Energy balance on non-reactive systems, balance on reactive systems, material and energy balances on transient processes, entropy, power and refrigeration cycles.

SETB 2043 - Fluid Mechanics
Physics of fluid: what is fluid, some definitions, surface tension, compressible and incompressible flow, classes of flow, and physical classification. Fluid statics: pressure, differential equations of fluid statics, manometry, fluid force on submerged bodies, buoyancy

and stability of floating bodies, and liquid in relative equilibrium. Fluid in motion: continuity equation, energy and mass equilibrium, Euler, Bernoulli and Momentum equations. Friction in fluid flow: velocity profile in pipes, roughness, friction factor, Moody chart. Flow measurement: venturi and pitot tube, orifice, notches and weirs. Pump and pumping: principle, types, selection, and application of pumps. Dimensional analysis, similitude in fluid mechanics, parameters of incompressible and compressible flow.

SETB 2721 - Fluid Mechanics Laboratory
The course covers seven fluid mechanics-related experiments which are friction losses in pipe, stability of floating body, jet impact, flow measurement, centrifugal pump, forced vortex flow, and calibration of bourdon tube pressure gauge.

SETB 2033 - Thermodynamics
Thermodynamics is an important basic engineering subject where concepts such as systems, boundaries, mass, heat, work and energy are introduced. These concepts are then related using the 1st and 2nd Law of Thermodynamics. In this subject properties of common substances such as water, air and general working fluids are introduced using property tables and basic state equations. These concepts are applied in many engineering equipments, basic refrigeration and power cycles. Such basic concepts are vital because they form the fundamentals for future chemical engineering subjects.

SETB 2133 - Chemical Engineering Computation
This course introduces students to some numerical techniques in solving chemical engineering problems that could not be solved analytically. Students will be exposed to the numerical solution for root of equation, simultaneous algebraic equation, curve fitting, ordinary differential equations, numerical differentiation and integration problems. MATLAB programming language will be implemented with the intention of illustrating the nuance of the methods, and showing more realistically how the methods are applied for problem solving.

SETB 2213 - Chemical Engineering Thermodynamics
Pre-Requisite: SETB 2033 Thermodynamics
Volumetric properties of pure liquid, heat effects, thermodynamics properties of fluids, properties relationship for homogeneous mixture, phase equilibrium and chemical reaction equilibrium.

SETB 2313 - Transport Processes
Pre-Requisite: SETB 2123 Energy Balance
Fundamentals of mass transfer, rate equation for molecular diffusion, mass transfer at boundary layer, mass transfer between phases, mass transfer rate at simple surface geometry, simultaneous mass transfer and chemical reaction. Also included is heat transfer theory, conduction, steady state conduction in two dimensions, steady state conduction with convection to environment, unsteady-state conduction, convection, radiation heat transfer, heat exchanger design.

SETB 2711 - Thermodynamics and Materials Engineering Laboratory
Pre-Requisite: SETB 2033 Thermodynamics

Experiments performed in this laboratory include boiler tests, diesel engine performance test, equilibrium test, energy (heat engine), tensile test, metal metalography, determination of Young modulus, air compressor, cooling system, torsion testing, stress and strain analysis.

SETB 3213 - Biochemistry
This course is designed to give an overall outlook on basic chemistry of major biomolecules and their roles in biological systems. Topics include introducing the structure, properties, and functionalities of major biomolecules such as carbohydrates, proteins, lipids; roles of lipids in membrane; Michaelis-menten enzyme kinetics, major catabolism pathways such as glycolysis, and TCA cycle; electron transport system and oxidative phosphorylation; structure and functions of DNA and RNA.

SETB 3123 - Molecular Biology & Genetic Engineering
The course introduces students to fundamental aspects of molecular biology and gene manipulation. Discussion will emphasize on synthesis, organization, replication of DNA and RNA both eukaryote and prokaryote systems; roles of RNA in translation and transcription; regulation in gene transcription; protein synthesis and post-translational modification; recombinant technology (e.g. gene transfer and splicing techniques, genomic library development).

SETB 3223 - Chemical Reaction Engineering
Topics in this course are: introduction to homogeneous reaction kinetic, batch reactor data analysis, introduction to reactor design, single reactor design, reactor design for single reaction and multiple reactor, temperature and pressure effect, nonideal flow, introduction to heterogeneous reaction system design, types of reactor test, catalytic reaction.

SETB 3323 - Separation Processes
Pre-Requisite: SETB 2313 Transport Processes
Introduction to unit operations in chemical engineering: evaporation, liquid-liquid separation, liquid vapour separation, liquid-liquid extraction and leaching.

SETB 3413 - Environmental Eng. and Sustainability
Introduction to pollution control includes: water pollution, air pollution, noise pollution and environmental acts and techniques to reduce pollutants.

SETB 3721 - Pollution Control and Reaction Laboratory
Experiments performed in this laboratory are: acidity and alkalinity, biological oxygen demand (BOD), coagulation and flocculation, ambient air quality monitoring, the use of direct spectrophotometer, conductivity measurement, sludge index, water sampling. To test the saponification reaction, iodine reaction, esterification reaction, continuous stirred tank reactor and biodiesel production

SETB 3113 - Bioseparation Technology
The aim of the course is to provide an overview of the various downstream processes involved in the production of bioproducts such as food, beverages, antibiotics, antiferons, vitamins, insulins, citric acid and others. The unique natures of biomolecules make their separation

processes different from conventional chemical processes. In addition, the application of mass transfer, mass balances, and thermodynamics principles are combined with life sciences so as to develop, impart and vary the biotechnology purification techniques. The various bioseparation techniques include centrifugation, microfiltration, ultrafiltration, adsorption, chromatography, electrophoresis, and many more.

SETB 3133 - Bioreactor Design & Analysis
The aim of the course is to analyze the bioreactor functions so that the intended fermentation performance can be achieved. It will emphasize on mass balances on growth and product formation, kinetics of three main operation modes, oxygen transfer in aerobic cultures, heat sources and their management, power consumption, rheological effect on mixing, scaling up, the architecture and functional parts of bioreactor, and instrumentation and control.

SETB 3812 - Undergraduate Project I
A first stage of the Undergraduate Project which involves preliminary studies and planning on how to carry out the study given to the student. The works include literature review, problem and scope identification, objective and method determination.

SETB 3731 - Separation Processes Laboratory
Pre-Requisite: SETB 3323 Separation Processes
Evaporation operation, distillation operation, gas-liquid absorption operation, drying operation, liquid physical and chemical properties identification and heat transfer.

SETB 3741 - Bioprocess Engineering Laboratory: Downstream
In this laboratory, students are given the opportunity to gain experience in bioreactor and downstream processes (bioseparation). This laboratory work will assist the students to consolidate their fundamental understanding involved in fermentation and downstream processes of bioproducts. The experiments performed are fermentation in shake flask and 2 L bioreactor, cell immobilization, microfiltration, cell homogenization, protein precipitation and a final project.

SETB 3143 - Process Control
Pre-Requisite: SSCE 1793 (passed), SETB 3323 Separation Processes
This subject covers chemical process control, static and dynamic process behaviour, mathematical modelling, analysis of dynamic chemical process behaviour, analysis and design of feedback control systems, analysis and design of complex control systems.

SETB 3173 Engineering Economics and Project Management
The engineering economy study involves computing a specific economic measure of worth for estimated cash flows over a specific period of time. Project Management is the art of planning, scheduling, and controlling of project activities to achieve performance, cost, and time objectives, for a given scope of works, while using resources efficiently and effectively.

SETB 3915 - Industrial Training
A 12-week training in industry. The main rationale of introducing the programme is to provide UTM students with exposure to practical aspects of industry and their work practices. During

the programme, the students will have the opportunity to relate their theoretical understanding to the real application in industry and to develop skills in work ethics, management, communication and human relations.

SETB 4741 - Process Control Laboratory
Experiments performed in this laboratory include: PLC, introduction to transducers and instrumentation, control of a heat exchanger, liquid level control, analysis of dynamic response, and controller tuning.

SETB 4814 - Undergraduate Project II
Pre-Requisite: SETB 3212 Undergraduate Project I (passed)
Students are required to do research projects where they are required to collect data from the apparatus in the laboratory and pilot plant under the supervision of a lecturer. The use of computers is also emphasised. Students are required to submit a report at the seminar at the end of the project.

SETB 4153 - Plant Design
Pre-Requisite: SETB 3143 Process Control
Introduction to process plant synthesis where design of each individual unit operation is combined with the objective of optimising the raw material and energy use for processing, cost factor and economics, environmental and also safety factor. Selection of reactor design, selection of separator design, reaction-separation system synthesis and also heat exchanger network synthesis, process safety, and waste minimisation.

SETB 4163 - Safety and Health in Chemical & BioIndustry
Main danger and act, introduction to relief, occupational safety and health, danger identification, risk analysis, accident inspection.

SETB 4824 - Plant Design Project
Pre-Requisite: SETB 4153 Plant Design, SETB 4163 Safety and Health in Chemical & BioIndustry (taken)
Students are divided into groups. Each group will be given a design topic and will be under the supervision of a lecturer. The design project involves process selection, building the process flow diagram (PFD), material and energy balances, detailed equipment design, equipment selection and material of construction, equipment control, operational instruction, economics and costing.

SETB 4133 - Quality Management in BioManufacturing
This course highlights the importance of a quality management system in bioproduct manufacturing processes/industries to meet customer satisfaction. The quality system will cover both management and technical elements according to the requirements of the International Organization for Standardization (ISO) and other relevant regulations. The management requirements focus on a clear organization structure with well-defined objectives and well-organized documentation, whereas the technical requirements ensure on the competency of staffs and validity of test methods for quality assurance. The techniques and validation procedures will be included for numerous types of bioproducts such as

cosmeceuticals, nutraceuticals, functional foods and pharmaceuticals. Up-to-date technologies combined with systematic validation plan will ensure bioproduct quality and its consistency.

BIOPROCESS ELECTIVE COURSES

SETB 4213 - Food Process Engineering
This course introduces students to some major principles, concepts and applications in handling, processing and packaging of foods including the design of process equipment. The course will also provide practice in case studies, carrying out an industrial visit project to observe the application of knowledge in food industries and setting informative research on the business planning of selective food processing operations.

SETB 4223 - Environmental Biotechnology for Engineers
This course describes the diverse problems of the environment and the approaches toward their solution or mitigation in connection to the modern or classical methods of biotechnology. It describes the significance in conservation of environmental resources and biodiversity, provision for alternate sources of energy, biological control of pests and pathogens, purification of environment, mitigation of problems of chemical fertilizers, and most important of all, improvement in the quality of life.

SETB 4233 - Bioproduct Development and Processing
This course introduces bioproduct and their processing technologies. Students are explored to various kinds of high potential bioproducts with their relevant processing technologies for formulation and development. Factors that affecting quality, safety and efficacy are highlighted in order to make them aware of the importance of these factors for bioproduct sustainability. Quality management systems in bioproduct manufacturing processes/industries are discussed and elaborated to lead students meeting customer satisfaction. The quality system will cover both management and technical elements according to the requirements of the International Organization for Standardization (ISO) and other relevant regulations. The technical requirements ensure the competency of staff and validity of test methods for quality assurance. The course will equip students with quality management skill and knowledge, especially in bioproduct selection and manufacturing.

SETB 4243 - Biopharmaceutical Manufacturing
This course describes the application of biotechnology procedures in the field of Pharmacy. It emphasizes on consolidating the fundamental understanding in biotechnology and phytochemical processing involved in the development and production of pharmaceutical products. The technologies covered in the course are methods to enhance the production, bioavailability and safety of biopharmaceutical products or services. Elements of businesses driven through biopharmaceutical discoveries and understanding of specific quality issues in compliance with regulatory requirements throughout the clinical development and post-approval processes are exposed to students.

SETB 4253 - Green Energy Engineering

The course introduces the fundamental principles and concepts in understanding bioenergy/biofuels systems. Fundamental concepts in understanding biofuels/bioenergy systems; renewable feedstocks, their production, availability and attributes for biofuel/bioenergy production; types of biomass derived fuels and energy; thermochemical conversion of biomass to heat, power and fuel; biochemical conversion of biomass to fuel; type of biofuels, environmental aspects of biofuel production; economics and life-cycle analysis of biofuel; value adding of biofuel residues; case studies on biofuel production, sustainable processes for biofuels.

Mapping of Courses to Programme Outcomes for
Bachelor of Chemical Engineering (Bioprocess) with Honours

		PROGRAMME LEARNING OUTCOMES (PLO)											
		Engineering Knowledge	Problem Analysis	Design/Development of Solution	Investigation	Modern Tool Usage	The Engineer and Society	Environment & Sustainability	Ethics	Communication Skills	Leadership and Teamwork	Life Long Learning	Project Management and Finance
COURSE CODE	**COURSE NAME**	**PLO1**	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**
PROGRAMME CORE COURSES													
SETB 1011	Industrial Career & Seminar	√				√				√		√	
SETB 1021	Engineering Drawing	√				√				√			
SETB 1023	Introduction to Chemical & Bioprocess Engineering	√	√					√		√	√		
SETB 1123	Statics & Biomaterial	√								√		√	
SETB 1721	Bioprocess Engineering Laboratory I: Upstream	√	√						√	√			
SETB 1133	Microbiology for Engineers	√										√	
SETB 1113	Mass Balance	√	√									√	
SETB 2113	Introduction to Programming	√				√						√	
SETB 2123	Energy Balance	√						√				√	
SETB 2043	Fluid Mechanics	√	√					√			√		
SETB 2721	Fluid Mechanics Laboratory		√		√						√	√	
SETB 2033	Thermodynamics	√	√								√		
SETB 2133	Chemical Engineering Computation	√	√		√							√	
SETB 2213	Chemical Engineering Thermodynamics	√										√	
SETB 2313	Transport Processes	√										√	
SETB 2711	Thermodynamics and Material Eng. Laboratory	√	√				√	√	√		√		
SETB 3213	Biochemistry	√										√	
SETB 3123	Molecular Biology & Genetic Engineering	√										√	
SETB 3223	Chemical Reaction Engineering	√		√	√	√		√					
SETB 3323	Separation Processes	√		√								√	
SETB 3413	Environmental Eng. and Sustainability	√		√			√					√	

		PROGRAMME LEARNING OUTCOMES (PLO)											
		Engineering Knowledge	Problem Analysis	Design/Development of Solution	Investigation	Modern Tool Usage	The Engineer and Society	Environment & Sustainability	Ethics	Communication Skills	Leadership and Teamwork	Life Long Learning	Project Management and Finance
COURSE CODE	**COURSE NAME**	**PLO1**	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**
SETB 3721	Pollution Control and Reaction Laboratory	√			√					√		√	
SETB 3113	Bioseparation Technology	√					√	√				√	
SETB 3133	Bioreactor Design & Analysis	√		√	√							√	
SETB 3212	Undergraduate Project I	√	√	√	√				√	√	√	√	
SETB 3721	Bioprocess Engineering Laboratory II : Downstream	√	√						√	√			
SETB 3143	Process Control	√	√								√		
SETB 3731	Separation Processes Laboratory	√	√		√					√	√		
SETB 3173	Engineering Economics and Project Management	√								√			√
SETB 4741	Process Control Laboratory	√	√	√							√	√	
SETB 4814	Undergraduate Project II	√	√	√	√	√	√		√	√	√	√	√
SETB 4153	Plant Design	√		√	√		√		√				√
SETB 4163	Safety and Health in Chemical & BioIndustry	√			√				√		√		
SETB 4824	Plant Design Project	√		√	√	√	√	√	√	√	√	√	√
SETB 4133	Quality Management in BioManufacturing	√				√	√	√	√				
PROGRAMME ELECTIVE COURSES													
SETB 4213	Food Process Engineering	√					√					√	
SETB 4223	Environmental Biotechnology for Engineers	√					√					√	
SETB 4233	Bioproduct Development and Processing	√					√					√	
SETB 4243	Biopharmaceutical Engineering	√					√					√	
SETB 4253	Green Energy Engineering	√					√					√	
SETB 4263	Tissue Culture and Cell Engineering	√					√					√	

BACHELOR OF CHEMICAL ENGINEERING (GAS) WITH HONOURS

PROGRAMME SPECIFICATIONS

The Bachelor of Chemical Engineering (Gas) with Honours is offered on a full-time basis. The programme is offered only at the UTM Main Campus in Johor Bahru. The duration of study for the full-time programme is subjected to the student's entry qualifications and lasts between four (4) years to a maximum of six (6) years.

The programme is offered on a full-time basis and is based on two semesters per academic session. Generally, students are expected to undertake courses equivalent to between twelve (12) to eighteen (18) credit hours per semester. Assessment is based on courseworks and final examinations given throughout the semester.

General Information

1. Awarding Institution			Universiti Teknologi Malaysia	
2. Teaching Institution			Universiti Teknologi Malaysia	
3. Programme Name			Bachelor of Chemical Engineering (Gas) with Honours	
4. Final Award			Bachelor of Chemical Engineering (Gas) with Honours	
5. National Education Code (NEC)			0711 (Chemical Engineering & Processes)	
6. Programme Code			SETGH	
7. Professional or Statutory Body of Accreditation			Board of Engineers Malaysia (BEM)	
8. Language(s) of Instruction			English and Bahasa Melayu	
9. Mode of Study			Conventional	
10. Mode of operation			Self-govern	
11. Study Scheme			Full Time	
12. Study Duration			Minimum : 4 years Maximum : 6 years	
Type of Semester	No. of Semesters		No of Weeks/Semester	
	Full Time	Part Time	Full Time	Part Time
Normal	8	-	14	-
Short	4	-	8	-

Course Classification

No.	Classification	Credit Hours	Percentage
i.	University Courses (a) General (b) Language (c) Entrepreneurship (d) Co-Curriculum (e) Free Electives	 6 6 2 2 5	15.5%
ii.	Faculty/ Programme Core	106	77.9%
iii.	Programme Elective	9	6.6%
	Total	**136**	**100%**
A	Engineering Courses A. Lectures B. Laboratory/Workshop C. Industrial Training D. Final Year Project E. Integrated Design Project	 78 7 5 6 4	73.5%
Total Credit Hours for Part A		**100**	
B	Related Courses (a) Applied Science/ Mathematics/ Computer (b) Management/Law/Humanities/Ethics/ Entrepreneur (c) Language (d) Co-Curriculum (e) Free Electives	 15 8 6 2 5	26.5%
Total Credit Hours for Part B		**36**	
Total Credit Hours for Part A and B		**136**	**100%**
Total Credit Hours to Graduate		**136 credit hours**	

Award Requirements

To graduate, students must:

- Attain a total of not less than 136 credit hours with a minimum CGPA of 2.00.
- Pass Industrial Training.
- Complete Five (5) Professional Skill Certificates (PSC).

CROSS-CAMPUS PROGRAMME

Students are given the opportunity to enroll in a few courses in participating universities. The grades and credits obtained during this period are transferable (up to 1/3 of the total credits of the curriculum). Currently, there are four participating universities i.e. Universiti Teknologi Malaysia, Universiti Sains Malaysia, Universiti Malaya and Universiti Malaysia Sarawak.

The programme is open to undergraduates who have undergone a minimum of two semesters of their studies with the following conditions:

(i) The total number of credits allowed to be taken is between twelve (12) and sixteen (16) credits only.
(ii) The student should hold a minimum CGPA of 3.00 at the time of application.
(iii) The student is not a resident of or originated from the state where the university that he/she intends to attend is located.

The student will not be charged tuition fees by the participating university but shall pay the regular tuition fees at UTM. However, should the participating university provide accommodation, the student will need to pay accommodation fees.

COURSE MENU

YEAR 1: SEMESTER 1			
Code	**Course**	**Credit**	**Pre-requisite**
SEEU 2003	Electrical Technology	3	
SETG 1233	Introduction to Chemical and Gas Engineering	3	
SETG 1323	Engineering Drawing	3	
SSCE 1693	Engineering Mathematics I@	3	
ULRS 1012	Value and Identity	2	
	TOTAL CREDIT	**14**	
	CUMULATIVE CREDITS	**14**	

YEAR 1: SEMESTER 2			
Code	**Course**	**Credit**	**Pre-requisite**
SECP 1013	Programming Technique I	3	
SETG 1313	Mechanics of Engineering	3	
SETG 1333	Thermodynamics@	3	
SETG 1413	Mass Balance*@	3	
SSCE 1993	Engineering Mathematics II@	3	SSCE 1693
ULRS 1182	Appreciation of Ethics and Civilization (for Local Students)	2	
UHLM 1012	Malay Language Communication 2 (for International Students)		
	TOTAL CREDIT	**17**	
	CUMULATIVE CREDITS	**31**	

YEAR 2: SEMESTER 1			
Code	**Course**	**Credit**	**Pre-requisite**
SETG 2343	Fluid Mechanics	3	
SETG 2353	Introduction to Organic and Analytical Chemistry for Engineers	3	
SETG 2363	Material Engineering	3	SETG1313
SETG 2423	Energy Balance@	3	SETG 1413#
SETG 3751	Thermodynamics and Material Engineering Laboratory	1	SETG 2363 SETG 1333
SSCE 1793	Differential Equations	3	
ULRF 2**2	Service Learning and Community Engagement Elective	2	
	TOTAL CREDIT	**18**	
	CUMULATIVE CREDITS	**49**	

YEAR 2: SEMESTER 2			
Code	**Course**	**Credit**	**Pre-requisite**
SETG 2133	Combustion Engineering and Gas Utilisation	3	
SETG 2433	Chemical Engineering Thermodynamics	3	SETG 1333# SETG 2423
SETG 2443	Transport Processes*	3	SETG 2423
SETG 3453	Chemical Engineering Computation	3	SSCE 1693 SSCE 1993
ULRS 1022	Philosophy and Current Issues	2	
UHLB 2122	Professional Communication Skills 1	2	
**** ***2	Free Elective 1	2	
	TOTAL CREDIT	**18**	
	CUMULATIVE CREDITS	**67**	

YEAR 3: SEMESTER 1			
Code	**Course**	**Credit**	**Pre-requisite**
SETG 2741	Fluid Mechanics Laboratory	1	SETG 2343
SETG 3213	Gas Transmission and Distribution*	3	SETG 2343
SETG 3373	Environmental Engineering and Sustainability	3	
SETG 3463	Chemical Reaction Engineering	3	SETG 2423
SETG 3473	Separation Process*	3	SETG 2443
SETG 3721	Combustion Engineering and Gas Utilisation Laboratory	1	SETG 2133
UHLB 3132	Professional Communication Skills 2	2	
UHL* 1112	Communication in Foreign Language Elective	2	
	TOTAL CREDIT	**18**	
	CUMULATIVE CREDITS	**85**	

YEAR 3: SEMESTER 2			
Code	**Course**	**Credit**	**Pre-requisite**
SETG 3123	Gas Processing and Liquefaction	3	
SETG 3383	Safety and Health in Petrochemical Industry	3	
SETG 3483	Process Control and Instrumentation	3	SSCE 1793 SETG 3473
SETG 3812	Undergraduate Project I**	2	
SETG 4711	Gas Flow System Laboratory	1	SETG 3213
SETG 4761	Pollution Control and Reaction Laboratory	1	SETG 3463 SETG 3373
ULRS 3032	Entrepreneurship and Innovation	2	
**** ***3	Free Elective 2	3	
	TOTAL CREDIT	**18**	
	CUMULATIVE CREDITS	**103**	

YEAR 3: SEMESTER 3			
Code	**Course**	**Credit**	**Pre-requisite**
SETG 3915	Industrial Training	5	
	TOTAL CREDIT	**5**	
	CUMULATIVE CREDITS	**108**	

YEAR 4: SEMESTER 1			
Code	**Course**	**Credit**	**Pre-requisite**
SETG 3731	Separation Process Laboratory	1	SETG 3473
SETG 4393	Engineering Economics and Project Management	3	
SETG 4493	Plant Design*	3	SETG 3473
SETG 4771	Process Control Laboratory	1	SETG 3483
SETG 4824	Undergraduate Project II**	4	SETG 3812#
SETG 4**3	Programme Elective I	3	
SET* 5**3	PRISMS Elective I		
	TOTAL CREDIT	**15**	
	CUMULATIVE CREDITS	**123**	

YEAR 4: SEMESTER 2			
Code	**Course**	**Credit**	**Pre-requisite**
SETG 4223	Gas Storage and Reticulation System*	3	SETG 3213
SETG 4610	Gas Engineering Seminar	0 (HW)	
SETG 4834	Plant Design Project**	4	SETG 3383 SETG 4493
SETG 4**3	Programme Elective II	3	
SET* 5**3	PRISMS Elective II		
SETG 4**3	Programme Elective III	3	
SET* 5**3	PRISMS Elective III		
	TOTAL CREDIT	**13**	
	CUMULATIVE CREDITS	**136**	

Note: * - cornerstone course; ** - capstone course; @ - with tutorial
- must pass (at least with grade D+) for prerequisite course

English Pre-Requisite
Students must register and pass UHLB 1112 course if the English pre-requisite is not fulfilled.

ENGLISH PRE-REQUISITE
a) MUET : ≥ Band 4
b) IELTS : ≥ Band 5.5
c) TOEFL: ≥ 525
d) TOEFL iBT : ≥ 60
e) CEFR : ≥ B2

Elective Courses
1. Energy
- SETG 4113 Carbon Capture and Sequestration
- SETG 4143 Energy Management and Economics
- SETG 4153 Energy Conversion Technology
- SETG 4163 Green Energy Technology
- SETG 4243 Non-Conventional Oil and Gas Exploitation

2. Gas
- SETG 4173 Membrane Based Gas Separation Technology
- SETG 4253 Gas Production Engineering
- SETG 4263 Fire and Explosion Safety
- SETG 4273 Gas Operation and Maintenance
- SETG 4283 Corrosion Engineering

PRISMS ELECTIVE COURSES
For students who intend to enroll in PRISMS, refer to the PRISMS Section for a list of related elective courses associated with the Postgraduate Programme.

GRADUATION CHECKLIST

To graduate, students must pass all the stated courses in this checklist. It is the responsibility of the students to ensure that all courses are taken and passed. Students who do not complete any of the courses are not allowed to graduate.

NO.	CODE	COURSE	CREDIT EARNED (JKD)	CREDIT COUNTED (JKK)	TICK (√) IF PASSED
CHEMICAL-GAS ENGINEERING COURSES					
1	SETG 1233	Introduction to Chemical and Gas Engineering	3	3	
2	SETG 1313	Mechanics of Engineering	3	3	
3	SETG 1323	Engineering Drawing	3	3	
4	SETG 1333	Thermodynamics	3	3	
5	SETG 1413	Mass Balance	3	3	
6	SETG 2133	Combustion Engineering and Gas Utilisation	3	3	
7	SETG 2343	Fluid Mechanics	3	3	
8	SETG 2363	Material Engineering	3	3	
9	SETG 2423	Energy Balance	3	3	
10	SETG 2433	Chemical Engineering Thermodynamics	3	3	
11	SETG 2443	Transport Processes	3	3	
12	SETG 2741	Fluid Mechanics Laboratory	1	1	
13	SETG 3123	Gas Processing and Liquefaction	3	3	
14	SETG 3213	Gas Transmission and Distribution	3	3	
15	SETG 3373	Environmental Engineering and Sustainability	3	3	
16	SETG 3383	Safety and Health in Petrochemical Industry	3	3	
17	SETG 3453	Chemical Engineering Computation	3	3	
18	SETG 3463	Chemical Reaction Engineering	3	3	
19	SETG 3473	Separation Process	3	3	
20	SETG 3483	Process Control and Instrumentation	3	3	
21	SETG 3721	Combustion Engineering and Gas Utilisation Laboratory	1	1	
22	SETG 3731	Separation Process Laboratory	1	1	
23	SETG 3751	Thermodynamics and Material Engineering Laboratory	1	1	
24	SETG 3812	Undergraduate Project I	2	2	
25	SETG 3915	Industrial Training	5	HL	

26	SETG 4223	Gas Storage and Reticulation System	3	3	
27	SETG 4393	Engineering Economics and Project Management	3	3	
28	SETG 4493	Plant Design	3	3	
29	SETG 4610	Gas Engineering Seminar	0 (HL)	0 (HL)	
30	SETG 4711	Gas Flow System Laboratory	1	1	
31	SETG 4761	Pollution Control and Reaction Laboratory	1	1	
32	SETG 4771	Process Control Laboratory	1	1	
33	SETG 4824	Undergraduate Project II	4	4	
34	SETG 4834	Plant Design Project	4	4	
35	SETG 4**3	Elective I	3	3	
	SET* 5**3	PRISMS Elective I			
36	SET* ***3	Elective II	3	3	
	SET* 5**3	PRISMS Elective II			
37	SET* ***3	Elective III	3	3	
	SET* 5**3	PRISMS Elective III			
		TOTAL CREDIT OF CHEMICAL-GAS ENGINEERING COURSES (a)	**97**	**92**	
MATHEMATICS/ SCIENCE/ TECHNOLOGY COURSES (Faculty of Science/ Faculty of Engineering)					
1	SECP 1013	Programming Technique I	3	3	
2	SEEU 2003	Electrical Technology	3	3	
3	SETG 2353	Introduction to Organic and Analytical Chemistry for Engineers	3	3	
4	SSCE 1693	Engineering Mathematics I	3	3	
5	SSCE 1793	Differential Equations	3	3	
6	SSCE 1993	Engineering Mathematics II	3	3	
		TOTAL CREDIT OF MATHEMATICS/ SCIENCE/ TECHNOLOGY COURSES (b)	**18**	**18**	
UNIVERSITY GENERAL COURSES					
Malaysia Core Value					
1	ULRS 1182	Appreciation of Ethics and Civilizations (for Local Students)	2	2	
	UHLM 1012	Malay Language Communication 2 (for International Students)			
2	ULRS 1022	Philosophy and Current Issues	2	2	
Value and Identity					
1	ULRS1012	Value and Identity	2	2	

Global Citizen					
1	ULRF2**2	Service Learning & Community Engagement Course	2	2	
Communication Skills					
1	UHLB 2122	Professional Communication Skills 1	2	2	
2	UHLB 3132	Professional Communication Skills 2	2	2	
3	UHL* 1112	Communication in Foreign Language Elective	2	2	
Entreprising Skills					
1	ULRS 3032	Entrepreneurship & Innovation	2	2	
Free Elective					
1	**** ***3	Free Elective 1	3	3	
2	**** ***2	Free Elective 2	2	2	
		TOTAL CREDIT of UNIVERSITY GENERAL COURSES (c)	**21**	**21**	
		TOTAL CREDIT TO GRADUATE (a + b + c)	**136**	**131**	

OTHER COMPULSORY COURSES – PROFESSIONAL SKILLS CERTIFICATE (PSC)			
Students are required to enroll and pass FIVE (5) PSC courses, to be eligible to graduate. Enroll the PSC courses as follows:			
COMPULSORY PSC COURSES (Enroll All 3 Courses)			
1	GLRB0010	Design Thinking for Entrepreneur	
2	GLRM0010	Talent and Competency Management	
3	GLRL0010	English Communication Skills for Graduating Students (ECS)	
ELECTIVE PSC COURSES (Choose Any 2 Courses only)			
1	GLRT0010	Data Analytics for Organization	
2	GLRM0020	Professional Ethics and Integrity	
3	GLRT0020	Construction Measurement (Mechanical & Electrical)	
4	GLRT0030	OSHE for Engineering Industry and Laboratory	
5	GLRT0040	OSHE for Construction Industry and Laboratory Works	
6	GLRT0050	Quality Management for Build Environment and Engineering Professionals	
7	GLRT0060	Safety and Health Officer Introductory Course	
8	GLRT0070	Industrial Machinery and Lubrication	
Or any other elective PSC courses offered by UTM iLeague. Information on PSC Courses: https://ileague.utm.my/utm-professional-skills-certificate-utm-psc/ Online PSC Registration: https://elearnpsc.utmspace.edu.my/			

COURSE SYNOPSIS

CORE COURSES

SETG 1233 - Introduction to Chemical and Gas Engineering

The objective of this course is to introduce chemical and gas engineering and prepare students for learning engineering to become an engineer of the future. This course serves to bridge pre-university education to university life and provide support for adjusting to learning and expectations in tertiary education. The topics/skills that will be learnt in this course include: overview of engineering & chemical gas engineering, basic principles of gas engineering related processes, uses of Microsoft Excel, basic calculations of common process variables and cooperative Problem-Based Learning (CPBL) case study on sustainable development. One of the important elements of the CPBL case study is Teaching-Research Nexus (TRN) in which students will learn through research even at the undergraduate level.

SETG 1313 - Mechanics of Engineering

This course is designed to introduce students to the basic principles and concepts in mechanics. It deals with statics in engineering mechanics that are the resultant and resolution of force(s) acting on a particle, the equilibrium of a particle, the effect of force(s) on a rigid body, how to replace a force system with equivalent system, the equilibrium of rigid bodies, determination of centroid as well as analysis of structure and friction. This course also includes the dynamics in engineering mechanics that are determination of rectilinear and curvilinear motions of particles and analysis of principle of work and energy. At the end of the course, students should be able to demonstrate and apply the knowledge by solving various problems in Statics and Dynamics, which forms the basis of further engineering subjects especially Mechanics of Materials and Fluid Mechanics.

SETG 1323 - Engineering Drawing

This course provides a fundamental background in engineering drawing to the students, which will enable them to work more effectively in the various fields of engineering. This course aims at developing the skills needed for documenting designs using drawings and for performing graphical analysis of two dimensional and three dimensional problems. The students will be exposed to available CAD for engineering drawing with more emphasis on the utilization of AutoCAD software. This course focuses on the introduction to engineering drawing, fundamentals of engineering drawing, geometry, orthographic and isometric drawing. This course also introduces sectional drawing and computer aided engineering drawing to the students. Besides that, this course also provides the basic skills and concept on the technical drawing of the gas engineering related Piping & Instrumentation Diagram (P&ID) that is essential for process industries.

SETG 1333 - Thermodynamics

Thermodynamics is an important basic engineering subject where concepts such as systems, boundaries, mass, heat, work and energy are introduced. These concepts are then related using the 1st and 2nd Law of Thermodynamics. In this subject properties of common substances such as water, air and general working fluids are introduced using property tables and basic state equations. These concepts are applied in many engineering equipment, basic

refrigeration and power cycles. Such basic concepts are vital because they form the fundamentals for future chemical-gas engineering courses.

SETG 1413 - Mass Balance
This course introduces students to the chemical engineering profession and the fundamental operations of chemical process equipment. It also provides students with the basic principles of chemical engineering material balances as well as calculation techniques to solve material balance problems for chemical process systems and equipment.

SETG 2343 - Fluid Mechanics
Physics of fluid: what is fluid, some definitions, surface tension, compressible and Incompressible flow, classes of flow, and physical classification. Fluid statics: pressure, differential equations of fluid statics, manometry, fluid force on submerged bodies, buoyancy and stability of floating bodies, and liquid in relative equilibrium. Fluid in motion: continuity equation, energy and mass equilibrium, Euler, Bernoulli and Momentum equations. Friction in fluid flow: velocity profile in pipes, roughness, friction factor, Moody chart. Flow measurement: venturi and pitot tube, orifice, notches and weirs. Pump and pumping: principle, types, selection, and application of pumps. Dimensional analysis, similitude in fluid mechanics, parameters of incompressible and compressible flow.

SETG 2423 - Energy Balance
Pre-requisites: SETG 1413 (pass with at least D+)
This course introduces students to the chemical engineering profession and the fundamental operations of chemical process equipment. It also provides students with the basic principles of chemical engineering energy balances as well as calculation techniques to solve the material and energy balance problems for chemical process systems and equipment.

SETG 2133 - Combustion Engineering and Gas Utilisation
This course enables students to understand the basic concept of combustion and related calculations as well as to expose them to the concept of flame, explosion, and detonation and its related safety aspects. In addition, it permits students to explain the use of gaseous fuels and its related energy generating technologies and equipment. The important concept and methods of fuel inter-changeability will be highlighted. The course also covers some fundamental aspects of gas utilization and equipment for various applications.

SETG 2363 - Material Engineering
Pre-requisites: SETG 1313 (taken)
The first part of SETG 2363 is introductory Materials Engineering. Topics include classification of materials (metals, ceramics, polymers, composites and semiconductors); atomic bonds; crystal structure; crystalline defects and solid solutions; and phase diagrams. Main emphasis is on metals because metals are structurally the simplest to characterize and a sound knowledge of structure-property relation of metals can be extended to the study of ceramics and polymers. The second part of the course deals with Mechanics of Materials. Topics cover stress and deformation of members under axial loading, torsion in circular shafts, analysis and design of beams for bending, and stress transformation. Throughout the course, strong

emphasis is placed on drawing a free-body diagram, selecting appropriate coordinate system, using the correct sign convention.

SETG 2433 - Chemical Engineering Thermodynamics
Pre-requisites: SETG 1333 (pass with at least D+), SETG 2423 (taken)
This course introduces students to the chemical engineering thermodynamic theory and applications in the areas of volumetric properties of fluids, heat effects, thermodynamic properties of fluids, thermodynamics of solutions, and physical and chemical equilibria.

SETG 2443 - Transport Processes
Pre-requisites: SETG 2423 (taken)
This course introduces principles and applications of unit operation involving separation processes in gas-liquid, liquid-liquid and solid-liquid systems. It also deals with design of separation operations using heat and mass transfer principles.

SETG 2741 - Fluid Mechanics Laboratory
Pre-requisites: SETG 2343 (taken)
This laboratory course contains 7 experiments that cover basic concepts in Fluid Mechanics. Laboratory experiments are designed for hands-on experience to understand the engineering principles. The experiment includes Flow Measurement, Bernoulli's Principles, Stability of Floating Body, Jet Impact, Forced Vortex Flow, Minor and Major Losses in Pipes. This course also emphasizes the technical writing aspect where all students' observation and arguments of each experiment must be reported in proper format.

SETG 3123 - Gas Processing and Liquefaction
This course is designed to expose students to techniques and technologies of processing and liquefying hydrocarbon and non-hydrocarbon gases. The course enables students to relate and apply the knowledge of some core chemical engineering courses such as mass and energy balance, separation process in gas production and liquefaction processes. A visit or exposure to the related industries which requires students to prepare a brief report will also be arranged for them gain some industrial insides.

SETG 3373 - Environmental Engineering and Sustainability
This course introduces the cause, effect and method to control pollution from industries. The course covers the three major categories of industrial pollution; water pollution, air pollution and industrial waste management. In the first part, the course includes the source and types of water pollutants, environmental regulations pertaining to waste water discharge, and techniques to treat wastewater before discharging to the environment. The second part of the course covers the source and effect of air pollution, regulations requirements for air pollution control, and technology to control air pollution emissions from industries. The third part covers the management of industrial waste that includes definition of scheduled waste, scheduled waste regulations, and techniques to manage the waste.

SETG 3453 - Chemical Engineering Computation
Pre-requisites: SSCE 1693, SSCE 1993 (taken)

This course introduces students to some numerical techniques in solving problems that could not be solved analytically. Students will be exposed to the numerical solution for the root of equation, system of linear algebraic equations, curve fitting, ordinary differential equations, differentiation and integration problems. MATLAB programming language will be implemented with the intention of illustrating the nuance of the methods, and showing more realistically how the methods are applied for problem solving.

SETG 3463 - Chemical Reaction Engineering
Pre-requisites: SETG 2423 (taken)
This course introduces students to chemical reactor design and theories in the area of chemical reaction engineering with emphasis on homogeneous and heterogeneous reactions. It will examine some problems related to multiple reactions and non-isothermal operations. Students will also work cooperatively on a computer assignment to expose them to solving problems using software packages such as PolyMath.

SETG 3473 - Separation Process
Pre-requisites: SETG 2443 (taken)
This course introduces principles and applications of unit operation involving separation processes in gas-liquid, liquid-liquid and solid-liquid systems. It also deals with design of separation operations using heat and mass transfer principles.

SETG 3751 - Thermodynamics and Material Engineering Laboratory
Pre-requisites: SETG 2363, SETG 1333 (taken)
This laboratory course contains 6 experiments that covered basic concepts in Thermodynamics and Strength of Material. Laboratory experiments are designed for hand-on experience to understand the engineering principles. The experiments application includes First Law of Thermodynamics, Second Law of Thermodynamics, Properties of Pure Substance and Properties & Strength of Materials. This course also emphasizes the technical writing aspect where all students' observation and arguments of each experiment must be reported in proper format.

SETG 3213 - Gas Transmission and Distribution
Pre-requisites: SETG 2343 (taken)
This course is design to expose student to hydrocarbon gas transmission and distribution system. The course contents include an introduction to gas industry, gas delivery concept, codes and standards in gas pipeline system, gas hydraulics, gas pipeline network analysis, construction, materials and procedures, operation and maintenance and gas regulation and measurements. A visit to the related industries which requires student to prepare a brief report and application of CEASER II software will be arranged for them to gain some industrial experience.

SETG 3383 - Safety and Health in Petrochemical Industry
This course presents fundamental principle of safety and risk assessment in chemical process industry. In particular, it emphasises on safety legislations, inherent safety design concept, and applies various method of process hazard identification on petrochemical process and health risk assessment. At the end of this course, it is expected that the students will be able

to appreciate the theoretical and practical aspect of occupational safety, health and environment in petrochemical process industry and also be able to use the techniques of hazard identification and risk assessment in the design and operation of petrochemical plant.

SETG 3483 - Process Control and Instrumentation
Pre-requisites: SSCE 1793, SETG 3473 (taken)
This course covers the fundamentals of dynamic process modelling, dynamic process behaviours and process control. Although more concentration is given to lumped parameter systems modelling, distributed parameter systems is introduced. Feedback control system design, analysis and tuning are dealt with in detail. Also included are model estimation techniques for first order plus deadtime (FOPDT) systems. Other commonly found control structures, such as feedforward, ratio, split-range and cascade control, and plant-wide control systems design are taught qualitatively. This course employs Active Learning (AL).

SETG 3721 - Combustion Engineering and Gas Utilisation Laboratory
Pre-requisites: SETG 2133 (taken)
The laboratory is the practical introduction to the method of determining fuel characteristics such as specific gravity and calorific value. This course also introduces students to the method of determining flame properties such as flame speed and flame characteristics. It also enables students to obtain understanding of a few phenomenon during combustion with some related factors. Students also are introduced into explosion study. At the end of this course, students will able to describe and explain the process and operation of equipment related to gas combustion engineering such as boiler, gas absorption refrigeration system, and gas turbine system.

SETG 4761 - Pollution Control and Reaction Laboratory
Pre-requisites: SETG 3463, SETG 3373 (taken)
This laboratory course contains experiments that are covered basis concept in chemical reaction engineering and pollution control such as kinetic analysis of reaction, ambient air and water quality analysis. All experiments require students to apply fundamental laboratory techniques and skills as well as communication skill. Students, in group will demonstrate a mastery of laboratory techniques and clearly describe the qualitative and quantitative aspects of the experiments performed.

SETG 3812 - Undergraduate Project 1
This course is designed to train students on some important aspects of research management. In the first part of the undergraduate research project course, the students are only required to carry out preliminary studies on the assigned chemical and gas engineering related topics but also to do research planning that will be implemented in the following semester. At the end of this course, students should be able to prepare a complete research proposal and subsequently present their proposal. In addition, students will have opportunity to gain important generic skills such as communication, team working, problem-solving and creative and critical thinking.

SETG 3915 - Industrial Training

Students shall attend industrial training prior to their final year at UTM. Students will undergo a practical training lasting for 12 weeks at an approved private, government or semi-government agency. Placement at the respective agency will be initiated by the applications from the students. Approval of the application is at the discretion of the Faculty after considering the suitability of the company. The industrial training provides an opportunity for students to experience the actual working environment and to be able to put into practice the theories that they learned in class. Undergraduates are expected to acquire hands on experience not only in the engineering aspects of work, but also to other related matters such as administration, accounting, management, safety, etc. during the industrial training period. Students will be supervised by Faculty's supervisor and Industrial's supervisor.

SETG 3731 - Separation Process Laboratory

Pre-requisites: SETG 3473 (taken)

This subject introduces students to the equipment in the separation processes discussed in Separation subject. This will give a 'hands on' experience to the students how to handle the equipments and to interpret the data taken from the experiments. There are also various types of packing and plate in the column (absorption and distillation) that are being used in the laboratory. Comparison can be made on the efficiency of each packing/plate after all the packing/plate types have been used.

SETG 4223 - Gas Storage and Reticulation System

Pre-requisites: SETG 3213 (taken)

This subject enables student to acquire and practice the fundamental knowledge of liquefied petroleum gases (LPG), natural gases (NG) and liquefied natural gases (LNG) storage. The course also emphasizes on gas reticulation systems which include service pipe sizing, pipe route, pressure testing and corrosion protection systems. The students are also required to prepare a group technical report and present their project at the end of the course. Students also will be exposed to computer software (PV Elite and CEASAR II) to enhance their learning quality. A visit to the related industries will also be arranged for them to gain some industrial experience.

SETG 4393 - Engineering Economics and Project Management

This is a two-in-one course covering both Engineering Economy and Project Management topics. Engineering economy is the application of economic factors and criteria to evaluate alternatives, considering the time value of money. The engineering economy study involves computing a specific economic measure of worth for estimated cash flows over a specific period of time. Project Management is the art of planning, scheduling, and controlling project activities to achieve performance, cost, and time objectives, for a given scope of works, while using resources efficiently and effectively.

SETG 4493 - Plant Design

Pre-requisites: SETG 3473 (taken)

This course presents the principles and methodology for product and process design. In particular, it emphasises on the key elements of process design which include process synthesis, heat integration, equipment sizing and cost estimation and process optimisation in

generating inherently safe, economic and environmentally friendly processes. The course features the use of process simulation tools.

SETG 4711 - Gas Flow System Laboratory
Pre-requisites: SETG 3213 (taken)
This course is designed to allow students to undergo some laboratory work related to gas engineering courses (SETG 3213 & SETG 4223). At the end of the course, students should be able to practically apply different methods of gas pipeline jointing technique, gas metering calibration, gas pipeline control, metering system and gas reticulation system. The students are required to prepare a group laboratory report. This course also implements an Industrial Project-based lab where the students are required to design and assemble a gas reticulation system that represents an actual industrial operation. In addition, students will have the opportunity to gain important generic skills such as responsibilities, communication, and team working.

SETG 4771 - Process Control Laboratory
Pre-requisites: SETG 3483 (taken)
This lab exposes students to areas of process control systems in the chemical industry. It also teaches the students how to control the specific control variables through the use of simple PID control. Students will experience how to perform open loop and closed loop tuning methods for specific processes. Also included is the application of PLC program to plan and control a simple process. Students will gain hands-on experience in process control through experiments that employ pilot-scale chemical processes.

SETG 4824 - Undergraduate Project II
Pre-requisites: SETG 3812 (pass with at least D+)
This course is a continuation of the Undergraduate Project I (SETG 3812). The second part of the Undergraduate Project requires students to implement the research proposal that has been prepared in the previous semester. This might involve practical activities such as laboratory works, data collection from industry and computer programming / simulation. At the end of the course, students should be able to prepare a full report compiling the first and second part of the Undergraduate Project and subsequently present their research findings. Finally, students must submit a bound thesis according to the UTM thesis-writing format. In addition, students will have the opportunity to gain important generic skills such as communication, team working, problem-solving and creative and critical thinking.

SETG 4610 - Gas Engineering Seminar
This seminar provides the platform for verbal sharing experience and providing forums of discussion amongst industrialists, academicians and final year gas engineering students. It is expected to prepare the students with current development in the related gas industry operation and activities. The actual industrial operation scenario will be addressed by various well-verse industrial personnel and experienced engineers. The dialog and presentation would strengthen students' understanding of the current, future and past trend of the gas industry and its relevant applications. It is expected that students would also be able to enlighten the correlation of professional ethics in societal and global context by appreciating the values of

resources, latest technological development, issues of health and environment, integrated safety, professional practices and personal integrity.

SETG 4834 - Plant Design Project
Pre-requisites: SETG 4493, SETG 3383 (taken)
This project is aimed at equipping the students with the skills and creativity in designing a process plant in the absence of complete data. In particular, this course emphasizes on the key elements of process design which include process creation/synthesis, process analysis, process evaluation and process optimization in generating inherently safe, economic and environmentally friendly processes. The students will acquire the skill for hands-on application and integration of the principles of chemical engineering required to design a process plant. Students will also learn the technique of writing a comprehensive technical plant design report. The students are also required to present their project at the interim level and end of the course. In this course, students also will be exposed to computer software (ASPEN HYSIS and PV Elite) to enhance their learning quality. The students are also required to do an industrial visit to the related industries to gain some industrial experience and submit an industrial visit report discussing the benefits of the visit.

ELECTIVE COURSES

1. Energy

SETG 4113 - Carbon Capture and Sequestration
This course enables students to examine CO_2 separation and capture technologies and also monitoring and verification. It provides an overview of current technologies and discuss critical technical challenges. Sequestration in geologic formation and sequestration in the oceans using injection methods are clarified. Costs, public acceptance and legal and environmental issues are clarified and factored into the strategy for future energy systems.

SETG 4143 - Energy Management and Economics
This course introduces basic background, terminology, and fundamentals of energy conversion. Discusses current and emerging technologies for production of thermal, mechanical, and electrical energy. Topics include fossil and nuclear fuels, solar energy, wind energy, fuel cells, and energy storage.

SETG 4153 - Energy Conversion Technology
This course introduces basic background, terminology, and fundamentals of energy conversion. It provides a broad conceptual and analytical understanding of the engineering aspects of energy generation, storage and conversion with an emphasis on sustainable energy use and renewable energy production.

SETG 4163 - Green Energy Technology
The aim of the programme is to prepare students for a professional career in the development of advanced technologies and systems that can satisfy energy demand while striving for environmental, social and economic sustainability. In addition to in-depth knowledge of energy technologies and systems, students will be trained to understand the basic challenges of

sustainable development, with a specific focus on the challenges that face the energy system. The course is unique in that it deals with the energy system on all relevant systems levels and that the courses are integrated in such a way that students are trained to approach problem solving in an interdisciplinary way. At the end of the course, students will have acquired a thorough insight into the possibilities and limitations of energy systems, specifically in relation to sustainable development.

SETG 4243 - Non-Conventional Oil and Gas Exploitation
This course enables students to describe formation of hydrocarbons, determine exploration methods and techniques, describe fundamentals of drilling and reservoirs, processing of effluent streams, safety and the environment, hydrodynamics of petroleum exploration, characterize the reserves and describe the principle of petroleum economics.

2. Gas

SETG 4173 - Membrane Based Gas Separation Technology
This course introduces students to the fundamentals of gas separation membrane and membrane processes. Students are exposed to membrane materials, morphology, and properties in relation to the gas separation application. In addition, the students will be able to evaluate the productivity and purity of the products under fixed operating conditions from transport equation or supplier information. This subject is also briefly provide the students with the knowledge of potential application of membrane gas separation technology in various industries including petrochemicals, environment and other energy related emerging applications.

SETG 4253 - Gas Production Engineering
This course is designed to expose students to the gas production system. The course contents include a natural gas source, gas well performance, production surface facilities, gas treatment and gas transportation and storage. The course covers the relationship between upstream and downstream activities and the processes involved in the transporting and treating.

SETG 4263 - Fire and Explosion Safety
This course enables students to understand the basic concept of fire science and combustion and related calculations as well as to expose them to the concept of explosion and detonation. In addition, the principles of fire and explosion protection and mitigation will be discussed within the context of understanding the fire and explosion development mechanism. At the end of the course, students should be able to explain and relate the fundamental knowledge of combustion, flame and explosion and its important safety aspects involving gaseous fuel utilization. Students should be able to apply general combustion and engineering principles to fires and explosions and should know the parameters involved in the initiation of both fire and explosion. The students should be also able to use CFD fire modeling (CFast) to analyze the fire development on the case studies given.

SETG 4273 - Gas Operation and Maintenance

This course is designed to expose students to gas supply operation and maintenance. The course contents include a gas supply system, legislature, maintenance activity, and asset management and control. The course covers pipeline and storage systems.

SETG 4283 - Corrosion Engineering

The aim of this course is to provide basic knowledge of corrosion and corrosion protection of metals and alloys from an electrochemistry perspective. This course is specially designed for students who want to have a basic understanding of the corrosion process. Students will be introduced to the underlying science of corrosion engineering principles, corrosion management with particular emphasis on the corrosion design of pipeline corrosion protection. Different types of corrosion, methods of corrosion protection and prevention standard corrosion tests will be discussed. This course also covers most traditional and non-traditional tests for corrosion studies, including electrochemical techniques for corrosion, analysis of corrosion phenomenon and corrosion monitoring principles. This course will examine the general mechanisms of corrosion and relate these to specific engineering issues and methods being used to reduce the cost of corrosion. At the end of the course students will be required to do a case study on corrosion problems that shall introduce students on real corrosion problems in industries and group projects allow students to become familiar with directing their own investigations of corrosion problems.

Mapping of Courses to Programme Outcomes for
Bachelor of Chemical Engineering (Gas) with Honours

		PROGRAMME LEARNING OUTCOMES (PLO)											
		Engineering Knowledge	Problem Analysis	Design/Development of Solution	Investigation	Modern Tool Usage	The Engineer and Society	Environment & Sustainability	Ethics	Communication Skills	Leadership and Teamwork	Life Long Learning	Project Management and Finance
COURSE CODE	**COURSE NAME**	**PLO1**	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**
PROGRAMME CORE COURSES													
SETG 2353	Introduction to Organic and Analytical Chemistry for Engineers	/	/							/			
SETG 1313	Mechanics of Engineering	/									/		
SETG 1233	Introduction to Chemical and Gas Engineering	/	/							/	/		
SETG 1323	Engineering Drawing	/				/					/		
SETG 1333	Thermodynamics	/	/								/		
SETG 1413	Mass Balance	/	/									/	
SETG 2343	Fluid Mechanics	/	/								/		
SETG 2423	Energy Balance	/	/									/	
SETG 2741	Fluid Mechanics Laboratory		/							/			
SETG 2363	Material Engineering	/									/		
SETG 2133	Combustion Engineering and Gas Utilisation	/	/								/		
SETG 2433	Chemical Engineering Thermodynamics	/	/								/	/	
SETG 2443	Transport Processes	/	/										
SETG 3751	Thermodynamics and Material Engineering Laboratory	/			/						/		
SETG 3453	Chemical Engineering Computation	/				/							
SETG 3123	Gas Processing and Liquefaction	/									/		
SETG 3463	Chemical Reaction Engineering	/				/					/		
SETG 3473	Separation Process	/										/	
SETG 3373	Environmental Engineering and Sustainability	/						/					
SETG 3483	Process Control and Instrumentation	/			/						/		

		PROGRAMME LEARNING OUTCOMES (PLO)											
		Engineering Knowledge	Problem Analysis	Design/Development of Solution	Investigation	Modern Tool Usage	The Engineer and Society	Environment & Sustainability	Ethics	Communication Skills	Leadership and Teamwork	Life Long Learning	Project Management and Finance
COURSE CODE	**COURSE NAME**	**PLO1**	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**
SETG 3213	Gas Transmission and Distribution	/	/							/			
SETG 3721	Combustion Engineering and Gas Utilisation Laboratory		/		/					/			
SETG 3731	Separation Process Laboratory		/		/					/			
SETG 3383	Safety and Health in Petrochemical Industry	/					/				/		
SETG 3812	Undergraduate Project I	/	/	/					/	/		/	/
SETG 3915	Industrial Training	/	/	/	/	/	/	/	/	/	/	/	/
SETG 4761	Pollution Control and Reaction Laboratory		/	/	/					/			
SETG 4771	Process Control Laboratory		/							/	/	/	
SETG 4493	Plant Design	/	/	/		/			/	/			/
SETG 4393	Engineering Economics and Project Management	/	/										/
SETG 4223	Gas Storage and Reticulation System	/	/	/					/	/	/		
SETG 4711	Gas Flow System Laboratory		/	/	/		/			/	/		
SETG 4824	Undergraduate Project II	/	/		/	/	/	/	/	/		/	/
SETG 4610	Gas Engineering Seminar						/			/			
SETG 4834	Plant Design Project	/		/	/					/			/
PROGRAMME ELECTIVE COURSES													
SETG 4**3	Gas Engineering Elective I	/	/							/		/	
SETG 4**3	Gas Engineering Elective II	/	/							/		/	
SETG 4**3	Gas Engineering Elective III	/	/							/		/	

BACHELOR OF NUCLEAR ENGINEERING WITH HONOURS

PROGRAMME SPECIFICATIONS

The Bachelor of Nuclear Engineering with Honours is offered on a full-time basis. The programme is offered only at the UTM Main Campus in Johor Bahru. The duration of study for the full-time programme is subjected to the student's entry qualifications and lasts between four (4) years to a maximum of six (6) years.

The programme is offered on a full-time basis and is based on two semesters per academic session. Generally, students are expected to undertake courses equivalent to between twelve (12) to eighteen (18) credit hours per semester. Assessment is based on courseworks and final examinations given throughout the semester.

General Information

1. Awarding Institution			Universiti Teknologi Malaysia	
2. Teaching Institution			Universiti Teknologi Malaysia	
3. Programme Name			Bachelor of Nuclear Engineering with Honours	
4. Final Award			Bachelor of Nuclear Engineering with Honours	
5. National Education Code (NEC)			0712 (Electricity and Energy)	
6. Programme Code			SETNH	
7. Professional or Statutory Body of Accreditation			Board of Engineers Malaysia (BEM)	
8. Language(s) of Instruction			English and Bahasa Malaysia	
9. Mode of Study			Conventional	
10. Mode of operation			Self-govern	
11. Study Scheme			Full Time	
12. Study Duration			Minimum : 4 years Maximum : 6 years	
Type of Semester	No. of Semesters		No of Weeks/Semester	
	Full Time	Part Time	Full Time	Part Time
Normal	8	-	14	-
Short	4	-	8	-

Course Classification

No.	Classification	Credit Hours	Percentage
i.	University Courses (f) General (g) Language (h) Entrepreneurship (i) Co-Curriculum (j) Free Electives	 6 6 2 2 3	14.1%
ii.	Faculty/ Programme Core	110	81.5%
iii.	Programme Electives	6	4.4%
	Total	**135**	**100%**
A	Engineering Courses (a) Lectures (b) Laboratory/Workshop (c) Industrial Training (d) Final Year Project (e) Integrated Design Project	 78 5 5 6 4	72.6%
Total Credit Hours for Part A		**98**	
B	Related Courses (a) Applied Science/ Mathematics/ Computer (b) Management/Law/Humanities/Ethics/ Entrepreneur (c) Language (d) Co-Curriculum (e) Free Electives	 18 8 6 2 3	27.4%
Total Credit Hours for Part B		**37**	
Total Credit Hours for Part A and B		**135**	**100%**
Total Credit Hours to Graduate		**135 credit hours**	

Award Requirements

To graduate, students must:

- Attain a total of not less than 135 credit hours with a minimum CGPA of 2.00.
- Pass Industrial Training.
- Complete 5 (Five) Professional Skill Certificates.

CROSS-CAMPUS PROGRAMME

Students are given the opportunity to enrol in a few courses in participating universities. The grades and credits obtained during this period are transferable (up to 1/3 of the total credits of the curriculum). Currently, there are four participating universities i.e. Universiti Teknologi Malaysia, Universiti Sains Malaysia, Universiti Malaya and Universiti Malaysia Sarawak.

The programme is open to undergraduates who have undergone a minimum of two semesters of their studies with the following conditions:

(i) The total number of credits allowed to be taken is between twelve (12) and sixteen (16) credits only.
(ii) The student should hold a minimum CGPA of 3.00 at the time of application.
(iii) The student is not a residence of or originated from the state where the university that he/she intends to attend is located.

The student will not be charged tuition fees by the participating university but shall pay the regular tuition fees at UTM. However, should the participating university provide accommodation, the student will need to pay accommodation fees.

COURSE MENU

YEAR 1: SEMESTER 1			
Code	**Course**	**Credit**	**Pre-requisite**
SETN 1113	Modern Physics	3	
SETN 1143	Introduction to Engineering	3	
SETN 1243	Statics@	3	
SSCE 1693	Engineering Mathematics I@	3	
ULRS 1012	Value and Identity	2	
	TOTAL CREDIT	**14**	
	CUMULATIVE CREDITS	**14**	

YEAR 1: SEMESTER 2			
Code	**Course**	**Credit**	**Pre-requisite**
SETN 1133	Engineering Drawing	3	
SETN 1123	Fluid Mechanics@	3	
SETN 1224	Electrical Engineering Fundamentals with Laboratory	4	
SETN 2213	Nuclear Physics	3	SETN 1113#
SSCE 1993	Engineering Mathematics II@	3	SSCE 1693
ULRS 1182	Appreciation of Ethics and Civilization (for Local Students)	2	
UHLM 1012	Malay Language Communication 2 (for International Students)		
	TOTAL CREDIT	**18**	
	CUMULATIVE CREDITS	**32**	

YEAR 2: SEMESTER 1			
Code	**Course**	**Credit**	**Pre-requisite**
SECP 2273	Programming for Engineers	3	
SETN 1711	Fluid Mechanics Lab	1	SETN 1123
SETN 2113	Thermodynamics@	3	
SETN 2123	Strength of Materials	3	
SETN 2243	Nuclear Engineering Fundamentals	3	
SSCE 1793	Differential Equations	3	SSCE 1993
ULRF 2**2	Service Learning and Community Engagement Elective	2	
	TOTAL CREDIT	**18**	
	CUMULATIVE CREDITS	**50**	

YEAR 2: SEMESTER 2			
Code	**Course**	**Credit**	**Pre-requisite**
SETN 2133	Dynamics@	3	SETN 1243
SETN 2223	Heat Transfer	3	SETN 2113#
SETN 2393	Numerical Methods for Nuclear Engineers	3	SSCE 1793
SETN 2711	Thermodynamics & Mechanics of Material Laboratory	1	SETN 2113 SETN 2123
SETN 3711	Nuclear Physics Laboratory	1	
SSCE 2193	Engineering Statistics	3	
ULRS 1022	Philosophy and Current Issues	2	
UHLB 2122	Professional Communication Skills 1	2	
	TOTAL CREDIT	**18**	
	CUMULATIVE CREDITS	**68**	

YEAR 3: SEMESTER 1			
Code	**Course**	**Credit**	**Pre-requisite**
SETN 3113	Nuclear Radiation Protection	3	
SETN 3173	Engineering Economics & Project Management	3	
SETN 3213	Nuclear Reactor Theory	3	
SETN 3224	Thermal Hydraulics with Laboratory	4	SETN 2223 SETN 1123
UHLB 3132	Professional Communication Skills 2	2	UHLB 2122
UHL* 1112	Communication in Foreign Language Elective	2	
	TOTAL CREDIT	**17**	
	CUMULATIVE CREDITS	**85**	

YEAR 3: SEMESTER 2			
Code	**Course**	**Credit**	**Pre-requisite**
SETN 3123	Nuclear Reactor Material	3	SETN 2123
SETN 3253	Nuclear Safety, Safeguard, Security & Regulation	3	
SETN 3233	Radiation Detection and Measurement	3	
SETN 3721	Nuclear Reactor Lab	1	SETN 3213
SETN 4812	Undergraduate Project I**	2	
ULRS 3032	Entrepreneurship and Innovation	2	
**** ***3	Free Elective	3	

	TOTAL CREDIT	**17**	
	CUMULATIVE CREDITS	**102**	

YEAR 3: SEMESTER 3			
Code	**Course**	**Credit**	**Pre-requisite**
SETN 3915	Industrial Training	5	
	TOTAL CREDIT	**5**	
	CUMULATIVE CREDITS	**107**	

YEAR 4: SEMESTER 1			
Code	**Course**	**Credit**	**Pre-requisite**
SETN 3223	Instrumentation and Control Engineering	3	
SETN 4711	Radiation, Detection & Measurement Laboratory	1	SETN 3233
SETN 4824	Undergraduate Project II*	4	SETN 4812#
SETN 4833	Nuclear Engineering System and Design I	3	SETN 4453
SETN 4**3	Programme Elective I	3	
SET* 5**3	PRISMS Elective I		
	TOTAL CREDIT	**14**	
	CUMULATIVE CREDITS	**121**	

YEAR 4: SEMESTER 2			
Code	**Course**	**Credit**	**Pre-requisite**
SETN 4453	Nuclear Power Plant System	3	
SETN 4113	Nuclear Fuel Cycle and Waste Management	3	
SETN 4611	Nuclear Engineering Professional Practice**	1	
SETN 4834	Nuclear Engineering System and Design II	4	SETN 4833
SETN 4**3	Programme Elective II	3	
SET* 5**3	PRISMS Elective II		
	TOTAL CREDIT	**14**	
	CUMULATIVE CREDITS	**135**	

Note: * - cornerstone course; ** - capstone course; @ - with tutorial
- must pass (at least with grade D+) for prerequisite course

English Pre-Requisite

Students must register and pass UHLB 1112 course if the English pre-requisite is not fulfilled.

ENGLISH PRE-REQUISITE
a) MUET : ≥ Band 4
b) IELTS : ≥ Band 5.5
c) TOEFL: ≥ 525
d) TOEFL iBT : ≥ 60
e) CEFR : ≥ B2

Elective Courses

- SETN 4413 Sustainable Energy
- SETN 4423 Ultrasonic Testing
- SETN 4433 Chemistry in Nuclear Engineering
- SETN 4443 Risk Assessment
- SETN 4483 Radiographic Testing

PRISMS ELECTIVE COURSES

For students who intend to enroll in PRISMS, refer to the PRISMS Section for a list of related elective courses associated with the Postgraduate Programme.

GRADUATION CHECKLIST

To graduate, students must pass all the stated courses in this checklist. It is the responsibility of the students to ensure that all courses are taken and passed. Students who do not complete any of the courses are not allowed to graduate.

NO.	CODE	COURSE	CREDIT EARNED (JKD)	CREDIT COUNTED (JKK)	TICK (√) IF PASSED
NUCLEAR ENGINEERING COURSES					
1	SECP 2273	Programming for Engineer	3	3	
2	SETN 1113	Modern Physics	3	3	
3	SETN 1123	Fluid Mechanics	3	3	
4	SETN 1133	Engineering Drawing	3	3	
5	SETN 1143	Introduction to Engineering	3	3	
6	SETN 1224	Electrical Eng. Fundamental with Lab	4	4	
7	SETN 1243	Statics	3	3	
8	SETN 1711	Fluid Mechanics Lab	1	1	
9	SETN 2113	Thermodynamics	3	3	
10	SETN 2123	Strength of Materials	3	3	
11	SETN 2133	Dynamics	3	3	
12	SETN 2213	Nuclear Physics	3	3	
13	SETN 2223	Heat Transfer	3	3	
14	SETN 2243	Nuclear Engineering Fundamentals	3	3	
15	SETN 2393	Numerical Methods for Nuclear Engineers	3	3	
16	SETN 2711	Thermodynamics & Mechanics of Material Lab	1	1	
17	SETN 3113	Nuclear Radiation Protection	3	3	
18	SETN 3123	Nuclear Reactor Materials	3	3	
19	SETN 3173	Engineering Economics & Project Management	3	3	
20	SETN 3213	Nuclear Reactor Theory	3	3	
21	SETN 3223	Instrumentation and Control Eng.	3	3	
22	SETN 3224	Thermal Hydraulics with Lab	4	4	
23	SETN 3233	Radiation Detection and Measurement	3	3	
24	SETN 3253	Nuclear Safety, Safeguard, Security & Regulation	3	3	
25	SETN 3711	Nuclear Physics Lab	1	1	

26	SETN 3721	Nuclear Reactor Lab	1	1	
27	SETN 3915	Industrial Training	5	HL	
28	SETN 4113	Nuclear Fuel Cycle & Waste Management	3	3	
29	SETN 4453	Nuclear Power Plant System	3	3	
30	SETN 4611	Nuclear Eng. Professional Practice	1	1	
31	SETN 4711	Rad. Detection & Measurement Lab	1	1	
32	SETN 4812	Undergraduate Project I	2	2	
33	SETN 4824	Undergraduate Project II	4	3	
34	SETN 4833	Nuclear Eng. System & Design I	3	3	
35	SETN 4834	Nuclear Eng. System and Design II	4	4	
36	SETN 4**3	Elective Nuclear I	3	3	
	SET* 5**3	PRISMS Elective I			
37	SETN 4**3	Elective Nuclear II	3	3	
	SET* 5**3	PRISMS Elective II			
		TOTAL CREDIT OF NUCLEAR ENGINEERING COURSES (a)	**104**	**99**	
MATHEMATICS COURSES (Faculty of Science)					
1	SSCE 1693	Engineering Mathematics I	3	3	
2	SSCE 1793	Differential Equations	3	3	
3	SSCE 1993	Engineering Mathematics II	3	3	
4	SSCE 2193	Engineering Statistics	3	3	
		TOTAL CREDIT OF MATHEMATICS COURSES (b)	**12**	**12**	
UNIVERSITY GENERAL COURSES					
Malaysia Core Value					
1	ULRS 1182	Appreciation of Ethics and Civilizations (for Local Students)	2	2	
	UHLM 1012	Malay Language Communication 2 (for International Students)			
2	ULRS 1022	Philosophy and Current Issues	2	2	
Value and Identity					
1	ULRS1012	Value and Identity	2	2	
Global Citizen					
1	ULRF2**2	Service Learning & Community Engagement Course	2	2	

Communication Skills					
1	UHLB 2122	Professional Communication Skills 1	2	2	
2	UHLB 3132	Professional Communication Skills 2	2	2	
3	UHL* 1112	Communication in Foreign Language Elective	2	2	
Entreprising Skills					
1	ULRS 3032	Entrepreneurship & Innovation	2	2	
Free Elective					
1	**** ***3	Free Elective Course	3	3	
		TOTAL CREDIT of UNIVERSITY GENERAL COURSES (c)	**19**	**23**	
		TOTAL CREDIT TO GRADUATE (a + b + c)	**139**	**134**	

OTHER COMPULSORY COURSES – PROFESSIONAL SKILLS CERTIFICATE (PSC)			
Students are required to enrol and pass FIVE (5) PSC courses, to be eligible to graduate. Enrol the PSC courses as follows:			
COMPULSORY PSC COURSES (Enrol All 3 Courses)			
1	GLRB0010	Design Thinking for Entrepreneur	
2	GLRM0010	Talent and Competency Management	
3	GLRL0010	English Communication Skills for Graduating Students (ECS)	
ELECTIVE PSC COURSES (Choose Any 2 Courses only)			
1	GLRT0010	Data Analytics for Organization	
2	GLRM0020	Professional Ethics and Integrity	
3	GLRT0020	Construction Measurement (Mechanical & Electrical)	
4	GLRT0030	OSHE for Engineering Industry and Laboratory	
5	GLRT0040	OSHE for Construction Industry and Laboratory Works	
6	GLRT0050	Quality Management for Build Environment and Engineering Professionals	
7	GLRT0060	Safety and Health Officer Introductory Course	
8	GLRT0070	Industrial Machinery and Lubrication	
Or any other elective PSC courses offered by UTM iLeague. Information on PSC Courses: https://ileague.utm.my/utm-professional-skills-certificate-utm-psc/ Online PSC Registration: https://elearnpsc.utmspace.edu.my/			

COURSE SYNOPSIS

CORE COURSES

SETN 1143 - Introduction to Engineering

The objective of this course is to introduce and prepare students for learning engineering and how to become engineers of the future. This course serves to bridge pre-university education to university life and provide support for adjusting to learning and expectations in tertiary education. This course introduces the students to the engineering profession, how to prepare for an exciting engineering career, the design process, engineering communication, thinking skills and ethics. The students will also be introduced with systematic approaches to deal with basic engineering problems. Special emphasis will be on enhancing students' communication skills. Problem-Based Learning (PBL) case study on sustainable development will be implemented for a mini project consisting of three stages.

SETN 1113 - Modern Physics

The course begins with a brief discussion on the nature of science in the quest of better understanding of the natural phenomena, the inadequacy and failures of classical physics. It is then followed by an introductory lesson on Special Relativity Theory and relevant consequences of this theory. A modern quantum mechanics interpretation on blackbody radiation, photoelectric and Compton effect will also be discussed. It will then proceed to the lesson on atomic models and quantum numbers. Finally, formalities of quantum mechanics are introduced by discussing the 1-D time independent Schrodinger equation (TISE), applied to an idealized infinite square potential well.

SETN 1243 - Statics

This course is designed to introduce students to the basic principles and concepts in mechanics. It deals with the resultant and resolution of force(s) acting on a particle, the equilibrium of a particle, the effect of force(s) on rigid bodies, how to replace a force system with an equivalent system and the equilibrium of rigid bodies. This course also includes the determination of centroid, analysis of structure and friction. At the end of the course, students should be able to demonstrate and apply the knowledge by solving various problems in Statics, which forms the basis of further engineering subjects especially Mechanics of Materials and Fluid Mechanics.

SETN 2213 - Nuclear Physics

Pre-requisite: SETN 1113 (pass with at least D+)

The course introduces some major concepts and theories of nuclear physics. The course begins with understanding the basic knowledge of the constituents of nucleus and the properties of nuclear forces. Nuclear models such as liquid drop model, shell model and optical model of the nucleus will be introduced afterward. The next topic of the course is introducing the radiation sources and the types of ionizing radiations. Nuclear decay process and the properties of ionizing radiation will be discussed in this topic. The interactions of nuclear radiations with matter and mechanism of nuclear reaction are also covered in this subject. The next topic is providing the students with some basic concepts on radioactivity including radioactive decay law, radioactive decay series and radioactive equilibriums. In general, the

course provides a basic concept of interaction processes of nuclear radiation in order to widen the appreciation of nuclear physics to the students.

SETN 1123 - Fluid Mechanics

This course introduces students to physics of fluid: what is fluid, some definitions, surface tension, compressible and Incompressible flow, classes of flow, and physical classification. Fluid statics: pressure, differential equations of fluid statics, manometry, fluid force on submerged bodies, buoyancy and stability of floating bodies, and liquid in relative equilibrium. Fluid in motion: continuity equation, energy and mass equilibrium, Euler, Bernoulli and Momentum equations. Friction in fluid flow: velocity profile in pipes, roughness, friction factor, Moody chart. Flow measurement: venturi and pitot tube, orifice, notches and weirs. Pump and pumping: principle, types, selection, and application of pumps. Dimensional analysis, similitude in fluid mechanics, parameters of incompressible and compressible flow.

SECP 2273 - Programming for Engineers

This course formally introduces the concept of computers, algorithms, programming languages, pseudocode, and problem solving. The two programming languages introduced in this course are Fortran and MATLAB. Topics covered in this course include data types, constants, variables, arithmetic operations, assignment statement, looping, formatted I/O, functions, arrays, matrix operations, data structures, plotting, and model building.

SETN 1224 - Electrical Engineering Fundamentals with Lab

This course introduces students to the fundamentals of electrical and electronic engineering through lecture and laboratory sessions. It covers components (passive, active, semiconductor-based), circuits (AC, DC, analogue, digital) and the methods for analyzing circuitry. The laboratory sessions reinforce students' understanding of the theory and expose them to electronics test and measurement equipment. At the completion of this course students are expected to be able to understand electrical and electronic engineering, draw and analyze electronic circuits, use test and measurement instruments, and design basic analogue and digital electronic circuits using active and passive components.

SETN 2243 - Nuclear Engineering Fundamentals

This course introduces students to the fundamentals of nuclear engineering. The course provides a broad overview of the fundamental aspects of nuclear engineering and an introductory comparative analysis of nuclear power and other energy sources. The course also provides comparative analysis between different types of nuclear reactors. Other topics covered include theory and thermal hydraulics of nuclear reactors, nuclear power generations, nuclear fuel cycle and control, Radiation and radiation control and nuclear safety.

SETN 2123 - Strength of Materials

The first part of this course is introductory to Materials Engineering. Topics include classification of materials (metals, ceramics, polymers, composites and semiconductors); atomic bonds; crystal structure; crystalline defects and solid solutions; and phase diagrams. Main emphasis is on metals because metals are structurally the simplest to characterize and a sound knowledge of structure-property relation of metals can be extended to the study of ceramics and polymers. The second part of the course deals with Mechanics

of Materials. Topics cover stress and deformation of members under axial loading, torsion in circular shafts, analysis and design of beams for bending, and stress transformation. Throughout the course, strong emphasis is placed on drawing a free-body diagram, selecting appropriate coordinate systems, and using the correct sign convention.

SETN 2113 - Thermodynamics

Thermodynamics is a fundamental engineering subject where thermodynamic system, boundaries, mass, heat, work, internal energy and enthalpy are explained. Properties of common fluid, such as water, air, and refrigerants are determined either using tables of properties or equations. These are then related to the concepts of 1st Law of Thermodynamics for energy balance calculation and analysis. To further analyze whether a process is possible or not requires a knowledge of 2nd Law of Thermodynamics where another thermodynamic property known as entropy is introduced. All these concepts are then applied to more integrated and complex power and refrigeration cycle systems.

SETN 1133 - Engineering Drawing

This course provides a fundamental background in engineering drawing to the students, which will enable them to work more effectively in the various fields of engineering. This course aims at developing the skills needed for documenting designs using drawings and for performing graphical analysis of two dimensional and three-dimensional problems. The students will be exposed to different available CAD for engineering drawing with more emphasis on the utilization of QCAD and AutoCAD software. This course focuses on the introduction to engineering drawing, fundamentals of engineering drawing, geometry, orthographic and isometric drawing. This course also introduces the sectional and flowchart drawing and computer aided engineering drawing to the students. Besides that, this course also provides the basic skills and concept on the technical drawing of the gas engineering related Piping & Instrumentation Diagram (P&ID) that is essential for process industries.

SETN 1711 - Fluid Mechanics Lab

Pre-requisite: SETN 1123 (taken)

This laboratory course contains 7 experiments that cover basic concepts in Fluid Mechanics. Laboratory experiments are designed for hands-on experience to understand the engineering principles. The experiment includes Flow Measurement, Bernoulli's Principles, Stability of Floating Body, Jet Impact, Forced Vortex Flow, Minor and Major Losses in Pipes. This course also emphasizes the technical writing aspect where all students' observations and arguments of each experiment must be reported in proper format.

SETN 2393 - Numerical Methods for Nuclear Engineers

This course formally introduces the steps involved in engineering analysis (mathematical modeling, solving the governing equation, and interpretation of the results). Examples of case studies in applied mechanics, strength of materials, thermal science, and fluid mechanics are presented. Methods for solving the nonlinear equations, simultaneous linear algebraic equations, eigenvalue problem, interpolation, numerical differentiation, numerical integration, initial value problems, boundary value problem and Monte Carlo method are introduced.

SETN 2223 - Heat Transfer

Pre-requisite: SETN 2223 (pass with at least D+)

In this course, three basic modes of heat transfer, namely conduction, convection and radiation, will be covered. Emphasis will be on developing a physical and analytical understanding of the three modes of heat transfer, as well as its applications. Students will develop an ability to apply governing principles and physical intuition to solve single and multi-mode heat transfer problems for one or two-dimensional systems of either steady or transient state. This course also introduces methods for calculating rates of heat transfer by these three modes. The concepts of thermal resistance networks will be developed for the analysis of heat flows.

SETN 2133 - Dynamics

Pre-requisite: SETN 2133 (taken)

This course is designed to introduce students to the second part of mechanics which deals with the analysis of particles and bodies in motion. It will include the kinematics and kinetics of particles. It will cover the rectilinear and curvilinear motion of particles, Newton's second law of particles, and work and energy for particles. At the end of the course, students should be able to demonstrate and apply the knowledge by solving various problems involving kinematics and kinetics of particles and kinematics of rigid bodies, which forms the basis of further engineering courses.

SETN 2711 - Thermodynamics & Mechanics of Material Lab

Pre-requisite: SETN 2113 and SETN 2123 (taken)

This laboratory course contains 6 experiments that covered basic concepts in Thermodynamics and Strength of Material. Laboratory experiments are designed for hand-on experience to understand the engineering principles. The experiment application includes the First Law of Thermodynamics, Second Law of Thermodynamics, Properties of Pure Substance and Properties and Strength of Materials. This course also emphasizes the technical writing aspect where all students' observations and arguments of each experiment must be reported in proper format.

SETN 3233 - Radiation Detection and Measurement

The important detection techniques for radiation are introduced in this course. The discussion begins with introducing the principles of radiation detection related to radiation units, radiation sources and radiation interactions. Nuclear radiation detector parameters such as detector model, detector efficiency, energy resolution, counting curve and counting statistics are discussed. The next topic will emphasize on the principles of operation and basic characteristics of various detection systems. Various nuclear detectors such as gas filled detector, scintillation detector and semiconductor detector are main concerns of the subject. The course also emphasizes on the principle and operation of thermal and fast neutron detectors. The principle of radiation dosimetry such as thermolumeniscent dosimetry, chemical dosimetry, film dosimetry and calorimeter are also discussed at the end of the course.

SETN 3113 - Nuclear Radiation Protection

This course is designed to ground students in the principles of radiation protection, that is, on justification, optimization and dose limits. It will emphasize on the theories, the techniques and the procedures for external dose control that is the use of distance, shielding and time; and internal dose control, including introduction to the physics of aerosol, use of unsealed sources, primary and secondary containments, radioactive laboratories and leak tests. The course will also discuss organization and radiation protection programmes; emergency procedures, monitoring, radiological protection in radiation devices, transport regulations and radioactive waste management. Upon completion, students should have an overall grasp of the radiation protection principles and practice; and most importantly the safety culture required**.**

SETN 3213 - Nuclear Reactor Theory

The course starts with discussion on neutron physics related to production, absorption and scattering of neutrons, neutron cross sections and nuclear fission. The next topics will emphasize on the principle of neutron moderation and neutron multiplication leading to steady state fission reactor core design based on diffusion theory. The next topic will emphasize on the reactor equation solutions of neutron flux, maximum to average flux and power for rectangular, cylindrical and spherical reactors. In general, the course provides on the general concepts of neutron physics and its application in nuclear reactors for energy generation. The course will solve the point reactor dynamic equation and apply safety characteristics using point kinetics models.

SETN 4453 - Nuclear Power Plant System

The degree program in Nuclear Power Plant System Engineering comprises a wide range of power engineering titles aimed at theoretical and practical exposure. This program has been developed to train highly qualified professionals to design, operate and maintain power plants. Students are required to describe sources of energy and types of power plants. The analysis of different types of steam cycles and estimation of the efficiencies in a steam power plant will be carried out. The basic working principles of gas turbine and diesel engine power plants are also described in terms of the performance characteristics and components of such power plants. Evaluation on cycle efficiency and performance of a gas cooled reactor power plant are included in this course by listing the different types of fuels used in power plants and estimating their heating values. Further, the calculation on the present worth depreciation, cost of different types of power plants and estimation on the cost of producing power per kW will be done.

SETN 3711 - Nuclear Physics Lab

Pre-requisite: SETN 2213 (taken)

The course covers eight nuclear physics-related experiments. Experiments of health physics and radiation safety are performed and laboratory reports are written by students. Experiments are performed at UTM. Topics of experiment include: 1. Geiger Muller Tube detector, 2. Resolving time 3. Counting statistics, 4. Linear absorption coefficient and inverse square law, 5. Attenuation of betas in aluminium, 6. Limitation of dose system, 7. Absolute efficiency of Geiger Muller.

SETN 3223 - Instrumentation and Control Engineering

This course introduces students to the concept of electrical measurement using analogue and digital instruments, methods for mathematical model building of physical systems and processes, control systems and the use of software in analyzing system and controller performance. Transducers that are used in instruments for measuring common parameters such as temperature and pressure are presented. Instrumentations used in nuclear facilities such as nuclear reactors are covered. This course will also show students the methods to obtain mathematical models of actual physical systems such as electrical, mechanical, thermal, and nuclear systems. Further the fundamental ideas and structures of control systems such as open loop and feedback controls, transfer functions, block diagrams, and controller responses will be covered. The use of transfer functions for controller construction and analysis of controller performance in time domain using MATLAB and Simulink will also be introduced.

SETN 3224 - Thermal Hydraulics with Lab

Pre-requisite: SETN 1123 and SETN 2223 (taken)

This course covers the thermo-fluid dynamic phenomena and analysis methods for conventional and nuclear power stations. Fundamental processes of heat generation and transport in nuclear reactors. Effects of boiling and critical heat flux. Fundamentals of reactor thermal and hydraulic design. Specific topics include: kinematics and dynamics of two-phase flows, boiling, and critical conditions, single channel transient analysis, loop analysis including single and two phase natural circulation, and sub-channel analysis. Students will also perform laboratory experiments to reinforce understanding of thermal hydraulic phenomena.

SETN 3721 - Nuclear Reactor Lab

Pre-requisite: SETN 3213 (taken)

A series of nuclear reactor related experiments are performed in Malaysia Nuclear Agency (MNA) research facilities. The students will be given hands-on experience in dealing with nuclear reactor systems and instrumentation. Students will carry out experiments on site and are required to prepare technical reports for each experiment.

SETN 3123 - Nuclear Reactor Materials

Pre-requisite: SETN 2123 (taken)

This course will provide a valuable insight on some of the key issues facing the nuclear power generation industry. Many of these are related to the materials involved, their response to, and their reliability under extreme conditions. The effects of radiation on various properties of materials in nuclear applications will be dealt with to get an appreciation of the materials' limitations on the operation of reactors. Students will first be introduced to the basic concepts of materials science. The basic aspects of the nuclear fuel cycle, current and future nuclear reactor designs, and the materials problems associated with nuclear energy production will be discussed. The key issues in materials failures and the requirements for efficient and safe operation of current reactor designs as well as design of novel materials for future reactors will be discussed. A few applications of radiation effects will then be treated with this newfound framework, including the change of material properties under irradiation, void swelling,

embrittlement and loss of ductility. At the end of this course, students will be familiar with the basic issues concerning the selection of materials for various components in nuclear reactors.

SETN 4812 - Undergraduate Project I
This course is designed to train students on the important aspects of research management. Students will be assigned to a nuclear engineering related topic and required to prepare a research proposal that will be implemented in the following semester. At the end of this course, students should be able to present their proposal. In addition, students will have the opportunity to gain important generic skills such as communication, team working, problem-solving and creative and critical thinking.

SETN 3915 - Industrial Training
This course is a core course which will assign students to industries, governments or semi-governments agencies and organizations for a period of 12 weeks. The training aims to expose students to real nuclear engineering practices while enhancing their knowledge and working experiences as well as improving their interpersonal skills. The students also have the opportunities to apply learned theories into real nuclear engineering practices. Students will be supervised by the faculty and industrial supervisors.

SETN 4824 - Undergraduate Project II
Pre-requisite: SETN 4812 (pass with at least D+)
This course is a continuation of the Undergraduate Research Project I (SETN 4812). The second part of the Undergraduate Research Project requires students to implement the research proposal that has been prepared in the previous semester. This might involve practical activities such as laboratory works, data collection from industry and computer programming / simulation. At the end of this course, students should be able to prepare a full report compiling the first and second part of the Undergraduate Research Project and subsequently present their research findings. Finally, students must submit a working paper and a bound thesis according to the UTM thesis-writing format. In addition, students will have the opportunity to gain important generic skills such as communication, problem-solving and creative and critical thinking.

SETN 4113 - Nuclear Fuel Cycle and Waste Management
This course consists of two parts: Nuclear Fuel Cycle and Waste Management. The first part introduces students to the front-end of the fuel cycle: ore extraction, conversion and enrichment, fuel fabrication and use in the power plant, and spent fuel reprocessing. In the second part, the back-end of the fuel cycle will be discussed. It includes the radioactive waste management, ranging from waste characteristics, waste treatment technologies, radioactive materials transportation and decontamination and decommissioning related to radioactive e processes and materials. At the successful completion of this course the students will be able to describe the following features of a Nuclear Fuel Cycle and Waste Management: Nuclear fuel resources, Uranium enrichment, Nuclear fuel fabrication, Spent fuel storage, Nuclear fuel reprocessing, Waste disposal, Radioactive materials transportation, and Decontamination and decommissioning.

SETN 3173 - Engineering Economics & Project Management

This is a two-in-one course covering both Engineering Economy and Project Management topics. Engineering economy is the application of economic factors and criteria to evaluate alternatives, considering the time value of money. The engineering economy study involves computing a specific economic measure of worth for estimated cash flows over a specific period of time. Project Management is the art of planning, scheduling, and monitoring of project activities to achieve performance, cost, and time objectives, for a given scope of work, while using resources efficiently and effectively.

SETN 4833 - Nuclear Engineering System and Design I

Pre-requisite: SETN 4453 (taken)

This course introduces students to nuclear engineering systems, particularly nuclear reactors and their systems, subsystems, and major components. It also introduces students to systematic engineering design approaches including needs definition, concept generation and selection, technical specifications, and design trade-offs. With respect to nuclear reactor design, the course focuses on core design, safety systems, fuel elements, and cooling systems. Students will be introduced to software packages for thermal hydraulics and core design, particularly MCNP code. Economics and financial aspects in the design of nuclear systems will also be introduced. This course is also aimed at preparing students with good knowledge and understanding of nuclear systems design.

SETN 3253 - Nuclear Safety, Safeguard, Security & Regulation

This course introduces students to safety, safeguards, security and regulations pertaining to nuclear activities. The focus of the course is on administrative and technical approaches to enhance nuclear safety, national and international safeguard regimes, and security measures to ensure safe use of nuclear technologies. National and international legal instruments and agencies will be introduced. Engineered and inherent safety features, reliability enhancement through redundancy, methods of safety and risk analysis such as probabilistic safety analysis, fault tree and event trees, FMEA will be covered. Students are expected to develop understanding on the importance of nuclear safety, security, safeguards and the legal instruments that are in place to ensure conformance to peaceful uses of nuclear technology.

SETN 4711 - Radiation, Detection & Measurement Lab

Pre-requisite: SETN 3233 (taken)

The course covers seven nuclear experiments. Experiments of radiation detection and measurement are performed, and laboratory reports are written by students. Topics of the experiment include energy calibration of detector, resolution of detector, efficiency calibration of detector, gamma spectroscopy, radon measurement, alpha spectrometry, and liquid scintillation.

SETN 4834 - Nuclear Engineering System and Design II

Pre-requisite: SETN 4833 (taken)

This capstone course is a group design project, with a nuclear industrial based case, involving integration of knowledge in nuclear physics, neutron transport, heat transfer, safety, materials, environmental impact and economic analysis. It provides opportunities to synthesize knowledge acquired in nuclear engineering and apply this knowledge to complex problems of

current interest in nuclear power plant design. Students are required to present an interim design project, final design presentation and submit the final design report.

SETN 4611 - Nuclear Engineering Professional Practice
This course emphasizes the nuclear engineering ethics and engineer's responsibilities towards safety, health and welfare of the public from a professional point of view. Few speakers from nuclear-related areas such as from Agensi Nuklear Malaysia (ANM), Malaysian Nuclear Power Corporation (MNPC), and Atomic Energy Licencing Board (AELB) will be invited to give talks to the students. The talks will place emphasis on the engineer as a professional man, engineers in society, code of ethics and professional conducts, standards, laws and regulations pertaining to professional engineering practice. At the end of this course, students will acquire the concept of professionalism and ethical responsibility and be able to demonstrate and apply engineering professional ethics in their career as an engineer.

ELECTIVE COURSES

SETN 4483 - Radiographic Testing
This course describes Non-Destructive Testing (NDT) which is the process of inspecting, testing or evaluating materials, components or assemblies for discontinuities without destroying their serviceability. The course introduces the six most common NDT methods which are Visual Testing, Liquid Penetrant Testing, Magnetic Particle Testing, Radiographic Testing, Ultrasonic Testing and Eddy Current Testing. Emphasis will be given to Radiographic Testing which is also known as Industrial Radiography. Metal forming and manufacturing processes and possible defects present in each process will be described. The most widely used industry inspection and acceptance standards for NDT such as ASME V, VIII and API 1104 will be described.

SETN 4413 - Sustainable Energy
In the context of depleting fossil fuel reserves and environmental consequences, the concept of sustainable energy warrants to be a contemporary subject matter. This course explains the concepts of sustainable energy technology based on ethics, environments and economy (E^3) and the role of sustainability in practical system applications and innovation. The course recognizes the effects from the fossil dominated energy systems over economics, environment and society. The course provides the latest review of the most important renewable energy resources, advanced technologies, and explains the sustainability basis for harnessing them. The course also demonstrates evaluating the energy technologies and systems to be economically feasible, environmentally bearable and socially acceptable. Comprehension of the issues associated with sustainable energy technology are achieved through lectures, discussions, combined with reports and student presentations on the literature reviewed.

SETN 4423 - Ultrasonic Testing
The course starts with the introduction of the underlying science of ultrasonic and acoustic wave propagation in elastic media, and its application to non-destructive evaluation. Students will be introduced to the mathematical equations that govern the propagation of ultrasonic and acoustic waves. The student will be exposed to different ultrasonic probes, their types and construction. This is followed by calibration of the testing device and sensitivity adjustment.

The theoretical material will be covered in a number of illustrated lectures, reinforced by worked example classes. In parallel with the theoretical aspect of the course, students will undertake a number of experimental tasks to demonstrate how the theory translates into practice. In general, these tasks will be drawn from examples from the field of non-destructive evaluation, using standard industrial procedure.

SETN 4433 - Chemistry in Nuclear Engineering

The subject focuses on the chemistry aspects of nuclear engineering. The physico-chemical properties in radioactivity and binding energy are presented in this course. The occurrence of radionuclide in nature as well as the stability and radioactivity of the radionuclides are evaluated. The chemical effects of radiation on the radiolysis of various organic and inorganic matters are also discussed. The production and separation methods of radionuclides and their chemical behaviors are also covered in this course. The applications of these radionuclides in qualitative and quantitative chemical analysis are included. This course also discusses the production of hydrogen gas as alternative fuel using nuclear energy. The final part of this course deals with the emerging application of nuclear reaction for transmutation of elements and isotopes.

SETN 4443 - Risk Assessment

Fundamental safety principles in the nuclear industry require assessment of safety for all facilities and activities that potentially give rise to radiation risks. Safety assessment in particular is a systematic process that is carried out to ensure that all safety requirements are met. This course addresses the fundamental aspects of safety assessment providing the basis for specialized training in the area of deterministic and probabilistic safety assessments. This course also discusses safety assessment of main system design that include reactor core, coolant and containment system. It provides for introductory and preparatory knowledge necessary for engineers and regulatory personnel engaged in safety.

Mapping of Courses to Programme Outcomes for
Bachelor of Nuclear Engineering with Honours

		PROGRAMME LEARNING OUTCOMES (PLO)											
		Engineering Knowledge	Problem Analysis	Design/Development of Solution	Investigation	Modern Tool Usage	The Engineer and Society	Environment & Sustainability	Ethics	Communication Skills	Leadership and Teamwork	Life Long Learning	Project Management and Finance
COURSE CODE	**COURSE NAME**	**PLO1**	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**
PROGRAMME CORE COURSES													
SETN 1143	Introduction to Engineering	/	/			/	/	/		/			
SETN 1113	Modern Physics	/	/									/	
SETN 1243	Statics	/									/		
SETN 2213	Nuclear Physics	/	/								/		
SETN 1123	Fluid Mechanics	/	/								/		
SETN 1224	Electrical Engineering Fundamental with Laboratory	/	/								/		
SETN 2243	Nuclear Engineering Fundamentals	/				/	/						
SETN 2123	Strength of Materials	/									/		
SETN 2113	Thermodynamics	/	/								/		
SETN 1133	Engineering Drawing	/				/							
SETN 1711	Fluid Mechanics Laboratory		/							/			
SETN 2393	Numerical Methods for Nuclear Engineers	/				/							
SETN 2223	Heat Transfer	/	/								/		
SETN 2133	Dynamics	/	/									/	
SETN 2711	Thermodynamics and Mechanics of Material Laboratory	/			/								
SETN 3233	Radiation Detection and Measurement	/	/								/		
SETN 3113	Nuclear Radiation Protection	/	/							/	/		
SETN 3213	Nuclear Reactor Theory	/	/	/						/			

		PROGRAMME LEARNING OUTCOMES (PLO)											
		Engineering Knowledge	Problem Analysis	Design/Development of Solution	Investigation	Modern Tool Usage	The Engineer and Society	Environment & Sustainability	Ethics	Communication Skills	Leadership and Teamwork	Life Long Learning	Project Management and Finance
COURSE CODE	**COURSE NAME**	**PLO1**	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**
SETN 4453	Nuclear Power Plant System	/	/				/						
SETN 3711	Nuclear Physic Laboratory			/						/	/		
SETN 3223	Instrumentation and Control Engineering	/	/								/		
SETN 3224	Thermal Hydraulics with Laboratory	/	/							/			
SETN 3721	Nuclear Reactor Laboratory	/			/	/				/			
SETN 2123	Nuclear Reactor Material	/	/							/			
SETN 3915	Industrial Training	/	/	/	/	/	/	/	/	/	/	/	/
SETN 4812	Undergraduate Project I	/	/	/			/	/			/	/	
SETN 4824	Undergraduate Project II	/	/	/					/	/	/	/	
SETN 4113	Nuclear Fuel Cycle and Waste Management	/								/			
SETN 3173	Engineering Economics and Project Management	/	/				/	/					/
SETN 4833	Nuclear Engineering System and Design I	/	/								/		
SETN 3253	Nuclear Safety, Safeguard, Security and Regulation	/	/								/	/	
SETN 4711	Radiation, Detection and Measurement Laboratory		/							/	/		
SETN 4611	Nuclear Engineering Professional Practice						/		/	/	/	/	
SETN 4834	Nuclear Engineering System and Design II	/	/	/	/	/	/	/	/	/	/	/	/
PROGRAMME ELECTIVE COURSES													
SETN 4**3	Elective Nuclear I	/									/	/	
SETN 4**3	Elective Nuclear II	/									/	/	

BACHELOR OF PETROLEUM ENGINEERING WITH HONOURS

PROGRAMME SPECIFICATIONS

The Bachelor of Petroleum Engineering with Honours is offered either on a full-time or part-time basis. The full-time programme is offered only at the UTM Main Campus in Johor Bahru while the part-time programme is offered at UTM Kuala Lumpur Campus and in Miri, Sarawak. The duration of study for the full-time programme is subjected to the student's entry qualifications and lasts between four (4) years to a maximum of six (6) years.

The programme is offered on full-time basis and is based on a two-semester per academic session. Generally, students are expected to undertake courses equivalent to between twelve (12) to eighteen (18) credit hours per semester. Assessment is based on courseworks and final examinations given throughout the semester.

General Information

1. Awarding Institution			Universiti Teknologi Malaysia	
2. Teaching Institution			Universiti Teknologi Malaysia	
3. Programme Name			Bachelor of Petroleum Engineering with Honours	
4. Final Award			Bachelor of Petroleum Engineering with Honours	
5. National Education Code (NEC)			0724 (Mining and Extraction)	
6. Programme Code			SETPH	
7. Professional or Statutory Body of Accreditation			Board of Engineers Malaysia (BEM)	
8. Language(s) of Instruction			English and Bahasa Melayu	
9. Mode of Study			Conventional	
10. Mode of operation			Self-govern	
11. Study Scheme			Full Time and Part Time	
12. Study Duration			Full Time: Minimum : 4 years Maximum : 6 years	
			Part Time: Minimum : 5 years Maximum : 10 years	
Type of Semester	No. of Semesters		No of Weeks/Semester	
	Full Time	Part Time	Full Time	Part Time
Normal	8	10	14	14
Short	4	5	8	8

Course Classification

No.	Classification	Credit Hours	Percentage
i.	University Courses (a) General (b) Language (c) Entrepreneurship (d) Co-Curriculum (e) Free Electives	 6 6 2 2 3	14.1%
ii.	Faculty/ Programme Core	110	81.5%
iii.	Programme Elective	6	4.4%
	Total	**135**	**100%**
A	Engineering Courses Distribution (a) Lecture (b) Laboratory/Workshop/Field Work (c) Industrial Training (d) Final Year Project (e) Field Development Project	 69 6 5 6 6	68.15%
Total Credit Hours for Part A		**92**	
B	Related Courses (a) Applied Science/ Mathematic/ Computer/ Electrical (b) Management/Law/Humanities/Ethics/ Entrepreneur (c) Language (d) Co-Curriculum (e) Free Elective	 24 8 6 2 3	31.85%
Total Credit Hours for Part B		**43**	
Total Credit Hours for Part A and B		**135**	**100%**
Total Credit Hours to Graduate		**135 credit hours**	

Award Requirements

To graduate, students must:

- Attain a total of not less than 135 credit hours with a minimum CGPA of 2.0.
- Pass Industrial Training
- Complete Five (5) Professional Skills Certificates (PSC)

CROSS-CAMPUS PROGRAMME

Students are given the opportunity to enroll in a few courses in participating universities. The grades and credits obtained during this period are transferable (up to 1/3 of the total credits of the curriculum). Currently, there are four participating universities i.e. Universiti Teknologi Malaysia, Universiti Sains Malaysia, Universiti Malaya and Universiti Malaysia Sarawak.

The programme is open to undergraduates who have undergone a minimum of two semesters of their studies with the following conditions:

(i) The total number of credits allowed to be taken is between twelve (12) and sixteen (16) credits only.
(ii) The student should hold a minimum CGPA of 3.00 at the time of application.
(iii) The student is not a resident of or originated from the state where the university that he/she intends to attend is located.

The student will not be charged tuition fees by the participating university but shall pay the regular tuition fees at UTM. However, should the participating university provide accommodation, the student will need to pay accommodation fees.

COURSE MENU

YEAR 1: SEMESTER 1			
Code	**Course**	**Credit**	**Pre-requisite**
SSCE 1693	Engineering Mathematics 1	3	
ULRS1012	Value and Identity	2	
SSCK 1203	Analytical Chemistry for Engineers	3	
SETP 1313	Introduction to Petroleum Engineering*	3	
SETP 1113	Engineering Mechanics	3	
	TOTAL CREDIT	**14**	
	CUMULATIVE CREDITS	**14**	

YEAR 1: SEMESTER 2			
Code	**Course**	**Credit**	**Pre-requisite**
SSCE 1793	Differential Equations	3	SSCE 1693
ULRS 1182	Appreciation Ethics and Civilizations (for Local Students)	2	
UHLM 1012	Malay Language For Communication 2 (for International Students)		
SETP 1123	Fluid Mechanics	3	
SETP 1133	Engineering Drawing	3	
SETP 2113	Thermodynamics	3	
	TOTAL CREDIT	**14**	
	CUMULATIVE CREDITS	**28**	

YEAR 2: SEMESTER 1			
Code	**Course**	**Credit**	**Pre-requisite**
ULRF 2**2	Service Learning and Community Engagement	2	
SECP 1103	C Programming Techniques	3	
SSCE 1993	Engineering Mathematics II	3	
SEEU 2003	Electrical Technology	3	
SETP 2123	Mechanics of Material	3	SETP 1113

SETP 2213	Basic Geosciences*	3	
SETP 1711	Fluid Mechanics Lab.	1	SETP 1123
	TOTAL CREDIT	**18**	
	CUMULATIVE CREDITS	**46**	

YEAR 2: SEMESTER 2			
Code	**Course**	**Credit**	**Pre-requisite**
SETP 2721	Basic Geoscience Lab	1	SETP 2213
SETP 2313	Reservoir Rock and Fluids Properties*	3	
SETP 2731	Thermodynamics & Mechanics of Material Lab.	1	SETP 2123 SETP 2113
UHLB 2122	Professional Communication Skills 1	2	
ULRS 1022	Philosophy and Current Issue	2	
**** ***3	Free Elective	3	
SSCE 2393	Numerical Methods	3	SSCE 1693
SSCE 2193	Engineering Statistics	3	SSCE 1693
	TOTAL CREDIT	**18**	
	CUMULATIVE CREDITS	**64**	

YEAR 3: SEMESTER 1			
Code	**Course**	**Credit**	**Pre-requisite**
SETP 3413	Drilling Engineering*	3	
SETP 3741	Drilling Fluid Lab.	1	SETP 3413
SETP 3213	Formation Evaluation	3	
SETP 3313	Reservoir Engineering*	3	SETP 2313
SETP 3731	Reservoir Engineering Lab.	1	SETP 3313
SETP 3921	Geology Field Work@	1	SETP 2213
UHLB 3132	Professional Communication Skills 2	2	ULHB 2122
UHL* 1112	Communication in Foreign Language	2	
	TOTAL CREDIT	**16**	
	CUMULATIVE CREDITS	**80**	

YEAR 3: SEMESTER 2			
Code	**Course**	**Credit**	**Pre-requisite**
SETP 3423	Well Completion	3	
SETP 3113	Petroleum Economics	3	
SETP 3513	Petroleum Production Engineering*	3	
SETP 3123	Health, Safety and Environment*	3	
SETP 3812	Undergraduate Project I**	2	
ULRS 3032	Entrepreneur and Innovation	2	
	TOTAL CREDIT	**16**	
	CUMULATIVE CREDITS	**96**	

YEAR 3: SEMESTER 3 (SHORT SEMESTER)			
Code	**Course**	**Credit**	**Pre-requisite**
SETP 3915	Industrial Training	5	
	TOTAL CREDIT	5	
	CUMULATIVE CREDITS	101	

YEAR 4: SEMESTER 1			
Code	**Course**	**Credit**	**Pre-requisite**
SETP 4814	Undergraduate Project II**	4	SETP 3812#
SETP 4822	Field Development Plan I**	2	SETP 4213, SETP 3213, SETP 3313, SETP 3413, SETP 3513
SETP 4213	Petroleum Geology	3	SETP 2213
SETP 4113	Petroleum Management and Entrepreneurship	3	SETP 3113
SETP 4313	Well Testing	3	SETP 3313
SETP 3323	Reservoir Simulation	3	SETP 3313, SSCE 2393
	TOTAL CREDIT	**18**	
	CUMULATIVE CREDITS	**119**	

YEAR 4: SEMESTER 2			
Code	**Course**	**Credit**	**Pre-requisite**
SETP 4834	Field Development Plan II**	4	SETP 4822#
SETP 4323	Secondary and Tertiary Oil Recovery	3	SETP 3313
SETP 4513	Gas Engineering	3	
SETP 4**3	Petroleum Eng. Elective	3	
SET* 4**3	Technical Elective	3	
	TOTAL CREDIT	**16**	
	CUMULATIVE CREDITS	**135**	

Note: * - cornerstone course; ** - capstone course;
- must pass (at least with grade D+) for prerequisite course

English Pre-Requisite

Students must register and pass UHLB 1112 course if the English pre-requisite is not fulfilled.

ENGLISH PRE-REQUISITE
a) MUET : ≥ Band 4
b) IELTS : ≥ Band 5.5
c) TOEFL: ≥ 525
d) TOEFL iBT : ≥ 60
e) CEFR : ≥ B2

Petroleum Engineering Elective Courses

Code	Course	Credit	Pre-requisite
SETP 4123	Petroleum Refining Technology	3	
SETP 4223	Geophysics	3	
SETP 4413	Advanced Drilling Engineering	3	SETP 3413#
SETP 4423	Advanced Well Completion	3	SETP 3423#
SETP 4523	Well Diagnosis and Treatment	3	
SETP 4533	Production Data Analysis	3	

Technical Elective Courses

Code	Course	Credit	Pre-requisite
SETG 4143	Energy Management and Economics	3	
SETG 4163	Green Energy Technology	3	
SETG 4263	Fire and Explosion Safety	3	
SETG 4283	Corrosion Engineering	3	
SETN 4483	Radiographic Testing	3	
SETK 4333	Gas Transportation and Storage	3	
SETK 4223	Smart Materials	3	
SETK 4613	Fundamental of Polymer	3	
SETK 4623	Polymer Physics and Properties	3	
SETK 4633	Polymer Rheology and Processing	3	

Minor in Petroleum Engineering

For students from different approved programmes who wish to have a Minor in the Petroleum Engineering Programme, they must complete and pass 15 credit hours of the following courses:

No.	Code	Course Name	Credit
1	SETP 2213	Basic Geoscience	3
2	SETP 2313	Reservoir Rock and Fluid Properties	3
3	SETP 3313	Reservoir Engineering	3
4	SETP 3413	Drilling Engineering	3
5	SETP 3413	Petroleum Production Engineering	3
Total Credit for Minor			15

GRADUATION CHECKLIST

To graduate, students must pass all the stated courses in this checklist. It is the responsibility of the students to ensure that all courses are taken and passed. Students who do not complete any of the courses are not allowed to graduate.

NO	CODE	COURSE	CREDIT EARNED (JKD)	CREDIT COUNTED (JKK)	TICK (√) IF PASSED
PETROLEUM ENGINEERING COURSES					
1	SETP 1313	Introduction to Petroleum Engineering	3	3	
2	SETP 1113	Engineering Mechanics	3	3	
3	SETP 1123	Fluid Mechanics	3	3	
4	SETP 1133	Engineering Drawing	3	3	
5	SETP 1711	Fluid Mechanics Lab.	1	1	
6	SETP 2213	Basic Geosciences	3	3	
7	SETP 2721	Geosciences Lab	1	1	
8	SETP 2113	Thermodynamics	3	3	
9	SETP 2123	Mechanics of Materials	3	3	
10	SETP 2313	Reservoir Rock and Fluids Properties	3	3	
11	SETP 2731	Thermodynamics & Mechanics of Material Lab.	1	1	
12	SETP 3413	Drilling Engineering	3	3	
13	SETP 3741	Drilling Fluid Lab.	1	1	
14	SETP 3213	Formation Evaluation	3	3	
15	SETP 3313	Reservoir Engineering	3	3	
16	SETP 3731	Reservoir Engineering Lab.	1	1	
17	SETP 3921	Geology Field Work	1	1	
18	SETP 3423	Well Completion	3	3	
19	SETP 3113	Petroleum Economics	3	3	
20	SETP 3513	Petroleum Production Engineering	3	3	
21	SETP 3123	Health, Safety and Environment	3	3	
22	SETP 3323	Reservoir Simulation	3	3	
23	SETP 3812	Undergraduate Project I	2	2	
25	SETP 3915	Industrial Training (Year 3/Short Sem.) for 12 weeks/3 months	5	HL	
27	SETP 4814	Undergraduate Project II	4	4	
28	SETP 4822	Field Development Plan I	2	2	
29	SETP 4213	Petroleum Geology	3	3	
30	SETP 4113	Petroleum Management and Entrepreneurship	3	3	
31	SETP 4313	Well Testing	3	3	

32	SETP 4834	Field Development Plan II	4	4	
33	SETP 4323	Secondary and Tertiary Oil Recovery	3	3	
34	SETP 4513	Gas Engineering	3	3	
35	SETP 4**3	Petroleum Eng. Elective	3	3	
36	SET* 4**3	Technical Elective	3	3	
		TOTAL CREDIT OF PETROLEUM ENGINEERING COURSES (a)	92	87	
APPLIED SCIENCE / MATHEMATICS / COMPUTER COURSES					
1	SECP 1103	C Programming Techniques	3	3	
2	SSCE 1693	Engineering Mathematics I	3	3	
3	SSCE 1793	Differential Equations	3	3	
4	SSCE 1993	Engineering Mathematics II	3	3	
5	SSCE 2193	Engineering Statistics	3	3	
6	SSCE 2393	Numerical Methods	3	3	
7	SEEU 2003	Electrical Technology	3	3	
8	SSCK 1203	Analytical Chemistry for Engineering	3	3	
		TOTAL CREDIT OF APPLIED SCIENCE / MATHEMATICS / COMPUTER COURSES (b)	24	24	
UNIVERSITY GENERAL COURSES					
Cluster 1: Malaysia Core Value (Faculty of Social Sciences and Humanities)					
1	ULRS 1182	Appreciation of Ethics and Civilizations (for Local Students)	2	2	
	UHLM 1012	Malay Language Communication 2 (for International Students)			
2	ULRS 1022	Philosophy and Current Issues	2	2	
Cluster 2: Value and Identify					
1	ULRS 1012	Value and Identity	2	2	
Cluster 3: Global Citizen					
1	ULRF 2**2	Service Learning & Community Engagement	2	2	
Cluster 4: Communication Skills (Language Academy, Faculty of Social Sciences and Humanities)					
1	ULHB 2122	Professional Communication Skills 1	2	2	
2	ULHB 3132	Professional Communication Skills 2	2	2	
3	UHL* 1112	Communication in Foreign Language Elective	2	2	
Cluster 5: Enterprising Skills					

1	ULRS 3032	Entrepreneurship & Innovation	2	2	
General Elective					
1	**** ***3	General Elective	3	3	
		TOTAL CREDIT of UNIVERSITY GENERAL COURSES (c)	**19**	**19**	
		TOTAL CREDIT TO GRADUATE (a + b + c)	**135**	**130**	

OTHER COMPULSORY COURSES – PROFESSIONAL SKILLS CERTIFICATE (PSC)			
Students are required to enrol and pass FIVE (5) PSC courses, to be eligible to graduate. Enrol the PSC courses as follows:			
COMPULSORY PSC COURSES (Enrol All 3 Courses)			
1	GLRB0010	Design Thinking for Entrepreneur	
2	GLRM0010	Talent and Competency Management	
3	GLRL0010	English Communication Skills for Graduating Students (ECS)	
ELECTIVE PSC COURSES (Choose Any 2 Courses only)			
1	GLRT0010	Data Analytics for Organization	
2	GLRM0020	Professional Ethics and Integrity	
3	GLRT0020	Construction Measurement (Mechanical & Electrical)	
4	GLRT0030	OSHE for Engineering Industry and Laboratory	
5	GLRT0040	OSHE for Construction Industry and Laboratory Works	
6	GLRT0050	Quality Management for Build Environment and Engineering Professionals	
7	GLRT0060	Safety and Health Officer Introductory Course	
8	GLRT0070	Industrial Machinery and Lubrication	
Or any other elective PSC courses offered by UTM iLeague. Information on PSC Courses: https://ileague.utm.my/utm-professional-skills-certificate-utm-psc/ Online PSC Registration: https://elearnpsc.utmspace.edu.my/			

COURSE SYNOPSIS

CORE COURSES

SETP 1313 - Introduction to Petroleum Engineering

This course introduces students to various disciplines in petroleum engineering. The contents of the course include the origin, migration, accumulation and the exploration of petroleum, the types and properties of reservoir rocks and reservoir fluid, and type of formation evaluation. This course also briefly discusses the operation and equipment used in drilling, well completion and production of petroleum. This course is conducted by normal lectures, classroom discussion, group project and presentation.

SETP 1113 - Engineering Mechanics

This course has been designed to introduce students to the basic principles and concepts in statics and dynamics. The course is divided into two parts: the first part deals with the analysis of particle and rigid body in static, which covers the resultant and resolution of force(s) acting on a particle and rigid body, the equilibrium of a particle and rigid body, how to replace a force system with an equivalent system, and analysis of friction. The second part deals with the analysis of particle(s) in motion. It includes the kinematics and kinetics of particles and kinematics of rigid bodies. It will cover the rectilinear and curvilinear motion of particles, Newton's Second Law of particles and work and energy for particles.

SETP 1123 - Fluid Mechanics

This course introduces students to basic concepts and principles of fluid mechanics. The contents of the course include the physics of fluid, analysis of fluid in statics and in motion, friction in fluid flow, flow measurement, and dimensional analysis. This course is conducted by normal lectures, class exercise activities and group assignment.

SETP 1133 - Engineering Drawing

This course provides a fundamental background in engineering drawing to the students, which will enable them to work more effectively in the various fields of engineering. This course aims at developing the skills needed for documenting designs using drawings and for performing graphical analysis of two-dimensional and three-dimensional problems. The students will be exposed to different available CAD for engineering drawing with more emphasis on the utilization of QCAD and AutoCAD software. This course focuses on the introduction to engineering drawing, fundamentals of engineering drawing, geometry, orthographic and isometric drawing. This course also introduces the sectional and flowchart drawing and computer aided engineering drawing to the students.

SETP 1711 - Fluid Mechanics Laboratory

Co-Requisites: SETP 1123 Fluid Mechanics (Taken)

This course covers eight fluid mechanics-related experiments which are friction losses in pipe, stability of floating body, jet impact, flow measurement, water hammer, forced vortex flow, calibration of bourdon tube pressure gauge, and an open-ended laboratory work.

SETP 2213 - Basic Geoscience
This course introduces students with the introduction of geosciences/geology and subtitles of physical geology. The course emphasizes on the Earth physical & chemical characteristics, especially its surface and internal features. Then, turn to a discussion of Earth materials and the related processes. Next, Earth's internal structure and the processes that deform rocks and give rise to mountains will also be included. Finally, the course concludes with geologic time and Earth history.

SETP 2721 - Geoscience Laboratory
Co-Requisites: SETP 2213 Basic Geoscience (Taken)
This course exposes the student to the practical aspect of basic geosciences laboratory. It provides the students with the identification of minerals and rocks, geologic maps construction, particle size analysis of sediments and the use of Brunton compass in measuring strike and dip of geological structure planes.

SETP 2113 - Thermodynamics
Thermodynamics is a basic engineering course where concepts such as system, boundaries, mass, heat, work and energy are introduced. These concepts are then related in the 1st and 2nd Law of Thermodynamics. Properties of common fluid, such as water, air, and refrigerants are determined using tables of properties or equations of state. The concepts are applied in power and refrigeration cycles.

SETP 2123 - Mechanics of Materials
Pre-Requisites: SETP 1113 Engineering Mechanics
The course covers both the theory and application of the fundamental principles of mechanics of materials. Emphasis is placed on the importance of satisfying equilibrium, compatibility of deformation, and material behavior requirement. Topics being covered include stress and strain under axial loading, torsion, bending, combined loadings, stress transformation, design of beams and shafts, and deflection of beams and shafts.

SETP 2313 - Reservoir Rock and Fluids Properties
This course introduces students to the important concepts, theories, and methods of properties determinations (calculation, correlation, and laboratory method) of some reservoir rock and fluid properties. The topics in reservoir rock properties include porosity, permeability, fluid saturation, rock compressibility, rock wettability, relative permeability, capillary pressure, and electrical properties of reservoir rocks. In reservoir fluid properties, the topics cover one- and two-phase behaviors of both ideal and real systems, gas properties, liquid properties, and reservoir fluid properties.

SETP 2731 - Thermodynamics and Mechanics of Material Lab.
Co-Requisites: SETP 2113 Thermodynamics, SETP 2123 Mechanics of Materials (Taken)
This laboratory course contains 6 experiments that cover basic concepts in Thermodynamics and Strength of Materials. Laboratory experiments are designed for hands-on experiences to understand the engineering principles. The experiments application includes First and Second

Law of Thermodynamics, Properties of Pure Substances and Properties & Strength of Materials. This course also emphasizes the technical writing aspect where all students' observation and arguments of each experiment must be reported in proper format.

SETP 3413 - Drilling Engineering

This course introduces the activities involved in drilling operations. The contents of the course include the rig components and drilling systems, types of drilling fluid and properties, drilling fluid formulations and calculations, drilling problems, drilling hydraulics calculation, formation pressures and its effect to the drilling operations, well control and well configurations. This course is conducted through lectures, group assignments, and presentations.

SETP 3741 - Drilling Fluid Laboratory

Co-Requisites: SETP 3413 Drilling Engineering (Taken)

This course requires the students to perform hands-on preparing and measuring drilling fluids properties according to the API standard. Laboratory experiments are designed to help students in better understanding of the factors controlling drilling fluid properties as well as familiarize students with field testing procedures of drilling fluids. This laboratory is equipped with complete drilling fluid testing and analysis. Equipment available include mud mixers, mud balances, marsh balances, rheometers, pH meters, resistivity meters, and the filter press unit, etc.

SETP 3213 - Formation Evaluation

This course exposes students to electric logging which covers the basic concept of reservoir resistivity, spontaneous potential, resistivity log, Gamma-ray log, neutron log, formation density log, and acoustic log. Lectures also cover on the open hole log analysis and interpretation, the use of Archie's equation and other methods to determine water saturation, lithology and porosity determination, and assessing the true formation resistivity prior to computing the hydrocarbon reserves.

SETP 3313 - Reservoir Engineering

Pre-requisites: SETP 2313 Reservoir Rock and Fluids Properties (Taken)

This course covers the fundamentals of reservoir engineering which include the description and characterization of the oil and gas reservoirs, calculation of fluid in-place and the recoverable reserves, theory and calculation of fluid flow in porous media, and the influence of aquifer on reservoir performance. This course is conducted by normal lectures and student group projects based on published reservoir data.

SETP 3731 - Reservoir Engineering Laboratory

Co-Requisites: SETP 3313 Reservoir Engineering (Taken)

The content of this laboratory works can assist students to understand better the theories they learned from the Reservoir Rock and Fluid Properties course. Measurement of absolute permeability: gas permeameter and liquid permeameter. Measurement of viscosity: glass capillary, Brookfield apparatus and Kern balance. Measurement of porosity: helium porosimeter and Ruska pump apparatus. Measurement of relative permeability: core lab retorted. Measurement of density: gas density, hydrometer. Measurement of capillary pressure.

SETP 3921 - Geology Field Work

Pre-requisites: SETP 2213 Basic Geoscience (Taken)

This course exposes the students to the practical aspect of geological field and geology of Malaysia. Students will be trained on how to make geological observations including simple geological mapping using the compass-step method.

SETP 3423 - Well Completion

The course covers casing design, cementing job, well completion practices, and completion and workover fluids in order to maintain well integrity. Lectures also cover types of perforations, tubing string and its accessories, production packer and tubing sealing assemblies that should be installed in production wells to produce oil and gas safely to the surface.

SETP 3113 - Petroleum Economics

This course introduces students to petroleum economics in evaluation of oil and gas development and production. The contents of the course include the principles, methods, and techniques of engineering economic analysis, such as topics on interest and time value of money, depreciation and income tax calculations, cash flow, economic indicators, decision making, and risk and sensitivity analysis. This course will allow students to finally be able to generate cash flow of the project and perform an economic evaluation of the project.

SETP 3513 - Petroleum Production Engineering

This course introduces students to a complete petroleum production system of a petroleum well/field. The course will provide an overview of the well/field petroleum production system components including production philosophy and objectives, present and future well productivity and performance, single and multiphase flow system for surface delivery, artificial lift system and surface facilities. By the end of the course, students should be able to identify and describe the major components of the petroleum production system, understand the mechanism of delivering the reservoir fluid to the surface and the process involved for optimum production of petroleum sellable products.This course is conducted by normal lectures, classroom work and group project report and presentation with software utilization in the classroom and group project work.

SETP 3123 - Health, Safety and Environment

The course presents a fundamental principle of safety and risk assessment in petroleum engineering. In particular, it emphasizes on the safety legislations, inherent safety design concept, methods of hazard identification, chemical health risk assessment and various methods of risk assessments. The course also covers health and environmental issues related to petroleum engineering. At the end of this course, it is expected that the students will be able to appreciate the theoretical and practical aspects of occupational safety, health and environment in petroleum engineering. Students should also be able to use the techniques of hazard identification and risk assessment in the design and operation of petroleum engineering projects.

SETP 3323 - Reservoir Simulation

Pre-Requisites: SETP 3313 Reservoir Engineering, SSCE 2393 Numerical Methods (Taken)

This course includes derivations of basic equations and underlying principles used in developing reservoir simulators. It covers the development of a simple governing equation, partial differential equations for single-phase and multiphase flow in porous media. Finite difference approximations are used to solve the equations. Input data requirements and applications of simulation models for history matching and prediction of field performance will be discussed. A spreadsheet, i.e. Microsoft Excel, would be used for many of the examples and exercises.

SETP 3812 - Undergraduate Project 1

This course is designed to train students on some important aspects of research management. In the first part of the undergraduate research project course, the students are not only required to carry out preliminary studies on the assigned petroleum engineering related topics but are also required to plan the research methodology that will be implemented in the following semester and maintain a log book. At the end of this course, students are required to prepare a complete research proposal, and subsequently present it. In addition, students will have the opportunity to gain important generic skills such as communication, team working, problem-solving and creative and critical thinking.

SETP 3915 - Industrial Training

A 12-week training in industry. The main rationale of introducing the programme is to provide UTM students with exposure to practical aspects of industry and their work practices. During the programme, the students will have the opportunity to relate their theoretical understanding to the real application in industry and to develop skills in work ethics, management, communication and human relations.

SETP 4814 - Undergraduate Project II

Pre-Requisites: SETP 3812 Undergraduate Project I (pass with at least D+)

This course is a continuation of the Undergraduate Project I. The second part of the Undergraduate Project requires students to implement the research proposal that has been prepared in the previous semester. This might involve practical activities such as laboratory works, data collection from industry and computer programming/simulation. At the end of the course, students should be able to prepare a full report compiling the first and second part of the Undergraduate Research Project and subsequently present their research findings. Finally, students must submit a bound thesis according to the UTM thesis-writing format. In addition, at the end of the course, students will have the opportunity to gain important generic skills such as communication, team working, problem-solving and creative and critical thinking.

SETP 4822 - Field Development Plan I

Pre-Requisites: SETP 3213 Formation Evaluation, SETP 3313 Reservoir Engineering, SETP 3413 Drilling Engineering, SETP 3513 Petroleum Production Engineering, SETP 4213, Petroleum Geology (Taken)

Field Development Plan courses expose students to the process and methods in developing an optimum plan for a particular petroleum field. It covers all aspects of field development planning, commencing with screening studies, after discovering hydrocarbons, to project sanction. The first part of the course covers collection and analysis of data, including proving of resources and reduction of uncertainty and risk. Students must build a model of geological layering of the subsurface to estimate the initial volume of oil and gas in the reservoir.

SETP 4213 - Petroleum Geology

Pre-Requisites: SETP 2213 Basic Geoscience (Taken)

This course exposes the students with the introduction of petroleum geology, sedimentology and applied geophysics to the search for and production of oil and gas. Explanation will be given on the source rocks, kerogen, the concept of maturity of organic matter, and the process of generation of petroleum. The topics on sedimentology and stratigraphy will also be included, to give the knowledge of reservoir rock characteristics and identifying areas of petroleum accumulation. The processes of migration, entrapment of petroleum, types of sedimentary basins and petroleum system will also be discussed to give an idea of the locations and distribution of oil and gas fields around the world as well as its relationship to the zone of seismicity.

SETP 4113 - Petroleum Management and Entrepreneurship

Pre-Requisites: SETP 3113 Petroleum Economics (Taken)

This course is pertinent to petroleum engineering and business topics. It will cover the types of PSC normally practised in Malaysia. A group project, utilizing a widely used industry software package for economic evaluations will be given. The project consisted of information regarding possible investments in oil and/or gas fields to determine the best options of development for the fields that would yield the maximum total return on investment. The knowledge of financing, costing, and budgeting will be considered in the analysis.

SETP 4313 - Well Testing

Pre-Requisites: SETP 3313 Reservoir Engineering (Taken)

This course introduces students to well testing practices in oil and gas industries. The contents of the course include the concept and principles of well testing, equipment, well test interpretation methods and well test design. This course is conducted by normal lectures, class workshop, and application software activities.

SETP 4834 - Field Development Plan II

Pre-Requisites: SETP 4822 Field Development Plan I (Taken)

The objective of this course is to provide training, assignment and understanding of a particular development plan and profitability analysis on a particular gas or oil fields or both which are found either onshore or offshore. The second part of the course covers the simulation of the reservoir fluid flow behavior and optimises the field development scenario. This simulation leads to the design of an appropriate production system. An economic assessment is performed taking into account revenue according to production forecasts and the estimated development costs. Students are required to work in small groups, submit written plans, and present their proposals to a panel.

SETP 4323 - Secondary and Tertiary Oil Recovery
Pre-Requisites: SETP 3313 Reservoir Engineering (Taken)
This course provides students with important concepts, theories, and methods of enhanced oil recovery (EOR). This course covers the general classification of EOR processes, microscopic displacement of multiphase fluids in porous media, the concept of mobilization and trapping of oil, mobility ratio, capillary number, gravity segregation, and recovery efficiencies. Also included are the important concepts and operational procedures of various types of EOR methods such as polymer flooding, surfactant/micellar flooding, alkaline flooding, ASP flooding, miscible gas flooding, thermal recovery processes and microbial EOR.

SETP 4513 - Gas Engineering
The course introduces students to connect the relationship between upstream and downstream gas processing which covers both theories and calculations. The contents of the course include the gas well deliverability, gas well performance, gas pipeline flow, gas compressors, gas dehydration, gas treatment, and gas measurement. This course is conducted through lectures, group assignments, and presentations.

PETROLEUM ENGINEERING ELECTIVE COURSES

SETP 4123 - Petroleum Refining Technology
This course introduces the characteristics of crude oil and that each of the hydrocarbon compounds has its own boiling temperature. The principles of distillation are introduced leading to the separation into fractions according to cut points. Maximisations of cuts or fractions are achieved through processes like catalytic cracking, alkylation, catalytic reforming and hydro cracking. Gasoline blending is introduced to increase octane number for better performance and to provide designed vapour pressure in gasoline to cope with seasonal altitudinal needs.

SETP 4223 - Geophysics
This course introduces students with the introduction and application of exploration geophysics in resource exploration and development, and pollution control. The course emphasis on the methods of geophysical techniques, especially seismic methods, including some of the modern interpretation techniques. It will discuss the general approach, equipment and field operations of the methods used. The course will also provide practice in carrying out a small-scale fieldwork project to investigate shallow geological features which are presumed to exist in the subsurface.

SETP 4413 - Advanced Drilling Engineering
Pre-Requisites: SETP3413 Drilling Engineering (Taken)
This course introduces students to special operations such as coring and fishing, advanced drilling operations and techniques used in the industry, drilling optimization and, procedures and legislation of well abandonment.

SETP 4423 - Advanced Well Completion

Pre-Requisites: SETP3423 Well Completion (Taken)

Upon completion of this course, students should be able to prepare well space-out for single and dual completions. This course also exposes students to a safe slickline and completion operations, and preparation of a completion report after the respective well has been released to production and slickline report upon completion of its operation. The content delivered also covers deepwater completion and slickline operations, and completion in unconventional hydrocarbon energy sources.

SETP 4523 - Well Diagnosis & Treatment

Pre-Requisites: SKTP3413 Drilling Engineering (Taken)

The course covers problem wells, diagnosis of problem wells, through tubing production tubing, formation damage, work over planning, sand control, and
stimulation.

SETP 4533 - Production Data Analysis

This course introduces students how to analyze the data from oil and gas production hystory. The contents of the course include the methods of how to analyze rate-time production data to estimate reserves, to analyze pressure-rate-time production data to obtain reservoir volume, and to make performance forecasts for well reservoir systems. This course is conducted by normal lectures, class workshop, and application software activities.

TECHNICAL ELECTIVE COURSES

SETG 4143 - Energy Management and Economics

This course introduces basic background, terminology, and fundamentals of energy conversion. Discusses current and emerging technologies for production of thermal, mechanical, and electrical energy. Topics include fossil and nuclear fuels, solar energy, wind energy, fuel cells, and energy storage.

SETG 4163 - Green Energy Technology

The aim of the programme is to prepare students for a professional career in the development of advanced technologies and systems that can satisfy energy demand while striving for environmental, social and economic sustainability. In addition to in-depth knowledge of energy technologies and systems, students will be trained to understand the basic challenges of sustainable development, with a specific focus on the challenges that face the energy system. The course is unique in that it deals with the energy system on all relevant systems levels and that the courses are integrated in such a way that students are trained to approach problem solving in an interdisciplinary way. At the end of the course, students will have acquired a thorough insight into the possibilities and limitations of energy systems, specifically in relation to sustainable development.

SETG 4263 - Fire and Explosion Safety

This course enables students to understand the basic concept of fire science and combustion and related calculations as well as to expose them to the concept of explosion and detonation. In addition, the principles of fire and explosion protection and mitigation will be discussed within the context of understanding the fire and explosion development mechanism. At the

end of the course, students should be able to explain and relate the fundamental knowledge of combustion, flame and explosion and its important safety aspects involving gaseous fuel utilization. Students should able to apply general combustion and engineering principles to fires and explosion and should know the parameters involved on the initiation of both fire and explosion. The students should be also able to use CFD fire modeling (CFast) to analyze the fire development on the case studies given.

SETG 4283 - Corrosion Engineering

The aim of this course is to provide basic knowledge of corrosion and corrosion protection of metals and alloys from electrochemistry perspective. This course is specially designed for students who want to have a basic understanding of the corrosion process. Students will be introduced to the underlying science of corrosion engineering principles, corrosion management with particular emphasis on the corrosion design of pipeline corrosion protection. Different types of corrosion, methods of corrosion protection and prevention standard corrosion tests will be discussed. This course also covers most traditional and non-traditional tests for corrosion studies, including electrochemical techniques for corrosion, analysis of corrosion phenomenon and corrosion monitoring principles. This course will examine the general mechanisms of corrosion and relate these to specific engineering issues and methods being used to reduce the cost of corrosion. Finally at the end of the course student will be required to do a case study on corrosion problem that shall introduces students on real corrosion problem in industries and group project allow students to become familiar with directing their own investigations of corrosion problem.

SETN 4483 - Radiographic Testing

This course describes Non-Destructive Testing (NDT) which is the process of inspecting, testing or evaluating materials, components or assemblies for discontinuities without destroying their serviceability. The course introduces the six most common NDT methods which are Visual Testing, Liquid Penetrant Testing, Magnetic Particle Testing, Radiographic Testing, Ultrasonic Testing and Eddy Current Testing. Emphasis will be given to Radiographic Testing which is also known as Industrial Radiography. Metal forming and manufacturing processes and possible defects present in each process will be described. The most widely used industry inspection and acceptance standards for NDT such as ASME V, VIII and API 1104 will be described.

SETK 4333 - Gas Transportation and Storage

This course enables students to develop an advanced knowledge in gas transportation and storage facilities. The course module covers a wide range of scope which includes the flow principles, operation and construction and maintenance. Sustainability of supply and storage system is well reviewed to incorporate state-of-the-art technology. The module also integrates the standards design of transportation system and relevant code of practices. Malaysian standard requirements also are highlighted thoroughly.

SETK 4223 - Smart Materials

This course will provide deeper understanding of smart materials and smart microstructures, as well as of the increased functionality of both inorganic and organic materials. This course also covers on the material synthesis as well as microstructure and properties relationships.

SETK 4613 - Fundamentals of Polymer

Basic terminologies, principles on polymers and structural relationship towards polymer classification are discussed. An overview on the polymer industry is elaborated together with its impact on human life. Molecular weight relationships toward polymer properties and its implication are briefly presented. This course emphasises specifically on the advanced of polymer synthesis including step-growth, chain-growth and co-ordination polymerizations. Kinetic for the polymerization mechanism is described and its relationship to molecular weight is explained in details. The limitations and application for each polymerization mechanism are discussed. The polymerization systems used for the polymerization process are discussed together with their advantages and the disadvantages. Finally, this course also exposed students to the pilot scale set-up of the polymerization systems.

SETK 4623 - Polymer Physics and Properties

This course is designed to expose students to the properties of polymer which have great importance. It will emphasize on the mechanical properties, electrical properties, chemical resistance, degradation effects and flammability properties, A strong emphasis will be given on the mechanical properties which include viscoelastic behavior, tensile, flexural and impact properties. Long term test using creep deformation is also included. At the end of the course the student should be able to explain the interrelation between polymer properties, structures and applications. The students should also be able to describe the appropriate test and characterization for each property.

SETK 4633 - Polymer Rheology and Processing

This course will discuss about Newtonian and non-Newtonian flow, pseudo-plastic, Bingham, dilatant and thixotropic behavior, origin of non-Newtonian flow. Students will be able to do Modelling of polymer melt flow-isothermal flow of Newtonian and power law fluids (drag and pressure flow) through different channels of uniform cross-section. This course will also cover topic such as measurement of flow properties, melt flow indexer, capillary viscometers, and cone and plate viscometer, characteristics and Rabinowitch correction. Students should be able to explain the application of rheological studies in polymer processing-extruder screw and die, analysis of pressure, drag and leakage flow, characterization and interaction of screw and die, balanced runner molding.

Mapping of Courses to Programme Outcomes for
Bachelor of Petroleum Engineering with Honours

		PROGRAMME LEARNING OUTCOMES (PLO)											
		Engineering Knowledge	Problem Analysis	Design/Development of Solution	Investigation	Modern Tool Usage	The Engineer and Society	Environment & Sustainability	Ethics	Communication Skills	Leadership and Teamwork	Life Long Learning	Project Management and Finance
COURSE CODE	**COURSE NAME**	**PLO1**	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**
PROGRAMME CORE COURSES													
SETP 1113	Engineering Mechanics	✓									✓		
SETP 1123	Fluid Mechanics	✓	✓								✓		
SETP 1133	Engineering Drawing	✓				✓					✓		
SETP 1313	Introduction to Petroleum Engineering	✓	✓							✓			
SETP 1711	Fluid Mechanics Lab		✓		✓					✓	✓		
SETP 2113	Thermodynamics	✓	✓								✓		
SETP 2123	Mechanics of Material	✓									✓		
SETP 2213	Basic Geosciences	✓	✓							✓			
SETP 2313	Reservoir Rock and Fluid Properties	✓	✓							✓			
SETP 2721	Geosciences Lab	✓			✓					✓	✓		
SETP 2731	Thermodynamics and Mechanics of Material Lab		✓		✓					✓	✓		
SETP 3113	Petroleum Economics	✓	✓			✓				✓	✓	✓	
SETP 3123	Health, Safety, and Environment	✓	✓				✓	✓	✓				
SETP 3213	Formation Evaluation	✓	✓							✓			
SETP 3313	Reservoir Engineering	✓	✓		✓						✓		
SETP 3323	Reservoir Simulation	✓	✓			✓				✓	✓		
SETP 3413	Drilling Engineering	✓	✓							✓			
SETP 3423	Well Completion	✓		✓							✓		
SETP 3513	Petroleum Production Engineering	✓	✓							✓	✓	✓	
SETP 3731	Reservoir Engineering Lab	✓			✓					✓	✓		
SETP 3741	Drilling Fluid Lab	✓			✓					✓	✓		

		PROGRAMME LEARNING OUTCOMES (PLO)											
		Engineering Knowledge	Problem Analysis	Design/Development of Solution	Investigation	Modern Tool Usage	The Engineer and Society	Environment & Sustainability	Ethics	Communication Skills	Leadership and Teamwork	Life Long Learning	Project Management and Finance
COURSE CODE	**COURSE NAME**	**PLO1**	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**
SETP 3812	Undergraduate Project I	✓	✓						✓	✓		✓	✓
SETP 3915	Industrial Training								✓	✓	✓	✓	
SETP 3921	Geology Field Work	✓								✓			
SETP 4113	Petroleum Management and Entrepreneurship	✓	✓	✓		✓				✓	✓	✓	✓
SETP 4213	Petroleum Geology	✓	✓							✓			
SETP 4313	Well Testing	✓	✓		✓						✓		
SETP 4323	Secondary and Tertiary Recovery	✓	✓	✓						✓	✓		
SETP 4513	Gas Engineering	✓	✓	✓						✓			
SETP 4814	Undergraduate Project II	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SETP 4822	Field Development Plan I	✓	✓	✓	✓	✓			✓	✓	✓	✓	
SETP 4834	Field Development Plan II	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PROGRAMME ELECTIVE COURSES													
SETP 4123	Petroleum Refining Technology	✓	✓		✓					✓	✓		
SETP 4223	Geophysics	✓	✓		✓					✓	✓		
SETP 4413	Advanced Drilling Engineering	✓	✓		✓					✓	✓		
SETP 4423	Advanced Well Completion	✓	✓		✓					✓	✓		
SETP 4523	Well Diagnosis and Treatment	✓	✓		✓					✓	✓		
SETP 4533	Production Data Analysis	✓	✓		✓					✓	✓		

INTEGRATED BACHELOR - MASTER PROGRAMME (PRISMS) ELECTIVE COURSES

LIST of PRISMS ELECTIVE COURSES

1. **Master of Science (Energy Management)**

- SKTK 5113 / SETK 5113 - Sustainable Energy Management
- SKTK 5123 / SETK 5123 - Thermal Energy Management
- SKTK 5133 / SETK 5133 - Energy Planning for Sustainable Development

2. **Master of Science (Safety, Health and Environment)**

- SKTK 5213 / SETK 5213 - Occupational Safety
- SKTK 5223 / SETK 5223 - Industrial Hygiene

3. **Master of Science in Polymer Technology**

- SKTK 5613 / SETK 5613 - Polymer Characterization
- SKTK 5623 / SETK 5623 - Polymer Synthesis
- SKTK 5633 / SETK 5633 - Polymer Additives, Blends and Rheology
- SKTK 5643 / SETK 5643 - Polymer Processing

4. **Master of Engineering in Chemical**

- SKTK 5513 / SETK 5513 - Advanced Thermodynamics
- SKTK 5523 / SETK 5523 - Numerical Computation in Chemical Engineering
- SKTK 5533 / SETK 5533 - Advanced Chemical Reaction Engineering

5. **Master of Engineering in Bioprocess**

- SETB 5103 - Biotechnology for Engineers
- SETB 5113 - Industrial Bio-processing
- SETB 5123 - Facilities and Infrastructure in Bioprocess Engineering
- SETB 5133 - Advanced Bio-product Development

6. **Master of Gas Engineering and Management**

- SETG 5123 - Hydrocarbon Gas Transportation and Storage
- SETG 5223 - Asset Management and Control
- SETG 5233 - Hydrocarbon Gas Contract Negotiation and Implementation
- SETG 5243 - Hydrocarbon Gas Project Planning, Development and Financing

PRISMS ELECTIVE COURSE SYNOPSIS

1. Master of Science (Energy Management)

SKTK 5113/SETK 5113 - Sustainable Energy Management

This course discusses life cycle cost analysis for energy conservation projects and emission analysis through the life cycle of a product. It presents the principles, methodology and case studies to develop an understanding of life cycle cost and emission analysis that can reduce environmental impact and promote sustainable practice.

SKTK 5123 / SETK 5123 – Thermal Energy Management
This course provides students with the ability to use computer aided tools for sustainable energy planning. Emphasis will be placed on the formulation of mathematical models, solve and interpret meaningful problems in energy related issues. The student will be exposed on the formulation of various energy issues including micro and macro level.

SKTK 5133 / SETK 5133 – Energy Planning for Sustainable Development
This course introduced the students on techniques to conduct mechanical and electrical energy audits for buildings. This course presents 3 parts of lecture, Part A is the introduction to general energy audit. Part B will cover energy audit on mechanical equipment such as electric motor, chiller, cooling tower, fans & blower, pumps, air compressor energy audit and Part C is the electrical systems energy audit that covers electrical systems.

2. Master of Science (Safety, Health and Environment)

SKTK 5213 / SETK 5213 - Occupational Safety
Occupational safety is an area concerned with the safety, health and well-being of people engaged in work or employment. It is a two-way relationship between work environment and safety. Occupational safety is a part of the safety science curriculum. Compared to process safety, occupational safety concerns more on the workers welfare merely due to day-to-day work activities than the impacts on lives, assets and environment due to abnormal process operation. This course introduces concepts of occupational safety with primary focus on various types of occupational hazards in a typical workplace environment. For each type of hazard, students are provided with detailed discussion, ranging from understanding the hazard to the factors that may cause the accidents in the workplace. Also the types of injuries that may be caused by the hazards are also discussed before appropriate recommendations and strategies to avoid or reduce the hazards are presented. Overall, through this course, students will acquire the knowledge and judgment to function as an entry-level practitioner in occupational safety and health. Students also should be able to contribute to the development and maintenance of a safe and healthy work environment.

3. Master of Science in Polymer Technology

SKTK 5613 / SETK 5613 - Polymer Characterization
This course introduces students with comprehensive knowledge of the various techniques available to characterize polymeric materials, the underlying principles of each characterization method, the use and the limitations of each technique. This course will focus mainly on four approaches of characterization, which are characterization of polymers in solution, spectroscopy, thermal analysis and microscopy. In characterization of polymers in solution, it will cover measurements of molecular weight and molecular weight distribution. In spectroscopy students will learn classification of spectroscopic methods and different types of spectroscopy instruments. In thermal analysis students will learn various techniques of thermal analysis such as differential scanning calorimeter (DSC), thermal gravimetric analysis (TGA), and dynamic mechanical analysis (DMA). The microscopy topic will cover various techniques

of microscopy analysis such as optical microscopy, scanning electron microscopy (SEM), transmission electron microscopy (TEM) and atomic force microscopy (AFM).

SKTK 5623 / SETK 5623 - Polymer Synthesis
Basic terminologies, principles on polymers and structural relationship towards polymer classification are discussed. An overview on the polymer industry is elaborated together with its impact on human life. Molecular weight relationships toward polymer properties and its implication are briefly presented. This course emphasizes specifically on the advance of polymer synthesis including step-growth, chain-growth and coordination polymerizations. Kinetic for the polymerization mechanism is described and its relationship to molecular weight is explained in detail. The limitations and application for each polymerization mechanism are discussed. The polymerization systems used for the polymerization process are discussed together with their advantages and the disadvantages. Finally, this course also exposed students to the pilot scale set-up of the polymerization systems.

SKTK 5633 / SETK 5633 - Polymer Additives, Blends and Rheology
This course consists of three parts: (a) polymer Additives (b) blending (c) rheology. Polymer additives cover the topics on heat and light stabilisers, impact modifiers, antioxidants, lubricants, plasticisers, flame retardants and colourants. The theory and mechanism of each additive will be explained. In polymer blending the methods of blending, compatibilizing mechanism and current development in polymer blends will be explained. Whilst polymer rheology elaborates the behaviour of polymer flow in a pipe as well as between plates. Polymer rheology covers a flow and deformation of polymer melts, understanding regarding the effect of shear on flow properties will be discussed in detail. Experimental method and equipment will provide an understanding of rheological properties of polymer melts. Data obtained from rheological experiments will be corrected by using several methods and models. Finally, final properties of polymer melts will be analysed and step by step methods will be explored to solve any defects and problems.

SKTK 5643 / SETK 5643 - Polymer Processing
This course introduces students on processing of thermoplastic and composite materials in general. Details fundamental of polymer processing such as extrusion and injection moulding will be emphasized. Elements of product design will also be covered in this course. The course will further discuss and explain the preparation and manufacture of fibre reinforced polymer composite. At the end of the course, students should be able to assess manufacturing processes to produce variation of polymer composite products.

4. Master of Engineering in Chemical

SETK 5513 - Advanced Thermodynamics
This course presents the fundamentals of thermodynamics theories in equilibrium systems. Selected equation of states as well as several equilibrium models will be utilised in predicting the chemical properties of chemical components at equilibrium with and without chemical reactions. The course features extensive work group exercises as well as individual projects and assignments.

SETK 5523 - Numerical Computation in Chemical Engineering
The main objective of this course is to provide the students with the opportunity to improve their programming skills using the MATLAB environment as a tool for solving problems in chemical engineering. This course includes the coverage of basics and application of MATLAB software to solve problems arising in chemical engineering which involve numerical operations like root of equations, curve fitting and ordinary differential equations problem. With this foundation of basic MATLAB applications in engineering problem solving, the course provides opportunities to explore advanced topics in application of MATLAB as a powerful engineering tool.

SKTK 5533 - Advanced Chemical Reaction Engineering
This course introduces students to chemical reactor design and theories in the area of chemical reaction engineering with emphasis on homogeneous and heterogeneous reactions. It will examine problems related to multiple reactions and non-isothermal operations. Students will also work cooperatively on computer assignments to expose them to solving problems using software packages such as PolyMath.

5. Master of Engineering in Bioprocess

SETB 5103 - Biotechnology for Engineers
This course covers basic understanding of microorganisms and genetic engineering involved in biotechnology. First, biotechnology definition and timeline is presented. The concept of protein expression, different expression systems used in biotechnology and the omics technology are also covered. The course is aimed at providing the fundamentals of biotechnology and knowledge on how biotechnology evolves from the ancient time. This course also consists of 6 modules and 1 fieldwork. The first 3 modules cover biotechnology application in different areas i.e. food, agriculture, medical, and environment. Next, 2 modules on the global scenario of biotechnology industry and biotechnology in Malaysia and current issues are discussed. It also discusses how this technology contributes towards wealth creation, health improvement, environmental protection and issues related to social security globally. The active involvement of Malaysia in biotechnology for a new source of economic engine is also discussed and evaluated. The last module deals with bioethics issues in biotechnology.

SETB 5113 - Industrial Bio-processing
This course introduces students to the fundamentals of various industrial bioprocessing areas based on the sources and applications. Emphasis will be on the technologies in which the students will be guided in being independently acquired and explain information on some key issues in food and bioproducts engineering, biopharmaceutical engineering, renewable resources and waste management bioprocessing science and technology.

SETB 5123 - Facilities and Infrastructure in Bioprocess Engineering
This course provides a complete overview about the production facility from the beginning of the project up to the production process and how to perform all project steps according to the guidelines of the Good Manufacturing Practice (cGMP). Topics will include: the primary and detailed engineering in the production area, flow inside the facility (personnel, material,

product and waste flow), the design of the HVAC system and clean area according to the cGMP requirements. Besides the engineering and design aspects, the course also encompasses all aspects of the cGMP requirements for the production equipment, from cell bank to the final product. Furthermore, non-design/equipment components of the cGMP such as, human resource, process design and operation procedure based on Standard Operation Procedures (SOPs) sheet is also introduced.

SETB 5133 - Advanced Bio-product Development
This course introduces students to the advance of bio-product development based on the sources and functional applications. Emphasis will be on the technologies in the development of bio-products; various types of materials/bio-materials, design, operations and analysis of their desired performances. The course also exposes students to the different stages in the development of a bio-product, from the research and development to manufacturing, bio-product approval and release of the final product.

6. Master of Gas Engineering and Management

SETG 5123 - Hydrocarbon Gas Transportation and Storage
This subject enables students to acquire and practice the fundamental knowledge of liquefied petroleum gases (LPG), and natural gases (NG) transportation and storage. The students are also required to prepare a group technical report and present their project at the end of the course. Students will also utilise computer software in executing their project.

SETG 5223 - Asset Management and Control
The Asset Management and Control course is dealing with the study of systems/methods/approaches/techniques that monitors and maintains things of value to an entity of a group/organization/company. It may apply to both tangible assets and to intangible concepts. Throughout the course, strong emphasis is placed on how the practice of managing assets to achieve the greatest return (particularly useful for productive assets such as plant and equipment) and the process of monitoring and maintaining facilities systems with the objective of providing the best possible service to users.

SETG 5233 - Hydrocarbon Gas Contract Negotiation and Implementation
This course enables students to understand the concept of hydrocarbon gas negotiation to sustain the stable supply of energy since consumers are interested in long term stability, predict the potential policy mistake, gas development risks, strategy for the gas chain and relationship between gas supply and purchase agreement, prepare the draft invoice for gas supply and purchase agreement, legal framework, contract structure, and explain the role of government with regard to the energy supply.

SETG 5243 - Hydrocarbon Gas Project Planning, Development and Financing
This course enables students to elaborate confidently on government policy and regulatory framework related to oil and gas industry, set out the principles of planning on development of gas projects, become leader in safe and efficient operation in the oil, gas and petrochemical industry in Malaysia, and prepare an analysis on investment and financing of gas potential projects.