MKAR 1013 Principles of Forensic Engineering *(3 credits)*
This course is designed for students to understand the activities of forensic experts in the engineering professions. It cover aspects of forensic activity that are common to all disciplines such as clients, and scope and purpose of investigation, techniques, procedures and tools used in investigation and analysis. Interface with forensic specialists from other discipline. Impact of forensic activity on improved practices, products, or planning to reduce the frequency and severity of failures.

MKAR 1023 Laws in Forensic Engineering *(3 credits)*
This course introduces students to laws related to the practices of professional in engineering. The course will emphasize on three main liabilities; tort, contract, statutory liabilities. The role of professional as expert witness will be introduced in law of evidence so as the students will be familiar to the role of expert witness and the procedures involved during experts at trial. The focus will be on building a credible and believable testimony. At the end of the course, the students are expected to understand the legal setting in the practise and be able to analyse and apply critical reasoning and make informed judgement in addressing legal issues in engineering practice and to stand as credible expert witness.

MKAR 1033 Safety Engineering *(3 credits)*
This course fundamental concepts of safety engineering, and understanding safety of equipments commonly used in engineering installation and maintenance, safety of chemicals used in engineering processes, and implementation of safety engineering programs in engineering installations and plants.

MKAR 1043 Risk Analysis *(3 credits)*
Risk is a probability. It is also known as an application of qualitative and quantitative techniques to reduce uncertainty of the outcomes and associated costs, liabilities, or losses. This course is designed for students to understand the risk analysis in the engineering professions. It covers risk definition, detailing of risk analysis, theory of basic probability, modeling of engineering problems, reliability methods, the risk assessment and the acceptance of the risk itself towards individual and society. Upon completion of the course, students are expected to be able to understand the possibilities of risks to occur in the engineering field and how to overcome the risk. Risk analysis is essential to develop the lifelong learning of generic attribute because risk is synonymic in the engineering field and eventually risk can be planned and minimized by the optimum understanding of the course.

MKAR 1053 Investigation of Structural Problems and Failures *(3 credits)*
This course is designed to expose the students on how to conduct forensic engineering investigation according to recommended scientific methods and engineering practice. It covers the different types of problems and failures in engineering infrastructures, the process of investigation as well as the tools and techniques commonly used in forensic engineering. The course also includes the use of various NDT techniques in forensic engineering investigation, how the results are interpreted and how failure hypothesis is developed to determine probable cause or causes of failure. The students will also learn how to present forensic engineering investigation results and gain a basic knowledge on legal aspects of forensic engineering.

MKAE 1043 Advanced Construction Materials *(3 credits)*
This course is designed for students to gain knowledge on advanced construction materials in civil engineering. It will emphasize on advanced materials on concrete, masonry, highway, and geotechnic. The topics covered include the use of waste materials and industrial by-products, natural fibres, and polymer in concrete; production of high performance and durable concrete, development of modern masonry in construction, properties and strength of masonry work, design and construction of flexible and rigid pavement, bituminous surfacing, geosynthetics materials. At the end of the course students

should be able to describe, identify, and discuss the properties and behaviour of different types of civil engineering materials together with the selection and applications of the materials in practice

MKAE 1013 Advanced Structural analysis *(3 credits)*
Energy method: Linear and non-linear theory, Theory of Plates and shells: Introduction to shell structures, types of shells and membrane, theory of shells, bending of thin cylindrical shells, application.

MKAE 1023 Analysis and Design of Structural System *(3 credits)*
Schematic building forms as total structural system, integrity and subsystem interaction, schematic analysis, structural loads and responses, design of horizontal subsystems, design of vertical subsystems, linear components, vertical components, applications to high rise buildings, bridges, suspension and shell systems load bearing structures and foundation subsystems.

MKAE 1153 Advanced Concrete Technology *(3 credits)*
Cement hydration, Concrete performance characteristics: permeability and pore structures. Concrete durability: seawater, acid and sulphate attack, alkaline reaction, corrosion of steel reinforcement, cracks in concrete. Medium and high strength concrete, design mix for durable concrete. Quality Control: development of quality assurance specifications and acceptance plans.

MKAG 1173 Water Supply Engineering *(3 credits)*
The course discusses broad range of topics that include water uses and demand, water demand forecasting, sources of water supply, water distribution and transmission systems, water treatment processes, water quality criteria and safe drinking water act, water tariff and non-revenue water (NRW).

MKAG 1193 Port and Harbour Engineering *(3 credits)*
This course introduces students to the fundamentals and functional requirements of port planning and design: tides, waves, currents, and methods of design. The course will focus on both hydrodynamic concerns and construction aspects such as breakwater design, berthing layout, land reclamation and dredging. Special considerations of sedimentation in navigation channels and in turning basins are also discussed.

MKAJ 1053 Software Application in Geotechnical Eng. *(3 credits)*
This course is designed to expose the students in analyzing geotechnical engineering problem using Plaxis 7.2 and Geo-Studio 2004 Products: SEEP/W, SIGMA/W and SLOPE/W. This course will illustrate what students can do with the modern software tools now available and highlight the important/benefits of numerical modeling. The series of example which taken from the existing literature are employed in this courses, intended to provide the students some example problems that they can use to develop their modeling skills. This course also exposes the knowledge on the usage some of the notation and basic input procedures that are used in the software effectively. At the end of the course, students should be able to utilize this software, improve modeling skills and give some new ideas on how to apply numerical models related to geotechnical engineering problems.

MKAJ 1083 Environmental Geotechnics *(3 credits)*
Site investigation for contaminated soils, site selection for waste disposal, forms of geotechnical contaminations. Regulations governing waste disposal, geotechnical control and environmental protection. Landfill design, groundwater leachate and contamination control, treatment of contaminated soils.

MKAQ 1023 Road Material and Pavement Evaluation *(3 credits)*

Properties and test of materials in road construction. Analyze the laboratory testing (Marshall mixture design, Superpave mixture design, and concrete pavement mixture). Recycled aggregate in road construction. Waste materials in road construction. Alternative binders for sustainable asphalt pavement. Nanotechnology and its impact on road construction.

MKAQ 1093 Transport Safety *(3 credits)*
Introduction and Overview, Transport and traffic hazards and comparison with other hazards. Road safety as a "Global Epidemic", policy and attitudes to transport and traffic safety. Methods for improving road safety: statistical approaches analysis, accident investigation. Quantitative risk analysis. Geometric design and traffic operational aspects of road safety. Accident costs to the society. Road safety projects- holistic approach.

MKMB 1703 Advanced Techniques Of Materials Characterisation *(3 credits)*
This course provides the students with a deep and broad insight into the basic principles of advanced techniques used in characterizing and determining the structure and properties of materials. These techniques include x-ray methods (XRD and XRF), spectroscopy, surface analysis (XPS, AES, SIMS) and analytical techniques of microscopy including light, scanning and transmission microscopy, as well as the basic principles of thermal analysis techniques.

MKMB 1723 Microstructure and Mechanical Properties of Materials *(3 credits)*
This course introduces is aimed at relating materials Microstructural variables to the properties of materials which include metals, polymers, ceramics and composites. To provide an understanding of the causes of failure in engineering components and structures, and to introduce methods of fracture control.

MKMB2713 CORROSION I *(3 credits)*
This course introduces students to the principles of electrochemical corrosion and its processes and provides the students with an understanding of the tools to analyse corrosion problems. The course also introduces students to the various methods of protection against corrosion.

MKMB 2753 Corrosion II *(3 credits)*
To expose the students to the various techniques used in corrosion testing and monitoring. The main types of corrosion testing will cover laboratory, field and pilot plant tests. The roles of corrosion monitoring and its importance in establishing a corrosion monitoring program are also discussed. The course will also provide students with knowledge of the methods of corrosion monitoring needed to diagnose and monitor corrosion in order to reduce costs, increase safety and protect the environment. Students will discuss cases studies of corrosion testing and monitoring in various applications and environments.

MKMJ 2163 Crashworthiness & Structural Impact *(3 credits)*
The course introduces and provides the basic principles involved in the impact and design of crashworthy structures. It aims to extend the student's knowledge and understanding of the behaviour of materials and structures under large deformation effects due to the various impact loading conditions. The course covers local collapse, energy absorption capability and failure modes of crashworthy structures namely thick-walled structures, thin-walled tubular structures, honey-comb, metallic foam and polymeric foam. The students are duly exposed to crashworthiness design features and virtual work approach for calculating energy absorption capacity and indentifying collapse mechanism by employing established theoretical models. Crash energy management is succintly introduced in the context of structural design in overall crashworthiness requirement partically in impact applications namely automotive, aviation and marine structures. The impact behavior of ductile material is of primary interest, in particular for simple structural members. An

understanding of their response is an essential prerequisite for revealing the dynamic behavior of a more complex system. Projects assigned to the students require their skill in demonstrating typical crash simulation and impact analysis numerically. At the end of the course, students should comprehend the key issues of structural crashworthiness and demonstrate an understanding of energy absorption capability of structures. In the oral presentation and report writing, they also must be able to critically evaluate the crashworthiness of structures by using underlying principles of impact analysis.

MKEL 1133 IC Testing *(3 credits)*

In this course, students will be taught on the importance of testing as one of the components in IC manufacturing industry. It begins with the introduction of economic costs and product quality of a production test. To test a circuit, it is essential to understand the fault types and how they are modeled. These fault models can be used for faults in combinational and sequential circuits. Advanced topics including design-for-test (DFT) and built-in self-test (BIST) are to create awareness of its importance in today's IC design and test activities. Standard method of test pattern generation and test compaction using LFSR would be the main part in this topic. Testing power issue is discussed also in this course.

MKEP 1003 Electrical Systems Forensics *(3 credits)*

The purpose of this course is to provide the techniques to perform forensic analysis on electrical system. Electrical forensic is associated with cases involving suspected electrical malfunctions. Typically the suspected malfunction may have caused a fire or an injury. This course introduces the students to the standard electrical practices and codes. Students will also learn the techniques of investigations related to electrical failures in wiring system, domestic appliances and industrial equipments. The students will be exposed to several case studies related to electrical failures.

MKEP 1103 Condition Assessment Of High Voltage Insulation *(3 credits)*

This course provides an understanding of high voltage phenomena, and to present the concepts of high voltage insulation in power systems networks. The first part of the course stresses on the phenomena of conduction and breakdown in insulation materials in order to provide the students with a firm knowledge on high voltage phenomena and insulation technology. The second part of the course covers the deterioration and failure of practical insulating materials. Insulation defects on most of power system equipment are also discussed in this part. For high voltage insulation assessment, insulation diagnostics techniques are introduced at the end of the course. By adapting this knowledge, students will be able to develop essential technical skills and have a competency in solving real-world problems involving high voltage insulation characteristics with some degree of acceptable conditions.

MKET1393 Network Modeling And Performance *(3 credits)*

Network simulation modeling is important in estimating the performance of a particular network. This course introduces the students to the techniques in network modeling using markov chain and discrete event simulation. Students will be expose to the probability and random processes in network modeling. The students will also learn queuing analysis and model error control protocol and network traffic.

MKKH 1223 Inherent Safety and Health Design *(3 credits)*

The main goal of any HSE design of new plant or of modification of existing plant should be to apply principles of inherent safety. This course covers the concept and principles of inherent safety. Students will be introduced to the methods available for inherent safety assessment before they are taught on systematic approaches for inherently safer design. This course also covers inherent occupational health, a new concept which is originated from inherent safety. Students will be taught on how to assess the inherent occupational health performance of a plant using different methods at different

stages of process design. Fugitive emissions will also be covered in detailed including the quantification of the amount released and the estimation of the associated health risk among the workers exposed. At the end of the course, students will be introduced to several simple techniques for multi-criteria decision making in designing a chemical plant which is inherently safer and healthier.

MKKH 1233 Emergency Response Management *(3 credits)*

This course offers students the basics steps to recognise the common major hazard in the chemical process industry (CPI) and the ways to handle emergency situation at work. Unwanted event such as toxic release, chemical spills, fire, and explosion are frequently occur in the chemical process industry. The readiness and effectiveness of response during emergency depends on many factors such as knowledge, planning, system implemented, and training. In this cause, students will be exposed the current issue in the CPI and fundamental of emergency management which is covers identifying, preventing, controlling, and mitigating the emergency situations.

MKKH 1243 Process Safety & Loss Prevention *(3 credits)*

This course is concerned with all aspects of Chemical Process Safety and Loss Prevention. The course emphasizes quantitative engineering analysis based upon the application of mass and energy balances, fluid mechanics, heat transfer and the conservation of energy, mass transfer, diffusion and dispersion under highly variable conditions, reaction kinetics, process control, and statistics. In addition to applications of engineering principles, concepts of management and individual responsibility are stressed, as well as teamwork and the appreciation for orders of magnitude estimation and relative significance.

MKKH 1343 Incident Investigation *(3 credits)*

This course presents the principles and methodology of incident investigation. In loss prevention, the strategy can be divided to proactive and reactive. Proactive strategy is about activity that provides feedback on safety performance within an organisation before an accident, case of ill-health or an incident. Meanwhile, reactive monitoring measures accidents, cases of ill-health and incidents. The idea being to identify the causes of these failures and to take remedial action which will prevent them occurring again. Results of these activities will allow organization to measure its effectiveness as well as assisting them in charting future action plan for improvement. In Malaysia, accident investigation is a legal requirement under OSHA 1994.

MKKH 1353 Asset Integrity *(3 credits)*

In process safety, the loss of asset integrity can have severe consequences for people, the asset, environment and company reputation. This course presents the principles, methodology and management of asset integrity. The course summarises ways to manage the asset integrity and reliability aspect of chemical plant throughout process lifecycle. The course provides detail explanation on the foundations of asset integrity management and describes how it should be implemented to prevent accidents.