FACULTY OF ENGINEERING

List of Courses Offered for University of Malaya Student Exchange (UMSEP) for 2018/2019 Academic Session

No.	Course Code	Topic	Pre-Requisite	Credit	Course Offered		Course Description
					Semester I	Semester II	
Bachelor of Civil Engineering							
1	KIA2002	Soil Mechanics	NIL	3	√		The course introduces soil as engineering material. It includes brief introduction on soil formation and its physical characteristics. Also includes identification, classification and description of soil for engineering purposes. Application of mechanics on soil such as compaction, permeability and seepage, stresses, effective stresses, consolidation and strength are also covered.
2	KIA2003	Fluid Mechanics	NIL	3	√		This course aims to introduce the fluid mechanics and establish its relevance in civil engineering. It starts with the definition of fluid properties, Pascal law and pressure measurement. The underlying concept of fluid statics and dynamics, the relevant equations and their applications are discussed. Ended with the analysis in boundary layer, flowing fluid in pipelines and dimensional analysis and similitude.
3	KIA2004	Land Use & Site Planning	KIA 1002 and KIA 1004	3		√	Introduction to structural design and materials for RC elements based on elastic and Limit State approach. Concepts of balanced design, under-design and over-design. General serviceability and durability requirements. Section analysis of rectangular and flanged beams based on Elastic Method. Design of rectangular and flanged beams for axial load and flexure based on Limit State Method. Shear and torsion resistance of RC elements. Design of rectangular and flanged beams for shear. Curtailments and detailing. Deflection and cracking checks. Deflection check, cracking, requirements for maximum and minimum sections. Introduction to RC slabs and design of one-way spanning solid slabs. Design of two-way spanning solid slabs. Introduction to RC columns and design of short columns for axial load and bending. Design of slender columns. Introduction to RC foundation and design of RC pad footings and strip footings.
4	KIA2005	Water Resources	NIL	3		√	Introduction to hydrological cycle, water balance, surface water and groundwater flow. Application of statistic and probability in hydrology and water resources management. Introduction to urban hydrology and application to Malaysian systems.
5	KIA2006	Environmental Engineering and Sustainability	NIL	3		√	Introduction to environment, standards and legislations and related issues in Malaysia. Water quality parameters, sources and characteristics of water and wastewater. Fundamentals of water and wastewater treatment processes. Introduction to sustainability Concepts-Principles of Green Engineering as a Foundation for Sustainability-Climate Change-Water Issues.
6	KIA3001	Statistics and Numerical Techniques	NIL	3		√	The first part introduces to engineering statistics which includes both descriptive and analytical methods for dealing with variability in observed data. Also, included are guided applications to simple statistical analysis using software. In the second part, this course provides students with sound introduction to numerical methods and inferential statistics in solving engineering problems. Students will be exposed to developing simple, well-structured programs in chosen software packages to find solution numerically.
7	KIA3002	Structural Steel Design	NIL	3	√		Introduction to Steel Structures, Principles of Limit State Design for Structural Steel, Load calculation, Design of Flexural members laterally restrained and unrestrained beams, Design of lattice truss, Design of axially, uni-axially and bi-axially loaded compression members, Design of bolted and welded Connections, Design of column bases, Introduction to long span built-up steel construction.
8	KIA3003	Traffic Engineering	NIL	3	√		Introduction to the transportation system, traffic flow theory, traffic flow variables and characteristics, traffic flow studies, road capacity, traffic control and management, traffic signal timing design, parking studies and road safety.

9	KIA3004	Construction Management and Technology	NIL	3	√		Introduction to the civil engineering project phases and cycle. Civil engineering project organization –structures and formation of design and construction organizations. The tendering process, construction contract administration and documentation, bills of quantities, method-related charges, the civil engineering standard method of measurement (CESMM), contract evaluation and variation, civil engineering claims. Types of construction contracts – admeasurement, lump sum, cost reimbursable, target cost contracts, contract strategy and professional ethics. The operational cost estimating technique and risk appraisal. Project planning and the Critical Path Method (CPM). Construction plant and materials management.
10	KIA3005	Hydraulics	KIA2003 (Fluid mechanics)	3		√	This course is the combination of open channels and pipe flow application in hydraulics. It covers the effects of channel complexity, floodplain dynamics, flood propagation, and transport of sediments in rivers and streams. It also covers the study of unsteady flows in pipelines and it's significant in hydraulics.
11	KIA3006	Foundation Engineering	KIA2002	3		√	The subject covers foundation design overview, bearing capacity of shallow foundation, pile foundation capacity, earth pressure and earth retaining structures, site investigation practice.
12	KIA3009	Structural Analysis	KIA2001	3		√	The course begins with an introduction to the theory of elasticity and Stiffness Matrix's method. This is followed by analysis of deep beam using strut and ties. Afterwards, the introduction to finite element analysis and elastic instability of structural framework and ended with an introduction to structural dynamics.
13	KIA3010	Geotechnical Engineering	KIA2002	3		√	The course covers the following topics: Stress distribution in soils, Boussinesq method (elastic theory), and methods using tables, graphs and charts. Compressibility and consolidation of soils, one-dimensional consolidation theory and characteristics, consolidation tests, estimation of the magnitude and rate of consolidation settlement. . Slope stability, modes of slope failure, analysis of infinite slope, analysis of circular failure surface, Fellenius or Swedish method, Bishop method, stability charts, non-circular failure surface. Advanced foundation Engineering, Geotechnical Hazards, Finite element for geotechnical engineering problem and introduction to geotechnical earthquake engineering.
Bachelor of Biomedical Engineering							
1	KIB2002	Electronics	KIB1007 Electrical Circuit Analysis	3	√		This course introduces electronic devices and their applications. The p and ntype materials, including its doping process and application of p-n junction as circuit element. Clipper and clamper and power supply. Diode equivalent circuits and applications. DC and AC equivalent analysis of BJT and FET including their bias configuration.
2	KIB2003	Mechanics of Materials	KIB1003 Statics	3	√		This course covers stress and strain of non rigid body. The topics include torsion, beam and column stress and displacement and plane stress and strain.
3	KIB2005	Safety, Standard and Ethics in Biomedical Engineering	NIL	2		√	The course covers the international and national medical devices regulation, safety and standards including the Global Harmonization Task Force Regulatory Framework. The electrical safety and tests in Medical devices are also explained.The course also covers ethical and bioethical issues related to biomedical engineering.
4	KIB2006	Computer and Programming	NIL	2		√	This course introduces the basic structural computer programming and object- oriented programming. The course covers the arithmetic and logical operations, control structures, functions, arrays, pointers and object-oriented programming. The student will learn to write useful computer programs in order to solve mathematical and engineering problems.
5	KIB2007	Medical Electronics	KIB1007 Electrical Circuit Analysis	3		√	This subject introduces to students the basic theory of sensors, transducers and electrodes. It covers the related electronic circuits and components for biomedical applications. The students are also exposed to filters, oscillators and ADC & DAC circuits. The specific circuit for ECG, EMG and EEG systems are also explained in this course.
6	KIB2008	Biomechanics of Human Motion	NIL	3		√	The principles of mechanics are applied to the study of human motion to provide students with an understanding of the internal and external forces acting on the body during human movement. Topics cover basics biomechanic, biomechanic of human growth, biomechanics of upper limb, lower limb, spine, joints and muscle, kinetics and analysis of human motion as well as rehabilitation biomechanics.

7	KIB3005	Biomedical Engineering Practice	NIL	2	√		This course offers the student to exposure with the environment, technology and the infrastructures within the Biomedical Engineering Practices in Hospital Environment. The students will be exposed with the current technology being used by the hospital. Other than that the students will be exposing with protocol and ways that are needed in handling problems regarding the clinical.
8	KIB3006	Mechanics of Machines	NIL	3	√		This course covers the mechanics of different machines. The topic includes slider, four bar, spur gear, compound gear, belt drive as well as vibrating body in 2D of freedom and rigid body mechanics in 3D.
9	KIB3009	Signal and System	KIX1002 Engineering Mathematic 2	2		√	This course introduces the basics signal and systems to the students. The students will be exposed to signal transformation and signal properties including Laplace and Fourier concept.
10	KIB3010	Control System	NIL	2		√	This subject introduces the concept of control system, transfer functions of cascaded systems and their parameters. Control approaches such as PID, system stability, sketching techniques and plotting are also included to equip students with necessary tools in solving biomedical engineering problems.
11	KIB3011	Microcomputer and Digital Systems	NIL	3		√	This subject introduces Microprocessor and its Architecture, number systems, digital logic circuits, addressing mode, data movement instructions, arithmetic and logic instructions, program control, memory interface, Input/Output interface, interrupts, subroutines, design of microprocessor system.
12	KIB3012	Fluid Mechanics	NIL	3		√	Basic principles covering fluid mechanics. Applying basic principles of fluid mechanics to solve engineering problems. Applying basic principles of fluid mechanics in biomedical engineering problems.
13	KIB3013	Biochemistry and Analysis	NIL	3		√	The course has an overall goal of equipping students to understand the key biomolecules within the human body, and making them aware of the existing analytical tools.
Bachelor of Electrical Engineering							
1	KIE2003	Probability and Random Signal	NIL	3	√		Basic probability, Discrete random variables, Summary statistics, Continuous random variables, Laws of large numbers, Detection, Estimation and Stochastic processes.
2	KIE2004	Electronic Circuit II	NIL	3	√		Design of low frequency amplifiers, frequency response, distortion, noise and gain, Multistage amplifiers, High frequency amplifiers, Hybrid model, Y-parameter and π model. Power amplifier design, Class A, B, C, and D. Frequency response, equivalent circuits, RF and IF amplifiers. Low noise amplifier design, Switching circuits, Bi-stable, mono-stable, and A-stable multi-vibrators. Schmitt trigger circuits.
3	KIE2005	Circuit Analysis II	NIL	3	√		Laplace transform in circuit analysis, Signal Flow Graph Circuit Analysis Techniques, frequency selective circuits, active Filter circuits, Fourier series, Fourier transform, two-port circuits, Attenuator design, Impedance Matching and Network Transformation
4	KIE2006	Signal and System	NIL	3	√		Time and frequency domain representation of continuous and discrete time signals. Introduction to sampling and sampling theorem. Time and frequency analysis of continuous and discrete linear system. Fourier series convolution, transfer functions, Fourier Transform, Laplace Transform and Z-transform.
5	KIE2007	Basic Electromagnetics	NIL	3		√	This course gives an introduction to static electromagnetic fields. The student is first given a grounding in vector analysis. Then, electrostatics are introduced, with emphasis on electrostatic vector fields, electrical materials, capacitors and its derived energy and forces. Then, magnetostatics are given similar treatment regarding magnetostatic vector fields, magnetic materials, inductors and its derived energy, force and torque. Boundary value problems in static electromagnetics are also addressed.
6	KIE2008	Communication System	NIL	3		√	This course introduces the basic principles that are used in the analysis and design of analog and digital communication systems. This course also presents analytical concepts in modern communication systems analysis and design.
7	KIE2009	Building Maintenance	NIL	3		√	This course introduces the students to the basics of electrical machines and simple drives. It provides opportunities for students to have hands on experience on design and construction of simple machines.

8	KIE3004	Applied Electromagnetics	NIL	3		√	Starting with fundamental postulates of electromagnetism, Faradays law is introduced, leading to the discussion on Maxwell's equations. The study of uniform plane wave includes the propagation of time harmonic plane wave in an unbounded homogeneous medium, the concept of pointing vector and the incidence of plane wave. Overview of the transmission lines will be explained. The general transmission-line equations can be derived from a circuit model, and the study of time harmonic steady-state properties of transmission line is facilitated by the use of graphical chart. Waveguides and basic of antennas will be explained.
9	KIE3006	Control System	NIL	3		√	This course presents the basic knowledge of control engineering and modelling. It gives an understanding of 1st and 2nd order system behavior. Topics covered include time and frequency domain descriptions of systems, properties of linear time invariant systems, stability, principles of feedback, control systems analysis, and design of simple controllers.
Bachelor of Mechanical Engineering							
1	KIG 2001	Fundamental of Electrical Engineering	NIL	3	√		This course introduces the students with the fundamentals of electrical circuit elements and circuit analysis principles.
2	KIG 2002	Dynamics	KIG 1001 (Statics)	3	√		This course exposing the student to applied mechanics by using vector analysis approach which is introduced early lecture and used throughout the presentation of statics and dynamics. This approach leads to more concise derivations of the fundamental principles of mechanics. It also results in simpler solutions of three-dimensional problems in statics, and makes it possible to analyze many advanced problem in kinematics and kinetics, which could not be solved by scalar methods. The emphasis in this syllabus, however, remains on the correct deriving and applying of the principles of mechanics and on their application to the solution of engineering problems, and vector analysis is presented chiefly as a convenient tool.
3	KIG 2003	Fluid Mechanics II	KIG 1002 (Fluid Mechanics I)	3	√		The aim of this course is to further the knowledge and understanding acquired in the basic fluid mechanics course given in the first year. This course includes mainly the application of the understanding acquired to the analysis of various phenomena encountered in the very broad field of fluid mechanics. Such phenomena include the flow of fluids in closed and open channels, the study of the lift and drag forces acting on bodies immersed in a fluid, the study and analysis of flow through turbo-machines, such as pumps and turbines and the applications of the laws of similarity and dimensional analysis.
4	KIG 2004	Mechanics of Materials II	KIG 1007 (Mechanics of Materials I)	3	√		Unsymmetric Bending, Composite Beams, Reinforced Concrete Beams, Bending in Curved Beams, Stress Concentrations, Inelastic Bending, Shear in Straight Members, The Shear Formula, Shear Flow in Built-Up Members, Shear Flow in Thin-Walled Members, Shear Centre for Open Thin-Walled Members, Thin-Walled Pressure Vessels, State of Stress Caused by Combined Loadings, Slope and Displacement by the Methods of Superposition and Discontinuity Functions, Statically Indeterminate Beams and Shafts—Methods of Integration and Superposition, Critical Load, Ideal Column with Pin Supports, Columns Having Various Types of Supports, The Secant Formula, Inelastic Buckling, Design of Columns for Concentric Loading, Design of Columns for Eccentric Loading, External Work and Strain Energy, Elastic Strain Energy for Various Types of Loading, Method of Virtual Forces Applied to Trusses and Beams, Conservation of Energy, Impact Loading, Castigliano's Theorem Applied to Trusses and Beams.
5	KIG 2005	Engineering Materials	KIG 1004 (Basic Materials for Mechanical Engineering)	3	√		This course focuses on the structures-rightful of engineering materials. It's includes the crystal structures, phase diagram, precipitation, deformation and others related mechanical properties. Then, introduction on the mechanisms in engineering materials such as mechanisms of dislocation, diffusion, deformation etc. Macroscopic and microscopic structures and the rightful of materials in engineering application are discussed. Interpretation and relation between materials, mechanism, and application in real life are explained and analyzed.
6	KIG 2007	Computer Programming	NIL	3		√	This course introduces students to computer systems and makes them familiar with the computer programming. The course helps students to develop their skill and feel confident to write computer programs and map scientific problems into computational frameworks.
7	KIG 2008	Land Use & Site Planning	NIL	3		√	Introduction to Manufacturing Technology, Workshop Safety, Casting, Welding/Joining Processes, Hot and Cold Working, Deformation and Metrology.

8	KIG 2009	Design of Machine Elements	KIG 1007 Mechanics of Materials I	3		√	Designs of Mechanical Elements have been prepared specifically to introduce the mechanical elements which often used in mechanical machines. This course also introduces the concept of design in the engineering environment and provides hands-on experience of the design process for the mechanical engineering students. The topic covered the review of failure mechanisms in the context of machine design and considers the analysis and safe design of various common elements of engineering systems such as shafts, bearings, gears and etc. Throughout the course, the application and integration of these components in assemblies are demonstrated through examples, case studies and projects involving the detail design of a number of mechanical assemblies and machines.
9	KIG 2010	Heat Transfer	KIG 1005 (Engineering Thermodynamics)	3		√	This course consists of the fundamental concepts of heat transfer, conduction, convection and radiation. Transient heat conduction, internal & external forced convections will be introduced. Besides, the applications and concepts of energy calculations in the heat transfer system will be introduced.
10	KIG 3001	Instrumentation and Measurement Techniques	NIL	3	√		The course is aimed at exposing the students the classical and current instrumentations and measurement techniques applied in industries. The course discusses the application and principles of transducers and data acquisition, post-processing and documentation. The advantages and disadvantages between measurement techniques and computational method are highlighted.
11	KIG 3002	Thermal Engineering Systems	KIG 1005 (Engineering Thermodynamics)	3	√		The course introduces the applications of fundamentals of thermodynamics for selected engines, cycles and processes which are used in our daily life. The First and Second Law of thermodynamic are used. This course is also aimed at enriching students with critical thinking skills and possesses the ability to use the laws correctly in engineering problems and solve energy problems.
12	KIG 3003	Mechanical Vibration	KIG 2002 (Dynamics)	3		√	It is aimed at introducing the fundamentals of vibrations for one degree of freedom (DOF) systems, 2 DOF systems, and multi DOF systems in engineering field. This includes undamped and damped with free and forced vibrations.
13	KIG 3005	Energy and Environment	NIL	3		√	This course exposes students to a societal problem of great concern-namely, energy utilization and environmental effects that result from energy use. This course utilizes core curriculum skills in describing and analyzing the policy and modern technology being implemented to ameliorate the adverse environmental effects. These enable the students to integrate the understanding into appreciation of both advance technology and science that must be employed by nation to maintain a liveable environment while providing improved economic status for their populations.
Bachelor of Chemical Engineering							
1	KIL2001	Chemical Process Principles II	Chemical Process Principles I	2	√		The students are introduced to the forms of energy and the derivation of the general energy balance equation for closed and open systems. Methods to obtain thermo-physical properties will be elaborated. Later students will solve energy balance problems for non-reactive processes. The use of degrees of freedom learnt in an earlier course will be extended. This is followed by reactive energy balance, using both the heats of formation as well as the heat of reaction. This course concludes with the more complex problems that involve simultaneous solutions of mass and energy balances.
2	KIL2002	Organic Chemistry	NIL	2		√	The course introduces fundamentals of organic chemistry with emphasis on the application in chemical engineering. The course exposes students to molecular structures, origin, reaction paths and industrial applications of various organic chemicals. The core of the subject focuses on an in-depth understanding of organic chemistry in petroleum, natural gas, petrochemicals and oleochemicals processes. The subject will also cover the essentials of polymerisation.
3	KIL2003	Applied Statistics	NIL	3	√		This course teaches students the use of statistical inference in determining and estimating the characteristics of populations under study. Students will be taught the processes and the requirements to produce a good experimental design based on full factorial and fractional factorial designs. Analysis using ANOVA will complete the course.

4	KIL2005	Chemical Engineering Thermodynamics II	Chemical Engineering Thermodynamics I	3	√		This course focuses primarily on the underlying principles of thermodynamics and the application of these principles to problems related to pure components, mixtures and reacting systems at equilibria. The use of the thermodynamic web and its generalization to any fluids will begin the course. This is followed by the theorem of corresponding state and other major equations of state (EOS). Subsequently, equilibria between coexisting phases or in the presence of chemical reactions will be examined for a closed system. The calculations for the properties of a species in a pure, mixed or reacting system are based upon the application of various fundamental property relations to Gibbs energy; thereby restricted to only providing information on the direction of the driving force for a given system but not on the rate with which a system reaches equilibrium. Other thermodynamic models such as NRTL and UNIQUAC would also be used to estimate the thermodynamic properties of complex phase equilibria. The effects of reaction conditions on chemical equilibrium and conversion will also be addressed in this course. Students would also be introduced to the various thermodynamic packages available in HYSYS/ASPEN.
5	KIL2006	Heat Transfer	NIL	3	√		This course introduces basic modes of heat transfer, i.e. conduction, convection and radiation, followed by heat transfer phenomena of boiling and condensation. The course then gives exposure to the experimental and empirical determination of heat transfer coefficients. Basic heat transfer equipment such as double-pipe, shell and tube, plate and spiral exchangers and evaporators are then covered. Finally, students will analyze heat exchanger performance by using log mean temperature difference and NTU- effectiveness methods.
6	KIL2007	Mass Transfer	Fluid Mechanics I	2	√		This course first introduces mass diffusion and flux, leading to Fick's Law and the diffusivity. The Fickian constitutive equation will then be incorporated into the material balance to arrive at the general mass transport equation. Various important scenarios amenable to analytical solution such as diffusion in a stagnant gas film, equimolar diffusion, diffusion with reaction will be examined. With these established, basic experimental methods of evaluating the diffusivity will be covered. For more complex situations including boundary layers and multiphase flows, the concept and application of convective mass transfer coefficient are introduced. Buckingham's π-Theorem is used to deduce its functional dependence. This is again followed by discussions on experimental techniques to determine the mass transfer coefficient. For cases with no empirical data, use and misuse of analogies are examined.
7	KIL2009	Reaction Engineering I	Chemical Process Principles I	3		√	This course introduces the concept of chemical reaction engineering such as rate expressions, conversion etc. These concepts are used to derive rate equation for reaction, based on pseudo steady state assumption, rate limiting step assumptions. The rate equations can be used to derive design equation for different types of reactors (batch, semi-batch, CSTR, PFR) and reaction schemes (constant and variable volume). Based on the knowledge of types of reactors, the experimental data for determination of kinetic parameters can be analysed. The course also covers mass and energy balances to examine the effects on the product yield and multiple steady state phenomenon for non isothermal and adiabatic reactors.
8	KIL2010	Biochemistry	NIL	3		√	This course aims to expose students to basics of biochemistry with emphasis on applications in various bioprocesses. Firstly, the structures and functions of microorganisms and biomolecules are introduced. Then, the mechanisms and inhibitions of enzymatic reactions are discussed, followed by typical cell growth pattern, various factors affecting the cell growth and the functions of important metabolic pathways in cells. Lastly, simple enzymatic and cell growth models are applied to determine kinetics of biological reactions.
9	KIL3001	Basic Material Science for Chemical Engineering	NIL	3	√		At the beginning of the course, the students will be exposed to the basic material science which comprises of atomic structures and configuration, types of bonding (primary and secondary), crystal structures, geometries and their space lattices. Important engineering materials such as metals, alloys, polymers, ceramics, composites and other advanced materials together with their properties, phase diagrams, treatments and types of testing will be included. In addition, the corrosion/ degradation of materials and prevention are also introduced.

10	KIL3002	Fluid Mechanics II	Fluid Mechanics I	2		√	Integral linear momentum balance begins the course. This is followed by stresses due to fluid motion and the stress tensor for compact representation. The extended Divergence Theorem or the differential linear momentum balance enables conversion into the differential form, i.e. Cauchy's First Equation of Motion. Application of constitutive equations leads to the Euler, Navier-Stokes and other non-Newtonian equations (e.g. shear thinning, under Herschel-Bulkley fluids). Discussions on initial and boundary conditions will follow. Sample problems amenable to analytical solutions will be covered, linking the solutions to applications. Finally, correlations and CFD software packages will be introduced to handle more complex problems.
11	KIL3003	Modelling of Chemical Processes	Chemical Engineering Thermodynamics II	2	√		This course shows the key steps in carrying out process modelling of a chemical process, degrees of freedom analysis, and solving different types of models using integration method and Laplace transform. Students will deal with both linear and nonlinear systems. Nonlinear systems are linearized through Taylor series expansion. Students will also be exposed to the usage of MATLAB and Simulink for modelling processes.
12	KIL3004	Process Control	Modelling of Chemical Process, Simulation of Chemical Process	3		√	The course will initially cover the dynamic responses of processes of various orders using transfer function approach. It is followed by the formulation of the closed loop control block diagram and study of the responses and stability of these closed loop systems using conventional controllers. Design and tuning of control systems through frequency based techniques and the Bode stability criteria will follow. The design of cascade control systems will end the course.
13	KIL3006	Process Synthesis and Simulation	Chemical Engineering Thermodynamics II, Heat Transfer, Separation Process I, Reaction Engineering I	3		√	This course enables students to learn the key steps in developing the process flow sheet for the production of chemicals. Students are exposed to basic principles of sequencing of separation columns, the design of mass exchanger network and heat exchanger network to minimize utility requirement and cost. This course also introduces the use of modern process simulator (e.g., AspenONE or Promax) to facilitate solving of complex engineering problems associated with the design of chemical process plants. Additionally, students are trained on how to conduct sensitivity analysis and optimization based on certain criteria such as product purity and cost.
14	KIL3007	Separation Processes II	Chemical Process Principles II	3	√		This course introduces the principles of various separation processes (e.g. humidification / dehumidification, drying, evaporation, crystallization, membrane separation). The relevant design calculations such as mass and energy balances, size distribution etc. will be introduced. This will be followed by more detailed descriptions of the different types of equipment available. Finally the course will conclude with discussions on the appropriate selection of separation equipment(s) for a specific application.
15	KIL3008	Process Safety and Loss Prevention	Chemical Engineering Thermodynamics II	3		√	Methods to identify hazards in workplace by application of Survey Checklist Inspection, Safety Review, Job Safety Analysis (JSA), Hazard and Operability (HAZOP) study and Fault Tree Analysis (FTA) will be explained. Analytical methods to estimate reliability of equipment are described. Impact from BLEVE and Vapor Cloud Explosion (VCE) will also be looked at. Source Dispersion Models to look on various scenarios leading to toxic release will also be included. Control Techniques will be discussed to look on possible control measures that can be applied to eliminate the hazards that may lead to loss of personnel, damage to property and environment. The successful prevention of fires and explosions in chemical plants requires a combination of many design techniques and these are also included such as ventilation, sprinkler system, safety equipment layout, safety signs, escape routes, etc. This course also includes method for accident investigation and to look for deficiencies in the Process Safety Management System and other control measures.
16	KIL3011	Reaction Engineering II	Reaction Engineering I	2		√	This course first introduces the properties, characterization and methods to manufacture porous catalysts, to be followed by the catalytic reactions and their criteria. All possible mechanisms for the catalytic reactions, i.e. bulk diffusion, adsorption, surface reaction and internal diffusion will be covered. This is followed by detailed coverage of the effectiveness factor and the Thiele Modulus. Identification of the rate limiting step (e.g. Weisz-Prater criterion) will be discussed. This course concludes with the preliminary designs of heterogeneous reactors.

17	KIL3012	Process Equipment Design	Separation Process I, Reaction Engineering I, Particle Technology, Separation Process II, Reaction Engineering II	3		√	This course first exposes the students to the codes, standards, criteria, and practices used in the design and installation of chemical engineering equipment and systems. This knowledge would then guide students to provide the basic design or arrive at suitable selections of the right equipment for a given process. This course then touches on the estimation of cost of individual equipment and packaged systems, before wrapping up with plant layout.