UTM
UNIVERSITI TEKNOLOGI MALAYSIA
Faculty of Chemical and Energy Engineering

UNDERGRADUATE GUIDEBOOK

Academic Session 2025/2026

FACULTY OF CHEMICAL AND ENERGY ENGINEERING

MARKETABLE | EMPLOYABLE | SUSTAINABLE | ENTREPRENEURIAL

https://fkt.utm.my

MESSAGE FROM THE DEAN

In the name of God, the most gracious and merciful.

I am very pleased to welcome all new students to the Faculty of Chemical and Energy Engineering (FKT), Universiti Teknologi Malaysia (UTM).

Congratulations on being among the top candidates selected to pursue your studies at one of the world's leading faculties in chemical and energy engineering. I am delighted to share that this year's undergraduate intake has achieved one of the highest cumulative grade point averages (CGPA) at UTM.

FKT is driven by the dedication of its academic and support staff, who strive to cultivate excellence within a dynamic, productive, and sustainable learning environment. Guided by our mission, we are committed to nurturing holistic graduates through a future-ready curriculum that is aligned with the national education agenda.

I urge you to embrace every opportunity to learn, explore and grow, not only within the disciplines of chemical, petroleum, gas, bioprocess, and nuclear engineering, but also in discovering the virtues that will guide you through life. Let your commitment, dedication, and discipline fuel the pursuit of your dreams. More importantly, may your experiences here shape the right mindset and attitude to make a lasting impact on society and to contribute meaningfully to the betterment of lives. This chapter of your journey is also the perfect time to build lifelong networks, create unforgettable memories, and fully immerse yourself in the vibrant campus experience at UTM.

This guidebook provides essential information about the faculty, its programmes and courses, as well as the rules and regulations related to undergraduate academic matters. By familiarising yourself with its contents, you will be better equipped to plan and manage your academic journey wisely.

We aspire to nurture future talents and prosper lives by producing high-quality graduates who are Marketable, Employable, Sustainable, and Entrepreneurial.

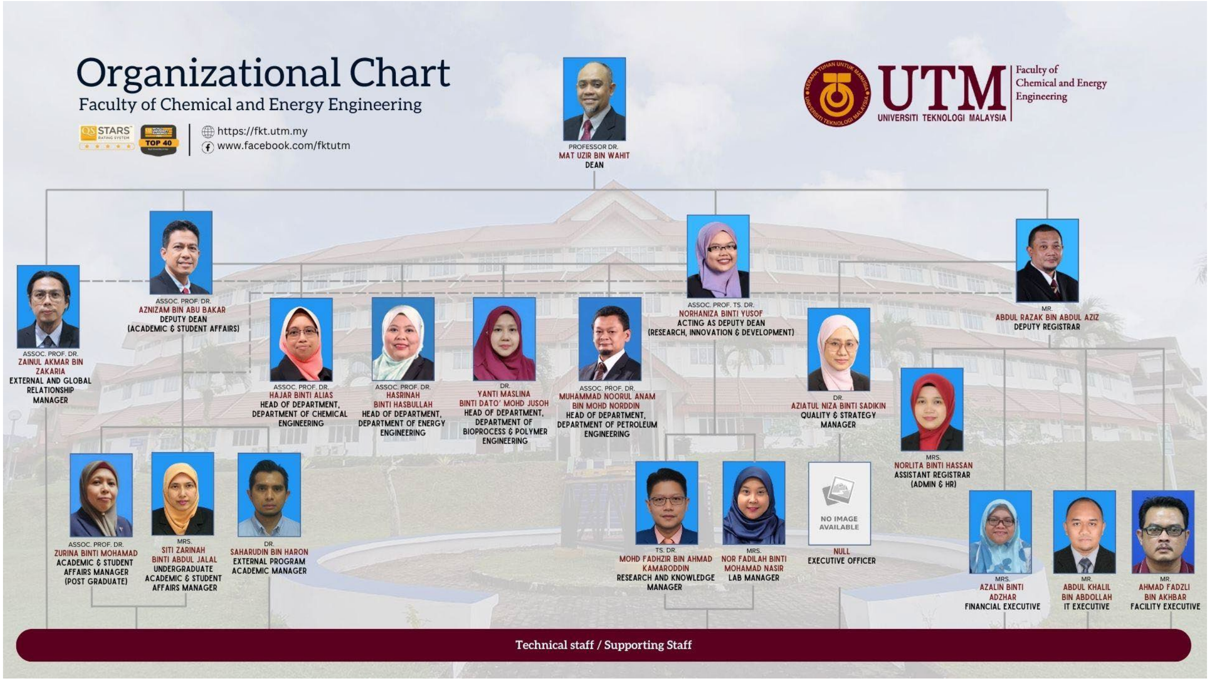
I wish you all the best in your studies and future undertakings.

In the name of God for Mankind.

Thank you and best regards,

PROF. DR. MAT UZIR BIN WAHIT
Dean,
Faculty of Chemical and Energy Engineering
Universiti Teknologi Malaysia

MANAGEMENT TEAM



Position	Name
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Head of Department Energy Engineering Department	Assoc. Prof. Dr. Hasrinah Hasbullah hasrinah@utm.my
Head of Department Petroleum Engineering Department	Assoc. Prof. Dr. Muhammad Noorul Anam Mohd Norddin anam@utm.my

Programme Educational Objectives

Programme Educational Objectives (PEO) are specific goals consistent with the vision and mission of the Institution of Higher Learning, responsive to the expressed interest of the programme stakeholders, and describe the expected achievements of graduates in their career and professional life a few years (such as three (3) to five (5) years) after graduation.

Code	Intended Educational Objectives
PEO1	Become competent holistic professionals in chemical/ petroleum/ bioprocess/ gas/ nuclear engineering or related industries.
PEO2	Contribute towards sustainable development through knowledge and innovative technologies to prosper lives.

Programme Learning Outcomes

Programme Learning Outcomes (PLO) are statements that describe what students expected to know and be able to perform or attain by the time of graduation. These relate to the skills, knowledge and behaviour that students acquire through the programme. After having completed the programme, graduates should be able to demonstrate the following competencies:

Code	Skills	Intended Learning Outcomes
PLO1	**Engineering Knowledge**	Apply knowledge of mathematics, natural science, computing and engineering fundamentals, chemical/ bioprocess/ gas/ petroleum/ nuclear engineering to develop solutions to complex engineering problems. (WK1-WK4)
PLO2	**Problem Analysis**	Identify, formulate, research literature and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences with holistic considerations for sustainable development. (WK1-WK4)
PLO3	**Design/ Development of Solutions**	Design creative solutions for complex engineering problems and design systems, components or processes to meet identified needs with appropriate consideration for public health and safety, whole-life cost, net zero carbon as well as resource, cultural, societal, and environmental considerations as required. (WK5)
PLO4	**Investigation**	Conduct investigations of complex engineering problems using research methods including research-based knowledge, design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions. (WK8)

PLO5	**Tool Usage**	Create, select and apply, and recognize limitations of appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering problems. (WK2, WK6)
PLO6	**The Engineer and The World**	Analyse and evaluate sustainable development impacts to: society, the economy, sustainability, health and safety, legal frameworks, and the environment, in solving complex engineering problems. (WK1, WK5, WK7)
PLO7	**Ethics**	Apply ethical principles and commit to professional ethics and norms of engineering practice and adhere to relevant national and international laws. Demonstrate an understanding of the need for diversity and inclusion. (WK9)
PLO8	**Individual and Collaborative Team Work**	Function effectively as an individual, and as a member or leader in diverse, and inclusive teams and in multidisciplinary, face-to-face, remote and distributed settings. (WK9)
PLO9	**Communication**	Communicate effectively and inclusively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentations, make effective presentations, taking into account cultural, language, and learning differences.
PLO10	**Project Management and Finance**	Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects in multidisciplinary environments.
PLO11	**Life Long Learning**	Recognise the need for and have the preparation and ability for independent and life-long learning adaptability to new and emerging technologies and critical thinking in the broadest context of technological change. (WK8)

BACHELOR OF CHEMICAL ENGINEERING WITH HONOURS

PROGRAMME SPECIFICATIONS

The Bachelor of Chemical Engineering with Honours is offered on a full-time and part-time basis. The full-time programme is offered at the UTM Main Campus in Johor Bahru while the part-time programme is offered at UTM Main Campus and UTMKL Campus. 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, while the duration of study for the part-time programme lasts between six (6) years to a maximum of ten (10) 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.

Programme Uniqueness

Various courses in the programme incorporate the following elements:

Elements	Courses
Sustainable Development Goals (SDG)	
SDG1: No Poverty	SKTC 3333 - Engineering Economics and Project Management
SDG3: Good Health and Well-being	SKTC 4562 - Occupational Safety and Health in Industry SKTC 4523 - Industrial Hygiene SKTC 4533 - Human Factors and Ergonomics
SDG6: Clean Water and Sanitation	SKTC 3413 - Environmental Engineering and Sustainability SKTC 4413 - Waste Management SKTC 4423 - Environmental Management SKTC 4433 - Environmental Sustainability
SDG7: Affordable and Clean Energy	SKTC 4113 - Sustainable Energy Management Systems SKTC 4133 - Energy Planning for Sustainable Development SKTC 4143 - Energy Integration and Resource Conservation
Artificial-Intelligence and Digitalisation	SKTC 1533 - Introduction to Computer

	Programming SKTC 2142 - Chemical Engineering Simulation SKTC 2543 - Numerical Method and Optimization
Work-Based Learning	SKTC 3915 - Industrial Training SKTC 4832 - Plant Design Project I SKTC 4842 - Plant Design Project II
Service Learning	SKTC 4562 - Occupational Safety and Health in Industry
EXCEL Framework	Research Infused Experiential Learning (REAL)
Level 1: Research Oriented	SKTC 1523 - Introduction to Engineering SKTC 1123 - Mass Balance SKTC 2133 - Energy Balance SKTC 2142 - Chemical Engineering Simulation SKTC 2223 - Chemical Engineering Thermodynamics
Level 2: Research Immersion	SKTU 2711 - Thermodynamics and Material Engineering Laboratory SKTU 2721 - Fluid Mechanics Laboratory SKTC 3731 - Chemical Reaction Laboratory SKTC 3741 - Environmental Engineering Laboratory SKTU 4751 - Process Control Laboratory SKTC 4761 - Separation Processes Laboratory
Level 3: Research Apprentice	SKTC 2543 - Numerical Method and Optimization SKTC 2233 - Chemical Reaction Engineering SKTC 3323 - Separation Processes SKTC 3413 - Environmental Engineering and Sustainability SKTC 3554 - Process Control and Instrumentation SKTC 4573 - Process Safety and Operability SKTC 4153 - Process Design SKTC 4163 - Plant Design
Level 4: Research Intensive	SKTC 3812 - Final Year Project I SKTC 4824 - Final Year Project II SKTC 4832 - Plant Design Project I SKTC 4842 - Plant Design Project II

General Information

1. Awarding Institution	Universiti Teknologi Malaysia
2. Teaching Institution	Universiti Teknologi Malaysia
3. Programme Name	Bachelor of Chemical Engineering with Honours
4. Programme Award	Bachelor of Chemical Engineering with Honours
5. Curriculum Review Approval by MOHE	JPT(A)1000/021/011/01 JLD 14 (14) 26th November 2024
5. National Education Code (NEC)	0711 (Chemical Engineering and Processes)
6. Programme Code	SKTCH
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. Method of Study	Full Time and Part Time
12. Duration of Study	Full Time: Minimum : 4 years Maximum : 6 years
	Part Time: Minimum : 6 years Maximum : 10 years

Type of Semester	No. of Semesters		No of Weeks/Semester	
	Full Time	Part Time	Full Time	Part Time
Normal	8	12	14	14
Short	4	6	8	8

Course Classification

No.	Classification	Credit Hours	Percentage
i.	University Courses (a) General (b) Language (c) Entrepreneurship (d) Co-Curriculum	 6 6 2 2	11.8 %
ii.	Programme Core	107	79.3 %
iii.	Electives (a) Programme Electives (b) Free Electives	 9 3	8.9 %
	Total	**135**	**100%**
A	Engineering Courses (a) Lectures (b) Laboratory (c) Industrial Training (d) Final Year Project (e) Integrated Design Project	 79 6 5 6 4	74.1 %
	Total Credit Hours for Part A	**100**	
B	Related Courses Applied Science/Mathematics/ Computer Management/Law/ Humanities/Ethics/Entrepreneur Language Co-Curriculum Free Electives	 16 8 6 2 3	25.9 %
	Total Credit Hours for Part B	**35**	
	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)

COURSE MENU

YEAR 1: SEMESTER 1			
Code	**Course**	**Credit**	**Prerequisite**
SKTC 1111	Engineering Drawings	1	
SKTC 1213	Statics and Mechanics of Material	3	
SKTC 1511	Industrial Seminar and Profession	1	
SKTC 1523	Introduction to Engineering	3	
SKTC 1533	Introduction to Computer Programming	3	
SSCE 1693	Engineering Mathematics I	3	
ULRS 1032	Integrity And Anti-Corruption Course	2	
UHLB 1112	English Communication Skills*	HW	
	TOTAL CREDIT	**16**	
	CUMULATIVE CREDITS	**16**	

**Note: UHLB 1112 - Please refer to English Prerequisite Section for details.*

YEAR 1: SEMESTER 2			
Code	**Course**	**Credit**	**Prerequisite**
SKTC 1123	Mass Balance	3	
SKTC 1613	Materials Science for Engineers	3	
SKTC 1623	Thermodynamics	3	
SSCE 1993	Engineering Mathematics II	3	SSCE 1693
SSCK 1623	Organic Chemistry for Engineering	3	
ULRS 1182	Appreciation of Ethics and Civilization (for Local Students)	2	
UHLM 1012	Malay Language for Communication 2 (for International Students)		
	TOTAL CREDIT	**17**	
	CUMULATIVE CREDITS	**33**	

YEAR 2: SEMESTER 1			
Code	**Course**	**Credit**	**Prerequisite**
SKTC 2133	Energy Balance	3	SKTC 1123
SKTU 2143	Fluid Mechanics	3	
SKTC 2142	Chemical Engineering Simulation	2	
SKTC 2223	Chemical Engineering Thermodynamics	3	SKTC 1623
SKTU 2711	Thermodynamics and Material Engineering Laboratory	1	SKTC 1213 SKTC 1623
SSCE 1793	Differential Equations	3	SSCE 1693
ULRF 2**2	Service Learning and Community Engagement Elective	2	
	TOTAL CREDIT	**17**	
	CUMULATIVE CREDITS	**50**	

YEAR 2: SEMESTER 2			
Code	**Course**	**Credit**	**Prerequisite**
SKTC 2233	Chemical Reaction Engineering	3	
SKTC 2313	Heat and Mass Transfer	3	SKTC 2133
SKTC 2543	Numerical Method and Optimization	3	
SKTU 2721	Fluid Mechanics Laboratory	1	SKTU 1143
UHLB 2122	Professional Communication Skills 1	2	
ULRS 1022	Philosophy and Current Issues	2	
**** ***3	Free Elective[1]	3	
	TOTAL CREDIT	**17**	
	CUMULATIVE CREDITS	**67**	

[1]*Note: Free Elective is a course offered by other Faculties.*

YEAR 3: SEMESTER 1			
Code	**Course**	**Credit**	**Prerequisite**
SSCK 1203	Analytical Chemistry for Engineering	3	
SSCK 1891	Analytical Chemistry Practical	1	
SKTC 3323	Separation Processes	3	SKTC 2313
SKTC 3333	Engineering Economics and Project Management	3	
SKTC 3413	Environmental Engineering and Sustainability	3	
UHL* 1112	Foreign Language for Communication	2	
UHLB 3132	Professional Communication Skills 2	2	UHLB 2122
	TOTAL CREDIT	**17**	
	CUMULATIVE CREDITS	**84**	

YEAR 3: SEMESTER 2			
Code	**Course**	**Credit**	**Prerequisite**
SKTC 3554	Process Control and Instrumentation*	4	SSCE 1793 SKTC 3323 SKTC 2233
SKTC 3343	Unit Operation and Industrial Processes	3	SKTC 2313
SKTC 3731	Chemical Reaction Laboratory	1	SKTC 2233
SKTC 3741	Environmental Engineering Laboratory	1	SKTC 3323
SKTC 3812	Final Year Project I	2	
SKEU 2003	Electrical Technology	3	
ULRS 3032	Entrepreneurship and Innovation	2	
	TOTAL CREDIT	**16**	
	CUMULATIVE CREDITS	**100**	

YEAR 3: SEMESTER 3			
Code	**Course**	**Credit**	**Prerequisite**
SKTC 3915	Industrial Training	5	
	TOTAL CREDIT	**5**	
	CUMULATIVE CREDITS	**105**	

YEAR 4: SEMESTER 1			
Code	**Course**	**Credit**	**Prerequisite**
SKTC 4153	Process Design	3	
SKTC 4562	Occupational Safety and Health in Industry	2	
SKTU 4751	Process Control Laboratory	1	SKTC 3554
SKTC 4761	Separation Processes Laboratory	1	SKTC 3323 SKTC 3343
SKTC 4824	Final Year Project II	4	SKTC 3812
SKTC 4832	Plant Design Project I	2	
SKT* 4**3	Elective Course I	3	
SKT* 5**3	PRISMS Elective I		
	TOTAL CREDIT	**16**	
	CUMULATIVE CREDITS	**121**	

YEAR 4: SEMESTER 2			
Code	**Course**	**Credit**	**Prerequisite**
SKTC 4163	Plant Design	3	SKTC 4153
SKTC 4573	Process Safety and Operability	3	
SKTC 4842	Plant Design Project II	2	SKTC 4832
SKT* 4**3	Elective Course II	3	
SKT*5**3	PRISMS Elective II		
SKT* 4**3	Elective Course III	3	
SKT*5**3	PRISMS Elective III		
	TOTAL CREDIT	**14**	
	CUMULATIVE CREDITS	**135**	

English Prerequisite

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

ENGLISH PREREQUISITE
a) MUET : $\geq$ Band 4.0
b) IELTS : $\geq$ Band 5.5
c) TOEFL: $\geq$ 525
d) TOEFL iBT : $\geq$ 60
e) CEFR : $\geq$ B2
f) CEQ : $\geq$ 160
g) CIEP-ELS : $\geq$ 108
h) PTE : $\geq$ 51

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
   - SKTC 4113 Sustainable Energy Management System
   - SKTC 4123 Thermal Energy Management and Audit
   - SKTC 4133 Energy Planning for Sustainable Development
   - SKTC 4143 Energy Integration and Resource Conservation

2. Advanced Chemical Engineering
   - SKTC 4213 Advanced Chemical Reaction Engineering
   - SKTC 4223 Computational Methods in Chemical Engineering
   - SKTC 4233 Separation Technology for Industrial Applications

3. Environment
   - SKTC 4413 Waste Management
   - SKTC 4423 Environmental Management
   - SKTC 4433 Environmental Sustainability

4. Occupational Safety and Health
   - SKTC 4513 Safety Management System
   - SKTC 4523 Industrial Hygiene
   - SKTC 4533 Human Factors and Ergonomics

5. Polymer Science and Technology
   - SKTC 4613 Fundamentals of Polymer
   - SKTC 4623 Polymer Physics and Properties
   - SKTC 4633 Polymer Rheology and Processing

ELECTIVE COURSE (SKT* 43)**
Students may enrol in any Elective Course offered by any Undergraduate Programme in FKT.

PRISMS ELECTIVE COURSES
For students who intend to enrol 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	SKTC 1123	Mass Balance	3
2	SKTC 2133	Energy Balance	3
3	SKTC 2233	Chemical Reaction Engineering	3
4	SKTC 3323	Separation Processes	3
5	SKTC 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	SKTC 1111	Engineering Drawing	1	1	
2	SKTC 1213	Statics and Mechanics of Material	3	3	
3	SKTC 1511	Industrial Seminar and Profession	1	1	
4	SKTC 1523	Introduction to Engineering	3	3	
5	SKTC 1533	Introduction to Computer Programming	3	3	
6	SKTC 1123	Mass Balance	3	3	
7	SKTC 1613	Material Science for Engineers	3	3	
8	SKTC 1623	Thermodynamics	3	3	
9	SKTC 2133	Energy Balance	3	3	
10	SKTU 2143	Fluid Mechanics	3	3	
11	SKTC 2142	Chemical Engineering Simulation	2	2	
12	SKTU 2711	Thermodynamics and Material Engineering Laboratory	1	1	
13	SKTC 2223	Chemical Engineering Thermodynamics	3	3	
14	SKTC 2313	Heat and Mass Transfer	3	3	
15	SKTU 2721	Fluid Mechanics Laboratory	1	1	
16	SKTC 2543	Numerical Method and Optimization	3	3	
17	SKTC 2233	Chemical Reaction Engineering	3	3	
18	SKTC 3323	Separation Processes	3	3	
19	SKTC 3413	Environmental Engineering and Sustainability	3	3	
20	SKTC 3333	Engineering Economics and Project Management	3	3	
21	SKEU 2003	Electrical Technology	3	3	
22	SKTC 3554	Process Control and Instrumentation	4	4	
23	SKTC 3731	Chemical Reaction Laboratory	1	1	
24	SKTC 3741	Environmental Engineering Laboratory	1	1	
25	SKTC 3343	Unit Operation and Industrial Processes	3	3	
26	SKTC 3812	Final Year Project I	2	2	
27	SKTC 3915	Industrial Training	5	HL	
28	SKTC 4153	Process Design	3	3	
29	SKTC 4562	Occupational Safety and Health in Industry	2	2	

30	SKTC 4824	Final Year Project II	4	4	
31	SKTU 4751	Process Control Laboratory	1	1	
32	SKTC 4761	Separation Process Laboratory	1	1	
33	SKTC 4832	Plant Design Project I	2	2	
34	SKTC 4163	Plant Design	3	3	
35	SKTC 4753	Process Safety and Operability	3	3	
36	SKTC 4842	Plant Design Project II	2	2	
37	SKT* 4**3	Elective Course I	3	3	
	SKT* 5**3	PRISMS Elective I			
38	SKT* 4**3	Elective Course II	3	3	
	SKT* 5**3	PRISMS Elective II			
39	SKT* 4**3	Elective Course III	3	3	
	SKT* 5**3	PRISMS Elective III			
		TOTAL CREDIT OF CHEMICAL ENGINEERING COURSES (a)	**100**	**100**	
MATHEMATICS AND SCIENCE COURSES					
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 1203	Analytical Chemistry for Engineering	3	3	
6	SSCK 1891	Analytical Chemistry Practical	1	1	
		TOTAL CREDIT OF MATHEMATICS AND SCIENCE COURSES (b)	**16**	**16**	
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 1032	Integrity And Anti-Corruption Course	2	2	
Global Citizen					
1	ULRF 2**2	Service Learning and Community Engagement Elective	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	Foreign Language for Communication	2	2	
Enterprising Skills					
1	ULRS 3032	Entrepreneurship and Innovation	2	2	
Free Elective					
1	S*** ***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 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 and 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 School of Undergraduate Studies (UGS). Information on PSC Courses: https://ugs.utm.my/utm-professional-skills-certificate-utm-psc/ Online PSC Registration: https://elearnpsc.utmspace.edu.my/			

COURSE SYNOPSIS

CORE COURSES

SKTC 1111 - Engineering Drawing

This core 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 CAD software. 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. The course covers the topics of introduction and fundamentals of engineering drawing, geometry, orthographic, isometric and sectional drawing. The course also gives exposure on 3D drawing to the students.

SKTC 1213 - Statics and Mechanics of Material

This core 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 a rigid body. This course also includes the determination of centroid, analysis of structure and friction. 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. At the end of the course, students should be able to demonstrate and apply the knowledge for solving various engineering problems.

SKTC 1511 - Industrial Seminar and Profession

This core course introduces students to the basic engineering knowledge and working environment through workshops and seminars by respective personnel (experts, engineers, lecturers, alumni, senior students etc.) and also industrial visits to various 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.

SKTC 1523 - Introduction to Engineering

The objective of this core 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 learning activities, and presentations. This course employs Active Learning, Cooperative Learning, and 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 sustainability development among first-year engineering students in order to foster environmentally responsible behaviours and provide a strong foundation for more sustainable societies.

SKTC 1533 - Introduction to Computer Programming
The main objective of this core 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.

SKTC 1123 - Mass Balance
This core 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.

SKTC 1613 - Material Science for Engineering
Materials Science for Engineers is a core course that covers the principles of atomic bonds, crystal structure, crystalline defects, solid solutions, phase diagrams, and crystallography. These concepts are linked to the structure, properties, processing, and performance of different classes of materials. Through a specific focus on metals, polymers, ceramics, and composites, students gain a profound understanding of material design, selection, and customization for specific applications. By the end of the course, students are well-equipped to make decisions regarding material design, ensuring that the chosen materials align with the specific needs.

SKTC 1623 - Thermodynamics
Thermodynamics is an important basic engineering core 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.

SKTC 2133 - Energy Balance
Prerequisite: SKTC 1123 (taken)
This core 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.

SKTU 2143 - 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.

SKTC 2142 - Chemical Engineering Simulation
Chemical Engineering Simulation is a core course intended for students who are for the first time and have little or no experience in computer simulation. This course will familiarise students with the simulation environment and thermodynamics data banks available in the simulation. Students will also simulate equipment related to pressure and temperature change. At the end of this course, the student will be able to work as a team to simulate complex chemical engineering problems.

SKTC 2223 - Chemical Engineering Thermodynamics
Prerequisite: SKTC 1623 (taken)
This core 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.

SKTU 2711 - Thermodynamics and Material Engineering Laboratory
Prerequisite: SKTC 1213, SKTC 1623 (taken)
This laboratory is a core course that covers basic concepts in Thermodynamics and Strength of Material. Laboratory experiments are designed for hand-on experience to understand the engineering principles and are divided into two methods of learning; guided experiment and open-ended experiment. The experiment's 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.

SKTC 2313 - Heat and Mass Transfer
Prerequisite: SKTC 2133 (taken)
This core course introduces students to the fundamentals and applications of heat and mass transfer in chemical engineering. The knowledge from this course will be useful for sizing of heat exchangers and understanding the principles of separation processes in chemical engineering.

SKTC 2543 - Numerical Method and Optimization
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.

SKTU 2721 - Fluid Mechanics Laboratory
Prerequisite: SKTU 1143 (taken)
The aim of this laboratory core course is for students to conduct experiment in conjunction with the theory course SKTU 1143 (Fluid Mechanics). This will give a hands-on experience to the students on handling the equipment and to interpret the data taken from the experiments. In this course, apart from the guided experiments, students will have the opportunity to design their own experiments in the open-ended experiments. Students will be assessed by their design of experimental methodology, skills in handling the equipment, and ability to discuss and analyse the results in the report submitted. The lab runs closely with the lectures' invigilation and based on the prior knowledge of the Prerequisite course.

SKTC 2233 - Chemical Reaction Engineering
This core 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 computational tools.

SKTC 3323 - Separation Processes
Prerequisite: SKTC 2313 (taken)
This core course introduces different types of unit operations and separation processes for mixtures in chemical plants. The unit operation to be taught will be covering gas-liquid separation, vapour-liquid separation and liquid-liquid separation, as well as the knowledge in mass transfer principles. Unit operations involved include humidification tower, cooling tower, distillation column, absorption column and solvent extraction. Students are also required to complete a project on designing gas-liquid and vapour-liquid separation systems in an assigned process flow diagram using computational tools.

SKTC 3413 - Environmental Engineering and Sustainability
This core course introduces the causes, effects, and methods to control domestic and industrial pollution. The course covers the three major categories of pollution sources: water pollution, air pollution, and scheduled waste. In the first part, the course includes the sources and types of water pollutants, environmental regulations pertaining to wastewater discharge, methods to treat wastewater before discharging it into the environment, and methods to treat water for drinking purposes. The second part covers the sources and effects of air pollution, regulatory requirements for air pollution control, and technologies to control air pollution emissions from industries. The third part covers the management of scheduled waste, which includes the definition of scheduled waste, regulations related to scheduled waste, and techniques to manage scheduled waste.

SKTC 3333 - Engineering Economics and Project Management

This core course covers both Engineering Economics and Project Management. Engineering economics focuses on evaluating different alternatives and making decisions based on economic factors. These decisions involve the fundamental elements of cash flows of money, time, and interest rates. Project Management is the art of planning, scheduling, and controlling project operations to accomplish performance, cost, time, and objectives for a specified scope of work while efficiently and effectively using resources.

SKTC 3343 - Unit Operation and Industrial Processes

Prerequisite: SKTC 2313 (taken)

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 topics are illustrated by detailed examples and is accompanied by homework exercises.

SKTC 3731 - Chemical Reaction Laboratory

Prerequisite: SKTC 2233 (taken)

In this core course, students learn how to design experiments effectively, conduct experiments safely, analyse experimental data, and prepare lab reports from various chemical reaction engineering experiments. In addition, lab reports, discussions, and presentations will be used to communicate important findings in this course. This course is designed to further students' understanding of chemical reaction engineering principles by demonstrating how to define objectives, select appropriate variables, and plan experiments that produce meaningful results. Among the experiments conducted in this laboratory are the saponification batch reaction, aspirin synthesis, ethylene production simulation using HySIS, and styrene polymerization.

SKTC 3741 - Environmental Engineering Laboratory

Prerequisite: SKTC 3413 (taken)

This core course includes experiments that cover the fundamental concepts covered in the Environmental Engineering and Sustainability course, which covers solid, air and water quality evaluations. This will provide students with hands-on experience with managing equipment and interpreting data from experiments. The experiments encourage students to use core laboratory procedures and skills while also developing their cooperation and communication abilities. Aside from the guided experiments, students will have the opportunity to design and test various water samples and solid waste as well as evaluate the quality, which also includes air quality, in accordance with the guidelines. This course exposes and nurtures students to contemporary global concerns connected to SDGs 6 (Clean Water and Sanitation) and 11 (Sustainable Cities and Communities).

SKTC 3554 - Process Control and Instrumentation

Prerequisite: SSCE 1793, SKTC 2233, SETK 3323 (taken)

This core course exposes students to the fundamentals of dynamic process modelling, dynamic process behaviours, process control and instrumentation. The course covers the suitable process instrumentation systems in chemical engineering and the derivation of lumped parameter dynamics models. Feedback control system design, analysis and tuning are dealt with in detail. This course also includes model estimation techniques for first order plus dead time (FOPDT) systems. Other commonly found control structures, such as feedforward, ratio and cascade control, and plant-wide control systems design are taught qualitatively. This course employs Cooperative Problem Based Learning (CPBL) which embraces authenticity of generic skills (oral communication and teamworking) when engaging in the process of learning and completing tasks given.

SKTC 3812 - Final Year Project I
This core 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 to writing a research proposal. It will emphasize on the research philosophy and research methodology. The works include literature review, writing a problem statement, scope identification, objective 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.

SKTC 3915 - Industrial Training
This is a core course. The purpose of implementing a 12-week industry training program is to expose UTM students firsthand experience on the practical aspects and work practices within the industry. Throughout the program, students will be able to apply their theoretical knowledge with real-world applications, while also enhancing their abilities in work ethics, management, communication, and interpersonal relationships.

SKTC 4562 - Occupational Safety and Health in Industry
This core 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, risk assessment, hierarchy of risk control 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 through CSR projects.

SKTC 4153 - Process Design
This core course presents the principles and methodology for process design. In particular, it emphasises on the key elements of process design which include market survey, ethics in design, process synthesis, heat integration and process optimisation of chemical processes. The course features the use of process optimisation tools.

SKTC 4824 - Final Year Project II
Prerequisite: SKTC 3812 (pass with at least D+)
This core 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 present their research to a group of panellists and to write

a research report in a professional practice. The students should also be able to manage and plan their research according to the time given.

SKTC 4832 - Plant Design Project I
Prerequisite: SKTC 3323
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.

SKTU 4751 - Process Control Laboratory
Prerequisite: SETK 3564 (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.

SKTC 4761 - Separation Processes Laboratory
Prerequisite: SKTC 3323, SKTC 3343 (taken)
This core course introduces students to the equipment in the separation processes covered in Heat and Mass Transfer, Separation Processes, and Unit Operation and Industrial Processes courses. This will give hands-on experience to the students on handling the equipment and to interpret the data taken from the experiments. In this course, apart from the guided experiments, students will have the opportunity to design their own experiments in the open-ended experiments. Students will be assessed by their design of experimental methodology, skills in handling the equipment, and ability to discuss and analyse the results in the report submitted.

SKTC 4163 - Plant Design
Prerequisite: SKTC 4153 (taken)
This core course presents the principles and methodology for chemical plant design. In particular, it emphasises on the key elements of equipment design which include, utilities and waste system synthesis, equipment sizing and cost estimation, mechanical design, sustainability analysis and process plant layout in generating inherently safe, economic and environmentally friendly plant

SKTC 4573 - Process Safety and 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.

SKTC 4842 - Plant Design Project II

Prerequisite: SKTC 4832 (pass with at least D+)

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

SKTC 4113 - Sustainable Energy Management System

This elective course presents a holistic approach for energy management for an organisation. It provides the key strategies and approaches to establish a sustainable energy management system in an organisation and to implement practical measures for energy conservation using various analysis tools, involving various process equipment, for thermal as well as electrical energy systems.

SKTC 4123 - Thermal Energy Management and Audit

This course presents the principles and a system approach methodology to analyse 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.

SKTC 4133 - Energy Planning for Sustainable Development
This elective course provides students with the ability to use optimization software such as Generalised Algebraic Modelling Systems (GAMS)/AIMMS as a tool for efficient and holistic energy planning. Students are expected to develop the strategic energy planning for micro and macro level including industry, regional and country wide. Emphasis will be placed on the formulation of mathematical model, interpret meaningful scenario analysis in engineering, science and business. A series of hands-on exercises will be conducted in class to enhance the understanding.

SKTC 4143 - Energy Integration and Resource Conservation
This elective course presents the principles and methodology of Pinch Analysis technique for optimal resource recovery. The course will cover mainly on Heat Pinch Analysis to maximise thermal energy recovery for process industries. The method can help industries to achieve a triple bottom line benefit: reducing energy bills, emissions, and investment costs. Besides thermal energy, the course will also introduce the concept of Pinch Analysis for other resource recovery such as power, waste and carbon emissions.

2. Environment

SKTC 4413 - Waste Management
The elective course aims to analyse the component 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 issues 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 pollution prevention and techniques.

SKTC 4423 - Environmental Management
The elective 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

SKTC 4433 - Environmental Sustainability
This elective 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

SKTC 4513 - Safety Management System

This elective course is intended to equip students with basic safety and health legislation and manage the occupational and process hazard at the chemical plant operations. It covers the fundamental aspects of safety and health such as legal register, risk register and real problem case application to identify and mitigate the hazard. On risk reduction, risk management tools will be used to foresee the hazard from design and operational stages using general principles of prevention (GPP) and best control techniques for safe operations. The course features extensive use of case studies from industry through group as well as individual project work.

SKTC 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.

SKTC 4533 - Human Factors and Ergonomics

This elective course concerns the understanding of interactions among humans and other elements of a system in chemical processing industries. The content of this course includes behaviours, cognitive, socio-technical systems, and the nature of human performance. The aim of human factors is to reduce human error, increase productivity, and enhance safety and comfort with a specific focus on the interaction between a human and the thing of interest. Human factors theory, principles and methods can be applied to the design and evaluation of tasks, environments and systems in order to optimize human well-being and overall system performance.

4. Polymer Science and Technology

SKTC 4613 - Fundamentals of Polymer

This elective course describes the fundamentals of polymer science which covers form basic classification of polymer up to the polymer synthesis and processing. Basic terminologies, principles on polymers and structural relationship towards polymer classification are discussed. Molecular weight relationships toward polymer properties and its implication are briefly presented. This course emphasizes specifically on the polymer synthesis including step-growth, chain-growth and coordination polymerizations as well as its polymerization technique. Polymer processing such as blending and compounding are also described.

SKTC 4623 - Polymer Physics and Properties
This elective 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 behaviour, tensile, flexural and impact properties. Long term tests using creep deformation are 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.

SKTC 4633 - Polymer Rheology and Processing
This elective course introduces to the students to some major theories in polymer rheology and processing, the application of rheology in polymer processing. Basic principles of extrusion, injection moulding and other major processing methods are introduced and their theoretical information also described in detail. Rheological topics include fundamental flow properties, Newtonian and non-Newtonian analyses, and methods of determination of rheological properties of polymer melts and solutions, structure-flow behaviour relationships, viscoelastic fluid theory and the relationship with polymer processing. Polymer processing describes the rheological application to extrusion, injection moulding and other polymer processes. The basic mathematical modelling and engineering design analysis of extruder screws and injection moulds will also be described. Finally, final properties of polymer melts will be analysed and steps by steps method will be explored to solve any defects and problems.

5. Advanced Chemical Engineering

SKTC 4213 - Advanced Chemical Reaction Engineering
The elective course focuses on evaluating reaction performance (rate of reaction, conversion, concentration, and profile of reactant and product) for mass-transfer-limited reactions. Students will learn the basic principles of external and internal diffusion by applying Fick's law to a mass-transfer-limited reaction. Students will learn to incorporate diffusivity and mass transfer coefficients into the concentration profile and reaction rate equations. In this course, students will be exposed to the utilization of the residence time distribution (RTD) function as a tool for reactor performance diagnostics. The concepts of RTD function will be applied to the reactor performance predictions. This will include understanding the mixing efficiency, flow patterns, dead zones, residence time, and reactant conversion in multiphase reactors. Students will be given an integrated project on the simulation of reaction profiles for various multiphase reactors. This will be done using computer simulation tools.

SKTC 4223 - Computational Methods in Chemical Engineering
The main objective of this elective course is to provide the students with the opportunity to improve their problem solving skills in chemical engineering using MATLAB as a tool. This course includes the coverage of basic and advanced application of MATLAB software to solve problems arising in chemical engineering which involve numerical operations like systems 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.

SKTC 4233 - Separation Technology for Industrial Applications
The elective course intends to develop comprehensive understanding on various type of separation process technology applied in industry, including the fundamental concept and theories underlying each technology.

SKTU 5113 - Research Methodology
This PRISMS elective course aims to equip students with the essential knowledge and skills to do research and dissertation systematically. This course has 8 modules which will be conducted through a weekly 3-hour seminar. Each seminar will consist of a lecture, discussion and workshop. In the end of course, students need to produce a research proposal and have a mini conference as part of assessment and proposal presentation practice.

MAPPING OF COURSES TO PROGRAMME LEARNING OUTCOMES FOR BACHELOR OF CHEMICAL ENGINEERING WITH HONOURS

		PROGRAMME LEARNING OUTCOMES										
		Engineering Knowledge	Problem Analysis	Design/ Development of solution	Investigation	Tool Usage	The Engineer and Society	Ethics	Individual and Collaborative Team Work	Communication	Project Management and Finance	Life Long Learning
Course Code	**Course Name**	**PLO1**	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**
PROGRAMME CORE COURSES												
SKTC 1511	Industrial Seminar and Profession						/	/		/		/
SKTC 1523	Introduction to Engineering	/	/						/	/		
SKTC 1533	Introduction to Computer Programming	/				/						/
SKTC 1213	Statics and Mechanics of Materials	/	/				/					
SKTC 1111	Engineering Drawing					/			/			
SKTC 1123	Mass Balance	/	/									/
SKTC 1613	Material Science for Engineers	/	/				/		/			
SKTC 1623	Thermodynamics	/	/						/			
SKTU 2143	Fluid Mechanics	/	/							/		
SKTC 2133	Energy Balance	/	/									/
SKTC 2142	Chemical Engineering Simulation			/		/			/			
SKTC 2223	Chemical Engineering Thermodynamics	/	/			/			/			
SKTU 2711	Thermodynamics and Material Engineering Laboratory				/				/	/		
SKTC 2313	Heat and Mass Transfer	/										/
SKTC 2543	Numerical Method and Optimization	/	/			/			/			
SKTC 2233	Chemical Reaction Engineering		/	/			/					
SKTU 2721	Fluid Mechanics Laboratory				/				/	/		
SKTC 3323	Separation Process		/	/					/			
SKTC 3333	Engineering Economics and Project Management	/									/	

SKTC 3413	Environmental Engineering and Sustainability	/		/			/		/			
SKTC 3343	Unit Operation and Industrial Processes		/							/		/
SKTC 3554	Process Control and Instrumentation		/			/			/	/		
SKTC 3731	Chemical Reaction Laboratory			/	/					/		
SKTC 3741	Pollution Control Laboratory			/	/					/		
SEEU 2003	Electrical Technology											
SKTC 3812	Final Year Project I		/	/	/					/		/
SKTC 3915	Industrial Training							/	/	/		/
SKTC 4153	Process Design		/	/				/				
SKTC 4562	Occupational Safety and Health in Industry						/	/		/		
SKTU 4751	Process Control Laboratory			/	/	/				/		
SKTC 4761	Separation Processes Laboratory			/	/					/		
SKTC 4832	Plant Design Project I		/	/		/	/		/	/	/	
SKTC 4824	Final Year Project II		/		/	/				/		/
SKTC 4163	Plant Design		/	/			/					/
SKTC 4573	Process Safety and Operability						/	/	/			
PROGRAMME ELECTIVE COURSE (CHOOSE 3 COURSES ONLY)												
SKTC 4113	Sustainable Energy Management Systems		/	/			/					/
SKTC 4123	Thermal Energy Management and Audit	/	/						/			/
SKTC 4133	Energy Planning for Sustainable Development	/				/	/					/
SKTC 4143	Energy Integration and Resource Conservation			/		/			/		/	/
SKTC 4213	Advanced Chemical Reaction Engineering		/	/						/		/
SKTC 4223	Computational Methods in Chemical Engineering		/			/				/		/
SKTC 4233	Separation Technology for Industrial Applications	/			/	/			/			
SKTC 4413	Waste Management	/		/					/			/
SKTC 4423	Environmental Management	/		/				/				
SKTC 4433	Environmental Sustainability		/				/	/		/		
SKTC 4513	Safety Management System	/								/		/
SKTC 4523	Industrial Hygiene						/			/		/
SKTC 4533	Human Factors and Ergonomics	/	/							/		/

SKTC 4613	Introduction to Polymer	/								/		/
SKTC 4623	Polymer Physic and Properties	/								/		/
SKTC 4633	Polymer Rheology and Processing	/								/		/

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 coursework and final examination given throughout the semester.

Programme Uniqueness

Various courses in the programme incorporate the following elements:

Elements	Courses
Sustainable Development Goals (SDG)	
SDG1: No Poverty	SKTU 3643 - Engineering Economics and Project Management
SDG3: Good Health and Well-being	SKTU 3283 - Process Control and Instrumentation SKTU 3293 - Safety and Health in Chemical and Related Industries SKTB 4243 - Biopharmaceutical Engineering
SDG6: Clean Water and Sanitation	SKTU 3273 - Environmental Engineering and Sustainability SKTB 4223 - Environmental Biotechnology for Engineers
SDG7: Affordable and Clean Energy	SKTB 4253 - Green Energy Engineering
Artificial-Intelligence and Digitalisation	SKTB 2323 - Programming and Robotics for Bioprocess Engineering SKTB 5173 - Introduction to Digital Transformation in the Process Industry
Work-Based Learning	SKTB 1313 - Introduction to Chemical and Bioprocess Engineering SKTB 3815 - Industrial Training SKTB 4534 - Plant Design Project

Service Learning	SKTU 3643 - Engineering Economics and Project Management
EXCEL Framework	Research Infused Experiential Learning (REAL)
Level 1: Research Oriented	SKTB 1313 - Introduction to Chemical and Bioprocess Engineering SKTB 1163 - Statics and Biomaterials SKTU 1213 - Material Balance SKTU 1133 - Thermodynamics SKTU 2223 - Energy Balance
Level 2: Research Immersion	SKTB 1633 - Microbiology for Engineers SKTB 2643 - Biochemistry and Bioinformatics SKTB 2653 - Bioengineering Molecular Systems SKTB 3761 - Bioprocess Engineering Laboratory: Upstream SKTB 3771 - Bioprocess Engineering Laboratory: Downstream SKTU 3731 - Pollution Control and Chemical Reaction Engineering Laboratory
Level 3: Research Apprentice	SKTB 3662 - Statistics for Engineers SKTB 4**3 - Bioprocess Elective Courses SKTB 5**3 - Bioprocess PRISMS Elective Courses SKTU 3263 - Separation Processes SKTU 2243 - Mass and Heat Transfer SKTU 3741 - Separation Processes Laboratory SKTU 4751 - Process Control Laboratory
Level 4: Research Intensive	SKTB 3512 - Undergraduate Project 1 SKTB 4254 - Undergraduate Project 2 SKTB 4373 - Plant Design SKTB 4534 - Plant Design Project

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. Programme Award	Bachelor of Chemical Engineering (Bioprocess) with Honours
5. Curriculum Review Approval by MOHE	JPT(A)1000/021/011/01 JLD 14 (15) 20th February 2025
6. National Education Code (NEC)	0711 (Chemical Engineering and Processes)
7. Programme Code	SKTBH
8. Professional or Statutory Body of Accreditation	Board of Engineers Malaysia (BEM)
9. Language(s) of Instruction	English and Bahasa Melayu
10. Mode of Study	Conventional
11. Mode of Operation	Self-govern
12. Method of Study	Full Time
13. Duration of Study	Minimum : 4 years Maximum : 6 years

Type of Semester	No. of Semesters		No. of Lecture 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	 6 6 2 2	11.8%
ii.	Programme Core	110	81.5%
iii.	Electives (a) Programme Electives (b) Free Electives	 6 3	6.7%
	Total	**135**	**100%**
A	Engineering Courses (a) Lecture (b) Laboratory (c) Industrial Training (d) Final Year Project (e) Integrated Design Project	 78 8 5 6 4	74.8%
Total Credit Hours for Part A		**101**	
B	Related Courses (a) Applied Science/ Mathematics/ Computer/ Technology (b) Management/ Law/ Humanities/ Ethics/ Entrepreneur (c) Language (d) Co-Curriculum (e) Free Electives	 15 8 6 2 3	25.2%
Total Credit Hours for Part B		**34**	
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)

COURSE MENU

YEAR 1: SEMESTER 1			
Code	**Course**	**Credit**	**Prerequisite**
SKTB 1633	Microbiology for Engineers	3	
SKTU 1111	Engineering Drawing	1	
SKTB 1313	Introduction to Chemical and Bioprocess Engineering	3	
SKTB 1163	Statics and Biomaterials@	3	
SSCE 1693	Engineering Mathematics I	3	
ULRS 1032	Integrity And Anti-Corruption Course	2	
UHLB 1112	English Communication Skills	HW	
	TOTAL CREDIT	**15**	
	CUMULATIVE CREDITS	**15**	

Note: UHLB 1112 - Please refer to English Prerequisite Section for details.

YEAR 1: SEMESTER 2			
Code	**Course**	**Credit**	**Prerequisite**
SKTU 1213	Material Balance*@	3	
SKTU 1133	Thermodynamics@	3	
SKTU 1612	Fundamental of Electrical Technology	2	
SKTU 1623	Organic Chemistry and Analytical Chemistry for Engineers	3	
SKTU 2711	Thermodynamics and Material Engineering Laboratory	1	
SSCE 1993	Engineering Mathematics II	3	
ULRS 1182	Appreciation of Ethics and Civilizations (for Local Students)	2	
UHLM 1012	Malay Language Communication 2 (for International Students)		
	TOTAL CREDIT	**17**	
	CUMULATIVE CREDITS	**32**	

YEAR 2: SEMESTER 1			
Code	**Course**	**Credit**	**Prerequisite**
SKTB 2323	Programming and Robotics for Bioprocess Engineering	3	
SKTU 2223	Energy Balance*@	3	SKTU 1213
SKTB 2173	Fluid Mechanics@	3	
SKTB 2643	Biochemistry and Bioinformatics	3	SKTB 1633
SSCE 1793	Differential Equations	3	
ULRF 2**2	Service Learning and Community Engagement Courses	2	
	TOTAL CREDIT	**17**	
	CUMULATIVE CREDITS	**49**	

YEAR 2: SEMESTER 2			
Code	**Course**	**Credit**	**Prerequisite**
SKTU 2633	Chemical Engineering Computation	3	
SKTU 2233	Chemical Engineering Thermodynamics	3	SKTU 1133
SKTU 2243	Mass and Heat Transfer*	3	SKTU 2223
SKTB 2653	Bioengineering Molecular Systems	3	SKTB 1633
SSCK 1891	Analytical Chemistry Practical	1	SKTU 1623
SKTU 2721	Fluid Mechanics Laboratory	1	SKTB 2173
ULRS 1022	Philosophy and Current Issues	2	
UHLB 2122	Professional Communication Skills 1	2	
	TOTAL CREDIT	**18**	
	CUMULATIVE CREDITS	**67**	

YEAR 3: SEMESTER 1			
Code	**Course**	**Credit**	**Prerequisite**
SKTU 3263	Separation Processes*	3	SKTU 2243
SKTU 3273	Environmental Engineering and Sustainability	3	
SKTU 3643	Engineering Economics and Project Management	3	
SKTU 3293	Safety and Health for Chemical and Related Industries	3	
SKTB 3761	Bioprocess Engineering Laboratory: Upstream	1	
UHLB 3132	Professional Communication Skills 2	2	UHLB 2122
UHL* 1112	Foreign Language for Communication	2	
	TOTAL CREDIT	**17**	
	CUMULATIVE CREDITS	**84**	

YEAR 3: SEMESTER 2			
Code	**Course**	**Credit**	**Prerequisite**
SKTU 3283	Process Control and Instrumentation*	3	SSCE 1793 SKTU 3263
SKTU 3253	Chemical Reaction Engineering	3	SKTU 2223
SKTB 3373	Bioreactor Design and Analysis	3	
SKTB 3512	Undergraduate Project I**	2	
SKTB 3771	Bioprocess Engineering Laboratory: Downstream	1	
SKTB 3662	Statistics for Engineers	2	
ULRS 3032	Entrepreneurship and Innovation	2	
	TOTAL CREDIT	**16**	
	CUMULATIVE CREDITS	**100**	

YEAR 3: SEMESTER 3			
Code	**Course**	**Credit**	**Prerequisite**
SKTB 3815	Industrial Training	5	
	TOTAL CREDIT	**5**	
	CUMULATIVE CREDITS	**105**	

YEAR 4: SEMESTER 1			
Code	**Course**	**Credit**	**Prerequisite**
SKTB 3343	Bioseparation Technology	3	
SKTB 4524	Undergraduate Project II**	4	SKTB 3512#
SKTB 4373	Plant Design*	3	SKTU 3283
SKTU 3731	Pollution Control and Chemical Reaction Engineering Laboratory	1	SKTU 3253 SKTU 3273
SKTU 3741	Separation Processes Laboratory	1	SKTU 3263
SKTB 4**3	Bioprocess Engineering Elective I	3	
SKT* 5**3	PRISMS Elective I		
S*** ***3	Free Elective[1]	3	
	TOTAL CREDIT	**18**	
	CUMULATIVE CREDITS	**123**	

[1]*Note: Free Elective is a course offered by other Faculties.*

YEAR 4: SEMESTER 2			
Code	**Course**	**Credit**	**Prerequisite**
SKTB 4534	Plant Design Project**	4	SKTB 4373 SKTU 3293
SKTB 4383	Quality Management in Biomanufacturing	3	
SKTB 4391	Industrial and Career Seminar	1	
SKTU 4751	Process Control Laboratory	1	SKTU 3283
SKTB 4**3	Bioprocess Engineering Elective II	3	
SKT* 4**3	Elective Course		
SKT* 5**3	PRISMS Elective II		
	TOTAL CREDIT	**12**	
	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 UHLB 1112 course if the English prerequisite is not fulfilled.

ENGLISH PREREQUISITE
a) MUET : $\geq$ Band 4.0 b) IELTS : $\geq$ Band 5.5 c) TOEFL: $\geq$ 525 d) TOEFL iBT : $\geq$ 60 e) CEFR : $\geq$ B2 f) CEQ : $\geq$ 160 g) CIEP-ELS : $\geq$ 108 h) PTE : $\geq$ 51

BIOPROCESS ELECTIVE COURSES
SKTB 4413 - Food Process Engineering
SKTB 4423 - Environmental Biotechnology for Engineers
SKTB 4433 - Bioproduct Development and Processing
SKTB 4443 - Biopharmaceutical Engineering
SKTB 4453 - Green Energy Engineering
SKTB 4463 - Tissue Culture and Cell Engineering
SKTB 4473 - Science and Engineering of Biopolymer
SKTU 5113 - Research Methodology

ELECTIVE COURSE (SKT* 43)**
Students may enrol in any Elective Course offered by any Undergraduate Programme in FKT.

PRISMS ELECTIVE COURSES
For students who intend to enrol 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 ENGINEERING (BIOPROCESS) COURSES					
1	SKTU 1111	Engineering Drawing	1	1	
2	SKTB 1313	Introduction to Chemical and Bioprocess Engineering	3	3	
3	SKTB 1163	Statics and Biomaterials	3	3	
4	SKTU 1133	Thermodynamics	3	3	
5	SKTU 1213	Material Balance	3	3	
6	SKTB 1633	Microbiology for Engineers	3	3	
7	SKTB 2323	Programming and Robotics for Bioprocess Engineering	3	3	
8	SKTU 2223	Energy Balance	3	3	
9	SKTB 2173	Fluid Mechanics	3	3	
10	SKTU 2721	Fluid Mechanics Laboratory	1	1	
11	SKTU 2633	Chemical Engineering Computation	3	3	
12	SKTU 2233	Chemical Engineering Thermodynamics	3	3	
13	SKTU 2243	Mass and Heat Transfer	3	3	
14	SKTU 2711	Thermodynamics and Material Engineering Laboratory	1	1	
15	SKTB 2643	Biochemistry and Bioinformatics	3	3	
16	SKTB 2653	Bioengineering Molecular Systems	3	3	
17	SKTU 3253	Chemical Reaction Engineering	3	3	
18	SKTU 3263	Separation Processes	3	3	
19	SKTU 3273	Environmental Engineering and Sustainability	3	3	
20	SKTU 3731	Pollution Control and Chemical Reaction Engineering Laboratory	1	1	
21	SKTB 3761	Bioprocess Engineering Laboratory: Upstream	1	1	
22	SKTB 3343	Bioseparation Technology	3	3	

23	SKTB 3373	Bioreactor Design and Analysis	3	3	
24	SKTB 3512	Undergraduate Project I	2	2	
25	SKTU 3741	Separation Processes Laboratory	1	1	
26	SKTU 3283	Process Control and Instrumentation	3	3	
27	SKTB 3771	Bioprocess Engineering Laboratory: Downstream	1	1	
28	SKTU 3643	Engineering Economics and Project Management	3	3	
29	SKTB 3662	Statistics for Engineers	2	2	
30	SKTU 3293	Safety and Health in Chemical and Related Industries	3	3	
31	SKTB 3815	Industrial Training (YEAR 3/SHORT SEM.) for 12 weeks/3 months	5	HL	
32	SKTU 4751	Process Control Laboratory	1	1	
33	SKTB 4524	Undergraduate Project II	4	4	
34	SKTB 4373	Plant Design	3	3	
35	SKTB 4534	Plant Design Project	4	4	
36	SKTB 4391	Industrial and Career Seminar	1	1	
37	SKTB 4383	Quality Management in Biomanufacturing	3	3	
38	SKTB 4**3	Bioprocess Engineering Elective I	3	3	
	SKT* 5**3	PRISMS Elective I			
39	SKTB 4**3	Bioprocess Engineering Elective II	3	3	
	SKTB 5**3	PRISMS Elective II			
	SKT* 4**3	Elective Course			
		TOTAL CREDIT OF CHEMICAL ENGINEERING (BIOPROCESS) COURSES (a)	**101**	**96**	
APPLIED SCIENCE/ MATHEMATICS/ COMPUTER/ TECHNOLOGY COURSES					
1	SSCE 1693	Engineering Mathematics I	3	3	
2	SSCE 1993	Engineering Mathematics II	3	3	
3	SSCE 1793	Differential Equations	3	3	
4	SKTU 1612	Fundamental of Electrical Technology	2	2	
5	SKTU 1623	Organic Chemistry and Analytical Chemistry for Engineers	3	3	
6	SSCK 1891	Analytical Chemistry Practical	1	1	

		TOTAL CREDIT OF APPLIED SCIENCE/ MATHEMATICS/ COMPUTER/ TECHNOLOGY COURSES (b)	**15**	**15**	
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 1032	Integrity and Anti-Corruption Course	2	2	
Global Citizen					
1	ULRF 2**2	Service Learning and Community Engagement	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	Foreign Language for Communication	2	2	
Enterprising Skills					
1	ULRS 3032	Entrepreneurship and Innovation	2	2	
Free Elective					
1	S*** ***3	Free 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 and 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 School of Undergraduate Studies (UGS). Information on PSC Courses: https://ugs.utm.my/utm-professional-skills-certificate-utm-psc/ Online PSC Registration: https://elearnpsc.utmspace.edu.my/			

COURSE SYNOPSIS

CORE COURSES

SKTU 1111 - 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. The course covers the topics of introduction and fundamentals of engineering drawing, geometry, orthographic, isometric, and sectional drawing. The course also gives exposure on 3D drawing to the students. All the drawings are to be constructed using AutoCAD software. Besides that, this course also requires students to work in teams in order to complete the projects assigned to them.

SKTB 1313 - Introduction to Chemical and Bioprocess Engineering

The objective of this core course is to introduce engineering and prepare students for learning engineering 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 covers the overview of engineering, the profession and its requirements in the Malaysian scenario, communication (oral and written), teamwork skills, learning styles, and time management, basic calculations of common process variables and unit conversions, project-based learning on sustainable development, creating engineering graph and solving simple iterative problems using Excel, and introduction to engineering ethics. This course employs Cooperative Learning (CL) and groom students with skills for

Cooperative Project-based Learning (CPBL). Work-based learning (WBL) is also embedded in this course.

SKTB 1163 - Statics and Biomaterials
This core course is an introduction to statics and biomaterials science. This course is divided into three parts. The first part of the course focuses on the basic principle of static. Focus will be on the analysis of particle and rigid body in static. These include the resultant and resolution of forces 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 of the course deals with the basic knowledge on mechanics of materials. Topics covered include introduction to the concept of stress, deformation of members under axial loading and analysis of beams for bending. In the third part of this course, special emphasis will be given to the fundamental of materials science and their interaction with biochemical environment. Chapters covered include introduction to biomaterials, characterization of materials, implant materials, structure- property relationships of biological materials, and advance applications of biomaterials in bioprocess engineering fields.

SKTB 1633 - Microbiology for Engineers
This course aims to provide engineering students with a strong foundation in fundamental microbiology. The overall concept of this course is about exploring the microbial world and life, its interaction with host and environment as well as its application. Additionally, students will gain insight into essential methodologies within microbiological research. Topics covered include microbial diversity and classification, growth and regulation, metabolic processes, genetics, ecology, the fundamentals of microbial diseases and immunology, environmental and applied microbiology, as well as basic microbiological techniques and computations.

SKTU 1213 - Material 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.

SKTU 1133 - 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 engineering subjects.

SKTB 2323 - Programming and Robotics for Bioprocess Engineering
The content of this course is divided into two parts. In the first part of the course, the focus is primarily on the training on the use of C programming language for chemical engineers whom has no or little experience of using compiled computer languages. Next, focus will shift on the introduction of Arduino data acquisition device where students will be taught on how to utilize

basic C programming language to operate Arduino for work related to chemical engineering field. In the second part of the course, focus will be on the use of basic robotic device (including drones) for application on the work related to chemical engineering field. One who completed the course will have the ability to (1) use C programming language for simple input/out functions and application of control loops at specific conditions, (2) apply Arduino for simple sensing and control applications, and (3) apply Robotic device for simple sensing and identification tasks in the field of chemical engineering.

SKTU 2223 - Energy Balance
Prerequisite: SKTU 1213 (taken)
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 energy balance problems for chemical process systems and equipment.

SKTB 2173 - Fluid Mechanics
This core course will introduce the fundamental principles for fluid mechanics in chemical and bioprocess engineering. The course covers the physics of fluid, classification of flow, fluid statics, fluid dynamics, the application of Bernoulli's, continuity, and momentum equations, friction flow in pipes includes the use of Moody chart, flow metering, pump, dimensional analysis and similarity. Examples of bioprocess applications in fluid mechanics are flow of biological fluids and mixing of bioreactors.

SKTU 2721 - Fluid Mechanics Laboratory
Prerequisite: SKTB 2173 (taken)
The aim of this laboratory course is for students to conduct experiments in conjunction with the theory course SKTB 2173 (Fluid Mechanics). This will give a hands-on experience to the students on handling the equipment and interpreting the data taken from the experiments. In this course, apart from the guided experiments, students will have the opportunity to design their own experiments in the open-ended experiments. Students will be assessed by their design of experimental methodology, skills in handling the equipment, and ability to discuss and analyse the results in the report submitted. The lab runs closely with the lectures' invigilation and is based on the prior knowledge of the Prerequisite course.

SKTU 2633 - Chemical Engineering Computation
This course introduces students to some numerical techniques in solving chemical engineering problems that cannot be solved analytically. Students will be exposed to the numerical solution for root of equation, simultaneous algebraic equations, 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.

SKTU 2233 - Chemical Engineering Thermodynamics
Prerequisite: SKTU 1133 (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.

SKTU 2243 - Mass and Heat Transfer
Prerequisite: SKTU 2223 (taken)
This course introduces students to the basic principles and application of heat and mass transfer in chemical engineering. The understanding from this course is useful for the better understanding in distillation, absorption, liquid-liquid extraction, membrane separation, leaching, evaporation and others chemical processes.

SKTU 2711 - Thermodynamics and Materials Engineering Laboratory
Prerequisite: SKTU 1133, SKTB 1163 (taken)
This laboratory course covered basic concepts in Thermodynamics and Strength of Material. Laboratory experiments are designed for hand-on experience to understand the engineering principles and are divided into two methods of learning; guided experiment and open-ended experiment. The experiments 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' observation and arguments of each experiment must be reported in proper format.

SKTB 2643 - Biochemistry and Bioinformatics
Prerequisite: SKTB 1633 (taken)
This course delves into the intricate metabolic pathways and cellular systems that govern the biochemical processes within living organisms. Students will explore the dynamic interactions between molecules, enzymes, and cellular structures that regulate metabolism, energy production, and cellular functions. The course emphasizes the integration of biochemical principles with cellular physiology and molecular biology to understand how metabolic pathways are regulated and coordinated to maintain cellular homeostasis. Additionally, computational analysis using in silico tools such as Expasy Server, NCBI, STRING, and EMBL-EBI will be utilised to enhance students understanding of the cellular physiology. Through lectures and discussions sessions, students will examine key metabolic pathways, metabolic diseases, and experimental techniques used to study metabolic cellular systems.

SKTB 2653 - Bioengineering Molecular Systems
Prerequisite: SKTB 1633 (taken)
This course delves into the intersection of bioengineering and genetic innovations, exploring cutting-edge advancements and fundamental principles. In this course students will gain a comprehensive understanding of the transformative potential of bioengineering in genetic contexts. The course encompasses a range of topics, including fundamentals of molecular biology, synthetic biology, genetic engineering techniques, applications of genetic innovations as well as future directions and emerging trends of molecular technology such as AI tools in biology. Throughout the course, students will be engaged in case studies and discussions to reinforce theoretical concepts and develop practical skills in bioengineering and genetic

innovations. By the end of the course, students will be equipped with the knowledge and skills to critically analyse genetic problems, design innovative solutions, and contribute to advancements in the field of molecular bioengineering.

SKTU 3253 - Chemical Reaction Engineering
Prerequisite: SKTU 2223 (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 computational tools.

SKTU 3263 - Separation Processes
Prerequisite: SKTU 2243 (taken)
This course introduces different types of unit operations involved in the chemical, bioprocess and other physical processing industries. Separation processes such as drying, humidification, absorption, distillation, liquid-liquid extraction and solid-liquid extraction (leaching) are covered which also include design of separation operations using mass transfer principles.

SKTU 3273 - Environmental Engineering and Sustainability
This course introduces the cause, effect and method to control pollution from industries. The course covers 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 wastewater discharge, and techniques to treat wastewater discharging to environment. The second part of the course covers the source and effect of air pollution, regulations requirement for air pollution control, technology to control air pollution emissions from industries. The last part covers the management of industrial waste that includes definition of scheduled waste, scheduled waste regulations, and technique to manage the waste.

SKTU 3731 - Pollution Control and Chemical Reaction Engineering Laboratory
Prerequisite: SKTU 3253, SKTU 3273 (taken)
This laboratory course contains experiments that covers the basic 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.

SKTB 3761 - 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.

SKTB 3771 - Bioprocess Engineering Laboratory: Downstream

In this core laboratory course, students will 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 bio-products. The experiments performed are basic principles of bioreactor and fermentation process, cell immobilization, yeast homogenization, ball mill application for protein extraction, and enzyme kinetics.

SKTB 3343 - Bioseparation Technology

This core course provides an overview of the various bioseparation processes involved in the production of bioproducts. There are many different techniques by which bioseparation can be achieved in the practice of purifying biological products on a large-scale, using fundamental aspects of engineering and scientific principles. Besides, the comparison between the conventional and current practice in industrial based on the unique natures of biomolecules are introduced. This course also covers the fundamental design concepts of various bioseparation operations involving solids, liquid, and gas processing based on the RIPP scheme (Recovery, Isolation, Purification, Polishing).

SKTB 3373 - Bioreactor Design and Analysis

This core course introduces students to analyse the bioreactor functions so that the intended fermentation performance can be achieved. It emphasizes on mass balances on growth and product formation, kinetics of three main operation modes, oxygen transfers 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. One who completed this course should be able to identify factors that bottleneck the fermentation performance, and accurately apply the right approach to solve them, and able to design and scale up a bioreactor for optimal production.

SKTB 3512 - Undergraduate Project I

This core course is the first stage of the Undergraduate Project, and it consists of preliminary studies and planning for how to carry out the study allocated to the students. It is intended to provide students with experience in preparing a research proposal. It will focus on research philosophy and methodology. The tasks include conducting a literature review, developing a problem statement, identifying the scope, and determining objectives, and methods. At the end of the course, students should be able to prepare a research proposal in a professional setting. Students should also be able to manage and plan their research based on the time given.

SKTU 3741 - Separation Processes Laboratory

Prerequisite: SKTU 3263 (taken)

This subject introduces students to the equipment in the separation processes discussed in Separation I subject. This will give a ‘hands on’ experience to the students how to handle the equipment 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 equipment involved in the chemical/bio-process industries such as liquid-liquid extraction and heat exchanger. Students will be assessed by their performance in the report submitted and by a test that will be conducted at the end of the course after the students have all completed the experiments.

SKTU 3283 - Process Control and Instrumentation
Prerequisite: SSCE 1793, SKTU 3263 (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 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).

SKTU 3643 - Engineering Economics and Project Management
This course covers both Engineering Economics and Project Management. Engineering economics focuses on evaluating different alternatives and making decisions based on economic factors. These decisions involve the fundamental elements of cash flows of money, time, and interest rates. Project Management is the art of planning, scheduling, and controlling project operations to accomplish performance, cost, time, and objectives for a specified scope of work while efficiently and effectively using resources.

SKTU 3293 - Safety and Health in Chemical and Related Industries
This course intends to provide an overview and basic knowledge of occupational safety and health (OSH) at work as well as process safety of chemical industries. 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. Besides, students will also be exposed to process safety related methods e.g. HAZOP and risk assessment. At the end of this course, it is expected that the students will be able to appreciate the legal requirements, theoretical and practical aspect of OSH in industry and its impact to surrounding public community. It is also expected that students are capable of applying HAZOP in their plant design project.

SKTB 3815 - Industrial Training
The purpose of implementing a 12-week industry training program is to provide UTM students with first-hand experience on the practical aspects and work practices within the industry. Throughout the program, students will be able to apply their theoretical knowledge with real-world applications, while also enhancing their abilities in work ethics, management, communication, and interpersonal relationships.

SKTB 4391 - Industrial and 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.

SKTB 4524 - Undergraduate Project II

Prerequisite: SKTB 3512 (pass with at least D+)

This core course is a second stage of the Undergraduate Project, which involves doing experimental work /studies and discussing the results of the project. It is designed to expose students in writing a research report. It will emphasize on the research philosophy and research methodology. The works include conducting literature review, writing a problem statement, identifying the research scopes and objectives, conducting experimental work, analysing data 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.

SKTB 4373 - Plant Design

Prerequisite: SKTU 3283 (taken)

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 safety factor. Selection of reactor design, selection of separator design, reaction-separation system synthesis and heat exchanger network synthesis, process safety, and waste minimisation.

SKTB 4534 - Plant Design Project

Prerequisite: SKTB 4373, SKTU 3293, SKTU 3273, SKTU 3643 (taken)

The plant design project is a core course 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 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 and bioprocess engineering required to design a process plant. Students will also learn the technique of writing a comprehensive technical plant design report.

SKTB 4383 - Quality Management in Biomanufacturing

This core course highlights the importance of a quality system in biomanufacturing 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), other relevant standards and regulations for pharmaceutical, cosmetic and food industries. A clear organization structure with well-defined objectives and well-organized documentation system will ensure the competence of staffs and validity of product specifications for quality assurance. The introduction of this course will equip students with the knowledge of quality system applicable in various biomanufacturing industries.

SKTU 4751 - Process Control Laboratory

Prerequisite: SKTU 3283 (taken)

This course exposes students to topics involving 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 method for specific processes. This course also includes the application of programable logic control and distributed control system program to automatically control chemical processes. Students will gain hands-on experience in process control through open-ended experiments that employ pilot-scale chemical processes.

BIOPROCESS ELECTIVE COURSES AND BIOPROCESS PRISMS ELECTIVE COURSES

SKTB 4413 - Food Process Engineering

This elective 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.

SKTB 4423 - Environmental Biotechnology for Engineers

This elective 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.

SKTB 4433 - Bioproduct Development and Processing

This elective 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.

SKTB 4443 - Biopharmaceutical Manufacturing

This elective 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.

SKTB 4453 - Green Energy Engineering
This elective course introduces the fundamental principles and concepts in understanding green energy and bioenergy/biofuels systems. Fundamental concepts in understanding renewable energy such as solar thermal and photovoltaic, wind, osmotic power, biofuels/bioenergy systems; renewable feedstocks, thermochemical conversion of biomass to heat, power and fuel; biochemical conversion of biomass to fuel such biogas, alcohol, biodiesel and hydrogen; fuel cell and microbial fuel cell will be introduced.

SKTB 4463 - Tissue Culture and Cell Engineering
This elective course introduces students to some major principles, concepts, and applications of tissue culture and cell engineering. It also provides students with the approach of culturing tissue and cells for both therapeutic and scientific purposes, as well as a broader understanding of the challenges of producing tissue-engineered products and their ethical and regulatory issues.

SKTB 4473 - Science and Engineering of Biopolymer
This elective course introduces students to biopolymers, including their types, applications, and processing. They will also understand that the way the component parts are put together determines how biological processes work. The distinctive quality of biopolymers is that their molecular structures exhibit a hierarchy, and their biological functions virtually naturally arise from these structures. Additionally, the students can study biodegradation and the latest findings on biopolymers. Lectures, assignments, quizzes, and student-presented review papers are all part of the curriculum.

SKTU 5113 - Research Methodology
This PRISMS elective course aims to equip students with the essential knowledge and skills to conduct research and prepare dissertation systematically. This course has 8 modules which will be conducted through weekly 3-hour seminar. Each seminar consists of a lecture, discussion and workshop. In the end of the course, students need to produce a research proposal and have a mini conference as part of the assessment and proposal presentation practice.

SKTB 5163 - Introduction to Professional Halal Executive
This elective course is designed for Halal Executive or Halal Consultants that will guide organisation to get Halal Certification. It is one of the requirements for a company to have a dedicated Halal Executive for them to comply to the new Malaysia Halal Standard. This course is also to produce Halal Executive equipped with theoretical knowledge and practical skills to assist organisation to meet the Halal Standards and compliance employing practical methods, techniques, procedures, technology and tools.

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	Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team Work	Communication	Project Management and Finance	Life Long Learning
COURSE CODE	**COURSE NAME**	**PLO 1**	**PLO 2**	**PLO 3**	**PLO 4**	**PLO 5**	**PLO 6**	**PLO 7**	**PLO 8**	**PLO 9**	**PLO 10**	**PLO 11**
PROGRAMME CORE COURSES												
SKTB 1313	Introduction to Chemical and Bioprocess Engineering	/						/	/	/	/	
SKTU 1111	Engineering Drawing					/				/		
SKTB 1163	Statics and Biomaterials	/								/		
SKTU 1213	Material Balance	/	/									/
SKTU 1133	Thermodynamics	/	/						/			
SKTB 1633	Microbiology for Engineers			/	/				/			
SKTU 1612	Fundamental of Electrical Technology	/							/			/
SKTU 1623	Organic Chemistry and Analytical Chemistry for Engineers	/							/			
SKTB 2323	Programming and Robotics for Bioprocess Engineering					/						
SKTU 2223	Energy Balance	/	/						/			
SKTB 2173	Fluid Mechanics	/	/							/		
SKTB 2643	Biochemistry and Bioinformatics			/	/	/			/			
SKTU 2633	Chemical Engineering Computation	/				/						
SKTU 2233	Chemical Engineering Thermodynamics	/							/			
SKTU 2243	Mass and Heat Transfer	/										/
SKTU 2711	Thermodynamics and Material Engineering Laboratory				/				/	/		
SKTU 2721	Fluid Mechanics Laboratory				/				/	/		
SKTB 2653	Bioengineering Molecular Systems			/	/	/						
SKTU 3253	Chemical Reaction Engineering		/			/	/					
SKTU 3263	Separation Processes	/		/		/						
SKTU 3273	Environmental Engineering and Sustainability	/					/	/				

COURSE CODE	COURSE NAME	PROGRAMME LEARNING OUTCOMES (PLO)										
		Engineering Knowledge	Problem Analysis	Design/Development of Solution	Investigation	Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team Work	Communication	Project Management and Finance	Life Long Learning
		PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO 10	PLO 11
SKTB 3761	Bioprocess Engineering Laboratory I: Upstream	/	/						/	/		
SKTB 3343	Bioseparation Technology	/	/						/	/		
SKTU 3283	Process Control and Instrumentation	/	/						/			
SKTU 3643	Engineering Economics and Project Management	/	/								/	
SKTB 3512	Undergraduate Project 1		/	/	/					/		/
SKTB 3771	Bioprocess Engineering Laboratory II: Downstream		/		/				/	/		
SKTU 3731	Pollution Control and Chemical Reaction Engineering Laboratory				/				/	/		
SKTB 3815	Industrial Training							/	/	/		/
SKTB 3662	Statistics for Engineers	/					/					
SKTB 3373	Bioreactor Design and Analysis	/		/								
SKTU 3293	Safety and Health in Chemical and Related Industries						/	/	/			
SKTU 3741	Separation Processes Laboratory				/				/	/		
SKTB 4524	Undergraduate Project 2		/	/	/					/		/
SKTB 4373	Plant Design	/	/	/					/	/		
SKTB 4391	Industrial and Career Seminar	/				/				/		/
SKTB 4534	Plant Design Project	/	/	/		/	/	/	/	/	/	/
SKTB 4383	Quality Management in Biomanufacturing				/			/		/		
SKTU 4751	Process Control Laboratory			/	/	/				/		
PROGRAMME ELECTIVE COURSES												
SKTB 4413	Food Process Engineering	/								/		/
SKTB 4423	Environmental Biotechnology for Engineers	/								/		/
SKTB 4433	Bioproduct Development and Processing				/					/		/

		PROGRAMME LEARNING OUTCOMES (PLO)										
		Engineering Knowledge	Problem Analysis	Design/Development of Solution	Investigation	Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team Work	Communication	Project Management and Finance	Life Long Learning
COURSE CODE	**COURSE NAME**	**PLO 1**	**PLO 2**	**PLO 3**	**PLO 4**	**PLO 5**	**PLO 6**	**PLO 7**	**PLO 8**	**PLO 9**	**PLO 10**	**PLO 11**
SKTB 4443	Biopharmaceutical Engineering	/		/	/					/		/
SKTB 4453	Green Energy Engineering		/							/		/
SKTB 4463	Tissue Culture and Cell Engineering			/	/					/		/
SKTB 4473	Science and Engineering of Biopolymer	/								/		/

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 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 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 coursework and final examination given throughout the semester.

Programme Uniqueness

Various courses in the programme incorporate the following elements:

Elements	Courses
Sustainable Development Goals (SDG)	
SDG1: No Poverty	SKTU 3643 - Engineering Economics and Project Management
SDG3: Good Health and Well-being	SKTG 4572 - Safety Instrumented Systems SKTU 3283 - Process Control and Instrumentation SKTU 3293 - Safety and Health in Chemical and Related Industries
SDG6: Clean Water and Sanitation	SKTU 3273 - Environmental Engineering and Sustainability
SDG7: Affordable and Clean Energy	SKTG 4313 - Carbon Capture, Utilisation and Storage SKTG 4323 - Sustainable Energy Transition
Artificial Intelligence	SKTG 4572 - Safety Instrumented Systems SKTG 2533 - Simulation and Programming SKTG 4373 - Machine Learning for Chemical Engineering
Work-Based Learning	SKTG 4434 - Plant Design Project
Service Learning	SKTU 3643 - Engineering Economics and Project Management
EXCEL Framework	Research Infused Experiential Learning (REAL)

Level 1: Research Oriented	SKTU 1213 - Material Balance SKTU 1133 - Thermodynamics SKTU 2223 - Energy Balance
Level 2: Research Immersion	SKTG 2523 - Combustion Engineering and Gas Utilisation SKTG 2533 - Simulation and Program SKTG 2771 - Combustion Engineering and Gas Utilisation Laboratory SKTU 3731 - Pollution Control and Chemical Reaction Engineering Laboratory
Level 3: Research Apprentice	SKTG 4581 - Gas Engineering Seminar SKTU 2243 - Mass and Heat Transfer SKTU 3263 - Separation Processes SKTU 3741 - Separation Process Laboratory SKTU 4751 - Process Control Laboratory
Level 4: Research Intensive	SKTG 3543 - Gas Storage System and Asset Integrity SKTG 3412 - Undergraduate Project I SKTG 4424 - Undergraduate Project II SKTG 4434 - Plant Design Project SKTG 4593 - Plant Design SKTG 4781 - Gas Flow System Laboratory

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.	Programme Award	Bachelor of Chemical Engineering (Gas) with Honours
5.	Curriculum Review Approval by MOHE	JPT(A)1000/021/011/01 JLD 14 (14) 26th November 2024
6.	National Education Code (NEC)	0711 (Chemical Engineering and Processes)
7.	Programme Code	SKTGH
8.	Professional or Statutory Body of Accreditation	Board of Engineers Malaysia (BEM)
9.	Language(s) of Instruction	English and Bahasa Melayu
10.	Mode of Study	Conventional
11.	Mode of Operation	Self-govern
12.	Method of Study	Full Time
13.	Duration of Study	Minimum : 4 years Maximum : 6 years

Type of Semester	No. of Semesters		No. of Lecture 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	 6 6 2 2	11.9%
ii.	Programme Core	107	79.2%
iii.	Elective (a) Programme Electives (b) Free Electives	 9 3	8.9%
	Total	**135**	**100%**
A	Engineering Courses (a) Lectures (b) Laboratory (c) Industrial Training (d) Final Year Project (e) Integrated Design Project	 76 7 5 6 4	72.6%
Total Credit Hours for Part A		**98**	
B	Related Courses (a) Applied Science/ Mathematics/ Computer/ Technology (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 Five (5) Professional Skill Certificates (PSC).

COURSE MENU

YEAR 1: SEMESTER 1			
Code	**Course**	**Credit**	**Prerequisite**
SKTG 1513	Introduction to Chemical and Gas Engineering	3	
SKTU 1123	Engineering Mechanics	3	
SKTU 1612	Fundamental of Electrical Technology	2	
SKTU 1623	Organic and Analytical Chemistry for Engineers	3	
SSCE 1693	Engineering Mathematics I	3	
ULRS 1032	Integrity and Anti-Corruption Course	2	
UHLB 1112	English Communication Skills	HW	
	TOTAL CREDIT	**16**	
	CUMULATIVE CREDITS	**16**	

Note: UHLB 1112 - Please refer to English Prerequisite Section for details.

<table>
<tr><th colspan="4">YEAR 1: SEMESTER 2</th></tr>
<tr><th>Code</th><th>Course</th><th>Credit</th><th>Prerequisite</th></tr>
<tr><td>SKTU 1111</td><td>Engineering Drawing</td><td>1</td><td></td></tr>
<tr><td>SKTU 1133</td><td>Thermodynamics</td><td>3</td><td></td></tr>
<tr><td>SKTU 1213</td><td>Material Balance</td><td>3</td><td></td></tr>
<tr><td>SKTU 2153</td><td>Mechanics of Materials</td><td>3</td><td>SKTU 1123</td></tr>
<tr><td>SSCE 1993</td><td>Engineering Mathematics II</td><td>3</td><td></td></tr>
<tr><td>SSCK 1891</td><td>Analytical Chemistry Practical</td><td>1</td><td>SKTU 1623</td></tr>
<tr><td>ULRS 1182</td><td>Appreciation of Ethics and Civilization (for Local Students)</td><td rowspan="2">2</td><td></td></tr>
<tr><td>UHLM 1012</td><td>Malay Language Communication 2 (for International Students)</td><td></td></tr>
<tr><td></td><td>TOTAL CREDIT</td><td>16</td><td></td></tr>
<tr><td></td><td>CUMULATIVE CREDITS</td><td>32</td><td></td></tr>
</table>

YEAR 2: SEMESTER 1			
Code	**Course**	**Credit**	**Prerequisite**
SKTG 2523	Combustion Engineering and Gas Utilisation	3	
SKTU 2143	Fluid Mechanics	3	
SKTU 2223	Energy Balance@	3	SKTU 1213
SKTU 2233	Chemical Engineering Thermodynamics	3	SKTU 1133
SKTU 2711	Thermodynamics and Material Engineering Laboratory	1	SKTU 1133 SKTU 2153
SSCE 1793	Differential Equations	3	
ULRF 2**2	Service Learning and Community Engagement Elective	2	
	TOTAL CREDIT	**18**	
	CUMULATIVE CREDITS	**50**	

YEAR 2: SEMESTER 2			
Code	**Course**	**Credit**	**Prerequisite**
SKTG 2533	Simulation and Programming	3	
SKTG 2771	Combustion Engineering and Gas Utilisation Laboratory	1	SKTG 2523
SKTU 2243	Mass and Heat Transfer	3	SKTU 2223
SKTU 2721	Fluid Mechanics Laboratory	1	SKTU 2143
SKTU 3273	Environmental Engineering and Sustainability	3	
UHLB 2122	Professional Communication Skills 1	2	
ULRS 1022	Philosophy and Current Issues	2	
S*** ***3	Free Elective[1]	3	
	TOTAL CREDIT	**18**	
	CUMULATIVE CREDITS	**68**	

[1]*Note: Free Elective is a course offered by other Faculties.*

YEAR 3: SEMESTER 1			
Code	**Course**	**Credit**	**Prerequisite**
SKTG 3543	Gas Storage System and Asset Integrity	3	
SKTU 2633	Chemical Engineering Computation	3	
SKTU 3253	Chemical Reaction Engineering	3	SKTU 2223
SKTU 3263	Separation Process*	3	SKTU 2243
UHLB 3132	Professional Communication Skills 2	2	
UHL* 1112	Communication in Foreign Language Elective	2	
	TOTAL CREDIT	**16**	
	CUMULATIVE CREDITS	**84**	

YEAR 3: SEMESTER 2			
Code	**Course**	**Credit**	**Prerequisite**
SKTG 3412	Undergraduate Project I**	2	
SKTG 3553	Gas Pipeline System	3	SKTU 2143
SKTU 3283	Process Control and Instrumentation	3	SSCE 1793 SKTG 3263
SKTU 3293	Safety and Health in Chemical and Related Industries	3	
SKTU 3643	Engineering Economics and Project Management	3	
SKTU 3731	Pollution Control and Chemical Reaction Engineering Laboratory	1	SKTU 3253 SKTU 3273
SKTU 3741	Separation Process Laboratory	1	SKTU 3263
ULRS 3032	Entrepreneurship and Innovation	2	
	TOTAL CREDIT	**18**	
	CUMULATIVE CREDITS	**102**	

YEAR 3: SEMESTER 3			
Code	**Course**	**Credit**	**Prerequisite**
SKTG 3815	Industrial Training	5	
	TOTAL CREDIT	**5**	
	CUMULATIVE CREDITS	**107**	

YEAR 4: SEMESTER 1			
Code	**Course**	**Credit**	**Prerequisite**
SKTG 4424	Undergraduate Project II**	4	SKTG 3412#
SKTG 4563	Gas Production, Processing and Liquefaction	3	
SKTG 4593	Plant Design*	3	SKTG 3283
SKTG 4781	Gas Flow System Laboratory	1	SKTG 3553
SKTU 4751	Process Control Laboratory	1	SKTU 3283
SKTG 4**3	Gas Engineering Elective I	3	
SKT* 5**3	PRISMS Elective I		
	TOTAL CREDIT	**15**	
	CUMULATIVE CREDITS	**122**	

YEAR 4: SEMESTER 2			
Code	**Course**	**Credit**	**Prerequisite**
SKTG 4434	Plant Design Project**	4	SKTG 4593
SKTG 4572	Safety Instrumented Systems	2	
SKTG 4581	Gas Engineering Seminar	1	
SKTG 4**3	Gas Engineering Elective II	3	
SKT* 5**3	PRISMS Elective II		
SKTG 4**3	Gas Engineering Elective III	3	
SKT* 4**3	Elective Course		
SKT* 5**3	PRISMS Elective III		
	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 UHLB 1112 course if the English prerequisite is not fulfilled.

ENGLISH PREREQUISITE
a) MUET : ≥ Band 4.0
b) IELTS : ≥ Band 5.5
c) TOEFL: ≥ 525
d) TOEFL iBT : ≥ 60
e) CEFR : ≥ B2
f) CEQ : ≥ 160
g) CIEP-ELS : ≥ 108
h) PTE : ≥ 51

Elective Courses

- SKTG 4313 Carbon Capture and Sequestration
- SKTG 4323 Sustainable Energy Transition
- SKTG 4333 Fire and Explosion Safety
- SKTG 4343 Membrane Separation Technology
- SKTG 4353 Corrosion Engineering
- SKTG 4373 Machine Learning for Chemical Engineering
- SKTU 5113 Research Methodology

ELECTIVE COURSE (SKT* 43)**

Students may enrol in any Elective Course offered by any Undergraduate Programme in FKT.

PRISMS ELECTIVE COURSES

For students who intend to enrol 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 ENGINEERING (GAS) COURSES					
1	SKTG 1513	Introduction to Chemical and Gas Engineering	3	3	
2	SKTG 2523	Combustion Engineering and Gas Utilisation	3	3	
3	SKTG 2771	Combustion Engineering and Gas Utilisation Laboratory	1	1	
4	SKTG 3412	Undergraduate Project I	2	2	
5	SKTG 3543	Gas Storage System and Asset Integrity	3	3	
6	SKTG 3553	Gas Pipeline System	3	3	
7	SKTG 3815	Industrial Training	5	HL	
8	SKTG 4424	Undergraduate Project II	4	4	
9	SKTG 4434	Plant Design Project	4	4	
10	SKTG 4563	Gas Production, Processing and Liquefaction	3	3	
11	SKTG 4572	Safety Instrumented Systems	2	2	
12	SKTG 4581	Gas Engineering Seminar	1	1	
13	SKTG 4593	Plant Design	3	3	
14	SKTG 4781	Gas Flow System Laboratory	1	1	
15	SKTU 1111	Engineering Drawing	1	1	
16	SKTU 1123	Engineering Mechanics	3	3	
17	SKTU 1133	Thermodynamics	3	3	
18	SKTU 1213	Material Balance	3	3	
19	SKTU 2143	Fluid Mechanics	3	3	
20	SKTU 2153	Mechanics of Materials	3	3	
21	SKTU 2223	Energy Balance	3	3	
22	SKTU 2233	Chemical Engineering Thermodynamics	3	3	
23	SKTU 2243	Mass and Heat Transfer	3	3	
24	SKTU 2633	Chemical Engineering Computation	3	3	
25	SKTU 2711	Thermodynamic and Material Engineering Lab	1	1	
26	SKTU 2721	Fluid Mechanic Laboratory	1	1	
27	SKTU 3253	Chemical Reaction Engineering	3	3	
28	SKTU 3263	Separation Processes	3	3	

29	SKTU 3273	Environmental Engineering and Sustainability	3	3	
30	SKTU 3283	Process Control and Instrumentation	3	3	
31	SKTU 3293	Safety and Health in Chemical and Related Industries	3	3	
32	SKTU 3643	Engineering Economics and Project Management	3	3	
33	SKTU 3731	Pollution Control and Chemical Reaction Engineering Laboratory	1	1	
34	SKTU 3741	Separation Process Laboratory	1	1	
35	SKTU 4751	Process Control Laboratory	1	1	
36	SKTG 4**3	Gas Engineering Elective I	3	3	
	SKT* 5**3	PRISMS Elective I			
37	SKTG ***3	Gas Engineering Elective II	3	3	
	SKT* 5**3	PRISMS Elective II			
38	SKTG ***3	Gas Engineering Elective III	3	3	
	SKT* ***3	Elective Course			
	SKT* 5**3	PRISMS Elective III			
		TOTAL CREDIT OF CHEMICAL ENGINEERING (GAS) COURSES (a)	**98**	**93**	
APPLIED SCIENCE/ MATHEMATICS/ COMPUTER/ TECHNOLOGY COURSES					
1	SKTG 2533	Simulation and Programming	3	3	
2	SKTU 1612	Fundamental of Electrical Technology	2	2	
3	SKTU 1623	Organic Chemistry and Analytical Chemistry	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	
7	SSCK 1891	Analytical Chemistry Practical	1	1	
		TOTAL CREDIT OF APPLIED SCIENCE/ MATHEMATICS/ COMPUTER/ 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	ULRS 1032	Integrity And Anti-Corruption Course	2	2	
Global Citizen					
1	ULRF 2**2	Service Learning and 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	
Enterprising Skills					
1	ULRS 3032	Entrepreneurship and Innovation	2	2	
Free Elective					
1	S*** ***3	Free 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 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 and 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 School of Undergraduate Studies (UGS). Information on PSC Courses: https://ugs.utm.my/utm-professional-skills-certificate-utm-psc/ Online PSC Registration: https://elearnpsc.utmspace.edu.my/			

COURSE SYNOPSIS

CORE COURSES

SKTG 1513 - Introduction to Chemical and Gas Engineering

This core 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 provides support for adjusting to learning and expectations in tertiary education. The topics/skills that will be learnt in this course include overview of engineering and 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.

SKTG 2523 - Combustion Engineering and Gas Utilisation

This core 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.

SKTG 2771 - Combustion Engineering and Gas Utilisation Laboratory

Prerequisite: SKTG 2523 (taken)

This core course (laboratory) introduces students to the method of determining flame properties such as flame speed and flame characteristics. It also enables students to obtain understanding of biogas production. Students also are introduced into explosion study. At the end of this course, students will be able to describe and explain the process and operation of equipment related to gas combustion engineering such as gas absorption refrigeration system, and burner.

SKTG 3412 - Undergraduate Project I

This core 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 to writing a research proposal. It will emphasize on the research philosophy and research methodology. The works include literature review, writing a problem statement, scope identification, objective 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.

SKTG 3543 - Gas Storage and Asset Integrity

This enables students to acquire and practice the fundamental knowledge of liquefied petroleum gases (LPG), natural gases (NG), and liquefied natural gas (LNG) storage systems. This course will also introduce students to operation and maintenance of gas storage vessels especially on asset integrity management. The students are also required to prepare technical project reports. Students will utilise computer software in executing their project.

SKTG 3553 - Gas Pipeline System
Prerequisite: SKTU 2143 (taken)
This core course enables students to learn and apply essential principles of hydrocarbon gas transmission, distribution, and reticulation systems. As part of the course requirements, students will collaborate on a group technical report and deliver a project presentation upon completion. Students will also utilise computer software in executing their project.

SKTG 3815 - Industrial Training
This core course is a 12-week industry training program aims to expose UTM students firsthand experience on the practical aspects and work practices within the industry. Throughout the program, students will be able to apply their theoretical knowledge with real-world applications, while also enhancing their abilities in work ethics, management, communication, and interpersonal relationships.

SKTG 4424 - Undergraduate Project II
Prerequisite: SKTG 3412 (pass with at least D+)
This core 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.

SKTG 4434 - Plant Design Project
Prerequisite: SKTG 4593 (taken)
This core course is an integrated project that 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 optimization in generating inherently safe, sizing, mechanical design, 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. This course also implemented a Work-based-Learning approach that requires students to visit a chemical process plant and learn from industry on the real process design and operation. This knowledge and experience shall be implemented in the design project. In addition to a faculty supervisor, each team is assigned to an industrial supervisor to ensure the design is relevant and comply with the industrial requirement. Students will also learn the technique of writing a comprehensive technical plant design report.

SKTG 4563 - Gas Production, Processing and Liquefaction
This core 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, plant design etc in respect to gas production and liquefaction processes.

SKTG 4572 - Safety Instrumented Systems
This core course provides an in-depth exploration of safety instrumented systems (SIS), which are critical for ensuring the safety and reliability of industrial processes. Designed for professionals and students in the field of industrial automation, process engineering, and safety management, this course covers the entire lifecycle of safety instrumented systems, from initial design through to installation, commissioning, and maintenance.

SKTG 4581 - Gas Engineering Seminar
This seminar core course provides the platform for verbal sharing experience and providing forums of discussion amongst industrialists, academicians, and final year 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.

SKTG 4593 - Plant Design
Prerequisite: SKTU 3283 (taken)
This core course presents the principles and methodology for chemical process design. In particular, it emphasises on the key elements of process design which include process synthesis, heat integration, and process optimisation in generating inherently safe, economic and environmentally friendly processes.

SKTG 4781 - Gas Flow System
Prerequisite: SKTG 3553 (taken)
This core course is designed to allow students to undergo some laboratory work related to the gas delivery system. At the end of the course, students should be able to practically apply different methods of gas pipeline jointing technique, gas pipeline control, and gas reticulation system. This course also implements project-based learning where the students are required to design, install, test and commission a gas reticulation system.

SKTU 1111 - 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. The course covers the topics of introduction and fundamentals of engineering drawing, geometry, orthographic, isometric and sectional drawing. The course also gives exposure on 3D drawing

to the students. All the drawings are to be constructed using AutoCAD software. Besides that, this course also requires students to work in a team in order to complete the projects assigned to them.

SKTU 1123 - Engineering Mechanics

This course is designed to introduce students to the basic principles and concepts in mechanics. It will deal 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 (kinematic and kinetics) 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.

SKTU 1133 - Thermodynamics

This core course is an important basic engineering concepts such as systems, boundaries, mass, heat, work and energy are introduced. These concepts are then related using the 1st and 2nd Laws of Thermodynamics. In this course, 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 formed the fundamentals for future chemical engineering courses.

SKTU 1213 - Material 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.

SKTU 1612 - Fundamental of Electrical Technology

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 analysing electronic circuitry. At the completion of this course students are expected to be able to understand electrical and electronic engineering, draw and analyse electronic circuits, use test and measurement instruments, and design basic analogue and digital electronic circuits using active and passive components.

SKTU 1623 - Organic Chemistry and Analytical Chemistry

This core course is a two-in-one course that covers the introduction to Organic chemistry and Analytical Chemistry topics. Organic Chemistry topics discuss the fundamental concepts of functional groups in organic compounds. These include aliphatic and aromatic hydrocarbons, alcohols and organohalogen compounds. Physical properties, preparations, reactions and visual tests will also be discussed. Inter-conversion of the related functional groups and their reaction mechanisms are also included. Analytical Chemistry introduces quantitative chemical analysis, with emphasis on wet chemistry and instrumental methods. Topics in wet chemistry include introduction to analytical chemistry, sampling, sample preparation, data analysis, method validation, gravimetric analysis and volumetric analysis. The course also introduces the principles and application of instrumental methods in chemical analysis.

SKTU 1143 - Fluid Mechanics

The core course will introduce 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 especially pump. The course covers the physics of fluid, classification of flow, fluid statics, fluid dynamics, the application of Bernoulli's, continuity, and momentum equations, friction flow in pipes includes the use of Moody chart, flow metering, pump, dimensional analysis and similarity.

SKTU 2153 - Mechanics of Materials

Prerequisite: SKTU 1123 (taken)

The core course covers both the theory and application of the fundamental principles for the structure-property of various engineering materials with the strength of materials. Emphasis is placed on the importance of satisfying equilibrium, compatibility of deformation, and material behaviour requirement. Topics being covered include material science and engineering, structure-property of engineering materials, crystal structure, stress and strain under axial loading, torsion, bending, combined loadings, stress transformation, design of beams and shafts.

SKTU 2223 - Energy Balance

Prerequisite: SKTU 1213 (taken)

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 energy balance problems for chemical process systems and equipment.

SKTU 2233 - Chemical Engineering Thermodynamics

Prerequisite: SETG 1133 (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.

SKTU 2243 - Mass and Heat Transfer

Prerequisite: SKTU 2223 (taken)

This introduces students to the basic principles and application of heat and mass transfer in chemical engineering. The understanding from this course is useful for the better understanding in distillation, absorption, liquid-liquid extraction, membrane separation, leaching, evaporation and other chemical processes.

SKTU 2633 - Chemical Engineering Computation
Prerequisite: SSCE 1793 (taken)
This 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 the 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 nuance of the methods and showing more realistically how the methods are applied for problem solving.

SKTU 2711 - Thermodynamics and Material Engineering Laboratory
Prerequisite: SKTU 1133, SKTU 2153 (taken)
This laboratory core course covers basic concepts in Thermodynamics and Strength of Material. Laboratory experiments are designed for hand-on experience to understand the engineering principles and are divided into two methods of learning; guided experiment and open-ended experiment. 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.

SKTU 2721 - Fluid Mechanics Laboratory
Prerequisite: SKTU 2143 (taken)
The aim of this laboratory core course is for students to conduct experiments in conjunction with the theory course Fluid Mechanics. This will give hands-on experience to the students on handling the equipment and to interpret the data taken from the experiments. In this course, apart from the guided experiments, students will have the opportunity to design their own experiments in the open-ended experiments. Students will be assessed by their design of experimental methodology, skills in handling the equipment, and ability to discuss and analyse the results in the report submitted. The lab runs closely with the lectures' invigilation and based on the prior knowledge of the prerequisite course.

SKTU 3253 - Chemical Reaction Engineering
Prerequisite: SKTU 2223 (taken)
This core 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 computational tools.

SKTU 3263 - Separation Processes
Prerequisite: SKTU 2243 (taken)
This core course introduces different types of unit operations involved in the chemical, bioprocess and other physical processing industries. Separation processes such as drying, humidification, absorption, distillation, liquid-liquid extraction and solid-liquid extraction (leaching) are covered which also include design of separation operations using mass transfer principles.

SKTU 3273 - Environmental Engineering and Sustainability
This introduces the cause, effect and method to control pollution from industries. The course covers 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 wastewater 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 last part covers the management of industrial waste that includes definition of scheduled waste, scheduled waste regulations, and technique to manage the waste.

SKTU 3283 - Process Control and Instrumentation
Prerequisite: SSCE 1793, SKTU 3263 (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 are 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.

SKTU 3293 - Safety and Health for Chemical and Related Industries
This core course intends to provide an overview and basic knowledge of occupational safety and health (OSH) at work as well as process safety of chemical industries. 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. Besides, students will also be exposed to process safety related methods e.g. HAZOP and risk assessment. 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. It is also expected that students are capable of applying HAZOP in their plant design project.

SKTU 3643 - Engineering Economics and Project Management
This course covers both Engineering Economics and Project Management. Engineering economics focuses on evaluating different alternatives and making decisions based on economic factors. These decisions involve the fundamental elements of cash flows of money, time, and interest rates. Project Management is the art of planning, scheduling, and controlling project operations to accomplish performance, cost, time, and objectives for a specified scope of work while efficiently and effectively using resources. This course also implements Service-Learning method that requires students to share their knowledge to the community.

SKTU 3731 - Pollution Control and Chemical Reaction Engineering Laboratory
Prerequisite: SKTU 3253, SKTU 3273 (taken)
This laboratory core 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.

SKTU 3741 - Separation Process Laboratory
Prerequisite: SKTU 3263 (taken)
This laboratory core course introduces students to the equipment in the separation processes discussed in the Separation Processes course. This will give a hand-on experience to the students how to handle the equipment 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 equipment involved in the chemical/bio-process industries such as liquid-liquid extraction and heat exchanger. Students will be assessed by their performance in the report submitted and by a test that will be conducted at the end of the course after the students have all completed the experiments.

SKTU 4751 - Process Control Laboratory
Prerequisite: SKTU 3283 (taken)
This laboratory core course presents fundamental principles of safety and risk assessment in the chemical process industry. In particular, it emphasises on safety legislations, inherent safety design concept, and applies various methods 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 the petrochemical process industry and also be able to use the techniques of hazard identification and risk assessment in the design and operation of petrochemical plants.

ELECTIVE COURSES

SKTG 4313 - Carbon Capture, Utilisation and Storage
This introduces students to the three-step technologies involved in carbon capture, utilisation, and storage (CCUS). At the beginning of this course, the student will be exposed to the current world situation, the importance of CCUS, and the highly-releasing-carbon industries. It is followed by an overview of current technologies that can be utilised for each step in CCUS and discuss critical technical challenges. At the end of the course, the students should be able to propose the best CCUS for future energy systems for selected industries, considering the cost, legal, and environmental issues.

SKTG 4323 - Sustainable Energy Transition
The provides a comprehensive overview and insight into sustainable energy transition including the energy sources, the global energy landscape, and the ongoing shift towards renewable and sustainable sources of energy. In addition, the course also emphasizes the importance of current and emerging sustainable energy technologies and the key issues related to the adoption of green technologies, their importance, advantages, limitations,

environmental impacts, and their socio-economic barriers. The course will help students to analyse the historical, political, economic, technological, and logistical factors that drive the sustainable energy transition while focusing on renewable energy and green energy technologies. At the end of the course, students should have a solid technical and economic understanding of these green energy technologies and be able to evaluate the various paths toward a low-carbon energy future.

SKTG 4333 - Fire and Explosion Safety

This elective 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 modelling (CFast) to analyse the fire development on the case studies given.

SKTG 4343 - Membrane Separation Technology

This enables students to analyse membrane fundamentals related to fluid separation. The knowledge in selecting the best fabrication technique will also be highlighted. This part enables the student to analyse and correlate the membrane performance and membrane preparation. Selection of characterization techniques will be discussed which are based on the material and membrane performance. This course also enables the student to differentiate the membrane applications in various fluid separations. The overall course provides a very good knowledge in membrane technology starting from material selection to application.

SKTG 4353 - Corrosion Engineering

This 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 and 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 are also included. Students are required to do a case study on corrosion problems that shall introduce them to real corrosion problems in industries, which will allow students to become familiar with directing their investigations of corrosion problems. Finally, at the end of the course, students are introduced to how to design cathodic protection for underground gas piping.

SKTU 5113 - Research Methodology

This PRISMS elective course aims to equip students with the essential knowledge and skills to do research and dissertation systematically. This course has 8 modules which will be conducted through a weekly 3-hour seminar. Each seminar will consist of a lecture, discussion and workshop. In the end of course, students need to produce a research proposal and have a mini conference as part of assessment and proposal presentation practice.

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	Tool Usage	The Engineer and the World	Ethics	Individual and Collaborative Team Work	Communication	Project Management and Finance	Life Long Learning
COURSE CODE	**COURSE NAME**	**PLO1**	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**
PROGRAMME CORE COURSES												
SKTG 1513	Introduction to Chemical and Gas Engineering					/	/			/		
SKTG 2523	Combustion Engineering and Gas Utilisation	/				/			/			
SKTG 2533	Simulation and Programming					/				/		/
SKTG 2771	Combustion Engineering and Gas Utilisation Laboratory			/	/				/			
SKTG 3412	Undergraduate Project I		/	/	/					/		/
SKTG 3543	Gas Storage System and Asset Integrity	/		/				/				
SKTG 3553	Gas Pipeline System	/		/				/				
SKTG 3815	Industrial Training							/	/	/		/
SKTG 4424	Undergraduate Project II		/	/	/					/		/
SKTG 4434	Plant Design Project			/		/	/	/	/	/	/	
SKTG 4563	Gas Production, Processing and Liquefaction			/			/		/			
SKTG 4572	Safety Instrumented Systems						/	/				/
SKTG 4581	Gas Engineering Seminar						/	/				/
SKTG 4593	Plant Design	/	/	/						/		
SKTG 4781	Gas Flow System Laboratory			/	/						/	
SKTU 1111	Engineering Drawing					/				/		
SKTU 1123	Engineering Mechanics	/							/			
SKTU 1133	Thermodynamics	/	/						/			

		PROGRAMME LEARNING OUTCOMES (PLO)										
		Engineering Knowledge	Problem Analysis	Design/ Development of Solution	Investigation	Tool Usage	The Engineer and the World	Ethics	Individual and Collaborative Team Work	Communication	Project Management and Finance	Life Long Learning
COURSE CODE	**COURSE NAME**	**PLO1**	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**
SKTU 1213	Material Balance	/	/									/
SKTU 1612	Fundamental of Electrical Technology	/							/			/
SKTU 1623	Organic Chemistry and Analytical Chemistry	/							/			
SKTU 2143	Fluid Mechanics	/	/							/		
SKTU 2153	Mechanics of Materials	/							/			
SKTU 2223	Energy Balance	/	/						/			
SKTU 2233	Chemical Engineering Thermodynamics	/							/			
SKTU 2243	Mass and Heat Transfer	/										/
SKTU 2633	Chemical Engineering Computation	/				/						
SKTU 2711	Thermodynamic and Material Engineering Lab				/				/	/		
SKTU 2721	Fluid Mechanic Laboratory				/				/	/		
SKTU 3253	Chemical Reaction Engineering		/			/	/					
SKTU 3263	Separation Processes	/		/		/						
SKTU 3273	Environmental Engineering and Sustainability	/					/	/				
SKTU 3283	Process Control and Instrumentation	/	/						/			
SKTU 3293	Safety and Health in Chemical and Related Industries						/	/	/			
SKTU 3643	Engineering Economics and Project Management	/	/								/	
SKTU 3731	Pollution Control and Chemical Reaction Engineering Laboratory				/				/	/		
SKTU 3741	Separation Process Laboratory				/				/	/		
SKTU 4751	Process Control Laboratory			/	/	/				/		
PROGRAMME ELECTIVE COURSES												

		PROGRAMME LEARNING OUTCOMES (PLO)										
		Engineering Knowledge	Problem Analysis	Design/ Development of Solution	Investigation	Tool Usage	The Engineer and the World	Ethics	Individual and Collaborative Team Work	Communication	Project Management and Finance	Life Long Learning
COURSE CODE	**COURSE NAME**	**PLO1**	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**
SKTG 4**3	Elective I						/			/		/
SKT* 5**3	PRISMS Elective I											
SKTG ***3	Elective II						/			/		/
SKT* 5**3	PRISMS Elective II											
SKT* ***3	Elective III						/			/		/
SKT* 5**3	PRISMS 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 coursework and final examination given throughout the semester.

Programme Uniqueness

Various courses in the programme incorporate the following elements:

Elements	**Courses**
Sustainable Development Goals (SDG)	
SDG1: No Poverty	SKTU 3643 - Engineering Economics and Project Management
SDG3: Good Health and Well-being	SKTN 3353 - Nuclear Safety, Safeguard, Security and Regulation SKTN 4393 - Radiographic Testing
SDG7: Affordable and Clean Energy	SKTN 4383 - Energy and Power Plant Systems
SDG8: Decent Work and Economic Growth	SKTG 4643 - Artificial Intelligence Application in Nuclear Engineering SKTG 2623 - Programming for Engineer
Artificial Intelligence	SKTN 4643 - Artificial Intelligence Application in Nuclear Engineering SKTN 4373 - Radiation Technology and Application
Work-Based Learning	SKTN 4434 - Nuclear Engineering System and Design Project
Service Learning	SKTU 3643 - Engineering Economics and Project Management
EXCEL Framework	Research Infused Experiential Learning (REAL)

	Industry Driven Experiential Learning (IDEAL)
REAL	
Level 1: Research Oriented	SKTN 1213 - Introduction to Engineering SKTN 2623 - Programming for Engineer SKTN 1613 - Nuclear Physics SKTU 1133 - Thermodynamics
Level 2: Research Immersion	SKTN 2633 - Numerical Methods for Nuclear Engineers SKTN 2323 - Heat Transfer SKTN 3263 - Nuclear Reactor Theory SKTN 2253 - Instrumentation and Control Engineering SKTN 2313 - Radiation Technology and Application SKTN 4643 - Artificial Intelligence Application in Nuclear Engineering
Level 3: Research Apprentice	SKTN 2761 - Nuclear Engineering Laboratory I SKTN 3363 - Nuclear Radiation Protection SKTN 3343 - Nuclear Fuel Cycle and Waste Management SKTN 4393 - Radiographic Testing
Level 4: Research Intensive	SKTN 4291 - Nuclear Engineering Professional Practice SKTN 3771 - Nuclear Engineering Laboratory II SKTN 3781- Nuclear Engineering Laboratory III SKTN 3412 - Undergraduate Project I SKTN 4424 - Undergraduate Project II SKTN 3283 - Nuclear Engineering System and Design SKTN 4434 - Nuclear Engineering System and Design Project
IDEAL	SKTN 4291 - Nuclear Engineering Professional Practice SKTN 3412 - Undergraduate Project I SKTN 4424 - Undergraduate Project II SKTN 4643 - Artificial Intelligence Application in Nuclear Engineering SKTN 4373 - Radiation Technology and Application SKTN 4333 - Nuclear Engineering Materials

General Information

1. Awarding Institution	Universiti Teknologi Malaysia
2. Teaching Institution	Universiti Teknologi Malaysia
3. Programme Name	Bachelor of Nuclear Engineering with Honours
4. Programme Award	Bachelor of Nuclear Engineering with Honours
5. National Education Code (NEC)	0712 (Electricity and Energy)
6. Programme Code	SETNH
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. Method of Study	Full Time
12. Duration of Study	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	 6 6 2 2	11.9%
ii.	Programme Core	110	81.5%
iii.	Electives (a) Programme Electives (b) Free Elective	 6 3	6.6%
	Total	**135**	**100%**

A	Engineering Courses (a) Lectures (b) Laboratory (c) Industrial Training (d) Final Year Project (e) Integrated Design Project	79 4 5 6 4	72.6%
Total Credit Hours for Part A		**98**	
B	Related Courses Applied Science/ Mathematics/ Computer/ Technology Management/Law/ Humanities/ Ethics/ Entrepreneur Language Co-Curriculum 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**	**Prerequisite**
SKTN 1213	Introduction to Engineering	3	
SKTN 1613	Nuclear Physics	3	
SKTU 1111	Engineering Drawing	1	
SKTU 1123	Engineering Mechanics	3	
SSCE 1693	Engineering Mathematics I	3	
ULRS 1032	Integrity And Anti-Corruption Course	2	
UHLB 1112	English Communication Skills	HW	
	TOTAL CREDIT	**15**	
	CUMULATIVE CREDITS	**15**	

Note: UHLB 1112 - Please refer to English Prerequisite Section for details.

YEAR 1: SEMESTER 2			
Code	**Course**	**Credit**	**Prerequisite**
SKTN 1334	Electrical Engineering Fundamentals with Laboratory	4	
SKTN 1223	Nuclear Engineering Fundamentals	3	
SKTU 1133	Thermodynamics	3	
SKTU 2143	Fluid Mechanics@	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	**18**	
	CUMULATIVE CREDITS	**33**	

YEAR 2: SEMESTER 1			
Code	**Course**	**Credit**	**Prerequisite**
SKTN 2133	Radiation Detection and Measurement	3	
SKTN 2623	Programming for Engineers	3	
SKTN 2323	Heat Transfer	3	SKTU 1133
SKTU 2153	Mechanics of Materials	3	
SKTU 2721	Fluid Mechanics Laboratory	1	SKTU 2143
SSCE 1793	Differential Equations	3	
ULRF 2**2	Service Learning and Community Engagement Elective	2	
	TOTAL CREDIT	**18**	
	CUMULATIVE CREDITS	**51**	

YEAR 2: SEMESTER 2			
Code	**Course**	**Credit**	**Prerequisite**
SKTN 2253	Instrumentation and Control Engineering	3	
SKTN 2633	Numerical Methods for Nuclear Engineers	3	SSCE 1793
SKTN 2761	Nuclear Engineering Laboratory 1	1	SKTN 1613 SKTN 2313
SKTU 2711	Thermodynamics and Mechanics of Material Laboratory	1	SKTU 1133 SKTU 2153
SKTU 3643	Engineering Economics and Project Management	3	
SSCE 2193	Engineering Statistics	3	
UHLB 2122	Professional Communication Skills 1	2	
ULRS 1022	Philosophy and Current Issues	2	
	TOTAL CREDIT	**18**	
	CUMULATIVE CREDITS	**69**	

YEAR 3: SEMESTER 1			
Code	**Course**	**Credit**	**Prerequisite**
SKTN 3263	Nuclear Reactor Theory	3	
SKTN 3343	Nuclear Fuel Cycle and Waste Management	3	
SKTN 3363	Nuclear Radiation Protection	3	
SKTN 3273	Thermal Hydraulics	3	SKTN 2323 SKTU 2143
SKTN 3771	Nuclear Engineering Laboratory 2	1	SKTN 3273
UHLB 3132	Professional Communication Skills 2	2	UHLB 2122
UHL* 1112	Communication in Foreign Language Elective	2	
	TOTAL CREDIT	**17**	
	CUMULATIVE CREDITS	**86**	

YEAR 3: SEMESTER 2			
Code	**Course**	**Credit**	**Prerequisite**
SKTN 3283	Nuclear Engineering System and Design	3	SKTN 3273 SKTN 3263
SKTN 3353	Nuclear Safety, Safeguard, Security and Regulation	3	
SKTN 3412	Undergraduate Project I**	2	
SKTN 3781	Nuclear Engineering Laboratory 3	1	SKTN 3263
SKTN 4**3	Programme Elective I	3	
SKT* 5**3	PRISMS Elective I		
ULRS 3032	Entrepreneurship and Innovation	2	
S*** ***3	Free Elective	3	
	TOTAL CREDIT	**17**	
	CUMULATIVE CREDITS	**103**	

YEAR 3: SEMESTER 3			
Code	**Course**	**Credit**	**Prerequisite**
SKTN 3815	Industrial Training	5	
	TOTAL CREDIT	**5**	
	CUMULATIVE CREDITS	**108**	

YEAR 4: SEMESTER 1			
Code	**Course**	**Credit**	**Prerequisite**
SKTN 4291	Nuclear Engineering Professional Practice	1	
SKTN 4333	Nuclear Engineering Materials	3	
SKTN 4373	Radiation Technology and Application	3	
SKTN 4424	Undergraduate Project II*	4	SKTN 3412#
SKTN 4643	Artificial Intelligence Application in Nuclear Engineering	3	
	TOTAL CREDIT	**14**	
	CUMULATIVE CREDITS	**122**	

YEAR 4: SEMESTER 2			
Code	**Course**	**Credit**	**Prerequisite**
SKTN 4383	Energy and Power Plant System	3	
SKTN 4393	Radiographic Testing	3	
SKTN 4434	Nuclear Engineering System and Design Project	4	SKTN 3283
SKT* 4**3	Programme Elective II	3	
SKT* 5**3	PRISMS Elective II		
	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 UHLB 1112 course if the English prerequisite is not fulfilled.

ENGLISH PREREQUISITE
a) MUET : ≥ Band 4.0
b) IELTS : ≥ Band 5.5
c) TOEFL: ≥ 525
d) TOEFL iBT : ≥ 60
e) CEFR : ≥ B2
f) CEQ : ≥ 160
g) CIEP-ELS : ≥ 108
h) PTE : ≥ 51

Elective Courses

- SKTN 4913 Ultrasonic Testing
- SKTN 4933 Chemistry in Nuclear Engineering
- SKTN 4943 Radiation Application in Medicine
- SKTU 5113 Research Methodology (PRISMS)

PRISMS ELECTIVE COURSE
For students who intend to enrol 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.	COURSE CODE	COURSE NAME	CREDIT EARNED (JKD)	CREDIT COUNTED (JKK)	TICK (√) IF PASSED
NUCLEAR ENGINEERING COURSES					
1	SKTN 1213	Introduction to Engineering	3	3	
2	SKTN 1223	Nuclear Engineering Fundamentals	3	3	
3	SKTN 1234	Electrical Engineering Fundamental with Laboratory	4	4	
4	SKTN 2253	Instrumentation and Control Engineering	3	3	
5	SKTN 2313	Radiation, Detection and Measurement	3	3	
6	SKTN 2323	Heat Transfer	3	3	
7	SKTN 2633	Numerical Methods for Nuclear Engineers	3	3	
8	SKTN 2761	Nuclear Engineering Laboratory I	1	1	
9	SKTN 3263	Nuclear Reactor Theory	3	3	
10	SKTN 3273	Thermal Hydraulics	3	3	
11	SKTN 3283	Nuclear Engineering System and Design	3	3	
12	SKTN 3343	Nuclear Fuel Cycle and Waste Management	3	3	
13	SKTN 3353	Nuclear Safety, Safeguard, Security, and Regulation	3	3	
14	SKTN 3363	Nuclear Radiation Protection	3	3	
15	SKTN 3412	Undergraduate Project I	2	2	
16	SKTN 3771	Nuclear Engineering Laboratory II	1	1	
17	SKTN 3781	Nuclear Engineering Laboratory III	1	1	
18	SKTN 3815	Industrial Training	5	HL	
19	SKTN 4291	Nuclear Engineering Professional Practice	1	1	
20	SKTN 4333	Nuclear Engineering Materials	3	3	
21	SKTN 4373	Radiation Technology and Application	3	3	
22	SKTN 4383	Energy and Power Plant System	3	3	
23	SKTN 4393	Radiographic Testing	3	3	
24	SKTN 4424	Undergraduate Project II	4	4	

25	SKTN 4434	Nuclear Engineering System and Design Project	4	4	
26	SKTN 4643	Artificial Intelligence Application in Nuclear Engineering	3	3	
27	SKTU 1111	Engineering Drawing	1	1	
28	SKTU 1123	Engineering Mechanics	3	3	
29	SKTU 1133	Thermodynamics	3	3	
30	SKTU 2143	Fluid Mechanics	3	3	
31	SKTU 2153	Mechanics of Materials	3	3	
32	SKTU 2711	Thermodynamics and Material Engineering Laboratory	1	1	
33	SKTU 2721	Fluid Mechanics Laboratory	1	1	
34	SKTU 3643	Engineering Economics and Project Management	3	3	
35	SKTN 4**3	Elective I	3	3	
	SKT* 5**3	PRISMS Elective I			
36	SKT* 4**3	Elective II	3	3	
	SKT* 5**3	PRISMS Elective II			
		TOTAL CREDIT OF NUCLEAR ENGINEERING COURSES (a)	**98**	**93**	
APPLIED SCIENCE/ MATHEMATICS/ COMPUTER/ TECHNOLOGY COURSES					
1	SKTN 1613	Nuclear Physics	3	3	
2	SKTN 2623	Programming for Engineer	3	3	
3	SSCE 1693	Engineering Mathematics I	3	3	
4	SSCE 1793	Differential Equations	3	3	
5	SSCE 1993	Engineering Mathematics II	3	3	
6	SSCE 2193	Engineering Statistics	3	3	
		TOTAL CREDIT OF APPLIED SCIENCE/ MATHEMATICS/ COMPUTER/ 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	ULRS 1032	Integrity And Anti-Corruption Course	2	2	

Global Citizen					
1	ULRF 2**2	Service Learning and 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	
Enterprising Skills					
1	ULRS 3032	Entrepreneurship and Innovation	2	2	
Free Elective					
1	S*** ***3	Free 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 and 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 School of Undergraduate Studies (UGS). Information on PSC Courses: https://ugs.utm.my/utm-professional-skills-certificate-utm-psc/ Online PSC Registration: https://elearnpsc.utmspace.edu.my/			

COURSE SYNOPSIS

CORE COURSES

SKTN 1213 - Introduction to Engineering
The objective of this core 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 provides support for adjusting to learning and expectations in tertiary education. The course introduces students to Nuclear engineering, rationale of considering nuclear power and various types of nuclear power plants with emphasis on Light Water and Heavy Water reactors. 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. A hybrid session webinar with industries that emphasis on enhancing students' communication skill. This course implements the Research Infused Experiential Learning (REAL) Level 1 - Research Oriented.

SKTN 1223 - Nuclear Engineering Fundamentals
This core 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. This course implements the Research Infused Experiential Learning (REAL) Level 2 - Research Immersion.

SKTN 1234 - Electrical Engineering Fundamentals with Laboratory
This core course introduces students to the fundamentals of electrical and electronic engineering through lectures and laboratory sessions. It covers electronics components (passive, active, semiconductor-based), circuits (AC, DC, analogue, digital) and methods for analysing electronic 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 analyse electronic circuits, use test and measurement instruments, and design basic analogue and digital electronic circuits using active and passive components.

SKTN 1613 - Nuclear Physics
The core course introduces some major concepts and theories of nuclear physics. The course begins with understanding the basic knowledge of the constituents of nucleus, binding energy 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 knowledge 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. This course implements the Research Infused Experiential Learning (REAL) Level 1 - Research Oriented.

SKTN 2253 - Instrumentation and Control Engineering
This core course introduces students to the measurement of process variables using electrical/electronic instrumentations (analogue and digital), and the methods for process control. It covers methods for mathematical model building of physical systems and processes, control systems and the use of software in analysing system and controller performance. Transducers that are used in instruments for measuring common parameters such as temperature and pressure are presented. Instrumentation 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. This course implements the Research Infused Experiential Learning (REAL) Level 2 - Research Immersion.

SKTN 2313 - Radiation Detection and Measurement
These important detection techniques for radiation are introduced in this core 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.

SKTN 2323 - Heat Transfer
Prerequisite: SKTU 1133 (taken)
This is a core course that focuses on heat transfer. 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. Also, the course will be discussed on processes of energy generation and transport from the core of a nuclear fission reactor to the thermal design of such a core. 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. The topics emphasize energy (heat) generation in nuclear processes, the transport of that energy by the reactor coolant to the power cycle, and the limitations imposed by the transport mechanism on the designer of nuclear reactor cores. This course implements the Research Infused Experiential Learning (REAL) Level 2 - Research Immersion.

SKTN 2623 - Programming for Engineers
This core course formally introduces the concept of computers, algorithms, programming languages, pseudocode, and problem solving. The two programming languages introduced in this course are MATLAB and Python. 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. This course implements the Research Infused Experiential Learning (REAL) Level 1 - Research Oriented.

SKTN 2633 - Numerical Methods for Nuclear Engineers
Prerequisite: SSCE 1793 (taken)
This is a core course that introduces the steps involved in engineering analysis (mathematical modelling, 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, and boundary value problems are introduced. Students will be required to use computing tools such as Matlab or Octave to implement the solutions for the problems. This course implements the Research Infused Experiential Learning (REAL) Level 2 - Research Immersion.

SKTN 2761 - Nuclear Engineering Laboratory 1
Prerequisite: SKTN 1613, SKTN 2313 (taken)
This core course is designed to allow students to conduct experiments related to nuclear physics and radiation detection and measurement learned in the prerequisite courses. A series of radiation and radioactivity related experiments are performed at UTM Nuclear Engineering Laboratory. The laboratory activities involve in-lab experiments and outdoor activities such as radon measurement and terrestrial gamma radiation using a survey meter. Students will conduct 6 experiments and prepare technical reports for each experiment. At the end of this course, students are able to explain the basic principles of ionizing radiation and accurately operate radiation detection and measurement systems using the Geiger counter.

SKTN 3263 - Nuclear Reactor Theory
The core course starts with discussion on neutron physics related to production, absorption and scattering of neutrons, neutron cross sections and nuclear fission. Next, the principle of neutron moderation and neutron multiplication will be explained, leading to steady state fission reactor core design based on diffusion theory. The following topics 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. This course implements the Research Infused Experiential Learning (REAL) Level 2 - Research Immersion.

SKTN 3273 - Thermal Hydraulics
Prerequisite: SKTN 2323, SKTU 2143 (taken)
This is a core course that 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 analysis including single and two phase natural circulation, and subchannel analysis.

SKTN 3283 - Nuclear Engineering System and Design
Prerequisite: SKTN 3273, SKTN 3263 (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.

SKTN 3343 - Nuclear Fuel Cycle and Waste Management
This core 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.

SKTN 3353 - Nuclear Safety, Security, Safeguard and Regulation
This core course introduces students to safety, security, safeguards principles and Malaysia regulations pertaining to nuclear activities. The focus of the course is on administrative and technical approaches to enhance nuclear safety, security measures, and national and international safeguard regimes 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 for nuclear activities 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. This course implements the Research Infused Experiential Learning (REAL) Level 2 - Research Immersion.

SKTN 3363 - Nuclear Radiation Protection
This core 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. This course implements the Research Infused Experiential Learning (REAL) Level 3 - Research Apprentice.

SKTN 3412 - Undergraduate Project I
This core 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 to writing a research proposal. It will emphasize on the research philosophy and research methodology. The works include literature review, writing a problem statement, scope identification, objective 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. This course implements the Research Infused Experiential Learning (REAL) Level 3 - Research Apprentice and the Industry Driven Experiential Learning (IDEAL).

SKTN 3771 - Nuclear Engineering Laboratory II
Corequisite: SKTN 3273
This is a laboratory core course involving a series of thermal hydraulics related experiments performed in UTM Nuclear Engineering Thermal Hydraulics Laboratory. Students will experience 2 modes of experiment activities; 1) Thermal hydraulics simulation in UTM Computer Lab, 2) Hands-on experiments in the thermal hydraulics lab. The laboratory activities involves; Convective heat transfer experiment, Two-phase flow experiment (constructing the flow regime map), Boiling heat transfer experiment, investigation of the boiling curve, Boiling crisis experiment. Students are required to prepare technical reports for each experiment. This course implements the Research Infused Experiential Learning (REAL) Level 2 - Research Immersion.

SKTN 3781 - Nuclear Engineering Laboratory III
Prerequisite: SKTN 3263 (taken)
This laboratory core course aims to allow students to verify and further explain the theories learned in the Nuclear Reactor Theory Course through experimental activities using a real operation of a nuclear reactor. A series of nuclear reactor related experiments are performed in selected facilities (UTM Nuclear Engineering Laboratory and Malaysia Nuclear Agency). Students will experience 2 modes of experiment activities; Nuclear reactor simulator in UTM Lab, and Work-Based Learning where hands-on experiments will be conducted at Malaysia Nuclear Agency (MNA). Students are required to prepare technical reports for each experiment. At the end of the course, students are expected to develop understanding of the nuclear reactor operation, the neutronic reaction inside the reactor core, and the safety system of nuclear reactors. This course implements the Research Infused Experiential Learning (REAL) Level 3 - Research Apprentice.

SKTN 3815 - Industrial Training
The purpose of implementing a 12-week industry training program is to expose UTM students firsthand experience on the practical aspects and work practices within the industry. Throughout the program, students will be able to apply their theoretical knowledge with real-world applications, while also enhancing their abilities in work ethics, management, communication, and interpersonal relationships.

SKTN 4291 - Nuclear Engineering Professional Practice
This core course introduces students to 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 from government agencies and industries will be invited to share their knowledge and experience to the students. The talks will be held in hybrid class to emphasise on the engineer as a professional man, engineers in society, code of ethics and professional conduct, standard, 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. This course implements the Industry Driven Experiential Learning (IDEAL).

SKTN 4333 - Nuclear Engineering Materials
Prerequisite: SKTU 2153 (taken)
This core course presents the intersection of nuclear engineering and materials science at a level approachable by undergraduate students. This course covers the key issues related to materials used in the nuclear industry. The initial part of this course introduces the basic concepts of material science and material properties related to nuclear engineering structures. Next, the interaction of nuclear structure materials with radiation and the key issues in material degradation / failures due to irradiation is properly discussed based on case studies and

historical incidents. This course also covers a range of topics related to reactor design, fuels, future technologies and lessons learned from past incidents. At the end of the course, students will be able to identify the materials used in the nuclear industry and be able to explain the effects of radiation to the materials in various parts and components of nuclear engineering structures.

SKTN 3213 - Radiation Technology and Applications
This core course introduces students to radiation technology and its applications across various socio-economic sectors such as industrial, manufacturing, food and agriculture, human health, and the environment. The principle of applications such as in the use of radioactive tracers, radiation imaging, tomography, and radiation sterilisation will be covered. Also covered is the use of mutation breeding in food and agriculture for pest control and in producing better crop varieties. The advantages of radiation technology such as in reducing industrial plant downtime and in identification of pollutant sources will be covered. The comparison of radiation technology with other techniques, where relevant, will also be covered. This course implements the Research Infused Experiential Learning (REAL) Level 3 - Research Apprentice.

SKTN 4333 - Nuclear Engineering Materials
Prerequisite: SKTU 2153 (taken)
This core course presents the intersection of nuclear engineering and materials science at a level approachable by undergraduate students. This course covers the key issues related to materials used in the nuclear industry. The initial part of this course introduces the basic concepts of material science and material properties related to nuclear engineering structures. Next, the interaction of nuclear structure materials with radiation and the key issues in material degradation / failures due to irradiation are properly discussed based on case studies and historical incidents. This course also covers a range of topics related to reactor design, fuels, future technologies and lessons learned from past incidents. At the end of the course, students will be able to identify the materials used in the nuclear industry and be able to explain the effects of radiation to the materials in various parts and components of nuclear engineering structures.

SKTN 4383 - Energy and Power Plant System
This core course introduces students to the concept of energy, its utilizations, resources and environmental impact as well power generation using different power plant systems. This course implements a work-based learning method (WBL) with sessions with experts at power generation related industries.

SKTN 4393 - Radiographic Testing
This core course describes Non Destructive Testing (NDT), in general, which is the process of inspecting, testing or evaluating materials, components or assemblies for discontinuities without destroying their serviceability. Specifically, this course describes in detail, Radiographic Testing method, the most widely used NDT method. Other common NDT methods such as Visual Testing, Liquid Penetrant Testing, Magnetic Particle Testing, Radiographic Testing, Ultrasonic Testing and Eddy Current Testing are described briefly. Metal forming and manufacturing processes and possible defects present in each process will also be described. Factors affecting quality of radiographic image and film processing are described in detail. Exposure determination on plates and pipes of various sizes using both x-ray and gamma ray (Iridium 192) are also described in detail. The most widely used industry inspection and acceptance standards for NDT such as ASME V, VIII or API 1104 will be introduced and applied. This includes a brief description of radiographic procedure and radiographic instruction writing. Radiation safety in radiographic testing work is highlighted

and described in detail. This course implements the Research Infused Experiential Learning (REAL) Level 3 - Research Apprentice.

SKTN 4424 - Undergraduate Project II
Prerequisite: SKTN 3412 (pass with at least D+)
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.

SKTN 4434 - Nuclear Engineering System and Design Project
Prerequisite: SKTN 4283 (taken)
This capstone core course is a group design project 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 will go through a series of lectures given by industrial experts while carrying out the capstone project. They are required to present a final design presentation and submit the final design report. The reports will be evaluated by a panel of evaluators from the industry and government agency. This course implements the Research Infused Experiential Learning (REAL) Level 4 - Research Intensive.

SKTN 4434 - Nuclear Engineering System and Design Project
This core course introduces students to artificial intelligent methods and their applications in nuclear engineering. It covers the concept of intelligence for inanimate systems, methods for incorporating some kind of intelligence in such systems for example using fuzzy logic, neutral networks, and neuro-fuzzy networks. It also covers methods for design optimization and data analysis for pattern discovery using for example clustering approach, machine learning, and data mining. The applications of these methods in nuclear engineering related to for example safety, operation, and design will be covered. This course implements the Research Infused Experiential Learning (REAL) Level 4 - Research Intensive.

SKTU 1111 - Engineering Drawing
This core 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. The course covers the topics of introduction and fundamentals of engineering drawing, geometry, orthographic, isometric and sectional drawing. The course also gives exposure on 3D drawing to the students. All the drawings are to be constructed using AutoCAD software. Besides that, this course also requires students to work in a team in order to complete the projects assigned to them.

SKTU 1123 - Engineering Mechanics
This core course is designed to introduce students to the basic principles and concepts in mechanics. It will deal 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 (kinematic and kinetics) 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.

SKTU 1133 - Thermodynamics
This core course is an important basic engineering concepts such as systems, boundaries, mass, heat, work and energy are introduced. These concepts are then related using the 1st and 2nd Laws of Thermodynamics. In this course, 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 formed the fundamentals for future chemical engineering courses.

SKTU 1143 - Fluid Mechanics
The will introduce 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 especially pump. The course covers the physics of fluid, classification of flow, fluid statics, fluid dynamics, the application of Bernoulli's, continuity, and momentum equations, friction flow in pipes includes the use of Moody chart, flow metering, pump, dimensional analysis and similarity.

SKTU 2153 - Mechanics of Materials
Prerequisite: SKTU 1123 (taken)
The core course covers both the theory and application of the fundamental principles for the structure-property of various engineering materials with the strength of materials. Emphasis is placed on the importance of satisfying equilibrium, compatibility of deformation, and material behaviour requirement. Topics being covered include material science and engineering, structure-property of engineering materials, crystal structure, stress and strain under axial loading, torsion, bending, combined loadings, stress transformation, design of beams and shafts.

SKTU 2711 - Thermodynamics and Material Engineering Laboratory
Prerequisite: SKTU 1133, SKTU 2153 (taken)
This laboratory core course covers basic concepts in Thermodynamics and Strength of Material. Laboratory experiments are designed for hand-on experience to understand the engineering principles and are divided into two methods of learning; guided experiment and open-ended experiment. 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.

SKTU 2721 - Fluid Mechanics Laboratory
Prerequisite: SKTU 2143 (taken)
The aim of this laboratory core course is for students to conduct experiments in conjunction with the theory course Fluid Mechanics. This will give hands-on experience to the students on handling the equipment and to interpret the data taken from the experiments. In this course, apart from the guided experiments, students will have the opportunity to design their own experiments in the open-ended experiments. Students will be assessed by their design of experimental methodology, skills in handling the equipment, and ability to discuss and analyse the results in the report submitted. The lab runs closely with the lectures' invigilation and based on the prior knowledge of the prerequisite course.

SKTU 3643 - Engineering Economics and Project Management
This course covers both Engineering Economics and Project Management. Engineering economics focuses on evaluating different alternatives and making decisions based on economic factors. These decisions involve the fundamental elements of cash flows of money, time, and interest rates. Project Management is the art of planning, scheduling, and controlling project operations to accomplish performance, cost, time, and objectives for a specified scope of work while efficiently and effectively using resources. This course also implements Service Learning method that requires students to share their knowledge to the community.

ELECTIVE COURSES

SKTN 4913 - Ultrasonic Testing
The elective 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.

SKTN 4933 - Chemistry in Nuclear Engineering
This elective course 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 application of radiation sources for the production and modification of polymers.

SKTN 4943 - Radiation Application in Medicine
This elective course introduces students to radiation application and instruments in the medical field. Fundamental aspects of nuclear medicine physics are introduced in the beginning of this course. Then, the principles of radiation protection in nuclear medicine activities will be explained. Next, students will learn the equipment, process and evaluation of nuclear imaging for human body and nuclear medicine and radiotherapy. At the end of this course, students are expected to understand the application of ionizing radiation in the medical field and the physics behind the instruments used for imaging using ionizing radiation.

SKTU 5113 - Research Methodology
This PRISMS elective course aims to equip students with the essential knowledge and skills to do research and dissertation systematically. This course has 8 modules which will be conducted through a weekly 3-hour seminar. Each seminar will consist of a lecture, discussion and workshop. In the end of course, students need to produce a research proposal and have a mini conference as part of assessment and proposal presentation practice.

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	Tool Usage	The Engineer and the World	Ethics	Individual and Collaborative Team Work	Communication	Project Management and Finance	Life Long Learning
COURSE CODE	COURSE NAME	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11
PROGRAMME CORE COURSES												
SKTN 1213	Introduction to Engineering	/	/			/			/	/		
SKTN 1223	Nuclear Engineering Fundamentals	/							/			/
SKTN 1234	Electrical Engineering Fundamental with Laboratory	/	/						/			
SKTN 1613	Nuclear Physics	/	/						/			
SKTN 2253	Instrumentation and Control Engineering	/	/			/				/		
SKTN 2313	Radiation, Detection and Measurement	/	/						/	/		
SKTN 2323	Heat Transfer	/	/						/			
SKTN 2623	Programming for Engineer	/				/				/		
SKTN 2633	Numerical Methods for Nuclear Engineers	/	/			/			/			
SKTN 2761	Nuclear Engineering Laboratory 1	/			/				/			
SKTN 3263	Nuclear Reactor Theory	/	/	/						/		
SKTN 3273	Thermal Hydraulics	/	/		/							
SKTN 3283	Nuclear Engineering System and Design			/		/			/	/		
SKTN 3343	Nuclear Fuel Cycle and Waste Management	/								/		
SKTN 3353	Nuclear Safety, Safeguard, Security, and Regulation			/			/	/	/			
SKTN 3363	Nuclear Radiation Protection						/		/			
SKTN 3412	Undergraduate Project 1		/	/	/					/		/
SKTN 3771	Nuclear Engineering Laboratory 2				/	/			/	/		

		PROGRAMME LEARNING OUTCOMES (PLO)										
		Engineering Knowledge	Problem Analysis	Design/ Development of Solution	Investigation	Tool Usage	The Engineer and the World	Ethics	Individual and Collaborative Team Work	Communication	Project Management and Finance	Life Long Learning
COURSE CODE	**COURSE NAME**	**PLO1**	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**
SKTN 3781	Nuclear Engineering Laboratory 3				/	/			/			
SKTN 3815	Industrial Training							/	/	/		/
SKTN 4291	Nuclear Engineering Professional Practice							/		/		/
SKTN 4333	Nuclear Engineering Materials	/		/						/		
SKTN 4373	Radiation Technology and Application	/	/				/					
SKTN 4383	Energy and Power Plant System	/	/	/	/							
SKTN 4393	Radiographic Testing	/	/					/		/		
SKTN 4424	Undergraduate Project 2		/	/	/					/		/
SKTN 4434	Nuclear Engineering System and Design Project			/				/	/	/	/	
SKTN 4643	Artificial Intelligence Application in Nuclear Engineering		/			/	/					/
SKTU 1111	Engineering Drawing					/				/		
SKTU 1123	Engineering Mechanics	/							/			
SKTU 1133	Thermodynamics	/	/						/			
SKTU 2143	Fluid Mechanics	/	/							/		
SKTU 2153	Mechanics of Materials	/							/			
SKTU 2711	Thermodynamic and Material Engineering Lab				/				/	/		
SKTU 2721	Fluid Mechanic Laboratory				/				/	/		
SKTU 3643	Engineering Economics and Project Management	/	/								/	
PROGRAMME ELECTIVE COURSES												
SKTN 4**3	Elective I						/			/		/
SKT* 5**3	PRISMS Elective I											

		PROGRAMME LEARNING OUTCOMES (PLO)										
		Engineering Knowledge	Problem Analysis	Design/ Development of Solution	Investigation	Tool Usage	The Engineer and the World	Ethics	Individual and Collaborative Team Work	Communication	Project Management and Finance	Life Long Learning
COURSE CODE	**COURSE NAME**	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11
SKT* ***3	Elective II						/			/		/
SKT* 5**3	PRISMS Elective II											

BACHELOR OF PETROLEUM ENGINEERING WITH HONOURS

PROGRAMME SPECIFICATIONS

The Bachelor of Petroleum Engineering with Honours is offered on a full-time and part-time basis. The full-time programme is offered 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 subject to the student's entry qualifications and lasts between four (4) years to a maximum of six (6) years, while the duration of study for the part-time programme lasts between six (6) years to a maximum of ten (10) 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.

Programme Uniqueness

Various courses in the programme incorporate the following elements:

Elements	**Courses**
Sustainable Development Goals (SDG)	
SDG 3: Good Health and Well Being	SKTP 3532 - Health, Safety, and Environment in Petroleum Engineering SKTP 3545 - Industrial Training
SDG 4: Quality Education	SKTP 1513 - Introduction to Petroleum Engineering
SDG 7: Affordable and Clean Energy	SKTP 2613 - Basic Geoscience SKTP 2643 - Petroleum Geology SKTP 3723 - Reservoir Engineering SKTP 3833 - Petroleum Production Engineering SKTP 3553 - Secondary Recovery SKTP 4926 - Field Development Project
SDG 9: Industry, Innovation and Infrastructure	SKTP 3753 - Well Test Analysis SKTP 3743 - Reservoir Simulation SKTP 3813 - Drilling Engineering SKTP 3843 - Well Completion
SDG 11: Sustainable Cities and Communities	SKTP 4533 - Petroleum Economics and Project Evaluation
SDG 13: Climate Action	SKTP 4926 - Field Development project
Artificial Intelligence	SKTP 3743 - Reservoir Simulation

	SKTP 3753 - Well Test Analysis SKTP 4926 - Field Development Project
Work-Based Learning	SKTP 4936 - Final Year Project SKTP 3545 - Industrial Training
Service Learning	SKTU 3643 - Engineering Economics and Project Management
EXCEL Framework	Research Infused Experiential Learning (REAL) Industry Driven Experiential Learning (IDEAL)
REAL	
Level 1: Research Oriented	SKTP 1513 - Introduction to Petroleum Engineering SKTP 2613 - Basic Geoscience
Level 2: Research Immersion	SKTP 2713 - Reservoir Rock and Fluid Properties
Level 3: Research Apprentice	SKTP 3553 - Secondary and Tertiary Oil Recovery SKTP 3833 - Petroleum Production Engineering
Level 4: Research Intensive	SKTP 3562 - Research Methodology SKTP 4936 - Final Year Project
IDEAL	SKTP 4571 - Petroleum Seminar SKTP 4936 - Final Year Project SKTP 4926 - Field Development Project

General Information

1. Awarding Institution	Universiti Teknologi Malaysia
2. Teaching Institution	Universiti Teknologi Malaysia
3. Programme Name	Bachelor of Petroleum Engineering with Honours
4. Programme Award	Bachelor of Petroleum Engineering with Honours
5. National Education Code (NEC)	0724 (Mining and Extraction)
6. Programme Code	SKTPH
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. Method of Study	Full Time and Part Time
12. Duration of Study	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	6	8	8

Course Classification

No.	Classification	Credit Hours	Percentage
i.	University Courses (a) General (b) Language (c) Entrepreneurship (d) Co-Curriculum	 6 6 2 2	11.9%
ii.	Programme Core	110	81.5%
iii.	Electives (a) Programme Elective (b) Free Electives	 6 3	6.6%
	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	 71 6 5 6 4	68.15%
Total Credit Hours for Part A		**92**	
B	Related Courses (a)Applied Science/ Mathematics/ Computer/ Technology (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)

COURSE MENU

YEAR 1: SEMESTER 1			
Code	**Course**	**Credit**	**Prerequisite**
SSCE 1693	Engineering Mathematics 1	3	
SECP 1013	Programming Technique 1	3	
ULRS 1032	Integrity And Anti-Corruption Course	2	
UHLB 1112	English Communication Skills	HW	
SKTP 1513	Introduction to Petroleum Engineering	3	
SKTU 1123	Engineering Mechanics	3	
SKTU 1223	Thermodynamics	3	
	TOTAL CREDIT	**17**	
	CUMULATIVE CREDITS	**17**	

Note: UHLB 1112 - Please refer to English Prerequisite Section for details.

YEAR 1: SEMESTER 2			
Code	**Course**	**Credit**	**Prerequisite**
SSCE 1793	Differential Equations	3	SSCE 1693
SSCK 1203	Analytical Chemistry for Engineers	3	
SEEU 2003	Electrical Technology	3	
ULRS 1182	Appreciation Ethics and Civilizations (for Local Students)	2	
UHLM 1012	Malay Language For Communication 2 (for International Students)		
SKTU 2143	Fluid Mechanics	3	
SKTU 2153	Mechanics of Material	3	SKTU 1123
SKTU 2711	Thermodynamics and Material Engineering Laboratory	1	SKTU 1223 SKTU 1123
	TOTAL CREDIT	**18**	
	CUMULATIVE CREDITS	**35**	

YEAR 2: SEMESTER 1			
Code	**Course**	**Credit**	**Prerequisite**
ULRF 2**2	Service Learning and Community Engagement	2	
SSCE 2393	Numerical Methods	3	SSCE 1693
SSCE 1993	Engineering Mathematics II	3	SSCE 1693
[a]SKTU 3643	Engineering Economics and Project Management	3	
SKTU 1111	Engineering Drawing	1	
SKTU 2721	Fluid Mechanics Laboratory	1	SKTU 2143
SKTP 2613	Basic Geoscience	3	
SKTP 2621	Basic Geoscience Laboratory	1	SKTP 2613
	TOTAL CREDIT	**17**	
	CUMULATIVE CREDITS	**52**	

YEAR 2: SEMESTER 2			
Code	**Course**	**Credit**	**Prerequisite**
SSCE 2193	Engineering Statistics	3	SSCE 1693
ULRS 1022	Philosophy and Current Issue	2	
ULRS 3032	Entrepreneur and Innovation	2	
UHLB 2122	Professional Communication Skills 1	2	UHLB 1112
SKTP 2713	Reservoir Rock and Fluids Properties*	3	
SKTP 2633	Formation Evaluation*	3	
SKTP 2643	Petroleum Geology*	3	SKTP 2613
	TOTAL CREDIT	**18**	
	CUMULATIVE CREDITS	**70**	

YEAR 3: SEMESTER 1			
Code	**Course**	**Credit**	**Prerequisite**
UHLB 3132	Professional Communication Skills 2	2	ULHB 2122
UHL* 1122	Foreign Language for Communication	2	
SKTP 3532	Health, Safety, and Environment in Petroleum Engineering	2	
SKTP 3813	Drilling Engineering*	3	
SKTP 3821	Drilling Fluid Analysis Laboratory	1	SKTP 3813
SKTP 3723	Reservoir Engineering*	3	SKTP 2713
SKTP 3761	Reservoir Analysis Laboratory	1	SKTP 3723
SKTP 3651	Geology Field Work	1	SKTP 2613
SKTP 3833	Petroleum Production Engineering*	3	
	TOTAL CREDIT	**18**	
	CUMULATIVE CREDITS	**88**	

YEAR 3: SEMESTER 2			
Code	**Course**	**Credit**	**Prerequisite**
SKTP 3843	Well Completion*	3	
SKTP 3753	Well test Analysis	3	SKTP 3723
SKTP 3853	Gas Engineering	3	
SKTP 3562	Research Methodology	2	
SKTP 3743	Reservoir Simulation	3	SKTP 3723 SSCE 2393
SKTP 3553	Secondary and Tertiary Oil Recovery	3	SKTP 3723
	TOTAL CREDIT	**17**	
	CUMULATIVE CREDITS	**105**	

YEAR 3: SEMESTER 3 (SHORT SEMESTER)			
Code	**Course**	**Credit**	**Prerequisite**
SKTP 3545	Industrial Training	5	
	TOTAL CREDIT	**5**	
	CUMULATIVE CREDITS	**110**	

YEAR 4: SEMESTER 1			
Code	**Course**	**Credit**	**Prerequisite**
SKTP 4936	Final Year Project**	6	SKTP 3562
SKTP 4533	Petroleum Economics and Project Evaluation	3	SKTU 3643
SKTP 4571	Petroleum Seminar	1	
[b]SKTP 4**3	Petroleum Engineering Elective	3	
	TOTAL CREDIT	**13**	
	CUMULATIVE CREDITS	**123**	

YEAR 4: SEMESTER 2			
Code	**Course**	**Credit**	**Prerequisite**
SKTP 4926	Field Development Project**	6	SKTP 3723 SKTP 3813 SKTP 3743 SKTP 3753 SKTP 3843 SKTP 3532 SKTP 4533
SKT* 4**3	Elective Course	3	
S*** ***3	Free Elective[1]	3	
	TOTAL CREDIT	**12**	
	CUMULATIVE CREDITS	**135**	

[1]Note: Free Elective is a course offered by other Faculties.

Note: * - cornerstone course; ** - capstone course;
[a] - Service learning course
[b] - Petroleum Engineering elective as in program elective course

English Prerequisite

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

ENGLISH PREREQUISITE
a) MUET : $\geq$ Band 4.0
b) IELTS : $\geq$ Band 5.5
c) TOEFL: $\geq$ 525
d) TOEFL iBT : $\geq$ 60
e) CEFR : $\geq$ B2
f) CEQ : $\geq$ 160
g) CIEP-ELS : $\geq$ 108
h) PTE : $\geq$ 51

Petroleum Engineering Elective Courses

Code	Course	Prerequisite
SKTP 4553	Petroleum Refining Technology	
SKTP 4663	Geophysics	
SKTP 4893	Advanced Drilling Engineering	SKTP 3413#
SKTP 4863	Advanced Well Completion	SKTP 3843#
SKTP 4873	Well Diagnosis and Treatment	

ELECTIVE COURSE (SKT* 43)**

Students may enrol in any Elective Course offered by any Undergraduate Programme in FKT.

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	SKTP 2613	Basic Geoscience	3
2	SKTP 2713	Reservoir Rock and Fluid Properties	3
3	SKTP 3723	Reservoir Engineering	3
4	SKTP 3813	Drilling Engineering	3
5	SKTP 3833	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 CORE COURSES					
1	SKTP 1513	Introduction to Petroleum Engineering	3	3	
2	SKTP 2613	Basic Geoscience	3	3	
3	SKTP 2621	Geosciences Laboratory	1	1	
4	SKTP 2713	Reservoir Rock and Fluids Properties	3	3	
5	SKTP 2633	Formation Evaluation	3	3	
6	SKTP 2643	Petroleum Geology	3	3	
7	SKTP 3532	Health, Safety and Environment in Petroleum Engineering	2	2	
8	SKTP 3813	Drilling Engineering	3	3	
9	SKTP 3821	Drilling Fluid Analysis Laboratory	1	1	
10	SKTP 3723	Reservoir Engineering	3	3	
11	SKTP 3761	Reservoir Analysis Laboratory	1	1	
12	SKTP 3651	Geology Field Work	1	1	
13	SKTP 3833	Petroleum Production Engineering	3	3	
14	SKTP 3843	Well Completion	3	3	
15	SKTP 3753	Well Test Analysis	3	3	
16	SKTP 3853	Gas Engineering	3	3	
17	SKTP 3562	Research Methodology	2	2	
18	SKTP 3743	Reservoir Simulation	3	3	
19	SKTP 3553	Secondary and Tertiary Oil Recovery	3	3	
20	SKTP 3545	Industrial Training (Year 3/Short Sem.) for 12 weeks/3 months	5	5	
21	SKTP 4936	Final Year Project	6	6	
22	SKTP 4533	Petroleum Economics and Project Evaluation	3	3	
23	SKTP 4571	Petroleum Seminar	1	1	
24	SKTP 4**3	Petroleum Engineering Elective	3	3	
25	SKTP 4926	Field Development Project	6	6	
26	SKT* 4**3	Elective Course	3	3	
		TOTAL CREDIT OF PETROLEUM ENGINEERING COURSES (a)	**74**	**69**	

FACULTY CORE COURSES					
1	SKTU 1123	Engineering Mechanics	3	3	
2	SKTU 1223	Thermodynamics	3	3	
3	SKTU 2143	Fluid Mechanics	3	3	
4	SKTU 2153	Mechanics of Material	3	3	
5	SKTU 2711	Thermodynamics and Material Engineering Laboratory	1	1	
6	SKTU 3643	Engineering Economics and Project Management	3	3	
7	SKTU 1111	Engineering Drawing	1	1	
8	SKTU 2721	Fluid Mechanics Laboratory	1	1	
		TOTAL CREDIT OF FACULTY GENERAL COURSES (b)	**18**	**18**	
APPLIED SCIENCE/ MATHEMATICS/ COMPUTER/ TECHNOLOGY COURSES					
1	SECP 1013	Programming Techniques 1	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 (c)	**24**	**24**	
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 1032	Integrity And Anti-Corruption Course	2	2	
Global Citizen					
1	ULRF 2**2	Service Learning and Community Engagement	2	2	
Communication Skills					
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	
Enterprising Skills					
1	ULRS 3032	Entrepreneurship and Innovation	2	2	
Free Elective					
1	S*** ***3	Free Elective	3	3	
		TOTAL CREDIT OF UNIVERSITY GENERAL COURSES (d)	**19**	**19**	
		TOTAL CREDIT TO GRADUATE (a + b + c + d)	**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 and 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 School of Undergraduate Studies (UGS). Information on PSC Courses: https://ugs.utm.my/utm-professional-skills-certificate-utm-psc/ Online PSC Registration: https://elearnpsc.utmspace.edu.my/			

COURSE SYNOPSIS

CORE COURSES

SKTP 1513 - Introduction to Petroleum Engineering
This core course introduces students to various disciplines in petroleum engineering. The contents of the course include the origin, migration, accumulation, and exploration of petroleum, the types and properties of reservoir rocks and reservoir fluid, and the type of formation evaluation. This course also briefly discusses the operation and equipment used in drilling, well completion, and production of petroleum.

SKTU 1123 - Engineering Mechanics
This core course is designed to introduce students to the basic principles and concepts in mechanics. It will deal 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 the equivalent system, the equilibrium of rigid bodies, determination of centroid as well as analysis of structure and friction. This course also includes the dynamics (kinematics and kinetics) in engineering mechanics, which involve the determination of rectilinear and curvilinear motions of particles, as well as the analysis of the principles 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 statistics and dynamics, which form the basis of further engineering subjects, especially Mechanics of Materials and Fluid Mechanics.

SKTU 1223 - Thermodynamics
Thermodynamics is an important basic engineering core course where concepts such as systems, boundaries, mass, heat, work, and energy are introduced. These concepts are then related using the 1st and 2nd Laws of Thermodynamics. In this course, 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 courses.

SKTU 2143 - Fluid Mechanics
The core course will introduce 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, especially pumps. The course covers the physics of fluid, classification of flow, fluid statics, fluid dynamics, the application of Bernoulli's, continuity, and momentum equations, friction flow in pipes includes the use of Moody chart, flow metering, pump, dimensional analysis, and similarity.

SKTU 2153 - Mechanics of Materials
Prerequisite: SKTU 1123 (taken)
The core course covers the theory and application of the fundamental principles for the structure-property of various engineering materials with the strength of materials. Emphasis is placed on the importance of satisfying equilibrium, compatibility of deformation, and material

behaviour requirements. Topics covered include material science and engineering, structure-property of engineering materials, crystal structure, stress and strain under axial loading, torsion, bending, combined loadings, stress transformation, and design of beams and shafts.

SKTU 2711 - Thermodynamics and Material Engineering Laboratory
Prerequisite: SKTU 1223 (taken), Corequisite: SKTU 2153
This laboratory core course covered basic concepts in Thermodynamics and Strength of Material. Laboratory experiments are designed for hands-on experience to understand engineering principles and are divided into two learning methods: guided experiment and open-ended experiment. The experiment application includes the First Law of Thermodynamics, the 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.

SKTU 1111 - Engineering Drawing
This core 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. The course covers the topics of introduction and fundamentals of engineering drawing, geometry, orthographic, isometric and sectional drawing. The course also gives exposure on 3D drawing to the students. All the drawings are to be constructed using AutoCAD software. Besides that, this course also requires students to work in team in order to complete the projects assigned to them.

SKTU 2721 - Fluid Mechanics Laboratory
Prerequisite: SKTU 2143 (taken)
The aim of this laboratory course is for students to conduct experiment in conjunction with the theory course SKTU 2143 (Fluid Mechanics). This will give a hands-on experience to the students on handling the equipment and to interpret the data taken from the experiments. In this course, apart from the guided experiments, students will have the opportunity to design their own experiments in the open-ended experiments. Students will be assessed by their design of experimental methodology, skills in handling the equipment, and ability to discuss and analyse the results in the report submitted. The lab runs closely with the lectures' invigilation and based on the prior knowledge of the prerequisite course.

SKTP 2613 - Basic Geoscience
This core course introduces students to the introduction of geosciences and physical geology. The course emphasizes the earth's physical and chemical characteristics, especially its surface and internal features, including its materials and related processes. The processes involved are surface processes and rock deformation, which will determine the geological structure over geological time.

SKTP 2721 - Geoscience Laboratory
Corequisite: SKTP 2613
This course introduces students to the practical aspects of basic geosciences laboratory work. It provides the students with the identification of minerals and rocks, geological mapping,

particle size analysis of sediments, and the use of a Brunton compass to measure the strike and dip of geological structure planes.

SKTP 2713 - Reservoir Rock and Fluids Properties
The Reservoir Rock and Fluid Properties core course explains the properties related to oil and gas fields. Examples of properties are porosity, permeability, fluid saturation, and capillary pressure. Those properties are impacted by pressure and temperature. Furthermore, the properties of the rock or fluid can be calculated using empirical equations or laboratory tests.

SKTP 2633 - Formation Evaluation
In this core course, students will be introduced to electric logging techniques in open boreholes, covering fundamental principles such as reservoir resistivity, spontaneous potential, and resistivity logs. The course also covers radioactive logging, including the basic concepts of radioactivity and specific logs such as gamma-ray, neutron, and formation density logs. Additionally, students will learn about acoustic logging, exploring the principles of elastic waves and the properties of acoustic logs. The course further delves into the practical applications and evaluation methods, such as Archie's equation, lithology determination, assessing true formation resistivity, and evaluating hydrocarbon reserves. Porosity logs will be used to determine porosity, minerals, and lithology.

SKTP 2643 - Petroleum Geology
Prerequisite: SKTP 2613 (taken)
This core course introduces students to petroleum geology, sedimentology, and applied geophysics, primarily in the context of oil and gas exploration. An explanation will be provided on the source rocks, kerogen, the concept of organic matter maturity, and the process of petroleum generation. The topics on sedimentology and stratigraphy are to provide knowledge of reservoir rock characteristics and identify areas of petroleum accumulation. The processes of migration, entrapment of petroleum, types of sedimentary basins, and petroleum systems will also be discussed to provide an understanding of the locations and distribution of oil and gas fields worldwide and their relationship to the zone of seismicity.

SKTU 3643 - Engineering Economics and Project Management
This core course covers both Engineering Economics and Project Management. Engineering economics focuses on evaluating different alternatives and making decisions based on economic factors. These decisions involve the fundamental elements of cash flows of money, time, and interest rates. Project Management is the art of planning, scheduling, and controlling project operations to achieve performance, cost, time, and objective goals within a specified scope of work, while efficiently and effectively utilizing resources. This course also implements the Service-Learning method that requires students to share their knowledge with the community.

SKTP 3532 - Health, Safety, and Environment in Petroleum Engineering
The core course presents fundamental principles of safety and risk assessment in petroleum engineering. In particular, it emphasizes safety legislation, inherent safety design concepts, methods of hazard identification, chemical health risk assessment, and various risk assessment methods. The course also covers health and environmental issues related to

petroleum engineering. Upon completing this course, students are expected to be able to appreciate the theoretical and practical aspects of occupational safety, health, and environmental considerations 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.

SKTP 3813 - Drilling Engineering

This core course introduces the activities involved in drilling operations. The course content includes rig components and drilling systems, types of drilling fluid and their properties, drilling fluid formulations and calculations, drilling problems, drilling hydraulics calculations, formation pressures and their impact on drilling operations, well control, and well configurations. This course is conducted through lectures, group assignments, and presentations.

SKTP 3821 - Drilling Fluid Analysis Laboratory

Corequisite: SKTP 3813

This core course requires students to prepare and measure the properties of drilling fluids according to the API standard. Laboratory experiments are designed to help students better understand the factors that control drilling fluid properties, as well as familiarize them with field testing procedures for drilling fluids. This laboratory is equipped with complete drilling fluid testing and analysis. Equipment available included, but was not limited to, blenders, mud balances, marsh balances, rheometers, pH meters, resistivity meters, and filter press units.

SKTP 3723 - Reservoir Engineering

Prerequisite: SKTP 2713 (taken)

This core course covers the fundamentals of reservoir engineering, including the description and characterization of oil and gas reservoirs, calculation of fluid in-place and recoverable reserves, the theory and calculation of fluid flow in porous media, and the influence of aquifers on reservoir performance.

SKTP 3761 - Reservoir Analysis Laboratory

Corequisite: SKTP 3723

The primary goal of this core course is to enhance the student's understanding of the knowledge related to the theories taught in reservoir rock and fluid properties, as well as reservoir engineering courses. This course also aims to provide students with hands-on experience in operating laboratory apparatus. The previous goals are fulfilled by planning, developing, and executing open-ended experiments related to the fundamental concepts in reservoir rock and fluid properties, as well as reservoir engineering courses. The open-ended experiments to be conducted by the students in groups of 4 or 5 are the rock properties analysis experiment, the fluid properties analysis experiment, the displacement test, and the improved recovery experiment.

SKTP 3651 - Geology Field Work

Prerequisite: SKTP 2613 (taken), SKTP 2643 (taken)

This core course exposes students to Malaysian geology. Students will be trained to make geological observations, including simple geological structure, stratigraphy, and geological mapping, using the compass-step method.

SKTP 3833 - Petroleum Production Engineering
This core course covers the principles and methodology for oil wells productivity, encompassing a wide range of petroleum production fundamentals pertinent to modern petroleum industries, including vapor and liquid mixture behaviour and related calculation, well productivity, performance analysis and evaluation, downhole and surface production system operation, well performance prediction and optimization, artificial lift system, and surface facilities. The graduate is also technically well-prepared and possesses a sound knowledge of the industry's production engineering requirements.

SKTP 3843 - Well Completion
This core course encompasses a wide range of topics related to well construction and completion. It includes in-depth discussions on casing design, cementing operations, best practices for well completion, the various components and accessories associated with tubing, production packers, tubing sealing assemblies, sub-surface equipment, perforation techniques, as well as the selection and utilization of completion and workover fluids.

SKTP 3753 - Well Testing
Prerequisite: SKTP 3723 (taken)
This course introduces students to well testing practices in the oil and gas industries. The course contents include the concepts and principles of well testing, equipment, well test interpretation methods, and well test design. This course is conducted through normal lectures, class workshops, and application software activities.

SKTP 3853 - Gas Engineering
The core course introduces the relationship between upstream and downstream gas processing, covering both theories and calculations. The course contents include gas well deliverability, gas pipeline flow, gas compressors, gas dehydration, gas treatment, and gas measurement. This course is conducted through lectures, group assignments, and presentations.

SKTP 3562 - Research Methodology
This core course aims to equip students with the essential knowledge and skills to conduct research and write dissertations systematically. This course consists of eight modules, which will be conducted through weekly seminars and classes. Each seminar will consist of a lecture, discussion, and workshop. At the end of the course, students are required to produce a research proposal and defend it through a technical presentation.

SKTP 3743 - Reservoir Simulation
Prerequisite: SKTP 3723 (taken), SSCE 2393 (taken)
This course includes derivations of basic equations and underlying principles used in the development of reservoir simulators. It covers the development of a simple governing equation, as well as 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.

SKTP 3553 - Secondary and Tertiary Oil Recovery
Prerequisite: SKTP 3723 (taken)
This core course provides students with important concepts, theories, and methods of improved oil recovery (IOR), which covers immiscible displacement methods (waterflooding and gas injection) and various types of EOR methods such as thermal, chemical, and physical.

SKTP 3545 - Industrial Training
The purpose of implementing a 12-week industry training program is to offer UTM students firsthand experience of the practical aspects and work practices within the industry. Throughout the program, students will be able to connect their theoretical knowledge with real-world applications, while also enhancing their abilities in work ethics, management, communication, and interpersonal relationships.

SKTP 4936 - Final Year Project
Prerequisite: SKTP 3562 (taken)
The Undergraduate Project requires students to identify gaps in industry-based research problems and then propose a hypothesis with clear objectives and scope to address these problems. The research activities involve practical activities such as laboratory work, data collection from industry, and computer programming/simulation. At the end of the course, students should be able to prepare a comprehensive report that compiles the Undergraduate Research Project and subsequently present their research findings. Finally, students must submit a bound thesis in accordance with the UTM thesis-writing format. In addition, at the end of the course, students will have the opportunity to acquire important generic skills, including communication, teamwork, problem-solving, and creative and critical thinking.

SKTP 4533 - Petroleum Economics and Project Evaluation
Prerequisite: SKTU 3643 (taken)
The core course provides a comprehensive understanding of the economic aspects of the petroleum industry. It explores the fundamental principles and methodologies used in analysing and evaluating the financial viability of oil and gas projects. The course covers various topics related to petroleum economics, including supply and demand dynamics, cost estimation, project evaluation, risk analysis, project sharing contracts, and decision-making within the oil and gas sector.

SKTP 4571 - Petroleum Seminar
This seminar provides a platform for verbal sharing of experiences and discussion forums amongst industrialists, academicians, and final-year petroleum engineering students. It is expected to prepare the students with current developments in the related oil and gas industry operations and activities. Various well-versed industrial personnel and experienced engineers will address the industrial operation scenario. The dialogue and presentation would strengthen students' understanding of the current, future, and past trends in the oil and gas industry and their relevant applications. Students would also be able to understand the correlation between professional ethics and societal and global contexts by appreciating the values of resources, the latest technological developments, health and environmental issues, integrated safety, professional practices, and personal integrity.

SKTP 4926 - Field Development Project
Prerequisite: SKTP 3723, SKTP 3813, SKTP 3743, SKTP 3753, SKTP 3843, SKTP 3532, SKTP 4533 (taken)
The Field Development project core course exposes students to the process and methods of developing a reservoir model. It covers all aspects of field development planning, including screening studies, data evaluation and interpretation, reservoir correlation, and reserves estimation. The course covers extensive data collection and analysis, particularly in the volumetric determination of hydrocarbon reserves, with a focus on reducing uncertainty and managing risk. Reservoir characterization includes reservoir geological modelling, which encompasses structural and rock properties modelling. The structural model is integrated with reservoir fluid properties to model the reservoir fluid's flow behaviour. Integrating structural and dynamic fluid flow models allows students to optimize the field development plan under various scenarios. This simulation leads to the design of an appropriate production system. An economic assessment is performed, accounting for optimized revenue based on production forecasts and estimated development costs. Students must work in small groups of 5, submit written plans, and present their proposals to a panel.

PETROLEUM ENGINEERING ELECTIVE COURSES

SKTP 4553 - Petroleum Refining Technology
This elective course is designed to introduce students to the processes of crude oil refining and illustrate the connections between the various disciplines involved. Its contents cover a comprehensive introduction to refinery technologies, including basic methods, concepts, current and emerging technologies used, and issues related to operations, safety, and the environment.

SKTP 4663 - Geophysics
This elective course introduces students to the application of exploration geophysics such as seismic, gravity, electric, and magnetic in oil and gas exploration and development. It will discuss the general approach, types of equipment, and field operations of the methods used. The course emphasizes the methods of geophysical techniques, especially seismic methods, including some of the interpretation techniques.

SKTP 4893 - Advanced Drilling Engineering
Prerequisite: SKTP 3813 (taken)
This course introduces students to specialized operations, including coring and fishing, advanced drilling techniques, and drilling optimization, as well as procedures and legislation related to well abandonment.

SKTP 4863 - Advanced Well Completion
Prerequisite: SKTP 3843 (taken)
By the end of this elective course, students will acquire the skills to design well spacing for single and dual completions. They will also gain practical knowledge in conducting slickline and completion operations safely and learn how to prepare comprehensive completion reports once the well is ready for production. Additionally, the course content includes exploring

deepwater completion and slickline operations, as well as completion techniques applicable to unconventional hydrocarbon energy sources.

SKTP 4873 - Well Diagnosis and Treatment

The elective course covers problem wells, the diagnosis of problem wells, and their relationship to the decline in oil production or inflow performance. Well, diagnosis is commonly analysed based on available surface data, production logging data, and wellbore surveys. From the analysis, specific formation damage can be pinpointed, allowing for targeted treatment design accordingly. Treatment is often accomplished through workover planning, sand control, and well stimulation. Most proposed treatments involve artificial lift, matrix acidizing, hydraulic fracturing, and the installation of a gravel pack or screen liner. This course is conducted through normal lectures and student group projects.

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	Tool Usage	The Engineer and the World	Ethics	Individual and Collaborative Team Work	Communication	Project Management and Finance	Life Long Learning
COURSE CODE	**COURSE NAME**	**PLO1**	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**
PROGRAMME CORE COURSES												
SKTU 1123	Engineering Mechanics	/							/			
SKTU 1223	Thermodynamics	/	/						/			
SKTP 1513	Introduction to Petroleum Engineering	/					/			/		
SKTU 2143	Fluid Mechanics	/	/							/		
SKTU 2153	Mechanics of Material	/							/			
SKTU 2711	Thermodynamics and Material Engineering Laboratory				/				/	/		
SKTU 2721	Fluid Mechanics Laboratory				/				/	/		
SKTU 1111	Engineering Drawing					/			/			
SKTU 3643	Engineering Economics and Project Management	/	/								/	
SKTP 2613	Basic Geoscience	/								/		
SKTP 2621	Basic Geoscience Laboratory				/				/	/		
SKTP 2713	Reservoir Rock and Fluid Properties	/	/									
SKTP 2633	Formation Evaluation	/	/							/		
SKTP 2643	Petroleum Geology	/	/							/		
SKTP 3532	Health, Safety, and Environment in Petroleum Engineering	/					/	/				/
SKTP 3813	Drilling Engineering		/	/						/		
SKTP 3723	Reservoir Engineering	/	/			/						
SKTP 3821	Drilling Fluid Analysis Laboratory				/				/	/		
SKTP 3761	Reservoir Analysis Laboratory				/				/	/		

		PROGRAMME LEARNING OUTCOMES (PLO)										
		Engineering Knowledge	Problem Analysis	Design/Development of Solution	Investigation	Tool Usage	The Engineer and the World	Ethics	Individual and Collaborative Team Work	Communication	Project Management and Finance	Life Long Learning
COURSE CODE	**COURSE NAME**	**PLO1**	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**
SKTP 3651	Geology Field Work	/								/		
SKTP 3833	Petroleum Production Engineering	/	/			/						
SKTP 3843	Well Completion	/		/					/			
SKTP 3753	Well Test Analysis		/	/		/				/		
SKTP 3853	Gas Engineering		/	/						/		
SKTP 3562	Research Methodology	/								/		
SKTP 3743	Reservoir Simulation	/		/		/						
SKTP 3553	Secondary and Tertiary Recovery		/	/						/		
SKTP 3545	Industrial Training							/	/	/		/
SKTP 4936	Final Year Project		/		/	/				/		/
SKTP 4533	Petroleum Economics and Project Evaluations	/				/					/	
SKTP 4571	Petroleum Seminar						/			/		
SKTP 4926	Field Development Project			/	/	/	/	/	/	/	/	/
PROGRAMME ELECTIVE COURSES												
SKTP 4553	Petroleum Refining Technology	/	/							/		
SKTP 4663	Geophysics	/	/							/		
SKTP 4413	Advanced Drilling Engineering	/	/							/		
SKTP 4863	Advanced Well Completion	/	/							/		
SKTP 4873	Well Diagnosis and Treatment	/	/							/		

INTEGRATED BACHELOR - MASTER PROGRAMME (PRISMS) ELECTIVE COURSES

LIST of PRISMS ELECTIVE COURSES

1. **Master of Science (Energy Management)**
   - SKTC 5113 - Sustainable Energy Management
   - SKTC 5123 - Thermal Energy Management
   - SKTC 5133 - Energy Planning for Sustainable Development

2. **Master of Science (Safety, Health and Environment)**
   - SKTC 5523 - Industrial Hygiene

3. **Master of Science in Polymer Technology**
   - SKTC 5623 - Polymer Physics and Properties
   - SKTC 5633 - Polymer Rheology and Processing

4. **Master of Gas Engineering and Management**
   - SKTG 5123 - Hydrocarbon Gas Transportation and Storage
   - SKTG 5223 - Asset Management and Control
   - SKTG 5233 - Hydrocarbon Gas Contract Negotiation and Implementation
   - SKTG 5243 - Hydrocarbon Gas Project Planning, Development and Financing

5. **Master of Science in Food Processing Innovation**
   - SKTB 5163 - Introduction to Professional Halal Executive

6. **Master (Coursework)/ Master of Philosophy/ Doctor of Philosophy**
   - SKTU 5113 - Research Methodology

PRISMS ELECTIVE COURSE SYNOPSIS

1. Master of Science (Energy Management)

SKTC 5113 - Sustainable Energy Management System
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.

SKTC 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.

SKTC 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 and 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)

SKTC 5523 - Industrial Hygiene
This elective course covers the fundamentals of industrial hygiene, which in most countries including the UK, Commonwealth countries and the 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 out from construction, mining and manufacturing industries, and is particularly familiar among process industries. The course is started by introducing the students to industrial hygiene field of area. Then students are exposed to fundamental knowledge an industrial hygienist should know, including industrial diseases, the concept of toxicology, exposure measurement, exposure limits and standards, health risk assessment and control approaches. Different categories of hazards are also covered so that students may understand the source of problems/hazards and how workers can be protected from these hazards. Fugitive emission, which is the main source of background exposure to workers in process industries, is also introduced to the students. Finally, the assessment and control measure of the hazards especially related to industrial hygiene, are also presented.

3. Master of Science in Polymer Technology

SKTC 5623 - 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.

SKTC 5633 - 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 Gas Engineering and Management

SKTG 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.

SKTG 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.

SKTG 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.

SKTG 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.

5. Master of Science in Food Processing Innovation

SKTB 5163 - Introduction to Professional Halal Executive
This elective course is designed for Halal Executive or Halal Consultants that will guide organisation to get Halal Certification. It is one of the requirements for a company to have a dedicated Halal Executive for them to comply to the new Malaysia Halal Standard. This course is also to produce Halal Executive equipped with theoretical knowledge and practical skills to assist organisation to meet the Halal Standards and compliance employing practical methods, techniques, procedures, technology and tools.

6. Master (Coursework)/ Master of Philosophy/ Doctor of Philosophy

SKTU 5113 - Research Methodology

This PRISMS elective course aims to equip students with the essential knowledge and skills to conduct research and prepare dissertation systematically. This course has 8 modules which will be conducted through weekly 3-hour seminar. Each seminar consists of a lecture, discussion and workshop. In the end of the course, students need to produce a research proposal and have a mini conference as part of the assessment and proposal presentation practice.