Project Code	Project Title	Group	Project Supervisor	Co-Supervisor	Project Description	Specialisation	Industrial collaborative project?	Category of this project	The minimum requirement or knowledge needed to embark on this project
AM40	Data Mining for Phased Array Ultrasonic Sector Scans	AM	Dr Ong Eng Teo	Luo Hong (A*Star SIMTech)	Phased array ultrasonic testing (PAUT) has a rising adoption in industrial applications of weld testing, especially for complex joints inspection. However, PAUT scans are still considered hard to interpret as it is complex and contain diverse appearance of noises and artefacts. This project is to develop data mining algorithms for the interpretation of PAUT sector scans for weld defect recognition and characterization. The algorithms will cover noise filtering, signal enhancement, artefacts removal, data clustering and feature extraction.	Offshore Oil & Gas Technology	A*Star SIMTech	Computing and Analysis; Software Development	Matlab and/or C++ programming
AM42	Dynamic and thermal analysis a server chassis for data storage application	AM	Dr Ong Eng Teo	He Zhimin (A*star DSI)	In big data era, more and more digital contents are stored in clouds which are actually connected to data centres. A server chassis is a mechanical structure which holds a large number of data storage devices (hard disk drives or solid storage drives). To ensure the chassis vibration level below that is specified for storage devices is the key challenge in mechanical design of a server chassis. The proposed project is to analyse the dynamic and thermal characteristics of the chassis with finite element modelling and simulation. Dynamic testing will be conducted to verify the design and simulation results. The project will train the student will get trained in design, modelling and simulation of mechanical components and mechatronic devices and experimental skills.	No Specialization	A*star DSI	Computing and Analysis; Laboratory Investigation	NA
AM62	Defeating projectiles with pneumatically pressurized sandbags	AM	Assoc. Prof Vincent Tan		Despite advances in methods to defeat fragments and projectiles, the simple sandbag continues to be a mainstay in battlefield fortification. To be effective, the sandbag must be compacted. It takes about one man-hour to fill and compact 12 sandbags. The objectives of this project is to improve the performance of and reduce the effort in preparing sandbags. Specifically, the effectiveness of sandbags made from high-strength Kevlar fabric and using inflatable airbags to aid compaction will be evaluated through laboratory based ballistic tests.	No Specialization	No	Laboratory Investigation	NA
AM63	Dynamic testing of yarns	AM	Assoc. Prof Vincent Tan		Fibres and yarns are now commonly used in systems subjected to impact loads, e.g. carbon and kevlar yarns are routinely used in sports equipment, aircraft and armour systems. Under impulsive loads such yarns become stiffer and stronger. To obtain their mechanical properties at high strain rates, yarns are attached between two collinear rods and a tensile pulse is sent into one of the rods. Changes in the pulse when it passes through the yarn to the other rod are used to calculate its dynamic properties. A simpler set-up involving the use of pre-stressed rods will be designed and tested in this project to enable a larger range of test parameters.	No Specialization	No	Laboratory Investigation	NA
AM64	Blast mitigation using auxetic foam	AM	Assoc. Prof Vincent Tan		An auxetic material is one that has negative Poisson's ratio. Applications that can exploit this unique property are being actively researched into. When an auxetic block is compressed in one direction, instead bulging out laterally, it shrinks. This means that more material is drawn toward the area where the compressive force is applied. This project will explore if this means that auxetic materials will be more resistant to compressive loads such as those induced by blasts. The project will involve in-house fabrication of normal and auxetic foams and subjecting them to controlled air blasts using a 60mm diameter shocktube.	No Specialization	No	Laboratory Investigation	NA
AM65	Detecting damage in fibre reinforced composites	AM	Assoc. Prof Vincent Tan		With modern commercial airliners containing up to 50% fibre reinforced composites (FRC), methods to detect damage in FRC are now being actively researched into. FRC comprises layers of aligned fibres stacked together and held in place by a polymer matrix. Delamination – inter-layer debonding – is a common damage that cannot be detected from visual inspection. Ultrasound methods are normally used but they are not comprehensive and fail to detect other forms of damage. This project will explore the use of thermal scans and high frequency vibrations as alternatives to existing methods of damage detection.	Aeronautical Engineering	No	Laboratory Investigation	NA
BN19	OpenSim Muscle Dynamics Modelling and Muscle Activity in Gait Rehabilitation	BN	Prof Yeow Chen Hua		Forward and backward walking are known to be the efficient exercises in regaining the walking ability among the neurological disorder patients. Nonetheless, both walking techniques have not been investigated among the elderly people. Therefore, this study is ought to understand the muscle characteristics of the young and elderly healthy individuals. The muscle activation differences may explain the degradation of the muscle function among the elderly people. Despite this, the insight of the muscle should be given attention in assessing the muscle function declination. OpenSim open-source software is used to assess the muscle functions such as muscle force and muscle length.	No Specialization	No	Computing and analysis	Matlab
CT09	Automatic generation of shear flow for silk strand formation	CT	Assoc. Prof Chen Chao Yu, Peter		It has been observed that stirring, shaking and mechanical agitation of silk protein solution promote silk strand formation due to the effect of the shear flow on amyloid fibril formation in vitro. Shear flow (Couette flow) is generated when two parallel plates separated by a liquid move relative to each other, which creates a uniform velocity gradient in the fluid. This project aims (i) to improve the current set-up for creating desirable shear flow patterns in silk protein solution and (ii) to conduct experiments to investigate the effect of various shear flow patterns in promoting silk strand formation.	No Specialization	No	Laboratory Investigation; Design	Knowledge of fluid dynamics and micro-controller programming would be helpful.
CT12	Mechanical design and fabrication of a polymer-based heat exchanger housing and distributor	CT	Assoc. Prof Chen Chao Yu, Peter		In this project, the student will design a polymer housing for a polymer-based heat exchanger with modular multi-cores by taking into account industry standards and principles of designing for manufacturing. The student will also design a fluid distributor which distributes fluid among modular multi-cores by considering its equal-distribution, dead zone, and fouling.	No Specialization	No	Laboratory Investigation; Design; Feasibility/Case Studies	Good grasp of SolidWorks or CAD modelling
CT15	Testing and evaluation of a microchannel heat exchanger test system	CT	Assoc. Prof Chen Chao Yu, Peter		The student will be involved in the experimental testing of an existing microchannel heat exchanger system over a range of studies, which would include modifying the hardware and software configuration for optimal effectiveness. In addition, the results gathered would require statistical analysis and presentation, which would be useful experience for practical engineering applications in related microscale industrial fields and experimental methodology in general.	No Specialization	No	Laboratory Investigation; Hybrid i.e. mixtures of experiment and theoretical, or experimental and numerical/software	Experience with experimental study.
CT23	Control system of atomic-force microscopy	CT	Assoc. Prof Chui Chee Kong	Assoc. Prof Zeng Kaiyang	Atomic-Force Microscopy (AFM) is a type of scanning probe microscopy with resolution more than 1000 times better than the optical diffraction limit. During manipulation, the forces between the tip of the probe of AFM and sample could be programmed to follow specific signal patterns from a signal generator. This will change the properties of the sample and aid the characterisation of its material properties. The student is required to implement a prototype control system for an AFM.	No Specialization	No	Others	NA

CT24	Simulation of BMS performance for Lithium ion battery.	CT	Assoc. Prof Hong Geok Soon		This project involves the dynamic modelling and simulation of a battery management system for multiple lithium ion batteries in various configurations. The project involves SciLab simulation of batteries performances with different control strategies for the BMS module.	No Specialization	No	Computing and analysis	Have background in dynamic modelling and MatLab programming
CT26	Design and development of PLC learning system	CT	Assoc. Prof Hong Geok Soon		This project involves the design and development of a PLC training set to for teaching purpose. It involves in selecting a set of sensors, actuators and PLC that is capable to test and configure for various sequences.	No Specialization	No	Software development; Design	Strong C-programming technique is required in this project
CT27	Development of Tool Condition Monitoring for Drilling	CT	Assoc. Prof Hong Geok Soon		In the drilling process with high aspect ratio for hard material, the tool will usually be worn out before the drilling process is completed. Continuous drilling with the worn tool may results in destroying the work-piece. This project involves the modelling and simulation of the dynamics of drilling process. You are expected to have good partial differential equation knowledge.	No Specialization	No	Computing and analysis	Have background in dynamic modelling and MatLab programming
CT39	System Integration towards Mobile Manipulation	CT	Assoc. Prof Marcelo H Ang Jr		We are developing a manipulation platform (mobile base + robot arm) for general and/or designated indoor mobile manipulation tasks. The final year project includes some work on hardware assembly/construction, software infrastructure, and system integration. An omnidirectional (Mecanum wheels) prototype of the mobile base, built upon EtherCat communication protocol and controlled through ROS (Robot Operation System http://www.ros.org/), is already available for remote control together with a simplified simulation model (in Gazebo) for monitoring and visualization (in Rviz). The assigned work will start from addition and improvements of onboard-units and robot arm (embedded PC, basic sensors, power supply, wiring, power distribution and safety check), followed by perception sensor integration and calibration (Laser scanner, Camera, RGBD sensors, etc.). Various robot arms are available for options (e.g., Kuka LBR IIWA, Kinova Mico, Denso, etc.), decision will be made according to the task needs and the mobile platform capability. Along with the hardware, software interface to ROS and the corresponding control strategy is to be developed. Detailed work includes completion and refinement of the modelling and configuration of the whole platform (building URDF, SRDF, TF, and CONFIG files, etc.), set-up and parameterization for localization, mapping, (Odometry, Collision Checking, AMCL, SLAM), and interface to other open source packages in ROS (e.g., Navigation Stack, PCL - point cloud library for perception, and MoveIt! - robot motion planning and control tool kit). This Final Year Project focuses on the integration of the mobile base. This FYP student will work closely with another FYP student who focuses on the system integration of the manipulator arm. These 2 FYP students will work together and share the workload while focusing on different aspects. Since the whole platform requires an integrated system, it is necessary that the two students collaborate with each other and share the resources throughout the project. Other divisions may also be negotiable as long as there is enough work for each student to be exposed to both hardware and software sides. It would be useful if the FYP student familiarizes himself/herself with ROS, programming using C++/Python/Java, etc, and the Point Cloud Library and Open CV. Experience in robot perception and motion planning are also very useful.	No Specialization	No	Hybrid i.e. mixtures of experiment and theoretical, or experimental and numerical/software.	Basic knowledge in computer programming
EBTS01	Conjugation of gold nanorods with HS-(CH2)11-NHCO-coumarin, HS-(CH2)11-indole for Photothermal Cancer Therapy.	EBTS	Assist. Prof Koh Yee Kan		Cancer cells can be selectively destroyed by heat through absorption of laser by gold nanorods. Gold nanorods are rod shaped gold nanoparticles. Working with lasers, these nanoparticles find wide applications in bio-imaging and sensing, drug delivery, photo-thermal therapy. In these applications, how the gold nanorods convert the laser light to heat and how this energy dissipates to surrounds are still not clear. In this project, the student will learn (from a PhD student in my group) how to synthesis the gold nanorods with controlled shape using seed mediation method and conjugate the gold nanorods with differen Raman reporters like HS-(CH2)11-NHCO-coumarin, HS-(CH2)11-indole and 4-ATP. The student will characterize the absorption spectrum and Raman spectrum of the functionalized gold nanorods to ensure successful conjugation. The student will mainly work with a PhD student, and this project could lead to a fully sponsored PhD scholarship. It is especially suitable for those who are considering to do a PhD and are interested to explore how research looks like.	No Specialization	No	Laboratory Investigation; Product Development	A good CAP and interest to pursue a PhD degree
EBTS02	Conjugation of gold nanorods with MUDA and thiolated polyethyleneglycol (PEG) for Photothermal Cancer Therapy.	EBTS	Assist. Prof Koh Yee Kan		Cancer cells can be selectively destroyed by heat through absorption of laser by gold nanorods. Gold nanorods are rod shaped gold nanoparticles. Working with lasers, these nanoparticles find wide applications in bio-imaging and sensing, drug delivery, photo-thermal therapy. In these applications, how the gold nanorods convert the laser light to heat and how this energy dissipates to surrounds are still not clear. In this project, the student will learn (from a PhD student in my group) how to synthesis the gold nanorods with controlled shape using seed mediation method and how to modify the surface capping layer of CTAB with other ligands like MUDA or thiolated polyethyleneglycol (PEG). The student will characterize the absorption spectrum and Raman spectrum of the functionalized gold nanorods to ensure successful conjugation. The student will mainly work with a PhD student, and this project could lead to a fully sponsored PhD scholarship. It is especially suitable for those who are considering to do a PhD and are interested to explore how research looks like.	Energy and Sustainability	No	Laboratory Investigation; Product Development	A good CAP and interest to pursue a PhD program
EBTS03	Novel Si Nanostructures for Thermoelectric Energy Conversion 1	EBTS	Assist. Prof Koh Yee Kan		Waste heat, for example from the car exhaust, could be converted into useful electricity by thermoelectrics. However, currently, the thermoelectric energy conversion process is rather inefficient, limited by the available materials. This project involves design, preparation and characterization of novel thermoelectric materials, manganese silicide nanoparticles in crystalline silicon. The project involves annealing of sputtered samples under different annealing temperature and duration, and study how the nanoparticles sizes and electrical properties changes with annealing conditions. The student will mainly work with a PhD student, and this project could lead to a fully sponsored PhD scholarship. It is especially suitable for those who are considering to do a PhD and are interested to explore how research looks like.	Energy and Sustainability	No	Laboratory Investigation; Product Development	A good CAP and interest in doing a PhD
EBTS04	Novel Si Nanostructures for Thermoelectric Energy Conversion 2	EBTS	Assist. Prof Koh Yee Kan		Waste heat, for example from the car exhaust, could be converted into useful electricity by thermoelectrics. However, currently, the thermoelectric energy conversion process is rather inefficient, limited by the available materials. This project involves design, preparation and characterization of novel thermoelectric materials, chromium silicide nanoparticles in crystalline silicon. The project involves annealing of ion-implanted samples under different annealing temperature and duration, and study how the nanoparticles sizes and electrical properties changes with annealing conditions. The student will mainly work with a PhD student, and this project could lead to a fully sponsored PhD scholarship. It is especially suitable for those who are considering to do a PhD and are interested to explore how research looks like.	Energy and Sustainability	No	Laboratory Investigation; Product Development	A good CAP and interest to do a PhD

EBTS06	Preparation of gold nanorods nanocrystal array on metal films for thermoelectric energy conversion.	EBTS	Assist. Prof Koh Yee Kan		Waste heat, for example from the car exhaust, could be converted into useful electricity by thermoelectrics. However, currently, the thermoelectric energy conversion process is rather inefficient, limited by the available materials. This project involves preparation of a new potential thermoelectric material, nanocrystal arrays. Nanocrystal array is a hybrid organic-inorganic material. It was demonstrated to have very low thermal conductivity due to the presence of organic-inorganic interfaces, which makes it a thermoelectric material. In this project, the student will learn (from a PhD student in my group) how to synthesis the gold nanorods with controlled shape using seed mediation method and conjugate Raman reporters like 4-NPT to the nanorods. The student will also learn (from a PhD student in my group) how to deposit gold/silver thin films by thermal evaporation and/or magnetron sputtering and preparing self-assembly monolayer on the metal film, and then prepare the nanocrystal array. The student will mainly work with a PhD student, and this project could lead to a fully sponsored PhD scholarship. It is especially suitable for those who are considering to do a PhD and are interested to explore how research looks like.	Energy and Sustainability	No	Laboratory Investigation; Product Development	A good CAP and interest to pursue a PhD degree
EBTS45	Development of Garnet-type solid electrolytes for rechargeable Li-air battery	EBTS	Assoc. Prof Palani Balaya	Dr. Vishwanathan Ramar	Rechargeable lithium-air batteries have received much attention due to their extremely high energy densities, which far exceeds that of current rechargeable Li-ion batteries. In view of this, there is a renewed focus on development of the Li-air battery. The solid electrolytes are key components to protect lithium electrode from aqueous, non-aqueous electrolytes in lithium-air battery. Among inorganic solid electrolytes, Li7La3Zr2O12 compounds with Garnet structure have drawn considerable attention due to their high ionic conductivity. In this project is designed to develop high ionic conductivity solid electrolyte for Li-Air battery.	Energy and Sustainability	No	Laboratory Investigation	NA
EBTS46	Understanding the Influence of Carbon Content on the Electrochemical Performance of Na2FePO4F Cathode Material for Sodium-ion Battery	EBTS	Assoc. Prof Palani Balaya	Mr. Markas Law	Nanostructured Na2FePO4F/C composite as a potential cathode material for sodium-ion battery is synthesised by a solvothermal-assisted soft template method using sucrose as the carbon source. Herein, sucrose not only prevents the increase of particle size, but also decomposes into a conductive composite after solvothermal treatment, providing high conductivity between the particles. This study will systematically investigate the influence of different carbon content on the material properties and electrochemical performance of Na2FePO4F as a cathode for sodium-ion battery.	Energy and Sustainability	No	Laboratory Investigation	Basic material characterisation and electrochemistry
FM07	Investigation of Flow Conditions which lead to Ice Jamming	FM	Assist. Prof Danielle Tan		Arctic activity is now increasing in popularity due to the demand for oil, which leads to greater attention towards the accompanying operational difficulties. One of these is ice jamming, whereby flow conditions lead to pieces of ice accumulating between the legs of standing structures, which is one of the research topics investigated by the NUS-Keppel Corp Lab. The aim of this project is to explore, through physical experiments, some of the parameters leading to ice jamming with the ultimate goal of establishing design guidelines for practical applications; the project direction will be guided by a Keppel liaison.	No Specialization	No	Laboratory Investigation	Good foundation in solid & fluid mechanics, comfortable with intensive physical experiments.
FM08	Numerical Model of Red Blood Cells	FM	Assist. Prof Danielle Tan	John Loh	As part of a larger project investigating atherosclerosis in blood vessels (formation and build-up of fatty plaque along vessel walls), it is necessary to have a numerical model representing the red blood cells which are a significant component of blood. Specifically, the model needs to exhibit key characteristics of red blood cells e.g. their flexibility, potential for aggregation and capability to form cell-free layer under various flow conditions.	No Specialization	No	Hybrid i.e. mixtures of experiment and theoretical, or experimental and numerical/software.	Good foundation in solid mechanics, comfortable with programming.
FM09	Numerical Model of Atherosclerotic Plaque	FM	Assist. Prof Danielle Tan	John Loh	As part of a larger project investigating atherosclerosis in blood vessels (formation and build-up of fatty plaque along vessel walls), it is necessary to have a numerical model representing the atherosclerotic plaque itself. Specifically, the model needs to include key characteristics such as the different layers and their relative components. This will be validated against experimental data.	No Specialization	No	Hybrid i.e. mixtures of experiment and theoretical, or experimental and numerical/software.	Good foundation in solid mechanics, comfortable with programming.
FM73	Discrete Numerical Model of Fluids	FM	Assist. Prof Danielle Tan		Fluids are typically modelled using continuous methods, e.g. CFD, whereas solids can be modelled using discrete (particle-based) methods. These two types are usually coupled when the system is multiphase (e.g. a fluid transporting multiple solid bodies). It is of interest to consider if the system can be fully-modelled using a discrete method, i.e. that the fluid is also modelled as a collection of particles. This project aims to successfully model a simple Newtonian fluid as a collection of 'solid' particles.	No Specialization	No	Hybrid i.e. mixtures of experiment and theoretical, or experimental and numerical/software.	Good foundation in solid mechanics, comfortable with programming
FM25	Aerodynamics of Swallow Flight – computational model 1	FM	Assoc. Prof Yeo Khoon Seng		Among birds, swallows and swifts are known for their great agility in flight. In this project, the student will study the aerodynamics of swallow model or a section of its body. The investigation will be conducted computationally using available commercial or open-source software, such as Solidworks©, Fluent© or Open Foam. The student is recommended to read the module ME4233 in Semester 1.	Aeronautical Engineering	No	Computing and analysis; Software development	Completed core fluid modules and comfortable with use of computer software.
FM26	Aerodynamics of Swallow Flight – computational model 2	FM	Assoc. Prof Yeo Khoon Seng		Among birds, swallows and swifts are known for their great agility in flight. In this project, the student will study the aerodynamics of swallow model or a section of its body. The investigation will be conducted computationally using available commercial or open-source software, such as Solidworks©, Fluent© or Open Foam. The student is recommended to read the module ME4233 in Semester 1.	Aeronautical Engineering	No	Computing and analysis; Software development	Completed core fluid modules and comfortable with use of computer software.
FM29	Fish Swimming	FM	Assoc. Prof Yeo Khoon Seng		In this project, the student will study the swimming of a model fish to gain understanding into the hydrodynamics of fish swimming. The project is computational and student will be using available software for the investigation. The student is recommended to read the module ME4233 in Semester 1.	No Specialization	No	Computing and analysis; Software development	Completed the core fluid modules and comfortable with use of computer software (Solidworks etc).
FM30	Friction-based serpentine bio-locomotion	FM	Assoc. Prof Yeo Khoon Seng		Friction is required for most locomotion in nature; thus may a snake slither along due to frictional contacts between parts of its body and the ground. The project seeks to firstly set up a simple dynamic model for a snake based on a multi-linked representation of its slithering body. The crawling/slithering motion of the model snake will be studied based on variety of friction models (such as Coulomb and viscous friction). This study will allow us to understand better how slithering motion may be driven and controlled. The student needs to be comfortable with the application of Newtonian dynamics and computation. This project may be done on a regular PC or laptop.	No Specialization	No	Computing and analysis; Software development	Completed ME3. Knowledge of mechanics/dynamics and computer programming required.
FM31	Application of phase-field finite element solver for free surface flows	FM	Prof Jaiman Rajeev Kumar		We will validate and employ in-house phase-field finite element solver for two-phase computations. Predicting and understanding the conditions for two-phase dynamics have a fundamental value and important for many engineering processes. In this project, accuracy and stability of in-house phase-field FEM solver will be systemically assessed for the air-water interface with the aid of experimental and other available numerical data. A particular application will be to simulate the interaction dynamics of regular wave with a submerged bluff body structure. This project will help developing analytical skills of student for any jobs in offshore/aerospace industry, finance or academic research. This project will be performed along with Research Scholar and has a potential for publication in leading journal.	Aeronautical Engineering Offshore Oil and Gas Technology	No	Product development; Computing and analysis; Software development	NA
FM36	On the wake dynamics of curved bluff body	FM	Prof Jaiman Rajeev Kumar		In this project, we will focus on investigating on a research question how curvature affects the wake dynamics of cylindrical bluff-body object. In particular, the emphasis will be to assess the force dynamics, wake formation lengths and vortex shedding frequencies for different curvatures of the bluff body. This bluff-body research will impact various curved structures and ultra-long deformable bodies employed in wide range of engineering applications. Of particular interest is to generate understanding of vortex-induced vibration in highly deformed riser, pipelines and mooring/cable lines in ocean and wind environments. The application can range from offshore systems to space elevator and climate control through a hose to sky aerosol to stratosphere. In-house solver will be used for this three-dimensional study.	Aeronautical Engineering Offshore Oil and Gas Technology	No	Computing and analysis; Software development; Design	NA
FM37	Side-by-side flexible riser systems in shear flow	FM	Prof Jaiman Rajeev Kumar		In this project, we will focus on the validation and fundamental investigation of side-by-side high-aspect ratio elastic riser system. In particular, the focus will be to assess the effect of gap flow and proximity on vortex excitation and amplitude of vibrations. In-house solver will be used for this three-dimensional fluid-structure interaction study. Of particular interest is to generate understanding of vortex-induced vibration and use the knowledge for VIV screening solver for riser arrays. Apart from offshore riser, this project embarks on the feasibility study of space elevator cables and hose-to-sky riser system for climate control in Earth atmosphere.	Aeronautical Engineering Offshore Oil and Gas Technology	No	Computing and analysis; Software development	NA
FM38	Three-dimensional simulations of flexible cylinders with near-wall effects	FM	Prof Jaiman Rajeev Kumar		In this project, we will focus on studying how a plane wall would affect the dynamics of a vibrating elastic body. In particular, wall-induced lift force is due to two competing mechanisms in a fluttering elastic structure with wall proximity. First, the presence of a nearby wall breaks the symmetry of wake vorticity distribution. Second, from inviscid theory one can argue that the flow relative to the cylinder will accelerate faster in gap between the cylinder and the wall. The resulting low pressure in the gap will induce a lift force directed toward the wall. In-house solver will be used for this flow-structure interaction study.	Aeronautical Engineering Offshore Oil and Gas Technology	No	Computing and analysis; Software development	NA
FM39	Verification of Superstructure Drag and Heeling Moment Simulations using CFD	FM	Prof Jaiman Rajeev Kumar	Jerry Baffa-Damen Shipyards Singapore	In moderate and high wind conditions, the contribution of aerodynamic drag to the overall resistance of a vessel becomes significant. Similarly, the heeling moment induced by this drag can also influence the stability and comfort of the vessel. It is therefore important to accurately predict the forces and moments that act on the air-exposed part of the vessel. This project will undertake a Computational Fluid Dynamics investigation to help identify the contributions to these forces and will seek to identify possibilities to improve the superstructure design. Any available CFD code is acceptable for use on this project.	Aeronautical Engineering Automotive Engineering Offshore Oil and Gas Technology	Damen Shipyard Singapore	Computing and analysis	Fluid mechanics is essential. CFD exposure is highly desirable.

FM40	Verification of Transverse Force Modelling on a Bluff Body Under Drift using CFD	FM	Prof Jaiman Rajeev Kumar	Jerry Baffa (Damen Shipyards Singapore)	Simulating flow separation on the aft curved surfaces of bluff bodies is a very challenging task for Computational Fluid Dynamics codes, given the highly complex dynamic turbulent behaviour inherent in such flows. Such separation behaviour occurs over the aft region of tugboats and strongly affects the transverse force when under drift. This force is therefore quite difficult to model. This project will undertake a verification analysis on a bluff body under drift in order to help ascertain the numerical approach required to predict this force with confidence. Any available CFD code is acceptable for use on this project.	Aeronautical Engineering Automotive Engineering Offshore Oil and Gas Technology	Damen Shipyard Singapore	Computing and analysis	Fluid mechanics is essential. CFD exposure is highly desirable.
FM41	Wake dynamics of fluttering 3D flexible light wing structure	FM	Prof Jaiman Rajeev Kumar		Due to high transverse velocity of the foil relative to the free stream velocity during flutter instability, the angle of attack is high. At high angles of incidence of the flow on the foil, the potential flow model shows its incapability in capturing the wake correctly. Our experience with potential flow calculations shows a reverse von Karman vortex sheet for a drag producing fluttering wing at low mass ratios which is incorrect. This indicates the necessity of calculating the flutter boundaries using viscous simulations with fully-coupled fluid-structure interaction. We explore the viscous effects on flutter boundary and wake vorticity. If time permits, we will explore bio-inspired localized traveling waves at the wing tip for drag reduction and thrust production.	Aeronautical Engineering	No	Computing and analysis; Software development	NA
FM53	Modelling of Yield-Stress Fluids by a Particle Method	FM	Prof Nhan Phan-Thien		This project is concerned with the modelling of a yield stress fluid by dissipative particle dynamics (DPD) or its variants. Student will work closely with a Research Fellow.	Offshore Oil and Gas Technology	No	Computing and analysis	NA
FM56	merical Simulation of Compressible Flows by Using Lattice Boltzmann Flux So	FM	Prof Shu Chang		The compressible flow is often appeared in aerospace engineering, which may have strong shock waves. From numerical point of view, it is a challenging task to accurately capture the strong shock waves and thin boundary layers for simulation of compressible flows. In this project, the student will use our newly-developed lattice Boltzmann flux solver to simulate compressible inviscid and viscous flows. It is advised that the student has some basic knowledge in fluid mechanics and numerical computation to do this project.	Aeronautical Engineering	No	Computing and Analysis	Good knowledge in fluid mechanics and numerical computation
FM58	Simulation of Natural Convection by Immersed Boundary-Lattice Boltzmann I	FM	Prof Shu Chang		Natural convective heat transfer from a body to a finite space enclosing it has a lot of industrial applications, which include nuclear reactor design, cooling of electric equipment, aircraft cabin insulation and thermal storage systems. In this project, the student will simulate the natural convection in a confined region by using our newly-developed immersed boundary-lattice Boltzmann flux solver. It is advised that the student has some basic knowledge in fluid mechanics and numerical computation to do this project.	Aeronautical Engineering	No	Computing and Analysis	Good knowledge in fluid mechanics and numerical computation
FM60	Numerical Study on interaction of multiphase flows with thin film	FM	Prof Shu Chang		The interaction of multiphase flows with thin film is an interesting phenomenon in nature. Fundamental understanding of this phenomenon is important in industrial applications. In this project, the student will use our newly-developed multiphase lattice Boltzmann flux solver to do numerical study. Some interesting phenomenon can be extracted from the numerical results. It is advised that the student has some basic knowledge in fluid mechanics and numerical computation to do this project.	Aeronautical Engineering	No	Computing and Analysis	Good knowledge in fluid mechanics and numerical computation
FM61	Simulation of Incompressible Flows by Using Lattice Boltzmann Flux Solver	FM	Prof Shu Chang		In recent years, the lattice Boltzmann method (LBM) has become an efficient approach to simulate incompressible flows. Unlike Navier-Stokes solvers, LBM does not need to solve partial differential equations and resultant algebraic equations. It only involves algebraic operation. The method is simple and easy for implementation. In this project, the student will use the lattice Boltzmann flux solver, which combines the good features of LBM and Navier-Stokes solvers, for the simulation of incompressible flows. It is advised that the student has some basic knowledge in fluid mechanics and numerical computation to do this project.	Aeronautical Engineering	No	Computing and Analysis	Good knowledge in fluid mechanics and numerical computation
FM63	Effect of Rotating Motion on the Vortex Development of a 3D Flapping Wing	FM	Research Assist. Prof Lua Kim Boon		The flapping motion of an insect-like wing consists of both sweeping and rotating motions. The sweeping motion generates forward velocity and gives rise to the formation of the leading-edge vortex (LEV). The rotating motion imposes the appropriate angle of attack and also generates rotational circulation that augments the force generation. In addition, recent observations on the flow structures of flapping wings suggest that the rotating motion may significantly impact the formation and shedding of the LEV. To further understand this phenomenon, a parametric study will be conducted to investigate the effect of rotating motion on LEV behaviour and force generation of a flapping wing at different angle of attack and angular velocity. This project will utilise numerical simulations validated against in-house force measurement data.	Aeronautical Engineering	No	Laboratory Investigation; Computing and analysis	NA
FM64	The study of aerodynamic force and flow regime of flapping hydrofoils with tubercle leading edge	FM	Research Assist. Prof Lua Kim Boon		The ongoing research on flapping hydrofoils is mainly limited to hydrofoils with regular shaped leading edge profile. However, in nature the hydrofoil (or fin) of the swimming animals does not have a perfectly smooth leading edge, for example the flippers of the humpback whale. In literature, the study on the flapping hydrofoils with leading edge corrugation is less explored, which serve as a primary motivation of the present research work. This research project aims to determine the propulsive force performance of a three dimensional flapping hydrofoil in a forward flight condition. The effects of the hydrofoil shape and leading edge corrugation on the flapping induced propulsive force will be investigated for wide range of flapping frequencies. Water tunnel experiments will be conducted on a newly developed three dimensional flapping mechanism to measure the flow induced hydrodynamic forces. Additional information on the vorticity and pressure distributions on the flapping hydrofoil will be obtained by performing computational fluid dynamics (CFD) simulations.	Aeronautical Engineering	No	Laboratory Investigation; Computing and analysis	NA
FM68	CFD Simulation for Hydrocyclone	FM	Assoc Prof Loh Wai Lam		This FYP aims to simulate the performance of a conventional Hydrocyclone under multiphase conditions.	Offshore Oil and Gas Technology	No	Computing and analysis	NA
FM74	Computational Aeromechanics and Control of a Quadcopter	FM	Dr. Murali Damodaran		The coupled aerodynamics, flight dynamics and control of a maneuvering quadrotor is addressed in this project by integrating high fidelity continuum based CFD, with rigid body dynamics (RBD) and flight control law are integrated in this project to study complex flight maneuvers. The dynamic fluid body interaction (DFBI) equations are used to obtain the body position and orientation of the quadrotor. The movement of quadrotor and propellers are handled using dynamic overset-mesh topology. The Proportional-Integral-Derivative (PID) and the Linear-Quadratic-Regulator (LQR) controllers designed in Matlab are coupled with the Star-CCM+ CFD solver for controlling the desired trajectory of the quadrotor.. (The proposed work will build upon on-going existing work. Interest in aerodynamics, flight mechanics, and willingness to learn and use Computational Modelling and High Performance Computing will be an advantage.)	Aeronautical Engineering	No	Computing and analysis, Software development	The proposed work will build upon on-going existing work. Interest in aerodynamics, flight mechanics, and willingness to learn and use Computational Modelling and High Performance Computing will be an advantage. Relevant modules for this project include ME2134, ME2135,ME3291,ME4231,ME4241 &ME4233.
FM75	Computational Aeromechanics of Propeller Powered Ring Wing Unmanned Aerial Vehicles	FM	Dr. Murali Damodaran		The computational aeromechanics modelling of two configurations of propeller powered annular wing unmanned aerial vehicles using Star-CCM+ CFD software will be explored in this work to study flight maneuvers for example transitioning from hover to forward flight. One configuration uses a propeller at the nose of the fuselage while the second configuration uses propellers inside the ring wings attached to the UAV fuselage. The dynamic fluid body interaction (DFBI) equations are used to obtain the position and orientation of the UAV. The motion of the propellers and the tilting of the ring wings to initiate flight maneuvers of the UAV will be handled using dynamic overset-mesh topology. (This FYP can cater for 2 students working on different UAV configurations independently. The proposed work will build upon on-going existing work Interest in aerodynamics, flight mechanics, and willingness to learn and use Computational Modelling and High Performance Computing will be an advantage.)	Aeronautical Engineering	No	Computing and analysis, Software development	The proposed work will build upon on-going existing work. Interest in aerodynamics, flight mechanics, and willingness to learn and use Computational Modelling and High Performance Computing will be an advantage. Relevant modules for this project include ME2134, ME2135,ME3291,ME4231,ME4241 &ME4233. This FYP can cater for 2 students working on the two different UAV configurations independently.
FM76	Computational Study of Unsteadiness in Propeller-Wing Wake Interaction	FM	Dr. Murali Damodaran	Dr. Dominic D.J. Chander-Research Scientist (A*Star IHPC)	Unsteady propeller-wing wake interactions are important in the light of renewed interest in unmanned aerial vehicle applications and also in turboprop engines. Modern high fidelity CFD tools and composite overset moving mesh technology offer opportunities for studying the complex propeller-wing wake interactions to characterise the aerodynamic interference effects of the propeller and wing or airframe. Open source flow compressible solvers SU2 and OpenFoam which recently incorporated high resolution density based modules for handling compressible flow such as rhoCentralFoam and DensityBasedTurbo together with LES wall modelling options available within the oodles package together and a recent overset mesh capability developed at A*Star IHPC within OpenFoam will be explored for this investigation by considering the wing-propeller experimental test set up of Samuelson for which experimental wind tunnel test data exist. This project can take two students- one exploring OpenFoam and the other exploring SU2. (Interest in aerodynamics, flight mechanics, and willingness to use Computational Modelling and using High Performance Computing will be an advantage.)	Aeronautical Engineering	No	Computing and analysis, Software development	Interest in aerodynamics, flight mechanics, and willingness to learn and use Computational Modelling and High Performance Computing will be an advantage. Relevant modules for this project include ME2134, ME2135,ME3291,ME4231,ME4241 &ME4233.
MN01	Assessing the thermal errors in thermally enhanced microcutting	MN	Assist. Prof Wang Hao		This project assesses the thermal errors associated with the temperature rise in the machining system which is collectively contributed by the cutting temperature and the external heat source of the thermally enhanced machining process. The temperature distribution and heat partition will be quantitatively studied. Finite element method simulation will be employed to support the experimental study of the thermal errors.	No Specialization	No	Hybrid i.e. mixtures of experiment and theoretical, or experimental and numerical/software.	Knowledge of machining technology and tool design

MN02	Microcutting of calcium fluoride single crystals at elevated temperatures	MN	Assist. Prof Wang Hao		Calcium fluoride manifests a poor machinability due to its brittle nature at the room temperature. This project aims to develop the new method for the microcutting of calcium fluoride single crystals at elevated temperatures. The thermal effects on the material anisotropy, cutting force fluctuation and machined surface integrity will be investigated. The optimised machining parameters and conditions are to be devised from the experimental work.	No Specialization	No	Hybrid i.e. mixtures of experiment and theoretical, or experimental and numerical/software.	Knowledge of machining technology and material characterisation
MN03	Nanofinishing of calcium fluoride by magnetic-field-assisted polishing	MN	Assist. Prof Wang Hao	Dr. Guo Jiang (SimTech)	This project develops the nanofinishing method by magnetic-field-assisted polishing for the fabrication of a near-perfect optical surface on calcium fluoride single crystals. The nanofinishing method will be applied to remove the crystal defects induced by the prior material removal process. The surface integrity and lattice defect will be examined by optical microscopy, interferometry, and electron microscopy.	No Specialization	No	Hybrid i.e. mixtures of experiment and theoretical, or experimental and numerical/software.	Knowledge of the machining and polishing processes and surface metrology
MN06	Tool wear in thermally assisted diamond turning of calcium fluoride	MN	Assist. Prof Wang Hao		This project investigates the abrasive wear of diamond tools in the CaF2 microcutting with different machining conditions. The thermally assisted machining technique will be applied to induce appreciable plasticity in the brittle crystal. Cutting force measurement will assist in confirming the friction reduction effect and a prolonged tool life is to be verified by the cutting distance and surface finish.	No Specialization	No	Hybrid i.e. mixtures of experiment and theoretical, or experimental and numerical/software.	Knowledge of machining technology and material characterisation
MN64	Development of novel finishing method for microstructured surfaces	MN	Assist. Prof Wang Hao	Dr Guo Jiang (SIMTech)	Microstructured surfaces, which are capable of performing many different functions, are increasingly important in the fields such as optics, microfluidics and surface engineering. Precision machining technologies such as diamond turning and milling have been increasingly employed for fabricating microstructures in the size of tens to hundreds of micrometres. To further improve the achievable surface quality, a post-polishing process is necessary to eliminate the surface defects and subsurface damages caused by machining processes. This project will develop the novel finishing method for microstructured surfaces prepared by precision machining.	No Specialization	No	Laboratory Investigation	Knowledge of machining technology and material characterisation
MN65	Hybrid machining of hard-to-machine materials	MN	Assist. Prof Wang Hao	Dr Deng Hui (SIMTech)	In this project, plasma and electrochemistry-based hybrid machining technologies will be used to machine typical hard-to-machine materials like CaF2, Zerodur, etc. which have a poor machinability and are usually chemically stable making it difficult to machine using conventional machining technologies. This project will employ plasma or electrochemical method to improve the machinability of the selected workpiece materials and realise the damage-free and high-efficiency machining of these materials.	No Specialization	No	Laboratory Investigation	Knowledge of machining technology and material characterisation
MN66	Design for evaluation of the cooling effect of MQL	MN	Assist. Prof Wang Hao		Minimum quantity lubrication (MQL) is an advanced technology to replace the traditional flood cooling method by applying a minute amount of machining fluid to the cutting zone which is atomised through a dedicated spray nozzle. This project will design and implement a measurement device to quantify the heat dissipation efficiency of the MQL spray. Different parameters and machining fluids will be employed to identify the optimal MQL conditions.	No Specialization	No	Laboratory Investigation, Design	Knowledge of machining technology and material characterisation
MN41	Mobile Augmented Reality Toys and Assistive Applications	MN	Assoc. Prof Ong Soh Khim	Prof Andrew YC Nee	In augmented reality applications, computer-generated graphics and sounds are superimposed on the user's view of the real world. This enhancement of the real world can allow for rich gaming and assistive content to augment a mundane everyday environment. In this project, augmented reality toys and assistive applications based on existing prototypes will be developed for mobile devices using an existing software framework.	No Specialization	No	Product development	Programming
MN46	Development of visualization aid for free-form surface modelling	MN	Assoc. Prof Zhang Yunfeng		In CAD, several parametric modelling methods are available for representing free-form surfaces, each having its unique characteristics. For students who study this subject, it is very much desirable to have an interactive graphical aid that helps visualise these methods with a user-friendly interface. In this project, an interactive demo software is to be developed to demonstrate the characteristics of various surface modelling methods, and composite surface construction methods.	No Specialization	No	Software development	NA
MN48	Production planning towards energy efficiency	MN	Assoc. Prof Zhang Yunfeng		The aim of this project is to study the energy consumption model of 3-axis milling process based one experimental data (which have already been collected). The student is expected to analyze the data and identify critical parameters and their relationships to energy consumption. Based on this finding, new strategies in production planning are to be proposed in order to reduce the energy cost. The student is expected to do programming.	No Specialization	No	Software development	NA
MN51	AR-FEA Educational Toolkit	MN	Prof Andrew YC Nee	Assoc. Prof Ong Soh Khim	Seeing FEA results through AR will stimulate FEA learning stage. This project aims to fabricate an AR-FEA educational toolkit consisting of a set of primitive components or structural modules that can be assembled into a number of different structures. Each component is equipped with load sensor and a communication sensor, allowing receiving input from user and transmitting signals with computer sever. After assembly, the load sensor on each component should be mapped to the load matrix of the assembled structure. A head-mounted device is used to visualize the FEA results and the interaction between the user and the assembled structure.	No Specialization	No	Product development	Basic microcontroller programming (Arduino) and ANSYS knowledge.
MN54	Robotic Welding Pass Planning for Different Welding Positions	MN	Prof Andrew YC Nee	Assoc. Prof Ong Soh Khim	In addition to welding current/voltage/speed, etc., welding position is a vital welding parameter that can affect the resulting welding beam geometry significantly. This project aims to develop methodology for pass planning for a welding task with multiple welding positions. In particular, given a knowledge database that relate the welding bead geometry and the various welding parameters, this project is to determine the number of layers and passes required for welding a Y-type joint. The planning results, including the offset between two adjacent passes, will be used to generate suitable welding robot motion.	No Specialization	No	Software development	C++ programming skills.
MN55	Welding Groove Reconstruction using A Laser-Line Profile Scanner	MN	Prof Andrew YC Nee	Assoc. Prof Ong Soh Khim	In robotic welding of complex joints, e.g., T-joint, Y joint, etc., the welding groove needs to be ready prior to subsequent welding robot motion planning. The objective of this project is the reconstruction of the groove model for a given Y-joint using a laser-line profile scanner attached on the robot's arm. First, a robot path is planned to guide the scanner traversing the entire welding groove; second, the scanned data needs to be filtered and stitched together under a universal coordinate system (e.g., robot base coordinate frame). This project requires knowledge on serial robot kinematics and necessary programming skills.	No Specialization	No	Hybrid i.e. mixtures of experiment and theoretical, or experimental and numerical/software.	Serial robot kinematics and C++ programming skills.
MN67	Design and development of a flushing device for micro-EDM process.	MN	Dr Woon Keng Soon	Dr Mustafizur Rahman	An attempt will be made in this study to design and develop a flushing device for micro-EDM process to enhance the machining performance.	No Specialization	No	Laboratory Investigation	N.A.
MN68	Micro-drilling of brittle materials - Glass	MN	Dr Woon Keng Soon	Dr Mustafizur Rahman	An attempt will be made in this study to establish the optimum machining conditions for engineering glass	No Specialization	No	Laboratory Investigation	N.A.
MN69	A study on the effect of grain size on surface finish.	MN	Dr Woon Keng Soon	Dr Mustafizur Rahman	An attempt will be made in this study to investigate the effect of grain size of materials on surface finish.	No Specialization	No	Laboratory Investigation	N.A.
MN70	Ultra-precision slicing of rare materials	MN	Dr Woon Keng Soon	Dr Mustafizur Rahman	The current practice of slicing a rare material pieces is by cracking it along its cleavage plane. A lot of material is lost due to unpredictable planes of breakage. An attempt will be made in this study to develop an ultra-precision slicing mechanism for rare materials and thereby saving as much material as possible.	No Specialization	No	Laboratory Investigation	N.A.
MN71	Optimization of Hybrid EDM-ECM Parameters	MN	Dr Woon Keng Soon	Dr Mustafizur Rahman	A basic study has been done recently on a break-through study of hybrid Electro-Discharge Machining (EDM) and Electro-Chemical Machining (ECM). An attempt will be made in this study to optimize the process parameters.	No Specialization	No	Laboratory Investigation	N.A.
MN72	Process Optimization of Coolant Application in Machining	MN	Dr Woon Keng Soon	Dr Mustafizur Rahman	In this project, the student will optimize the lubrication, cooling and chip evacuation for the machining of difficult-to-machine materials to increase the tool life and surface finish.	No Specialization	No	Laboratory Investigation	N.A.
MN73	Diamond Milling of Brittle Materials	MN	Dr Woon Keng Soon	Dr Mustafizur Rahman	The aim of this project is to establish the machining parameters and techniques to generate mirror surface finish on brittle materials by milling.	No Specialization	No	Laboratory Investigation	N.A.
MN74	Effects of Drill Geometries on Hole Straightness	MN	Dr Woon Keng Soon	Dr Mustafizur Rahman	Geometries on twist drills have strong, lasting influences on the resultant hole straightness in guiding the drill bits into the workpiece and subsequent material removal. This study aim to establish the optimum combination of drill geometries and drilling parameters for high precision drilling.	No Specialization	No	Laboratory Investigation	N.A.

MN75	The Effects of Tool Edge Radius on Surface Finish of Brittle Materials	MN	Dr Woon Keng Soon	Dr Mustafizur Rahman	Tool edge radius effects on ductile materials have been established profoundly through the transformation of chip formation mechanism. This project aims to develop new theories of the same effects on the finishing of brittle materials like glass, silicon, ceramics, etc.	No Specialization	No	Laboratory Investigation	N.A.
MN76	Studies of Knee Joint Movement	MN	Assoc. Prof Lu Wen Feng		Movement of our body, like bending at the knee, require complex interactions between bones, muscles and ligaments. The knee joint is basically a hinge joint with the main movement of flexion-extension. However, with different radius and the length at the articular surface of the knee joint, the knees have a "Screw Home" rotation that allows for full knee extension and flexion. This rotation might not seem all that significant, but it is important for healthy movement of the knee. In this project, the student will work with NUH to study the rotational movement of the joint. The student will start the background studies of knee joint motion and later conduct simulation and experimental analysis of knee joint motion with the help of a PhD student.	No Specialization	No	Hybrid i.e. mixtures of experiment and theoretical, or experimental and numerical/software.	N.A.
MN77	Temperature Monitoring and Control of a 3D Plastic Injection Printing Machine	MN	Assoc. Prof Lu Wen Feng		Additive manufacturing could be the next manufacturing technology with the potential to revolutionize the industry as it currently stands. There are many types of additive manufacturing machines with strength and weakness. 3D plastic injection printing machine provides the flexibility with the usage of various polymer materials and geometries of 3D printed parts. In this project, student will work on an existing 3D plastic injection printing machine and improve its functions. The student will start with the understanding of the working principle of this 3D plastic injection printing machine. Temperature monitoring and control will be designed and fabricated with nozzle heads for the 3D plastic injection printing machine for selected materials.	No Specialization	No	Laboratory Investigation, Design	N.A.
MS06	Computational modelling of fullerene-based materials	MS	Assist. Prof Sergei MANZHOS		Fullerene-based materials are used in organic solar cells and in OPV-type perovskite solar cells. A single fullerene based molecule – PCBM – has been mostly used even though other fullerene based molecule can provide better performance. This project involves simulations of fullerene molecules other than PCBM for rational design of better solar cell.	Energy and Sustainability No Specialization	No	Computing and analysis	Ability to quickly learn methods and software, including the linux environment. Good basic physics and math.
MS08	Modelling of oxide materials for aluminum ion batteries	MS	Assist. Prof Sergei MANZHOS		Post-lithium batteries such as magnesium ion and aluminium ion are a promising technology to enable large scale and high-energy density electricity storage with batteries (something for which the common lithium ion batteries are not suited). In this project, you will use atomistic and ab initio simulations to predict the performance of promising oxide electrode materials for aluminum ion batteries.	Energy and Sustainability No Specialization	No	Computing and analysis	Ability to quickly learn methods and software, including the linux environment. Good basic physics and math.
MS09	Using machine learning to find kinetic energy functionals for large-scale ab initio simulations	MS	Assist. Prof Sergei MANZHOS		Large scale ab initio simulations are possible with orbital free density functional theory. A critical piece is still missing to enable such simulations of most types of materials – a so-called kinetic energy functional. In this project you will use a machine learning tool such as neural networks to make the computer learn the kinetic energy functional.	Energy and Sustainability No Specialization	No	Computing and analysis	Ability to quickly learn methods and software, including the linux environment. Good basic physics and math.
MS10	Using neural networks to build interatomic potentials	MS	Assist. Prof Sergei MANZHOS		Neural networks are able to encode input output relations using a simple and general mathematic model. They can be used in particular to build interatomic potentials (force field) which are required to perform molecular dynamics or quantum simulations of molecules and materials. In this project you will build a neural network force field for a practically relevant molecular or reactive system.	No Specialization	No	Computing and analysis	Ability to quickly learn methods and software, including the linux environment. Good basic physics and math.
MS11	Modelling of oxide materials for sodium ion batteries	MS	Assist. Prof Sergei MANZHOS		Post-lithium batteries (such as sodium ion, magnesium ion…) are a promising technology to enable large scale and sustainable electricity storage with batteries (something for which the common lithium ion batteries are not suited). In this project, you will use atomistic and ab initio simulations to predict the performance of promising oxide electrode materials for sodium ion batteries.	Energy and Sustainability No Specialization	No	Computing and analysis	Ability to quickly learn methods and software, including the linux environment. Good basic physics and math.
MS18	Investigating Electromagnetic Shielding Response of Magnesium Nanocomposites	MS	Assoc. Prof Manoj Gupta		In this project, synthesis of light weight magnesium nanocomposite will be done using a casting route followed by hot extrusion. Microstructure will be characterized using optical and scanning electron microscopy along with X-ray diffraction technique. Mechanical response will be analysed through hardness, tensile and compressive response. Further, electromagnetic response will be assessed to check their suitability in electronic applications.	Automotive Engineering	No	Laboratory Investigation	NA
MS27	Coupling of optical and electrical properties in metal oxide films	MS	Assoc. Prof Zeng Kaiyang	Ho Ghim Wei (ESP)	This project is to use Scanning Probe Microscopy (SPM) based techniques to study the coupling of optical and electrical properties in some transitional metal oxides thin films. In particular, the project will study the resistive switching and polarization switching processes and mechanisms of the thin films, with and without light, as well as the effects of wave-length of the light, especially the UV light, to those properties. SPM based technique can provide high spatial resolution on both the lateral and vertical directions information on the switching processes and mechanisms. In addition, it has the ability to reveal local surface information such as surface topography, electrical conduction (resistance), surface potential (space charge distribution), polarization directions etc.	No Specialization	No	Laboratory Investigation	NA
MS31	Understanding the Scanning Probe Microscopy experiments and Analysis	MS	Assoc. Prof Zeng Kaiyang		This project aims to use multivariable statistical methods to analyse the images obtained from Scanning Probe Microscopy (SPM) based techniques. In particular, to study the conductive phenomena on complex oxide thin films. The project will use certain analysis methodologies to develop the analysis. The student will work closely with the Ph.D students in the lab during this project.	No Specialization	No	Computing and Analysis; Others	NA
MS34	Effect of conductive carbon-based material on capacity and rate capability of lithium metal phosphate	MS	Prof Lu Li		Lithium metal phosphate has been used in lithium ion batteries while it has low electronic conductivie resulting in low capacity and low rate capability. Therefore increase in electronic conductivity can enhance performance of lithium metal phosphate. The proposed project will use different carbon-based conductive materials such as carbon nanotubes, graphene etc to increase its conductivity.	Energy and Sustainability	No	Laboratory Investigation	NA
MS36	Exploration of lead-free ceramics for pyroelectric applications	MS	Prof Lu Li	Kropelnicki Piotr (Excelitas Technoogy Singapore)	Lead titanate has occupied commercial markets for more than half decay due to its high electromechanis performance in all categories. However, Lead titanate contains more than 50% of lead causing big environmental issues. Many countries have banned using Lead titanate although lead titanate has provided the best and desirable performance up-to-date. Therefore it is important and urgent to develop new and high performance piezoelectric, ferroelectric and pyroelectric ceramics to replace current lead titanate while this project aims to investigate one of old but potential lead-free ceramics, bismuth sodium titanate for pyroelectrics.	Offshore Oil & Gas Technology	Excelitas Technoogy Singapore	Laboratory Investigation	materials science
MS46	Life Cycle Analysis of Nanocellulose Technology	MS	Prof Seeram Ramakrishna		Given the potential of nanocellulose in a long range of applications over a wide array of fields, much has been done in regards to its uses. However, can we really conclude that nanocellulose is truly environmental friendly? This project serves to look into the carbon footprint of nanocellulose over its entire lifetime and determine the true cost of producing and using it.	No Specialization	No	Feasibility/case studies	NA
MS47	Development of a Similarity Measure for Waste-to-Resource Matching	MS	Prof Seeram Ramakrishna		Resources in terms of materials, energy and waste are often connected to each other by different forms of relations and features. Understanding these similarities between resources can improve resource efficiencies that can in turn lead to economic and environmental gains. This project formulates calculations to assess similarities between resources. By presenting a similarity measuring algorithm, a numerical score for resource matching can provide a good measure for substitution and recycling of resources.	No Specialization	No	Computing and analysis	NA
MS48	Development of a method for determining eco-efficient pathways for wastewater recycling	MS	Prof Seeram Ramakrishna		Singapore is a water scarce country owing to its deficit in local renewable water resources and high water demand. The 2060 National target is to be water self-sufficient. However, in 2060, annual water demand is projected to almost double from today. To reach the 2060 National target, the expansion of wastewater recycling is central. The objective of this project is to develop a systematic method to prioritise pathways for wastewater recycling considering eco-efficiency (economic and environmental performance) along the water life cycle. The scope includes the construction of a water-specific taxonomy and matching wastewater to resources.	No Specialization	No	Computing and analysis, Feasibility/case studies	NA
MS49	Evaluation of Waste-to-Resource Matches using Agent-based Simulation	MS	Prof Seeram Ramakrishna		In 2015, Singapore generated more than 7.7 million tonnes and the amount is growing each year. One grand strategy to curb this waste problem is through industrial symbiosis, whereby the waste of one company is the resource for another. However, companies lack the visibility of possible waste-to-resource matches and whether industrial symbiosis is viable for them. With the aim to provide companies with this visibility and the needed decision support, the objective of this project is to build an agent-based simulation model that is able to simulate waste-to-resource matches for industrial symbiosis.	No Specialization	No	Computing and analysis	NA

MS50	Life cycle assessment of food waste recycling	MS	Prof Seeram Ramakrishna		In 2014, 788,600 tonnes of food waste was generated in Singapore. Out of the generated food waste, only 12.9% of the food waste was recycled. The remaining food waste was sent for incineration. This produces a large amount of greenhouse gas (GHG) emission that can be avoided through better food waste recycling. Therefore, the objective of this project is conduct a life cycle assessment (LCA) of food waste recycling technologies.	No Specialization	No	Feasibility/case studies	NA