Course Synopsis
Master of Science (Mechanical Engineering)
Faculty of Mechanical Engineering
Universiti Teknologi Malaysia

Programme Core Courses	
Research Methodology MEMM1903 3 Credits	This course covers the general principles of Research Methodology that are applicable to any discipline. It discusses the fundamental process in conducting an academic research. The theoretical and practical aspects of preparing a research proposal presented. Amongst topics that will be covered are introduction to research and its philosophy, problem formulation and research objective, literature review, research methodology and design, data collection procedures, data analysis, research proposal and thesis preparation and research management
Emerging technologies and management MEMM1013 3 Credits	This course covers description of current trends and recent technology in mechanical engineering as well as basic description on financial and management. A wide range of topics are discussed which may include design and applied mechanics, thermofluid engineering, renewable energy, materials and composite, industrial and manufacturing, vehicle and marine engineering as well as management and maintenance relevant to the mechanical engineering. Emerging technologies derived from major mechanical fields are disseminated to students through four (4) different modules plus 1 module on financial and management. It is expected that the contents provide an overview of the state-of-the-art in recent mechanical engineering research. Given to the topics covered, the course will be of interest for students, researchers and professionals working in mechanical engineering.
Product Innovation and development MEMM1023 3 Credits	This course introduces the students to the various stages of product design and development methods that can be put into immediate practice in developing products or projects. The development procedures blend the various perspectives of marketing, design, and manufacturing into a single approach to product development. Aspects of sustainable design and manufacturing will also be covered. The course also provides practice in carrying out small projects to expose the various stages of product development. It also includes the various prototyping and manufacturing systems strategies in developing product prototypes.

Master Project	
Master Project I MEMM1914 4 Credits	Master Project 1 requires a student to prepare a research proposal which will be conducted over two semesters (Projects 1 and 2). Master Project 1 covers introduction (problem statement, objective and scope), literature review, methodology, proposed method of solution, provide preliminary data and research model and planning for Projects 1 and 2. The student is required to write a draft report and to present and defend his/her research proposal.
Master Project II MEMM2926 6 Credits	Master Project 2 is a continuation of Master Project 1. The student conducts the research work either in a laboratory, workshop, computer laboratory, or industry. The student then required to do data collection, analyses data and interpret the results to solve the research problem that has been identified in Master Project 1. The student is required to write a complete report and defend the findings. On top of the report writing, student also requires to produce a technical article based on the project findings.

General Mechanical	
Elasticity and Plasticity MEMM1133 3 Credits	This course introduces students to general in-depth theories in the area of elasticity and plasticity. Stress analysis is extended to 3D stress transformation using the stress transformation equation and 3D Mohr's circle in conjunction with typical failure criteria. The stress states of plane stress and plain strain problems are theoretically evaluated in rectangular coordinate systems and by using the stress function concept. For the plasticity concept, fundamental theory of plasticity is introduced for practical applications. Furthermore, the elastoplastic in bending and torsion with strain hardening effect in beams including residual stress is also included in the plasticity analysis. Plasticity analysis on beams and frames is taught to be applied for more complicated structures. Commercial finite element code LS-DYNA is employed as the simulation tools for plasticity application. Upon mastering the software, a case study is given as a group project for evaluating energy absorption capacity of thin-walled structure under large deformation.
Plates, Shell and Pressure Vessels MEMM1143 3 Credits	In this course students are provided with the definitive concepts and principles of pressure vessel design. Students are introduced to the basic theories of elasticity, bending of rectangular and circular flat plates and shell theory. Concepts of plasticity, limit analysis, shakedown, design-by-rule and design-by-analysis are covered. In the former the course covers topics built around the relevant Standards, principally the BS and ASME. Examples are used to illustrate the various topics required to design the majority of 'basic' pressure vessels. In the latter, students are provided with an introduction to the stress analysis of pressure vessels: shell analysis, finite element analysis and the basic concepts of DBA. Pressure vessel components are encompassed within topics including design of dished ends, including buckling aspects, design for external pressure, local loading, supports and mountings, nozzle design and branch connections. At the end of the course, students will be able to consider how the shape and configuration of the vessel will perform under service loading and design them so that they are fit for service.
Adaptive control and Intelligent System MEMM1223 3 Credits	The course shall cover the essential and basic theory of adaptive control engineering and intelligent systems. It shall cover the followings: System identification using least squares, generalised least squares, recursive least squares, adaptation concepts, theory of adaptive algorithms, and their use in control and estimation, servo follower and regulator, self-tuning and adaptive model reference controllers. The intelligent system part shall cover the history, basic theory and architecture of Neural Network (MLP), Adaptive Neural Networks (Elman Networks), Deep Learning and Meta-heuristic Algorithms such as Genetic Algorithm, Particle Swarm Algorithm and Firefly Algorithm. MATLAB and Simulink software package shall be demonstrated and used as a tool in solving system identification, adaptive control and artificial intelligent problems throughout the course.
Robotic System and Control MEMM1233 3 Credits	This course is designed to enable the students at graduate level to develop the necessary insight into the areas of robotic and control. It will examine the fundamental elements of robot system related to anatomy and configuration, robot main components, programming feature and methods and robot's performance specifications. The students are expected to acquire analytical skills through the analyses of robot manipulators related to their kinematics, statics and dynamics which typically constitute the important prerequisites to designing the mechanical structure, planned trajectory path and control aspects. The robot control topic that is included in the later section provides a platform for the students to explore the various control algorithms that address the stability, accuracy and robustness of the systems. Particular emphasis is laid on the mathematical

	modelling and simulation of the control schemes. A number of case studies pertaining to selected robotic systems are expected to further strengthen the students understanding and insight into the actual systems.
Advanced Control System MEMM2213 3 Credits	This course prepares the students to grasps the concept, theory and application of topics of advanced control system theory for postgraduate students with adequate preparation in linear discrete and continuous system control theory. Students will have hands-on experience on the use of Hardware-In-the-Loop (HIL) technology in the design and development of an automated discrete control systems.
Acoustics MEMM1253 3 Credits	This course prepares the future engineers with the physical principles of acoustics together with the tools and analysis techniques for sound measurements. Students will be taught on the physics of sound, measurement instrumentations, analysis techniques, sound inside room & enclosure, transmission of sound through structure and outdoor sound. Students will also be introduced and exposed to the typical acoustic and sound measurement instrumentations available in the acoustics laboratory. The project/s assigned to students during this course requires understanding on the basic principles of sound along with the use of sound measurement instrumentations and data analysis. At the end of this course, students should understand thoroughly all the underlying physical principles of acoustics and should be able to measure and analyse sound levels whenever required.
Vibration measurement and control MEMM1273 3 Credits	The course relates to practical aspects of vibration measurements and the control of vibration in mechanical and engineering systems. Cause and effects of vibration related failures are presented that highlight the importance of measurements, diagnosis, assessment, and control of vibration in the industry. A review of vibration basics from a measurement perspective is presented. Important aspects of vibration data acquisition, signal processing and data interpretation are covered. Topics in vibration fault analysis, avoidance of vibration induced failures, and reduction of vibration and design of control solutions are covered. The course involves measurements and design exercises to demonstrate and to apply knowledge in vibration instrumentation and control.
Structural Dynamics MEMM1283 3 Credits	Structural dynamics investigate the vibrating or oscillating of mechanical structure subjected to dynamic loads. These structures are continuous system thus requiring wave propagation methods in determining the dynamic response of various beams, rods, shafts, and plates. Mobility technique in determining and measuring the response of structures are introduced. Topics also cover on modal analysis which analytically and experimentally determine the natural frequencies, damping and the corresponding mode shapes of structure in motion. Vibration measurement instrumentations are introduced, and laboratory works are offered related to the mobility of structures and modal testing and analysis.
Viscous fluid flow MEMM1313 3 Credits	This course is intended for graduate students wishing to have deep understanding in viscous flow and boundary layer. In this course, it starts with basic properties of fluid and derivation of basic equations for viscous flow problems. Student also will be introduced the boundary condition for viscous flow problems. Then, the derivation of equation of viscous flow regarded to conservation of mass, conservation of momentum and energy equation will be introduced. After that, a set of equations based on the conservation of momentum were used to solve Couette flow and Poiseuille flow. Finally, applying the momentum equation to solve boundary layer related engineering problems and incompressible turbulent mean flow problems.
Compressible Flows MEMM1323 3 Credits	This course is designed to provide students with a clear explanation of the physical phenomena encountered in compressible flow, to develop in them an awareness of practical situations in which compressibility effects are likely to be important, to provide

	a thorough explanation of the assumptions conventionally used in the analysis of compressible flows, to provide a broad coverage of the subject, and to provide a firm foundation for the study of more advanced and specialized aspects of the subject. The course starts with the basic principles and thermodynamics concepts, then expose the students with the analysis of one-dimensional isentropic flow together with area-Mach number relationships, of normal and oblique shock waves, and of expansion waves. The course also covers the analysis of nozzle characteristics, of friction effects, of heat exchange effects and of steady two-dimensional which includes small perturbation theory.
Thermo Fluid Measurement and Diagnostic MEMM1423 3 Credits	The course will explore the thermal and fluid measurement parameters such as pressure, flow, temperature, heat flux, combustion pollutant, sprays and tools to measure them by either intrusive or nonintrusive methods. The classical, standard and advanced thermal-fluid measuring tools will be discussed. This course also introduces students to the basics of advanced optical of fluids and combustion flow diagnostics concepts, principles, and techniques. Quantitative and qualitative measurement techniques for reacting and non-reacting flows will also be emphasized in this course. The course will be conducted through lectures, laboratory works and projects-based methods.
Indoor environmental quality MEMM1453 3 Credits	The course describes factors that affect Indoor Environmental Quality (IEQ) in buildings. The course covers materials related to Thermal Comfort, Indoor Environmental Health, Air Contaminants, and Odors. In this course, to increase students' knowledge of digital technology, they will also be given a project related to environmental modeling using a numerical technique, such as computational fluid dynamics (CFD) analysis. The modeling project will provide added value to students related to information on contaminant characteristics and how numerical analysis could quickly examine the IEQ parameters. Understanding the IEQ factors inside buildings is a first step in identifying the actions necessary to avoid and reduce these aspects' adverse impacts on health.
Advanced Engineering Thermodynamics MEMM2413 3 Credits	This course in advanced engineering thermodynamics provides a strong foundation in the fundamentals of thermal sciences for further advanced research. The students shall be exposed to the restrictions on possible properties and systems. An advanced treatment of the First and Second law of Thermodynamics will be given. Exergy analysis will be given in depth regarding fundamental concepts, techniques and application in various systems.
Advanced Combustion MEMM2423 3 Credits	This course explores deeper into the fundamentals of combustion. Multi-component conservation equations are explored taking into account chemical reactions. Combustion process is also analyzed from the point of view of chemical kinetics to gain better understanding of species production especially pollutant formation. Numerical approach to solving combustion problems is introduced via equilibrium and kinetics packages. Detonation is given special treatment due to its increasing importance and potential for propulsion. At the end of the course, students are expected to be familiar with the thermodynamics and chemical kinetics concept related to the combustion process. The students will be able to analyse deflagration-type combustion like diffusion and premixed flame along with the detonation-type combustion by implementing the fundamental analysis method that are presented in this course.
Virtual Reality for Engineers MEMM1533 3 Credits	The course will introduce techniques used to synthesize and recreate the real world by imitating its physical, visual and audio stimuli and “immersing” a person in one such artificially created environment especially for engineers. To achieve this, OpenGL programming will be used and its applications will focus on kinematics such as robot arm and slider crank. This course will expose students to current research on VR and look at future scopes of the same area.

Creative Design Engineering MEMM1553 3 Credits	This course introduces the new approach in the field of engineering design that has traditionally been primarily concerned with 'how to make things' – but as technology has advanced – the challenge has changed to 'what to make'. Topics highlighted are basic concerns associated with innovation. First, design is considered a kind of universal human act. Second, it is an interdisciplinary approach that brings together perspectives from fields such as cognitive science, cognitive psychology, and science of knowledge. Third, the scope of the discussion includes the process of creating an initial idea for a new product (pre-design phase) as well as the use of the product in society (the post-design phase).

Structural Health and monitoring	
Automatic control & instrumentation MEMM1213 3 Credits	The course shall cover the essentials of both instrumentation and control aspects for graduate students. It will emphasize on the concepts and characteristics of instrumentation system; signal conditioning, transducers and continuing system. Students should be able to relate and describe the operating principle of various transducers and design instrumentation system for measuring load, displacement, temperature and other physical quantities, select suitable instrumentation components and tools for intended application and solve problems related to basic instrumentation system. Special emphasis is given on the microcomputer-based application and data acquisition technique. The control section shall encompass the essence of control theory, mathematical modelling of dynamical system, time response, control action, stability analysis, frequency response and design of control system. A number of practical case studies shall be presented to include modelling and simulation of systems using MATLAB and Simulink.
Condition monitoring MEMM1263 3 Credits	The course relates to practical aspects of maintenance and assets management practices in industry. The course focus on the condition base maintenance strategy where condition monitoring is the key aspects of this success. Several condition monitoring techniques such as vibration, ultrasonic, thermography, oil analysis/tribology-based analysis, acoustic emission, temperature monitoring and performance monitoring are discussed in details. Important aspects of data acquisition, signal processing and data interpretation are covered in detail. The course involves practical exercises to demonstrate and to apply knowledge in condition monitoring.
Conduction and convection heat transfer MEMM1463 3 Credits	This course aims to increase the student's understanding of the fundamentals of conduction heat transfer and to demonstrate the variety of analytical techniques used in the formulation and solution of classical and applications-oriented conduction problems. Learn about the mathematical methods to solve one- and two-dimensional heat conduction problems. Get an overview of some specialized topics in heat conduction, such as the inverse heat conduction problem and experiments for heat conduction problems. This course also introduces the students to convective heat transfer mechanisms; derivation of general conservation equations; dimensional analysis; boundary layer approximation for laminar flow; similarity solution; integral method; laminar forced convection in pipes and ducts, integral solution; convection in turbulent flow; forced heat convection around the bodies immersed in a fluid; natural convection and enhanced convective heat transfer.
Computational method in solid mechanics MEMM1123 3 Credits	This course extends the undergraduate-level introduction to the Finite Element Method for obtaining approximate solution to a wide variety of engineering problems in mechanics of materials and structures. The scope of analysis covers elastic-plastic range of continuous materials behaviour, including low-cycle fatigue. Emphasis is placed on the mathematical derivation of the constitutive equations for numerical implementation.

	Process and procedures in finite element modelling and simulation of realistic engineering problems are described and rigorously discussed using examples in plane, axis-symmetric and 3-D analyses in solid mechanics. Physical interpretation of the 3-D finite element simulation results is also discussed.
Friction, wear & lubrication MEMM1343 3 Credits	This course covers basic knowledge on tribological contact in mechanical systems in relative motion. The course presents the importance, role and properties of contact surfaces, materials and surroundings. Furthermore, the influence of the components of a tribological system and contact conditions on the properties of friction and tear is explained. The course covers the types and the role of lubricants, as well as their influence on the quality of lubrication, friction, and on various friction and wear mechanics. In relation to these topics, the analytical techniques available for the analysis of surface properties, lubricants, tribological behaviour and wider systems are presented.
Assets Integrity & Management MEMB1633 3 Credits	This course is introducing the students to the Asset Integrity Management (AIM) system especially for an aging offshore oil field infrastructure. The platforms, pipelines and onshore facilities were aged and needed some extensive refurbishment and a new inspection and integrity regime put in place. The course also provides a comprehensive coverage of the various non-destructure techniques (NDT) used to assess the intergrity of engineering components. The concepts and techniques used in assessing assets through risk based assessement (RBI) be covered.
Fatigue & fracture mechanics MEMM1113 3 Credits	This course describes the theories of metal fatigue and fracture mechanics, and their applications to engineering structures. Both aspects of materials (metallurgical) and mechanics of the failure processes are discussed. Stress-life and strain-life approaches to fatigue analyses are described. Linear elastic fracture mechanics (LEFM) are elaborated. Fatigue crack propagation behaviour in pre-cracked solids is appropriately discussed. Relevant applications of fatigue, LEFM and fatigue crack growth analyses in design and life assessment of engineering structures are also demonstrated.

Sustainable Engineering	
Automatic control & instrumentation MEMM1213 3 Credits	The course shall cover the essentials of both instrumentation and control aspects for graduate students. It will emphasize on the concepts and characteristics of instrumentation system; signal conditioning, transducers and continuing system. Students should be able to relate and describe the operating principle of various transducers and design instrumentation system for measuring load, displacement, temperature and other physical quantities, select suitable instrumentation components and tools for intended application and solve problems related to basic instrumentation system. Special emphasis is given on the microcomputer-based application and data acquisition technique. The control section shall encompass the essence of control theory, mathematical modelling of dynamical system, time response, control action, stability analysis, frequency response and design of control system. A number of practical case studies shall be presented to include modelling and simulation of systems using MATLAB and Simulink
Energy management MEMM1413 3 Credits	Energy management is meant for guiding energy-sector activities to conserve energy and enhance energy supply and security. Energy management includes four main functions: analysis of historical data, energy audit and accounting, engineering analysis of systems, and energy economics. This course covers contemporary energy management topics such as energy sector challenges, energy system thinking, energy management control systems, energy economics, and emerging energy technologies. This course also provides

	training in gathering updated energy related information to apply in real-life applications. The course is multidisciplinary in nature and students will be required to look at the energy sector problems from different points of views. Thus, the course is well suited to students from any of the mechanical, electrical, chemical, and environmental engineering major. After successful completion of this course, the students would comprehend the energy management knowledge to play their role in conserving and efficient use of energy in buildings and industry.
Sustainable energy system and technology MEMM1433 3 Credits	In the context of depleting fossil fuel reserves and environmental consequences, the concept sustainable energy has drawn a central focus among energy stakeholders. This course embraces both sustainable energy system and technology. The energy system is an entity that includes all components and technology related to energy exploration, production, conversion, delivery and end uses. This course explains the concepts of sustainable energy system and technology based on ethics, environments and economy (E3) and their role on sustainability in practical system applications. The course first recognizes the effects from the fossil dominated energy system and technology and then provides the latest review of the most important renewable energy resources and advanced technologies. The course also demonstrates evaluating the fossil and alternative energy systems and technologies in terms of the sustainability criteria. Comprehension of the issues associated with sustainable energy system and technology are achieved through lectures, discussions, combined with reports and student presentations on the literature reviewed.
Advanced mechanics of composite structure MEMM2113 3 Credits	This course introduces students to some major views and theories in the area of composite materials especially in the polymer based composite learning with emphasis on the types of materials, production methods, failure analysis and the mechanics of laminated composites. It will examine some key issues in the mechanics of laminated composites with special focus on the stress-strain relationship and interaction to the extensional, coupling and bending stiffness matrices in promoting learning. Sandwich structures and interlaminar fracture toughness will also be included in this syllabus. The course will also provide a visit to industries dealing with polymer based composite materials in order the students to understand more regarding the practical sides of the subject.
Engineering design and reliability MEMM1543 3 Credits	The course provides understanding of the statistical nature of design parameters (i.e.: stress and strength) as well as material properties and design performance. These understandings are used to develop design for reliability concepts. The basic concepts are extended to 'real world' problems, such as fatigue analysis, through class examples and case studies. Emphasis is placed on application to the optimization and reliability simulation of engineering designs. Some special topics on real life application are discussed. Although emphasis is on mechanical designs and structures, the concepts can be extended to other specialties in mechanical engineering (energy and fluids, and systems and dynamics).
Green manufacturing technology MEMP1723 3 Credits	This course introduces students to green manufacturing technology and sustainability considerations in product design and manufacture. It presents the principles, methodology and case studies to develop an understanding of sustainable development that can reduce environmental impact and promote green technology for sustainable practice. Besides that, it is also introduce the Life Cycle Assessment consists of four main phases, goal and scope definition, inventory, impact assessment, and interpretation. Analysis of use valid life cycle assessment method to collect and process data of the product's life cycle or the manufacturing processes consumption or declaring the total emissions from the manufacturing.

Computational Mechanics	
Advance Engineering Mathematics MEMM1913 3 Credits	The course provides engineers and scientists with the basis of intelligent working knowledge with the capacity to handle complex problems, equipped with the basic principles and methods, facts and techniques in applied mathematics and post-calculus relevant to engineering applications. This course prepares the mechanical engineering students to be proficient in solving engineering problems through suitable mathematical methods and interpreting the mathematical results meaningfully. The first part of the course deals with the ordinary and partial differential equations (ODE, PDE) that has significant importance in mechanical engineering field. The second part of the course consists of the vector calculus that includes vector differential and vector integral with and extension to the tensors. An emphasis to the mathematical modelling is placed throughout the course to allow the engineers to describe a system using mathematical tools, which constitutes an important task for accurate analysis and rapid optimization of real engineering applications. Therefore, understanding of the physical meaning of mathematical terms are placed at high priority in this course to serve as a continuation of the pure mathematical understanding that has been acquired in the related undergraduate courses.
Computational method in solid mechanics MEMM1123 3 Credits	This course extends the undergraduate-level introduction to the Finite Element Method for obtaining approximate solution to a wide variety of engineering problems in mechanics of materials and structures. The scope of analysis covers elastic-plastic range of continuous materials behaviour, including low-cycle fatigue. Emphasis is placed on the mathematical derivation of the constitutive equations for numerical implementation. Process and procedures in finite element modelling and simulation of realistic engineering problems are described and rigorously discussed using examples in plane, axis-symmetric and 3-D analyses in solid mechanics. Physical interpretation of the 3-D finite element simulation results is also discussed.
Computational Fluid Dynamics MEMM1333 3 Credits	This course connects the gap between the introductory level and the applied in engineering practice as well as in research and development of using computational fluid dynamics (CFD) for solving fluid flow problems. In the first part, the spatial and time discretization methods for solving fluid mechanics problems governed by the incompressible Navier-Stokes equations are introduced. This course also provide hands-on experience using both commercial and community developed CFD software. This is followed by introducing advanced numerical schemes in CFD and various multiphysics methods for modelling complex fluid flow.
CAD and It's Applications MEMM1513 3 Credits	This course is divided into two parts. The first part covers the foundation theories in CAD. Then, the second part discusses the applications the foundation theories. These applications include from the applications in the engineering design and extends to the framework in the creation an intelligent system. The course also exposes the possible research and emerging technologies related to CAD.
Advanced Industrial Automation MEMM2223 3 Credits	The course is an elective for students seeking a specialty in mechanical engineering. It shall introduce students to the methods, tools, and technologies used to automate a product or a plant. Primary automation technologies include sensors, actuators, signal conditioners, microprocessor/microcontroller, programmable logic controllers (PLCs), ON/OFF and automatic control, and PC-based control are covered within this course. Students will also experience development of automated product/plant through hardware programming and interfacing implementation.

Optimization in Engineering design MEMM1523 3 Credits	This course introduces the traditional non-linear optimisation methods that can be used to solve a wide range of problems across all engineering disciplines, mainly for engineering design. Optimisation involves finding the 'best' solution according to specified criteria. In Engineering Design, this might typically be minimum cost or weight, maximum quality or efficiency, or some of the performance index pertaining to a disciplinary objective. Realistic optimal design involves not only an objective function to be minimized or maximized, but also constraints that represent limitations on the design space. Numerical programming requires the mathematical representation of the design space (objective function and constraints) in terms of design variables- (parameters that signify some potential for change). Generally, the problems of interest in engineering are of a non-linear nature, in that the dependence of the objective function and constraints on the design variables is non-linear.

Manufacturing Engineering	
Digital Manufacturing MEMP1733 3 Credits	This course aims to prepare students with fundamental of knowledges under industrial 4.0 industrial revolutions. Digital Manufacturing (DM), comprising Subtractive, Additive and Laser technology as key technologies for supporting manufacturing techniques that involves part creation by joining material together without part-specific tooling, driven by a computer. The technologies focus on prototypes and low/high-technology applications, DM service parts are being used in safety-critical fields including aerospace, automotive, biomedical, and services industries. The purpose of this course is to provide participants with knowledge and tools for informed decision making relative to integration of DM processes and parts into the industrial application. The coverage includes current DM practice for metals, polymers and ceramics; mechanical properties; DM processing for production; and application related to industrial applications. At the end of the course, students should be able to describe fundamental aspects of the Subtractive processes, Additive Manufacturing/3D Printing Technology techniques, laser technology and their applications. Finally, this subject also performs engineering analysis to solve product manufacture problems and evaluate engineering investment/projects by utilised these technologies.
IT for Manufacturing MEMP2733 3 Credits	Knowledge Management and Knowledge Management Infrastructure are the main contents. The lecture is supplemented with the real data mapping and development of information systems. This course is an Instructional lecture and Cooperative learning (CL) enriched with student assignments and group projects. Students are required to perform problem solving using real case study and projects in their individual assignments/projects to measure their skill in communication and analysis of data. Students are guided through the real-life case study that requires them to construct into real data for database design. They are also to prove their ability by constructing a database information system using selected tools. The contents include Business System of project and Product Based, Information Security, Cyber physical system, networking, vertical & horizontal integration, Data exchange, Cloud manufacturing and computer integrated manufacturing (CIM).
Statistical Quality Engineering MEMP1713 3 Credits	This course is designed to provide the students with sound understanding to statistical methods in quality improvement. It encompasses various statistical process control problem-solving tools. For control charts, emphasis was given on additional control charts not covered previously at the undergraduate level. Advanced tools and techniques such as Gauge Repeatability and Reproducibility (GR & R), Quality Function Deployment (QFD), Failure Mode Effect Analysis (FMEA) and experimental design methodology were also covered.

Automation systems and robotics MEMP2703 3 Credits	This course is designed to enable the students at graduate level to develop the necessary insight into the areas of automation, robotic and control. It will examine the fundamental elements of automation and robot systems related to anatomy and configuration, robot main components, programming features and methods and robot's performance specifications with their integration. The student will study automation and control both on a theoretical level and on a practical level – learning to design, test and implement the automation systems function. The students are expected to acquire digital skills on simulation study of several robotic control systems. This provides a platform for the students to explore the performance of different control algorithms that address the stability, accuracy and robustness of the systems. A number of case studies pertaining to selected robotic automated systems are expected to further strengthen the students' understanding and insight into the actual systems which meet the 4th Industrial revolution system requirements.
Green Manufacturing Technology MEMP1723 3 Credits	This course introduces students to green manufacturing technology and sustainability considerations in product design and manufacture. It presents the principles, methodology and case studies to develop an understanding of sustainable development that can reduce environmental impact and promote green technology for sustainable practice. Besides that, it is also introduce the Life Cycle Assessment consists of four main phases, goal and scope definition, inventory, impact assessment, and interpretation. Analysis of use valid life cycle assessment method to collect and process data of the product's life cycle or the manufacturing processes consumption or declaring the total emissions from the manufacturing.
Advanced Manufacturing Processes MEMP2763 3 Credits	This course introduces automation and advanced techniques used in the modern manufacturing. Types of automation systems, applications, advantages and disadvantages are discussed. It also includes discussion on the principle of CAD/CAM/CNC and other applications in various manufacturing automation systems such as GT, FMS and CIM. This course will also allow student to carry out small case studies in the real environments for exposing them on certain issues related to manufacturing automation.
Machining and Machine Tools Technology MEMP2773 3 Credits	This course introduces the students to the fundamental knowledge in metal cutting theory and principle. Some of the essential topics that will be covered include machinability, cutting forces, cutting tool, tool wear mechanism and tool life. The basic metal cutting concept and operations for product manufacture such as turning, milling and grinding processes will be taught. The students are also exposed to the various aspects of machine tools technology and its elements such as the constructional and design features, guideways and slideways, drives, vibration and chatter, machine tool metrology. Individual assignments and exercise are given to the students to enhance their knowledge in machining theory and machine tool technology
Welding technologies and Applications MEMP2713 3 Credits	This course discusses the physical principles, operating characteristics and practical applications of a variety of welding processes to enable selection of a suitable process for a particular application. The importance to understand the principles behind the most recent developments in welding processes. There is a strong emphasis on laser welding, as well as recent developments in arc, friction and resistance welding. The module will cover the operating principles, characteristics and practical applications of each process.
Smart Manufacturing MEMP2723 3 Credits	This course introduces the overview of Smart Manufacturing architectural framework, its application, related technologies and its future directions related to various case studies around the globe. The aim is to introduce students to the new era of Industrial Revolution (IR4.0) related to the power of digital manufacturing and product model data for manufacturing integration. Students will also gain deep insights into how various support systems are used in harnessing from product design, knowledge management, data

	analysis and other technologies being seamlessly transfer through the entire lifecycle of a manufactured product.
Manufacturing Science MEMP1753	This course is designed to expose the students on various principles and theories related to Precision Engineering fields. It involves derivation of fundamental tolerance from basic principle, application of tolerance on system design, interpreting machining and inspection symbols, fundamental of precision machining, principles of precision measurement and recent development in Precision Engineering fields will also be discussed.

Materials Engineering	
Advanced Materials Processing MEMB1613 3 Credits	This course introduces students to the manufacturing methods of materials engineering into the desired shapes. It starts with the basic concepts of manufacturing and processing and their applications to materials engineering as it introduces students to solidification in casting, powder metallurgy, deformation processes. The course will examine the various processing methods for metals, ceramics, polymers and composite materials, including joining and recycling processes for metals, polymer and ceramics. The course emphasis on the role played by materials and their properties in selecting the optimum manufacturing method. In addition to the advanced processes of traditional materials, the course also covers the advanced process for semiconductor materials and optical fibre, the thin film deposition process on nanoscale application, and Layer-Based Additive Manufacturing Technologies.
Smart Materials MEMB1623 3 Credits	This course introduces students to the recent developments on the various classes of smart materials or functional materials used in applications such as aerospace, automotive, biomedical and electronic industries. It will emphasize on the important properties exhibited by smart materials that make them selected for high-end and advanced applications. The physical and mechanical properties of the various classes of smart materials will be detailed as well as the unique processing techniques associated with producing these materials. The course will also cover shape memory alloys, self-healing materials, materials for sensor and actuator, and sustainable materials. The students are enabled to describe structural setup and function of advanced and functional materials. They command modern synthesis techniques and are able to apply these techniques to the preparation of new compounds. The students can interpret and evaluate the results of various methods for structural analysis of functional materials and apply the knowledge to select suitable materials for a given engineering project.
Assets Integrity and Management MEMB1633 3 Credits	This course is introducing the students to the Asset Integrity Management (AIM) system especially for an aging offshore oil field infrastructure. The platforms, pipelines and onshore facilities were aged and needed some extensive refurbishment and a new inspection and integrity regime put in place. The course also provides a comprehensive coverage of the various non-destructure techniques (NDT) used to assess the intergrity of engineering components. The concepts and techniques used in assessing assets through risk based assessement (RBI) be covered.
Structural composites MEMB1643 3 Credits	Advanced composite materials are used in many industries including aerospace, marine, automotive, medical, energy, and recreation. Striking examples of the expanding use of composites are the Boeing 787 and Airbus A350, as these materials improve performance and save weight. To better prepare engineers in applying these new material technologies to the design and manufacturing of composite structures. This subject provides an introduction to structural composites, starting with the "trinity" - the interaction between shape design, base material and manufacturing. The course covers

	the design principles of composites structure; durability and fatigue; testing; manufacturing methods and mechanics. The main focus is on composites structures made with polymer matrices but use of metals and ceramics as matrices will be addressed as well. By the end of this course students will be able to know what design choices they have to make for different requirements. Also, the student will be able to identify the unique characteristics of composites and apply the fundamental and practical knowledge necessary to build and maintain composite structures.
Advanced Materials Characterization MEMB2613 3 Credits	This course provides the students with a deep and broad insight into the principles of advanced techniques used in characterising and determining the structure and properties of materials. The technique includes x-ray analysis method such as XRD, XRF, Raman spectroscopy and fourier transform infrared (FTIR). The students will also introduced microscopy techniques which covers from light to electron microscopy (SEM, TEM, HRTEM, STEM) and analytical techniques such as energy dispersive x-ray (EDX/WDX), electron energy loss spectroscopy (EELS). To learn the principles and application of advanced surface characterisation techniques including atomic force microscopy (AFM), X-ray photoelectron spectroscopy (XPS). The principles and interpretation of various thermal analysis techniques will also covered in this course.
Advanced Surface Modification for metallic materials MEMB2623 3 Credits	Corrosion, wear, or the combined effects of these destructive failure modes cost industrial economic hundreds of billions of dollars each year. One of the most effective means of mitigating damage due to corrosion and wear is to treat or 'engineer' the surface so that it can perform functions that are distinct from those functions required from the bulk of the material. Understanding corrosion and wear problems and the factors involved must be considered before selecting the specific surface modification process. Different process demonstrates different thickness ranges, hardness, wear resistance, corrosion resistance, cost, processing time, operating temperature, surface finish/roughness and other surface characteristics. The course provides an overall view of the advanced surface modification processes with emphasis on the strengths and limitations of each method and practical design guidelines for surface modification. At the end of the course students should gain an understanding of how improvements in the surface properties are achieved through a range of processes and also be able to apply the knowledge to select an appropriate surface modification process for the specific application.
Electron Microscopy for Nanomaterials MEMB2633 3 Credits	This course introduces the fundamental aspects of nanomaterials and electron microscopy. The importance of nanomaterials and their improved properties compared to conventional materials. The principles and relative merits of a range of techniques for fabricating nanostructures in one-dimensional and two-dimensional materials, including a single atomic layer and multilayers, are discussed. The analytical and imaging characterization techniques of electron microscopy will be introduced in detail to students. Students will also learn how to analyze digital data using digital software and understand how to evaluate nanomaterials properties.
Mechanical Behavior of Materials MEMB2643 3 Credits	This course introduces students to the dislocation theory and the role of these dislocations on the metal's ability to deform plastically as well as strengthening mechanisms. It will focus on the mechanical behaviour of all classes of materials (metals, polymers, ceramics and composites) under different stressing conditions such as fatigue, creep, and fracture. The course will also provide students with the principles of fracture mechanics and its application. At the end of the course the student should be able to relate between the behaviour of materials and their structures and design procedures to control failure of materials.
Corrosion and Materials Degradation	This course will give an overview on the importance of corrosion, electrochemical reactions, thermodynamics and kinetics of electrochemical phenomena. Different forms

MEMB2653 3 Credits	of corrosion related to materials, environment and stresses will also be discussed followed by the five main corrosion control methods. Apart from aqueous corrosion, the high temperature oxidation will be addressed and discussed. Degradation of various materials classes such as polymers, composites and electronic materials will also be covered in the course. The course will also provide students to the various techniques of corrosion testing and monitoring
Advanced Ceramic Processing MEMB2663 3 Credits	This course covers on the concepts of processing of advanced ceramics materials, such as electroceramic, bioceramic, oxide ceramics, non-oxide ceramics and their characterizations. The aims are to broaden the knowledge on oxide ceramics towards that of the expanding family of carbides, nitrides and borides. Specific case studies will be discussed to illustrate the potential of multiple phase technical ceramics as well superconducting and ceramic sintering. Students will be involved in the case studies and will be exposed to new materials and processing techniques.

Future generation vehicle	
Automotive Noise, Vibration and Harshness MEMV2213 3 Credits	This course focuses on the principle of vehicle vibration and acoustics and its application in automotive. The course modules include understanding the effects of vibration and acoustic on vehicle systems and components. Students will learn the human perception of noise and vibration according to guidelines and assessment methods. Common methods using signal processing such as Fast Fourier transform (FFT) to reduce vehicle noise and vibration will be explored. Students may also engage with the industry such as visiting a local car/car parts manufacturer or conducting an industrial level of experimentation to boost their knowledge.
Advanced Vehicle Dynamics MEMV1313 3 Credits	This course discusses vehicle dynamics in general which covers the vehicle's ride and handling behaviours. The systems which contribute to a better vehicle dynamic performance in modern passenger vehicle will be covered in this course. This includes the semi-active and active suspension systems, roll control systems, electronic brake force distribution (EBD) system, antilock braking system (ABS) and active steering system. The importance of vehicle dynamics for automated vehicle will also be covered in this course. This includes handling modelling and control system of an automated vehicle which utilises sensors data to maneuver. All of the mentioned systems will be introduced theoretically followed by the development of the systems' simulation model using MATLAB/SIMULINK. At the end of the course, the students are able to develop modern vehicle dynamics controlled systems which are typically used for an outstanding dynamics performance for a vehicle.
Future Mobility Solution MEMV1613 3 Credits	Urban transport is strategically important for economic competitiveness, social cohesion, and sustainable growth. This course focuses on innovative and sustainable urban mobility solutions implemented in different parts of the globe, to tackle urban congestion, greening the transport network and making it safer, more efficient, and accessible.
Automotive Electronics & Control MEMV1203 3 Credits	This course focuses on vehicle electronic, incorporating studies on the principles of sensors and actuators used in automotive control applications. The major topics cover the variety and role of electronic sensors and actuators, sensor's signal conditioning systems, actuator's drivers and control systems in automotive applications. At the end of this course, students are expected to be able to design and develop electronic and control system for vehicles.
Vehicle Connectivity MEMV1623	This course provides advancements in enabling connected cars are astonishing. Advances in connectivity are creating opportunities in the automotive industry. Dashboard

3 Credits	navigation, infotainment systems, and Bluetooth-enabled dashboards are a glimmer of what is coming in the notso-distant future. It will explain connectivity is turning the car into smart devices with the potential to become crucial pieces in enabling the Internet of Things (IoT). Vehicle to Vehicle (V2V) and Vehicle to Infrastructure (V2I) technology allow the cars to communicate with other cars and infrastructure like traffic light. This course focuses on innovative and technologies in vehicle connectivity in the cars that will transform driving experience and challenging issues in terms of traffic infrastructure and product affordability
Advanced Automotive Technology MEMV1013 3 Credits	This course focuses on advanced technology in automotive development. The topics covered includes environmental policy and safety in automotive design standards, advanced materials, alternative fuels and alternative powertrain technology. Development and the future of autonomous technology will also be taught. At the end of this course, students are expected to be able to propose advanced automotive technology design in compliance with the current established standards.

Energy efficient vehicle	
Automotive Noise, Vibration and Harshness MEMV2213 3 Credits	This course focuses on the principle of vehicle vibration and acoustics and its application in automotive. The course modules include understanding the effects of vibration and acoustic on vehicle systems and components. Students will learn the human perception of noise and vibration according to guidelines and assessment methods. Common methods using signal processing such as Fast Fourier transform (FFT) to reduce vehicle noise and vibration will be explored. Students may also engage with the industry such as visiting a local car/car parts manufacturer or conducting an industrial level of experimentation to boost their knowledge.
Internal Combustion Engine & Boosting system MEMV1403 3 Credits	This course is designed to deliver the principles of internal combustion engine and boosting systems. The subject covers the types of internal combustion engines and its operations. Furthermore the latest technologies that make internal combustion engine to be more efficient and less polluting are also covered in this subject. Additionally, the course emphasizes on the engine air induction system, in particular the turbocharging and supercharging methods. It covers the science governing the operation of turbochargers and superchargers – which include aerodynamics, gas dynamics and thermodynamics. Upon completion of this course, students will have advanced understanding of how internal combustion engine with boosting system can meet the strict emission and energy efficiency targets.
Advanced Vehicle Powertrain MEMV1503 3 Credits	This course covers principle knowledge of conventional and alternative powertrain systems for automotive applications. It includes main components in the powertrain systems namely powerplant (internal combustion engine/electric motor), transmissions and power storage (battery). At the end of the course, students should be able to propose the powertrain system for a passenger vehicle.
Low Carbon Fuel MEMV2413 3 Credits	This course focuses on low-carbon transportation fuels, that are emerging options to displace petroleum-based fuels. The topics covered includes low carbon fuel standards, alternative fuels technology, economics, and transitional issues. Assessment of Life-cycle Analysis of the alternative fuels will also be taught. At the end of this course, students are expected to be able to analyse a range of policy tools and mechanisms that could be employed to deliver greenhouse gas emission reductions and decarbonisation of transport fuels for a sustainable transportation future.
Automotive Tribology MEMV2513	Tribology is focusing on the friction, wear and lubrication principle and application. The course is originated from the art of lubrication but has developed to many different types

3 Credits	and range of applications. Among the topics discussed are principle of lubrication and surface topography characterization. In automotive application, almost half of the mechanical power generated by the engine is wasted in friction between pistons and cylinders and within the gearbox and transmission gears. At the end of this course, students are able to predict the most suitable tribological surfaces characteristic for best tribological performance.
Advanced Automotive Technology MEMV1013 3 Credits	This course focuses on advanced technology in automotive development. The topics covered includes environmental policy and safety in automotive design standards, advanced materials, alternative fuels and alternative powertrain technology. Development and the future of autonomous technology will also be taught. At the end of this course, students are expected to be able to propose advanced automotive technology design in compliance with the current established standards.

Industrial Aerodynamics	
Advanced Aerodynamics MEMF1313 3 Credits	This course gives a foundation for advanced study in aerodynamics by focussing on the fundamentals as well as the distinctive characteristics of flow around solid boundary. Emphasis will be given to turbulence flow since this area of study is still a mystery. The course will continue to cover aircraft aerodynamics and high-speed aerodynamics.
Computational Aerodynamics MEMF2323 3 Credits	This course deals with the applications of computational methods to the solutions of aerodynamics problems. Emphasis on introductory concepts in finite difference and finite volume methods as applied to various ordinary and partial differential model equations in aerodynamics; fundamentals of spatial discretization and numerical integration; numerical linear algebra. Introduction to applied engineering and scientific computing environment. Advanced topics may include finite element methods, spectral methods, grid generation, turbulence modelling.
Industrial Aerodynamic and Wind Engineering MEMF2343 3 Credits	This course deals with industrial aerodynamics where contents of learning include the physics of the air, wind energy, vehicle and building aerodynamics and flow induced vibration. Students shall be given projects where they need to conduct the experimental work in wind tunnel and analyse the data accordingly.
Experimental Aerodynamics MEMF2353 3 Credits	This course is on aerodynamic experimental work covering topics on wind tunnel designs and classifications, instrumentation, flow qualities, aerodynamic load measurements, flow visualisations, blockage correction and moment transfers. Wind-tunnel testing is one of the fundamental tools to determine the flow characteristics and the aerodynamic forces and moments acting on the tested object. Students shall be given a mini-project where they need to conduct the wind tunnel tests and analyse the data accordingly.
Advanced Aircraft Dynamics and Control MEMF2213 3 Credits	This course is about the dynamics behavior of rigid body aircraft and the application of control system theory to design aircraft stability augmentation systems to more complex automatic flight control systems. This includes the application of modern multivariable control system design using classical and modern control techniques, the nonlinear aircraft model, transfer function models, numerical solution of the state equations, stability augmentation, control augmentation system, the handling-qualities requirements and autopilots. Examples are demonstrated by using MATLAB and FLIGHTGEAR. At the end of the course, the aircraft behavior can be demonstrated by using a flight simulator.

Advanced Aerospace Engineering	
Advanced Aerodynamics MEMF1313 3 Credits	This course gives a foundation for advanced study in aerodynamics by focussing on the fundamentals as well as the distinctive characteristics of flow around solid boundary. Emphasis will be given to turbulence flow since this area of study is still a mystery. The course will continue to cover aircraft aerodynamics and high-speed aerodynamics.
Advanced Aircraft Dynamics and Control MEMF2213 3 Credits	This course is about the dynamics behavior of rigid body aircraft and the application of control system theory to design aircraft stability augmentation systems to more complex automatic flight control systems. This includes the application of modern multivariable control system design using classical and modern control techniques, the nonlinear aircraft model, transfer function models, numerical solution of the state equations, stability augmentation, control augmentation system, the handling-qualities requirements and autopilots. Examples are demonstrated by using MATLAB and FLIGHTGEAR. At the end of the course, the aircraft behavior can be demonstrated by using a flight simulator.
Computational Method for Aerostructures MEMF2013, 3 Credits	This course gives an understanding on the principles of the finite element method and its implementation in solving real-life structural problems
Advanced Aircraft Structures and Materials MEMF2113 3 Credits	This course focuses on the structural analysis of aircrafts and understanding the structural and material behaviour of airframes. The topics covered include plane stress field equations, plate bending and buckling, wing and fuselage analysis of light aircrafts, advanced alloys, advanced composites, and aircraft structural integrity.
Jet Propulsion MEMF2423 3 Credits	Introduction to jet propulsion system including its historical background. Review of thermodynamics and fluid mechanics. Review of gas dynamics. Cycle analysis: air standard cycle and real cycle (with friction). Turbojet engine cycle. Gas turbine engine components and their functions. Turbine blades cooling techniques. Gas turbine emissions. Introduction to rocket engines. Types of rocket engines. Rocket basic principles. Chemical rocket engines: solid rocket, liquid rocket, hybrid rocket.
Rocket Technology MEMF2433 3 Credits	Classification of Rocket Propulsion Systems (chemical, electric and nuclear). Performance parameters (thrust equation, propulsive efficiency, characteristic velocity, thrust coefficient, specific impulse, nozzle flow). Theoretical rocket performance calculation. Solid propellants and combustion. Grain design. Liquid propellants and combustion. Injector and combustion chamber design. Hybrid rocket. Electric rockets. Nuclear rocket.
Gas Turbine Technology MEMF2443 3 Credits	An Overview of Gas Turbines. Theoretical and Actual Cycle Analysis. Compressor and Turbine Performance Characteristics. Performance and Mechanical Standards. Rotor Dynamics. Centrifugal and Axial-Flow Compressors. Radial-inflow and Axial flow turbines. Combustors. Gas turbine emissions, their sources, impact, and method of mitigation. Materials. Fuels.
Helicopter System and Performance MEMF2513 3 Credits	This course presents a comprehensive introduction to rotorcraft technology covering a wide range of disciplines. Student will be exposed to the theory of helicopter flight which is relevant to the helicopter system and performance. Each student will be given a mini project to enhance his/her understanding in the principle work of helicopter technology.
Aviation Management and Airworthiness MEMF2613 3 Credits	This course is about the management of the aviation industry. It covers the basic concepts of management, project management, human factors, airspaces, airport management, air traffic management and airworthiness. The course shall use documents from the International Civil Aviation Organisation (ICAO) and Civil Aviation Authority Malaysia (CAAM). Site visits to the established aviation organisations will be part of the course.

Aircraft Instrumentation and Avionics MEMF2223 3 Credits	This course delivers fundamental knowledge of aircraft instrumentation design, avionics system design, analysis and development. The course covers topics from sensor and transducers, signal conditional circuits, data transmission, data acquisition system, measurement errors, reliability study, failure analysis, fault tolerance and aircraft data bus.

Ship technology	
Dynamic of Marine Structures MEMO1213 3 Credits	This subject equips the students with knowledge of the environment and relating it with performance of the vessel in seakeeping and maneuvering. The first part of the subject introduces the ocean environment (Theory of regular/irregular waves and wave energy spectrum). The second part covers the seakeeping aspect – By applying the knowledge of dynamics, vessel's motions due to ocean waves can be predicted. The third part covers the aspect of vessel's maneuvering and directional stability. The final part discusses on the aspect of using devices such as bilge keels and rudders to control vessel's motions. Besides that, this subject also introduces to student the skill for computer modelling and simulation engineering (CMSE). The CMSE software such as Rand Model Designer and MATLAB Simulink will be used to solve the engineering problem and complete the given project/assignment.
Safety, Risk and Reliability in Marine Operation MEMO2813 3 Credits	The course equips the students with important concepts and theories on safety, risk and reliability in marine operations especially those that supports standards, rules and regulations imposed by maritime regulating bodies like IMO. The course content is divided into three parts related to marine system and operation, first being hazard and risk assessment, secondly reliability analysis and lastly the safety procedures based on the maritime regulating bodies. Risk evaluation tools will include formal safety assessment method such as failure mode and effect analysis and fault tree analysis, Monte Carlo simulation method, moment likelihood method, queuing theory, etc. The delivery of the course will be case study assisted
Strength and Vibration of Marine Structures MEMO2113 3 Credits	This course covers to the fundamentals and calculations of structural plastic analysis, strength design of column and beam-column, strength design of unstiffened and stiffened plate, and analysis of structural vibrations for ship and offshore platform. The course begins with the basics and marine structural safety concerns, and design process through all phases of calculations: loads, response, and limits state stress. The focus of this course in on the structural design synthesis including design philosophy and procedures, and the importance of vibration in ship and offshore structural design. The course is presented through classroom lectures, student participation in practical exercises. The course addresses the universally accepted mathematical calculations of unstiffened and stiffened plate response, and analysis on vibrations model.
Marine Environment and Renewable Energy MEMO2003 3 Credits	This course is designed to give students an understanding of the science of marine environment particularly waves and tides, and how this affects efforts to exploit energy from these resources. Students will first be introduced to fundamentals of oceanography and marine meteorology. It explains the fluid physical characteristics and movement on the earth surface. As such, the student will have a clear understanding of the weather that results from the interaction between the atmosphere and the sea surface. Student will then learn on marine environmental issues related to ship and offshore structure. This course also introduces the main forms of marine renewable energy particularly wind, wave and tidal, focusing on the technology and resource assessment associated with each.

Ship Repair, Survey and Inspection MEMO1713 3 Credits	This course is offered with aim of preparing the students to be able to assume the middle management roles of identifying, planning, scheduling, monitoring the ship construction and ship repair project, managing the tasks, time, material, manpower and money of a given project effectively. The students can learn how to perform the duty of a ship surveyor effectively and identify the critical items to be considered during the inspection process. The course also covers the NDT works to be carried out during new construction, repair and maintenance, survey and inspection works. The course can be delivered in module-by-module base, 2 days x 7 hours per day per module.
Ship Powering and Propulsion MEMO2313 3 Credits	This course provides the knowledge on hydrodynamics theory and practices that enable the students to perform calculation, analysis, design and evaluation of ship's performance and behavior in seaway. The first part of the course provides students with knowledge on ship resistance and its component, prediction ship resistance according to the standard procedures and discuss the effect of weather condition on ship performance. The second part of the course touch the knowledge on ship propulsion system which covers the basic propeller action, propeller design parameters, and procedures of engine-propeller matching.
Dynamic of Marine Power Plant MEMO1413 3 Credits	The course is designed for introducing the students to the various aspects of marine power plant dynamic behaviors. This includes the different types of power plant characteristics, plant performance and selection procedures, machinery control systems, balancing and vibration characteristics of the power plant.
Marine Transport System MEMO2833 3 Credits	Generally, marine transport is one of the main activities for shipping. The requirement for marine transport system will naturally support direct and indirectly many other shipping or maritime based related activity such shipbuilding, oil and gas, port operation, logistic and supply chain, etc. In the process of executing these activities, several relevant policies, rules, and regulation such as Flag of Convenient, Chartering, etc. to be considered and applied accordingly ensuring the optimum transport undertakings.
Maritime Management and Law MEMO3843 3 Credits	This course provides candidates with advanced knowledge on marine management and law. The objective is to expose candidates to advanced issues in the marine industry that currently challenge the traditional management principles. The syllabus has three main categories: firstly, management principle for organization and project. The second category is strategic project management. The third category is the theory and practice on maritime law. There will be sub modules for management planning, human resources, managerial skills, project management and maritime law. Each sub module starts with a preview of a one to two pages of case study material, short series of lectures on the underlying principles, detail synthetizing of the case study material, preparation of short report, presentation of report with questions and answer and finally feedback from the lecturer.
Design for Advance Marine Vehicles MEMO2513 3 Credits	This course equips the students with knowledge on the development of advance marine vehicles (AMV) and emphasizes the differences between conventional-ship design and AMV-design. The course starts with the philosophy of evolution of maritime transportation from the early days to the present state of the transportation system. Students are then provided with the definition and classification of AMV together with the method of quantifying the means of achieving high transport. The course also includes the discussions of each of the 'nodes' of the ship design spiral which students should enable to relate it with the AMV criteria. Students are provided with numerous examples of high transportation case studies that enhances the ability to critically decide the viability of the future transportation requirement. Students will be required to comprehend the future potential of AMV and the limitations that systems and technology limits.

Offshore technology	
Dynamic of Marine Structures MEMO1213 3 Credits	This subject equips the students with knowledge of the environment and relating it with performance of the vessel in seakeeping and maneuvering. The first part of the subject introduces the ocean environment (Theory of regular/irregular waves and wave energy spectrum). The second part covers the seakeeping aspect – By applying the knowledge of dynamics, vessel's motions due to ocean waves can be predicted. The third part covers the aspect of vessel's maneuvering and directional stability. The final part discusses on the aspect of using devices such as bilge keels and rudders to control vessel's motions. Besides that, this subject also introduces to student the skill for computer modelling and simulation engineering (CMSE). The CMSE software such as Rand Model Designer and MATLAB Simulink will be used to solve the engineering problem and complete the given project/assignment.
Safety, Risk and Reliability in Marine Operation MEMO2813 3 Credits	The course equips the students with important concepts and theories on safety, risk and reliability in marine operations especially those that supports standards, rules and regulations imposed by maritime regulating bodies like IMO. The course content is divided into three parts related to marine system and operation, first being hazard and risk assessment, secondly reliability analysis and lastly the safety procedures based on the maritime regulating bodies. Risk evaluation tools will include formal safety assessment method such as failure mode and effect analysis and fault tree analysis, Monte Carlo simulation method, moment likelihood method, queuing theory, etc. The delivery of the course will be case study assisted
Strength and Vibration of Marine Structures MEMO2113 3 Credits	This course covers to the fundamentals and calculations of structural plastic analysis, strength design of column and beam-column, strength design of unstiffened and stiffened plate, and analysis of structural vibrations for ship and offshore platform. The course begins with the basics and marine structural safety concerns, and design process through all phases of calculations: loads, response, and limits state stress. The focus of this course in on the structural design synthesis including design philosophy and procedures, and the importance of vibration in ship and offshore structural design. The course is presented through classroom lectures, student participation in practical exercises. The course addresses the universally accepted mathematical calculations of unstiffened and stiffened plate response, and analysis on vibrations model.
Marine Environment and Renewable Energy MEMO2003 3 Credits	This course is designed to give students an understanding of the science of marine environment particularly waves and tides, and how this affects efforts to exploit energy from these resources. Students will first be introduced to fundamentals of oceanography and marine meteorology. It explains the fluid physical characteristics and movement on the earth surface. As such, the student will have a clear understanding of the weather that results from the interaction between the atmosphere and the sea surface. Student will then learn on marine environmental issues related to ship and offshore structure. This course also introduces the main forms of marine renewable energy particularly wind, wave and tidal, focusing on the technology and resource assessment associated with each.
Decommissioning and Recycling of Marine Structures MEMO2123 3 Credits	This course equips the students with knowledge on the development of decommissioning and recycling of offshore structures. The course starts with the introduction to national and international legislations regarding decommissioning of offshore structures. Students are then provided with the definition and classification of decommissioning and recycling methods. Health and safety issues in decommissioning and recycling will also be covered. The course will enable students to develop the best option for sustainable decommissioning and recycling of marine structures.

Mooring and Riser Analysis MEMO2223 3 Credits	This course provides the design and installation operations for riser and mooring systems. Emphasis is made on design of deep water moorings and riser system by the accepted industry practices and design codes and criteria. It starts with the types and layout of risers, layout and geometry of mooring and line types. Then the riser and mooring line design cycle is introduced and in this section the students calculate the environmental loads, pretension and static equilibrium, and Vortex Induced Vibration (VIV), and analyze the static and dynamic performances including floaters. The students also solve the dynamic performances of riser/mooring lines using simulation software and analyze the fatigue of riser and mooring chains.
Unmanned Underwater Vehicles for Offshore Operations MEMO2723 3 Credits	Unmanned Underwater Vehicle (UUV) is essential in marine and offshore operations. Generally, there are two types of unmanned underwater vehicle namely the Remote Operated Vehicle (ROV) and Autonomous Underwater Vehicle (AUV). This course will develop the student's knowledge and understanding on the basic principles and operations required for both types of unmanned underwater vehicles. Essential topics which include the hull form and pressure hull design, hydrostatics and hydrodynamic requirements, onboard systems and power and propulsion specific to underwater vehicles will be introduced in this course. Students will apply the knowledge they have by designing, constructing and evaluating the performance of their model scale underwater vehicle which capable to execute predetermined tasks.