BACHELOR OF NUCLEAR ENGINEERING WITH HONOURS

PROGRAMME SPECIFICATIONS

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

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

General Information

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

Course Classification

No.	Classification	Credit Hours	Percentage
i.	University Courses (a) General (b) Language (c) Entrepreneurship (d) Co-Curriculum	 10 8 2 3	16.6%
ii.	Faculty/ Programme Core	110	79.1%
iii.	Programme Electives	6	4.3%
	Total	**139**	**100%**
A	Engineering Courses (a) Lecture (b) Laboratory/ Workshop (c) Industrial Training (d) Final Year Project (e) Integrated Design Project	 74 6 5 6 4	68.3%
	Total Credit Hours for Part A	**95**	
B	Related Courses (a) Applied Science/ Mathematics/ Computer (b) Management/ Law/ Humanities/ Ethics/ Economy (c) Language (d) Co-Curriculum	 18 12 8 3	31.7%
	Total Credit Hours for Part B	**44**	
	Total Credit Hours for Part A and B	**139**	**100%**
	Total Credit Hours to Graduate	**139 credit hours**	

Award Requirements

To graduate, students must:

- Attain a total of not less than 139 credit hours with a minimum CGPA of 2.00.
- Pass Industrial Training.
- Complete all Professional Skill Courses.

CROSS-CAMPUS PROGRAMME

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

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

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

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

COURSE MENU

YEAR 1: SEMESTER 1			
Code	**Course**	**Credit**	**Pre-requisite**
SETN 1113	Modern Physics	3	
SETN 1143	Introduction to Engineering	3	
SETN 1243	Statics@	3	
SSCE 1693	Engineering Mathematics I@	3	
UHMS 1182	Appreciation of Ethics and Civilizations (for Local Students Only)	2	
UHIS 1022 OR UHMS 1182	Philosophy and Current Issues (for International Students) OR Appreciation Ethics and Civilizations (for International Students)		
UHLB 1112	English Communication Skills	2	
	TOTAL CREDIT	**16**	
	CUMULATIVE CREDITS	**16**	

YEAR 1: SEMESTER 2			
Code	**Course**	**Credit**	**Pre-requisite**
SETN 1133	Engineering Drawing	3	
SETN 1123	Fluid Mechanics@	3	
SETN 1224	Electrical Engineering Fundamentals with Laboratory	4	
SETN 2213	Nuclear Physics	3	SETN 1113#
SSCE 1993	Engineering Mathematics II@	3	SSCE 1693
UHIS 1022	Philosophy and Current Issues (for Local Students)	2	

UHLM 1012	Malay Language Communication 2 (for International Students)		
	TOTAL CREDIT	**18**	
	CUMULATIVE CREDITS	**34**	

YEAR 2: SEMESTER 1			
Code	**Course**	**Credit**	**Pre-requisite**
SECP 2273	Programming for Engineers	3	
SETN 1711	Fluid Mechanics Lab	1	SETN 1123
SETN 2113	Thermodynamics@	3	
SETN 2123	Strength of Materials	3	
SETN 2243	Nuclear Engineering Fundamentals	3	
SSCE 1793	Differential Equations	3	SSCE 1993
UHLB 2122	Academic Communication Skills	2	UHLB 1112
	TOTAL CREDIT	**18**	
	CUMULATIVE CREDITS	**52**	

YEAR 2: SEMESTER 2			
Code	**Course**	**Credit**	**Pre-requisite**
SETN 2133	Dynamics@	3	SETN 1243
SETN 2223	Heat Transfer	3	SETN 2113#
SETN 2393	Numerical Methods for Nuclear Engineers	3	SSCE 1793
SETN 2711	Thermodynamics & Mechanics of Material Laboratory	1	SETN 2113 SETN 2123
SETN 3711	Nuclear Physics Lab	1	SETN 2213
SSCE 2193	Engineering Statistics	3	
UHMT1012	Graduate Success Attributes	2	
UKQF 2**2	Co-curriculum	2	
	TOTAL CREDIT	**18**	
	CUMULATIVE CREDITS	**70**	

YEAR 3: SEMESTER 1			
Code	**Course**	**Credit**	**Pre-requisite**
SETN 3173	Engineering Economics & Project Management	3	
SETN 3213	Nuclear Reactor Theory	3	
SETN 3233	Radiation Detection and Measurement	3	
UBSS 1032	Introduction to Entrepreneurship	2	
UHIT 2302	The Thought of Science and Technology	2	
UHLB 3132	Professional Communication Skills	2	UHLB 2122
UKQT 3001	Extracurricular Experiential Learning (ExCEL)	1	
	TOTAL CREDIT	**16**	
	CUMULATIVE CREDITS	**86**	

YEAR 3: SEMESTER 2			
Code	**Course**	**Credit**	**Pre-requisite**
SETN 3113	Nuclear Radiation Protection	3	
SETN 3123	Nuclear Reactor Material	3	SETN 2123
SETN 3223	Instrumentation and Control Engineering	3	
SETN 3224	Thermal Hydraulics with Lab	4	SETN 2223 SETN 1123
SETN 3721	Nuclear Reactor Lab	1	SETN 3213
SETN 4812	Undergraduate Project I	2	
UHL* 1112	Foreign Language Elective	2	
	TOTAL CREDIT	**18**	
	CUMULATIVE CREDITS	**104**	

YEAR 3: SEMESTER 3			
Code	**Course**	**Credit**	**Pre-requisite**
SETN 3915	Industrial Training	5	
	TOTAL CREDIT	**5**	
	CUMULATIVE CREDITS	**109**	

YEAR 4: SEMESTER 1			
Code	**Course**	**Credit**	**Pre-requisite**
SETN 3253	Nuclear Safety, Safeguard, Security & Regulation	3	
SETN 4453	Nuclear Power Plant System	3	
SETN 4711	Radiation, Detection & Measurement Lab	1	SETN 3233
SETN 4824	Undergraduate Project II*	4	SETN 4812#
SETN 4833	Nuclear Engineering System and Design I	3	SETN 4453
SETN 4**3	Elective I	3	
SET* 5**3	PRISMS Elective I		
	TOTAL CREDIT	**17**	
	CUMULATIVE CREDITS	**126**	

YEAR 4: SEMESTER 2			
Code	**Course**	**Credit**	**Pre-requisite**
SETN 4611	Nuclear Engineering Professional Practice**	1	
SETN 4834	Nuclear Engineering System and Design II	4	SETN 4833
SETN 4113	Nuclear Fuel Cycle and Waste Management	3	
SETN 4**3	Elective II	3	
SET* 5**3	PRISMS Elective II		
U*** 2**2	University Elective (Generic Skill Cluster)	2	
	TOTAL CREDIT	**13**	
	CUMULATIVE CREDITS	**139**	

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

English prerequisite is shown below:

ENGLISH LANGUAGE TESTS	UHLB 1112	UHLB 2122	UHLB 3132
a) MUET : ≥ Band 4 b) IELTS : ≥ Band 5.5 c) TOEFL: ≥ 525 d) TOEFL iBT : ≥ 60 e) CEFR : ≥ B2	Exemption*	Compulsory	Compulsory

*Eligible students are required to apply for UHLB 1112 course credit exemption. The credit exemption form (UTM.E/3.8) is provided at the academic office.

Elective Courses

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

PRISMS ELECTIVE COURSES

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

GRADUATION CHECKLIST

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

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

22	SETN 3224	Thermal Hydraulics with Lab	4	4	
23	SETN 3233	Radiation Detection and Measurement	3	3	
24	SETN 3253	Nuclear Safety, Safeguard, Security & Regulation	3	3	
25	SETN 3711	Nuclear Physics Lab	1	1	
26	SETN 3721	Nuclear Reactor Lab	1	1	
27	SETN 3915	Industrial Training	5	HL	
28	SETN 4113	Nuclear Fuel Cycle & Waste Management	3	3	
29	SETN 4453	Nuclear Power Plant System	3	3	
30	SETN 4611	Nuclear Eng. Professional Practice	1	1	
31	SETN 4711	Rad. Detection & Measurement Lab	1	1	
32	SETN 4812	Undergraduate Project I	2	2	
33	SETN 4824	Undergraduate Project II	4	3	
34	SETN 4833	Nuclear Eng. System & Design I	3	3	
35	SETN 4834	Nuclear Eng. System and Design II	4	4	
36	SETN 4**3	Elective Nuclear I	3	3	
	SET* 5**3	PRISMS Elective I			
37	SETN 4**3	Elective Nuclear II	3	3	
	SET* 5**3	PRISMS Elective II			
		TOTAL CREDIT OF NUCLEAR ENGINEERING COURSES (a)	**104**	**99**	
MATHEMATICS COURSES (Faculty of Science)					
1	SSCE 1693	Engineering Mathematics I	3	3	
2	SSCE 1793	Differential Equations	3	3	
3	SSCE 1993	Engineering Mathematics II	3	3	
4	SSCE 2193	Engineering Statistics	3	3	
		TOTAL CREDIT OF MATHEMATICS COURSES (b)	**12**	**12**	

UNIVERSITY GENERAL COURSES					
Cluster 1: Appreciation of Philosophy, Value and History (Faculty of Social Sciences and Humanities)					
1	UHMS 1182	Appreciation of Ethics and Civilizations (for Local Students)	2	2	
	UHMS 1022 OR UHMS 1182	Philosophy and Current Issues (for International Students) OR Appreciation of Ethics and Civilizations (for International Students			
2	UHIS 1022	Philosophy and Current Issues (for Local Students)	2	2	
	UHLM 1012	Malay Language Communication 2 (for International Students)			
Cluster 2: Generic Skills					
1	UHMT 1012	Graduate Success Attributes	2	2	
2	U*** 2**2	University General Elective	2	2	
Cluster 3: Knowledge Enhancement					
1	UHIT 2302	The Thought of Science and Technology	2	2	
Cluster 4: Co-Curriculum and Service Learning					
1	UKQF 2**2	Co-Curriculum	2	2	
2	UKQT 3001	Extracurricular Experiential Learning (ExCEL)	1	1	
Cluster 5: Language Skills (Language Academy, Faculty of Social Sciences and Humanities)					
1	UHLB 1112	English Communication Skills	2	2	
2	UHLB 2122	Academic Communication Skills	2	2	
3	UHLB 3132	Professional Communication Skills	2	2	
4	UHL* 1112	Foreign Language Elective	2	2	
Cluster 6: Entrepreneurial Skills					
1	UBSS 1032	Introduction to Entrepreneurship	2	2	
		TOTAL CREDIT of UNIVERSITY GENERAL COURSES (c)	**23**	**23**	
		TOTAL CREDIT TO GRADUATE (a + b + c)	**139**	**134**	

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

COURSE SYNOPSIS

CORE COURSES

SETN 1143 - Introduction to Engineering

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

SETN 1113 - Modern Physics

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

SETN 1243 - Statics

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

SETN 2213 - Nuclear Physics

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

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

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

SETN 1123 - Fluid Mechanics

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

SECP 2273 - Programming for Engineers

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

SETN 1224 - Electrical Engineering Fundamentals with Lab

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

SETN 2243 - Nuclear Engineering Fundamentals

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

SETN 2123 - Strength of Materials

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

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

SETN 2113 - Thermodynamics

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

SETN 1133 - Engineering Drawing

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

SETN 1711 - Fluid Mechanics Lab

Pre Requisite: SETN 1123 (taken)

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

SETN 2393 - Numerical Methods for Nuclear Engineers

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

SETN 2223 - Heat Transfer

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

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

SETN 2133 - Dynamics

Pre Requisite: SETN 2133 (taken)

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

SETN 2711 - Thermodynamics & Mechanics of Material Lab

Pre Requisite: SETN 2113 and SETN 2123 (taken)

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

SETN 3233 - Radiation Detection and Measurement

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

SETN 3113 - Nuclear Radiation Protection

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

SETN 3213 - Nuclear Reactor Theory

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

SETN 4453 - Nuclear Power Plant System

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

SETN 3711 - Nuclear Physics Lab

Pre Requisite: SETN 2213 (taken)

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

SETN 3223 - Instrumentation and Control Engineering

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

SETN 3224 - Thermal Hydraulics with Lab

Pre Requisite: SETN 1123 and SETN 2223 (taken)

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

SETN 3721 - Nuclear Reactor Lab

Pre Requisite: SETN 3213 (taken)

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

SETN 3123 - Nuclear Reactor Materials

Pre Requisite: SETN 2123 (taken)

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

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

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

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

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

SETN 3173 - Engineering Economics & Project Management
This is a two-in-one course covering both Engineering Economy and Project Management topics. Engineering economy is the application of economic factors and criteria to evaluate alternatives, considering the time value of money. The engineering economy study involves

computing a specific economic measure of worth for estimated cash flows over a specific period of time. Project Management is the art of planning, scheduling, and monitoring of project activities to achieve performance, cost, and time objectives, for a given scope of work, while using resources efficiently and effectively.

SETN 4833 - Nuclear Engineering System and Design I
Pre Requisite: SETN 4453 (taken)
This course introduces students to nuclear engineering systems, particularly nuclear reactors and their systems, subsystems, and major components. It also introduces students to systematic engineering design approaches including needs definition, concept generation and selection, technical specifications, and design trade-offs. With respect to nuclear reactor design, the course focuses on core design, safety systems, fuel elements, and cooling systems. Students will be introduced to software packages for thermal hydraulics and core design, particularly MCNP code. Economics and financial aspects in the design of nuclear systems will also be introduced. This course is also aimed at preparing students with good knowledge and understanding of nuclear systems design.

SETN 3253 - Nuclear Safety, Safeguard, Security & Regulation
This course introduces students to safety, safeguards, security and regulations pertaining to nuclear activities. The focus of the course is on administrative and technical approaches to enhance nuclear safety, national and international safeguard regimes, and security measures to ensure safe use of nuclear technologies. National and international legal instruments and agencies will be introduced. Engineered and inherent safety features, reliability enhancement through redundancy, methods of safety and risk analysis such as probabilistic safety analysis, fault tree and event trees, FMEA will be covered. Students are expected to develop understanding on the importance of nuclear safety, security, safeguards and the legal instruments that are in place to ensure conformance to peaceful uses of nuclear technology.

SETN 4711 - Radiation, Detection & Measurement Lab
Pre Requisite: SETN 3233 (taken)
The course covers seven nuclear experiments. Experiments of radiation detection and measurement are performed and laboratory reports are written by students. Topics of the experiment include energy calibration of detector, resolution of detector, efficiency calibration of detector, gamma spectroscopy, radon measurement, alpha spectrometry, and liquid scintillation.

SETN 4834 - Nuclear Engineering System and Design II
Pre Requisite: SETN 4833 (taken)
This capstone course is a group design project, with a nuclear industrial based case, involving integration of knowledge in nuclear physics, neutron transport, heat transfer, safety, materials, environmental impact and economic analysis. It provides opportunities to synthesize knowledge acquired in nuclear engineering and apply this knowledge to complex problems of current interest in nuclear power plant design. Students are required to present an interim design project, final design presentation and submit the final design report.

SETN 4611 - Nuclear Engineering Professional Practice

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

ELECTIVE COURSES

SETN 4483 - Radiographic Testing

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

SETN 4413 - Sustainable Energy

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

SETN 4423 - Ultrasonic Testing

The course starts with the introduction of the underlying science of ultrasonic and acoustic wave propagation in elastic media, and its application to non-destructive evaluation. Students will be introduced to the mathematical equations that govern the propagation of ultrasonic and acoustic waves. The student will be exposed to different ultrasonic probes, their types and construction. This is followed by calibration of the testing device and sensitivity adjustment. The theoretical material will be covered in a number of illustrated lectures, reinforced by worked example classes. In parallel with the theoretical aspect of the course, students will undertake a number of experimental tasks to demonstrate how the theory translates into

practice. In general, these tasks will be drawn from examples from the field of non-destructive evaluation, using standard industrial procedure.

SETN 4433 - Chemistry in Nuclear Engineering

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

SETN 4443 - Risk Assessment

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