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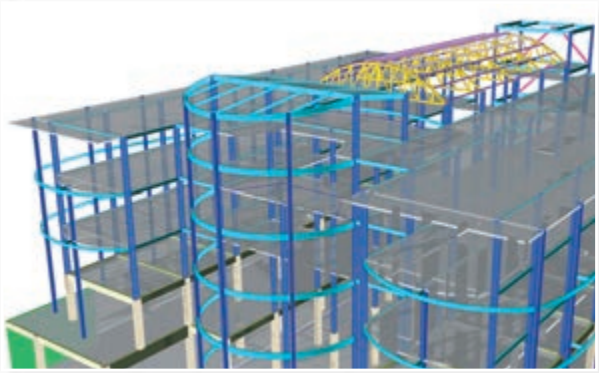

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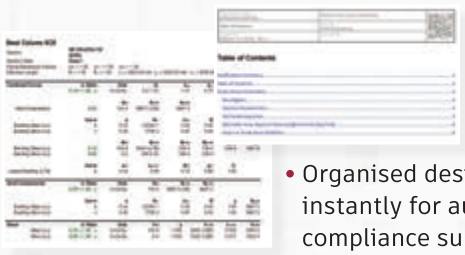

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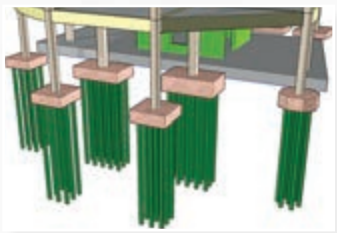

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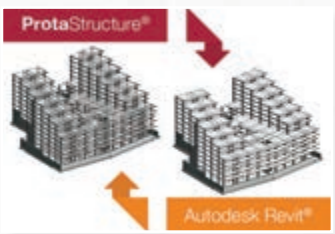

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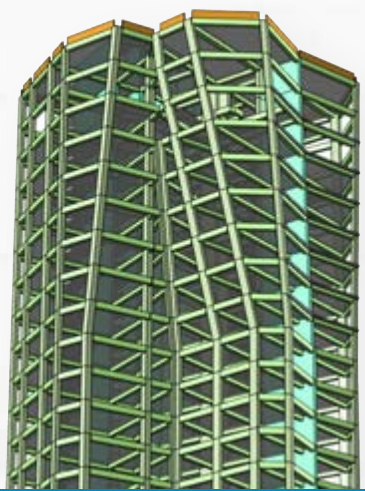

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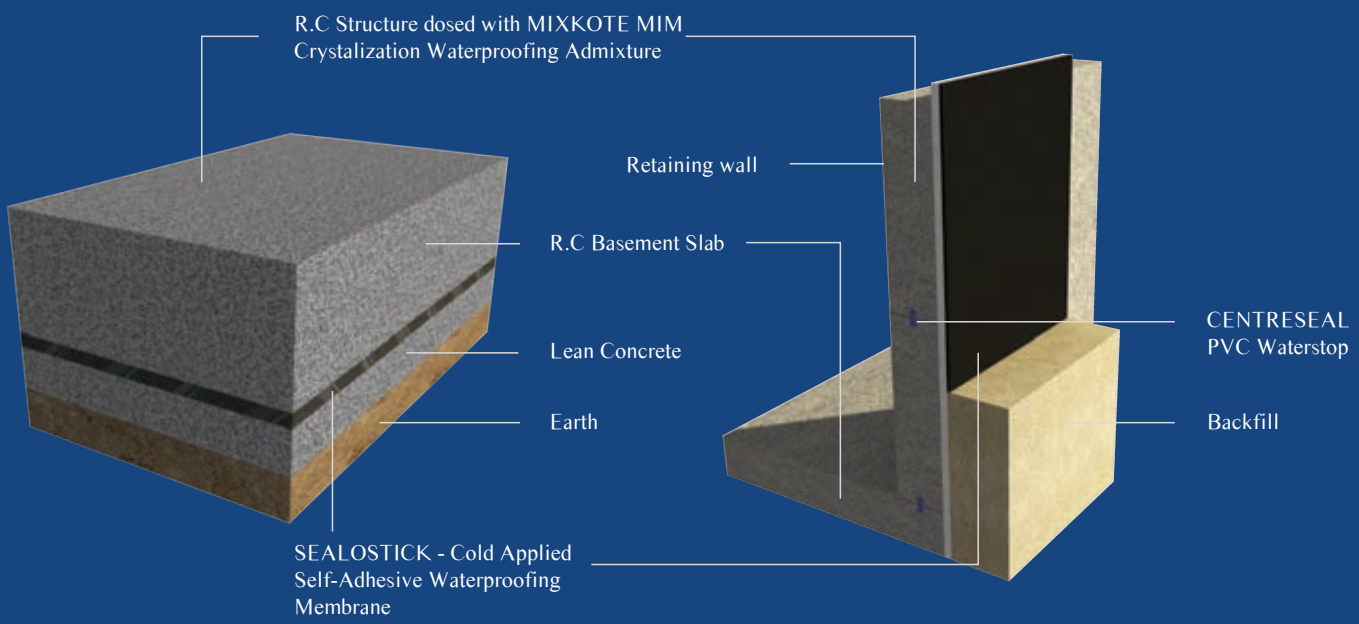

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cover note

Safety for All

by Ir. Loo Chee Kin
Chairman,
Mechanical Engineering Technical Division (METD)

We usually see Safety First and Utamakan Keselamatan signs at construction sites or in factories. Because of this, the public thinks safety is a concern only at construction sites or factories and that it's the sole responsibility of safety officers or enforcement bodies. But that's not true. Safety is everyone's concern, as accidents can be prevented when risks are identified, mitigated and managed by following rules or performing risk assessments.

Like all other countries, we are vulnerable to natural disasters, and updated standards have addressed problems of flooding, earthquake and windstorm as proper installations will withstand more adverse loading, weathering and corrosion.

Safety problems are also compounded by the lack of technical knowhow as we often depend on foreign labour, ill-prepared operations and poor maintenance attitudes. Where necessary, additional engineering controls, safeguards, interlocks and protection should be designed and implemented.

Safety should start from conceptual stage and design to material specification, installation supervision, commissioning procedures, instructed operation and planned maintenance. Proper check and balance (peer review, audit, inspection and risk assessment) should all be part of the engineered process. ■

editor's note

by Ir. Razak Yakob
Bulletin Editor

Salam & Hello All IEMers,

The October 2018 issue has been very challenging for us at the Editorial Board. Many changes in organisations took effect in recent months, post GE14. Not many people appreciate the fact that, even for a bulletin with limited readership like *JURUTERA*, it still takes months of planning and preparation. Some articles are updated or replaced at the very last minute to ensure readers get the latest relevant information.

With just two months to 2019, many technical divisions and sections are scrambling to come up with activities to meet the annual planned targets which have been postponed earlier or cancelled. Please remember that all engineers in IEM are volunteers. We volunteer because we care for this fraternity. So, the next time you attend any activity, do thank the organisers. It will be much appreciated.

This month, METD has the theme "Safety First" which, needless to say, is very important in engineering. Every two months, we also have "Safe Tea Time", a short section on safety. All are welcome to contribute. Coming from the oil & gas industry, safety is our ultimate culture; it saves lives. "Safety is about caring for each other. I care."

Let's continue to engineer our country to greater heights! ■

Safety
in Construction Engineering

Engineering is a broad discipline that's often broken down into several sub-disciplines. One such sub-discipline is Construction Engineering which deals with designing, planning, construction and management of infrastructures such as roads, tunnels, bridges, airports, railroads, facilities, buildings, dams and utilities.

Ir. Haji Omar bin Mat Piah
Director General, Department Occupational Safety & Health (DOSH)

The construction site is an important element in engineering. One key aspect to ensuring the success of a construction project is Safety & Health. However, quite often, this is viewed as a hindrance rather than a key element.

In this issue of *JURUTERA*, Ir. Haji Omar bin Mat Piah, Director General, Department Occupational Safety and Health (DOSH), talks about the importance of safety engineering in the construction field and gives an overview of safety and health as well as a glimpse into the future of safety regulation in Malaysia.

After he graduated in mechanical engineering from Universiti Malaya in 1985, Ir. Haji Omar joined DOSH. He then completed his postgraduate Masters in Industrial Safety in 2004 at Universiti Kebangsaan Malaysia.

At DOSH, he started his career in the Petroleum Safety Division which encompassed, among other things, pipeline system, LPG reticulation system and pressure vessels where he was exposed to the safety culture of the Oil & Gas industry. He was later transferred to the Major Hazard Division at DOSH headquarters in Putrajaya. This special division monitors and regulates the installation of any work environment which contains potentially hazardous elements and where any accident can turn into a major hazard with consequences that can spread beyond the workplace.

SAFETY AWARENESS

When asked for his opinion on safety awareness among Malaysians, Ir. Haji Omar says there has been a big improvement in terms of awareness of the importance of safety. Malaysians are now more aware of their rights and are complaining to DOSH. Safety incidents are also well publicised.

But there remains a gap in the awareness of safety practices. At the top end of the spectrum are the giant multinational companies in Oil & Gas and Electronic industries. Then there are the medium to small industries and the self-employed in rural areas where safety awareness is not at the level where it is supposed to be. It is

the vision of safety regulators for such gaps in awareness and practices to be kept at the minimum level.

There are many differences in safety practices between these companies. Big organisations usually have a master plan for preventive culture. The right to a safe and healthy working environment is respected at all levels of the organisations. It starts at the top management and moves down to the lowest rung in the organisation hierarchy.

In Malaysia, the average number of daily accidents on the road is 18. At the workplace, the reported daily average is 2 fatalities and 116 accidents. Unfortunately, most people typically believe that an accident will not befall them until it happens.

DOSH measures the rate of fatalities and accidents to gauge the effectiveness of existing Safety Acts and Guidelines. Since the Occupational Safety & Health Act (OSHA) was gazetted in 1994, the rate of fatalities and accidents has plateaued although there has been no improvements in the past 3 years.

Ir. Haji Omar believes this is because of people's attitude towards safety. Accidents happen because of an unsafe act or an unsafe condition. DOSH has addressed unsafe conditions with Acts and Guidelines which are already in place but if people persist in engaging in unsafe acts, then accidents will continue to happen.

Malaysia uses foreign labour extensively and safety culture will be influenced by the organisation that employs them.

Another example is the difference between working in Singapore and Malaysia. Why do foreign workers in Singapore generally exhibit better safety practices than their counterparts in Malaysia? Ir. Haji Omar is reminded of his experiences with a Japanese organisation which was involved in a water pipeline project in Pahang in 2010.

To illustrate just how the sense of civic duty and safety culture can be ingrained in the individual, he says that the project manager, when walking in a nearby village, could be seen picking up cigarette butts and disposing them in the dustbin.

While it may be effective to mould a safety culture through strict enforcement and fines, the best way to develop safety awareness is through education and organisation culture.

HAZARD IDENTIFICATION, RISK ASSESSMENT & RISK CONTROL (HIRARC)

The purpose of the Hazard Identification, Risk Assessment & Risk Control guideline is to provide a systematic and objective approach to assessing hazards and their associated risks which will provide an objective measure of an identified hazard as well as provide a method to control the risk.

It is one of the general duties prescribed under OSHA 1994 (Act 514) for employers to provide a safe workplace for their employees and other related persons. The 4 steps in the HIRARC process are:

1. Classify work activities
2. Identify hazard
3. Conduct risk assessment
4. Decide if risk is tolerable and apply control measures.

The purpose of hazard identification is to highlight critical operations or tasks that pose significant risks to the health and safety of employees as well as highlight hazards pertaining to certain equipment due to energy sources, working conditions or activities.

Hazards can be divided into three main groups.

1. The first is Health Hazards which is an occupational hazard that can cause serious and immediate effects or long term problems.
2. The second is Safety Hazards which is defined as any force strong enough to cause injury or damage to the property and workers. Injuries from such incidents are usually obvious, such as injury to or loss of limbs.
3. The third is Environmental Hazards which is defined as hazards released into the environment and which may cause harm or deleterious effects. An environmental release may not be always obvious, such as releasing chemical agents into the storm/ sewer system.

MAJOR HAZARD RISK EVALUATION

An example of a major hazard risk is a working environment where hazardous substances are used. These substances are classified as either toxic, flammable or explosive, such as chlorine. Each hazardous substance has a threshold quantity which is used to classify the substance as a major hazard installation.

For the safety of the workplace environment and the population around the hazardous installation, it is imperative that DOSH studies and classifies the impact of accidents which can happen at such premises and to validate the proper implementation of mitigation measures to control identified hazard risks.

To start, a major hazard control exercise which consists of risk assessments and which contains every possible accident scenario, is prepared. Take for example, chlorine. An evaluation of the risks of the chlorine tank is done using simulations of different scenarios of various leakage rates to simulate the effect of various flow rates of a chemical leak from the tank, in relation to different pressure levels within the tank.

With hazardous substances, a study will also be done, in coordination with the Meteorological Department, on the typical wind speed and direction over the period of one year at the major hazard installation location to evaluate exposure risk of the substance to the surrounding areas.

Based on the location and population level around the installation, a simulation test will be done to calculate the parts per million (ppm) of the substance which can be safely allowed into the environment. This simulation must take into account the type of hazardous substance as different substances have different threshold limits which will pose immediate danger to the health of people exposed to it.

Group photo

For example, if the substance is LPG, a risk assessment of such an installation has to consider 2 different phases (liquid and gas) and the different position of leakage from the LPG tank. Leakage towards the top of the tank will cause LPG gas to leak out immediately and leakage at the lower end will cause LPG liquid to flow out, pool under the tank and vaporise. In such a case, there is the possibility of explosion should an ignition element be accidentally exposed to the leakage location. A simulation on the effect of such risk scenarios must be done to determine its effect on people in the area and to ensure that measures to protect the workplace and surroundings are implemented. Today, such a simulation can be obtained quickly and easily but it was not so easy back when computers were first introduced!

An example of a major accident happened in 1997 in Bintulu, where an O&G plant suffered major damage and losses because a hazardous element was not identified during the risk assessment study. The plant was the first of its kind to utilise the gas to liquid process. During the hazard identification phase, an unexpected but critical element was not identified, so there were no mitigation measures put in place. Atmospheric particles from forest fires during the haze period caused an explosion at the plant. These tiny air particles from the haze had accumulated and entered the air separation unit after by-passing the air filters. When mixed with the gas process, these caused the explosion. Fortunately, the accident occurred during the festive season, so there were no fatalities. This was an example where a risk was not identified but which caused a catastrophic accident.

RISK CONTROL MANAGEMENT

In general, risk control consists of 5 control methods.

1. Elimination
2. Substitution
3. Engineering Control
4. Administrative Control
5. Personnel Protective Equipment

The first control method is elimination. The best example in Malaysia is the ban on firecrackers which totally eliminates the risk or physically removes the hazard. The elimination control method is the most difficult to implement especially in an existing process. Other socio-economic considerations will also have to be kept in mind such as employment opportunities for people.

In the second control method, substitution, the hazard element is replaced. This method is also difficult to implement in an existing process. If a project is still at the design stage, the substitution control method should be less expensive. For example, instead of chlorine, the management of Sunway Lagoon in Bandar Sunway, Selangor, opted for a less hazardous chemical in its water treatment and yet maintained its performance and functionality.

The third control method is engineering control. This means isolating people from the hazard by removing the hazard at the source before it comes into contact with humans. An example of engineering control is the introduction of enclosures to reduce noise pollution from a genset or generator set. A well-designed engineering control method can be most effective. While the cost may be higher initially than the fourth control method discussed below, it will be more economical and effective in the long run.

The fourth control method is administrative control. This procedural method changes the way people work and includes the implementation of procedures and methods of working. However, it may not be as effective as workers may not follow the safety procedures.

The fifth control method is Personal Protective Equipment (PPE) which includes the use of gloves, ear protection and protective clothing. This is the least effective way to protect people from workplace hazards. For safety professionals, this method should be used only as the last resort but to the public, PPE is the first line of risk control though this cannot be further from the truth. The best method is always to control the risk at source.

RISK CONTROL

DOSH practises strict enforcement and zero corruption. It makes evaluations based on risk controls implemented at the workplace, compared/benchmark to the code of practice, regulation and standard. If there are no gaps between the risk control standards tabled out and the actual practice, then the risk control is considered effective. If there are gaps, DOSH will evaluate the seriousness of the breach and either give a notice of prohibition or improvement. If the breach is too large, DOSH will issue a summons to the employer and make re-inspections of the workplace. If there is still no improvement, the employer will be charged in court.

Last year, apart from 324 cases brought to court, approximately 23,000 notices of prohibition and 34,000 notices of improvement were also issued.

CONCEPT OF OSHA

Ir. Haji Omar says: "All our regulations are written in blood as they are written after an incident has happened."

In 1994, the Occupational Safety & Health Act (OSHA) was gazetted. In tandem with existing safety legislations, it was designed to reduce industrial accident rates.

An important concept in OSHA is self-regulation. The philosophy here

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BUILDING TRUST

is that responsibility for managing safety and health lies with those who create the risks and those who work with the risks. The employer creates the risk and the employee works with the risk.

It shall be the duty of every employer and every self-employed person to ensure, so far as is practicable, the safety, health and welfare at work of all his employees. "So far as is practicable" means:

- To provide and maintain plant and system of work
- To make arrangements for the safe use, operation, handling, storage and transportation of substances and plant
- To provide information, instruction, training and supervision
- To provide and maintain place of work and means of access to and egress from any place of work
- To provide and maintain a working environment that is safe and without health risk as well as adequate welfare facilities.

Practicable itself means practicable with regards to:

- The severity of the hazard or risk in question
- The state of knowledge about the hazard or risk and the way of removing or mitigating the hazard or risk
- The availability and suitability of ways to remove or mitigate the hazard or risk and
- The cost of removing or mitigating the hazard or risk.

The employer cannot say he/she doesn't know about the guidelines and code of practice as these are available on the DOSH website. Even though there is enforcement, DOSH encourages all employers to practise self-regulation.

In 2017, DOSH completed inspections on 34,000 lifts, 10,000 mobile cranes and 113,000 pressure vessels despite having only some 1,000 employees.

EXEMPTION OF CERTIFICATE

When asked about the recent Exemption of Certificate, which was gazetted under Factories & Machinery (namely the 2015 Order on hoisting machine and 2017 Order on unfired pressure vessel), Ir. Haji Omar says the decision was based on DOSH's risk-based enforcement. As the pressure vessel is a very low risk system, owners can do this on their own. OSHA is based on self-regulation and self-assessment.

As for hot works, he says safety programmes such as Hot Work Permit and Explosive Atmosphere, come under administrative control. It is based on the employer's self-regulation to control the risks. DOSH provides operation safety guidelines and codes of practice but it is up to the industry to follow the guidelines.

In addition, he says that safety committees are important because these provide employers with the opportunity to sit down with front line workers to discuss prominent safety concerns at the workplace. Safety committees set the lead for worker safety and allow them to play an important role in keeping not only themselves safe but also their co-workers.

DOSH has taken a pragmatic approach to enforce and educate NGOs or SMEs which do not have such committees by interviewing those who have lost limbs, inviting the victims to speak and share their experiences and showing videos of accidents.

Ir. Haji Omar says DOSH will be introducing new guidelines for Occupational Safety & Health Construction Industry Management (OSHCIM). These include stating that safety at the workplace is not only the duty of the main contractor but also that of the project owner and designer who must ensure safety during construction, maintenance and others. Risk assessment and risk control must be conducted during design stage (OSHCIM).

According to the current law, safety at the construction site falls under the main contractor, so project owners typically pass on the risk and do not bother about the safety elements. However, this will change with the new guidelines for construction industry management (which are expected to be introduced at the end of 2018), which states that it's the duty of the owner and designer to ensure safety during construction, maintenance and demolition.

INTERNAL AIR QUALITY (IAQ) MONITORING

When it comes to indoor air quality, Ir. Haji Omar says DOSH will usually go to the industry with the highest risk exposure. Every year DOSH runs a programme on Internal Air Quality (IAQ) awareness and it will only investigate if there are complaints about a certain workplace. Again, this falls back on self-regulation – the guidelines are available as is knowledge of the hazard and control. DOSH has suggested that another way to pave the path to self-regulation is to create a competent person responsible for IAQ, i.e. every building owner must be responsible for its temperature, humidity and air change.

This is also how DOSH audits offshore Oil & Gas facilities. All inspection is done by an offshore inspector appointed by the O&G company. The offshore inspector must go through modules and examinations set by DOSH before he/she can be accredited.

VISION

Last but not least, Ir. Haji Omar hopes that someday, products on the supermarket shelves will come with safety ratings as even the manufacturing of something as simple as a pen, is not without risks. If sales are affected by safety policies, it will encourage manufacturers to improve safety levels.

Currently, the processing of palm oil has to comply with RSPO (Roundtable on Sustainable Palm Oil) criteria before it is allowed to be exported. If this can be applied to all products, the need for DOSH will be minimised.

In conclusion, it is imperative that engineers and employers understand the concept philosophy of self-regulation, risk assessment, risk management as far as practicable and design for safety. ■

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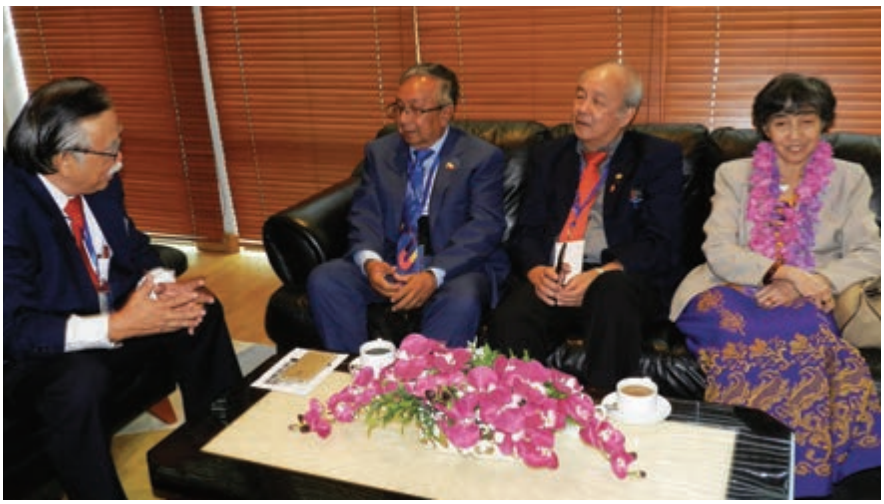
After the FEIAP General Assembly 2018 in Ipoh, Perak – Reflecting on the Impact of International Meetings

The 26th General Assembly (GA) of the Federation of Engineering Institutions of Asia and the Pacific (FEIAP) was held at Casuarina Hotel in Meru, Ipoh, from 11 to 13 July, 2018.

As an Ipoh resident, it was my privilege to take charge of this prestigious event immediately after I was elevated President of the Institution of Engineers Malaysia (IEM). I had to ensure it was a huge success and it was, all due no less to the ardent support given me by the many IEM volunteers. They spent a lot of time and effort to ensure everything went smoothly. My heartfelt gratitude to everyone who has, in one way or another, contributed to this event.

IEM President introducing the President of FEIAP, Dr John Li to the guest of honour, Y.B. Dato' Seri Ir. Mohammad Nizar bin Jamaluddin

FEIAP GA 2018 drew delegates from as far away as Rwanda and Nigeria in the African continent, the Netherlands in Europe, Japan and Korea to the north and Australia down south. In total, there were 69 delegates from 25 countries as well as another 196 local delegates. The Perak state government was very supportive and donated generously to make sure the event was a success and a pleasant occasion for all the delegates, both foreign and local.



Hosting His Excellency Union Minister U Han Zaw from the Ministry of Construction, Republic of the Union of Myanmar

The General Assembly was officiated by the Menteri Besar of Perak who was represented by Y.B. Dato' Seri Ir. Mohammad Nizar bin Jamaluddin, the State Exco for Investment, Industry and Corridor Development.

Dr Marlene Kanga, President of World Federation of Engineering Organisations (WFEO) took time off from her busy schedule to attend the event and to participate in various discussions on matters related to the engineering profession. We also had the privilege of having His Excellency Union Minister U Han Zaw from the Ministry of Construction, Republic of the Union of Myanmar, to grace the occasion.

Besides the various meetings on the many policy issues required

The FEIAP GA Opening Ceremony – speech by IEM President Ir. David Lai and delegates in attendance

to keep the organisation in good shape, the 26th General Assembly also witnessed the admission of three economies into FEIAP – Nepal Engineers Association (NEA), Institution of Engineers, Rwanda (IER) and Iraqi Engineers Union (IEU). Myanmar Engineering Society (MES) and Technological Association of Malaysia (TAM) were admitted as Associate Members.

Apart from meetings, there were several talks by technical experts in their respective fields, a seminar on the 4th Industrial Revolution, an exhibition by various companies, a distinguished lecture by Y.D.H. Toh Paduka Setia Dato' Ir. Dr Safry Kamal Ahmad, a promotion by Matrade on the Services Export Fund and a briefing on the AEI Electrical Inspection Guidelines initiative.

True to the Malaysian spirit of hospitality, it was not all work and no play for the delegates. Tours to places of interest were organised to showcase the more relaxed side of Ipoh and to savor the many good food that the city is famous for. Judging from the happy faces that we see, we can assume that everyone had an enjoyable time; making new friends and developing strong bonds with fellow engineers from around the world.

With the curtains drawn on the FEIAP GA, I sit back and ponder on what has been the impact of such international meetings. What I can see is the sense of cooperation, motivation and camaraderie that exulted from people coming together to express their thoughts, share ideas and enjoy the company of each other. The innocuous way that international meetings can promote friendship, understanding and a healthy respect for diversity in our world can make an impact on human relationships, on society at large and on making this world a better place. I find such thoughts reassuring – I hope you too feel the same. ■

FEIAP Meeting in session
L to R: FEIAP President, FEIAP Sec Gen, IEM President

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Flood Safety for Basement Spaces

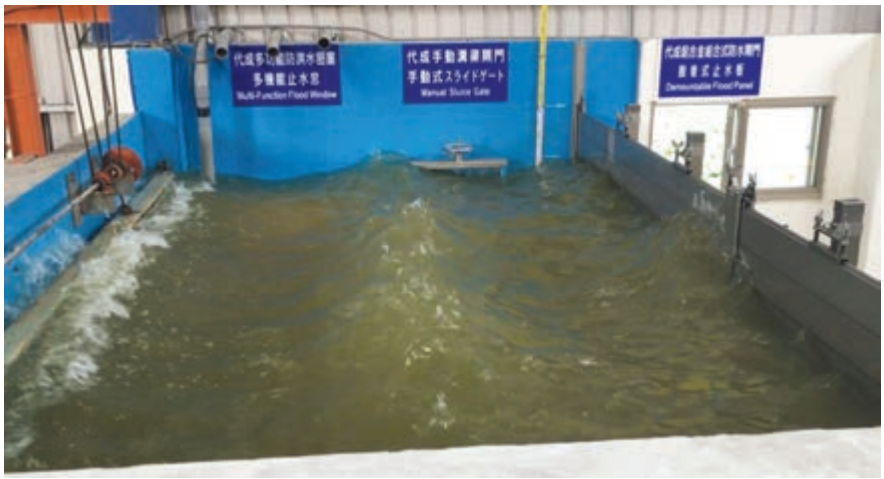
Ir. Loo Chee Kin

The basement of a building can house important articles. In commercial buildings, this may be used for mechanical and electrical utilities as well as a carpark. In a hospital, heavy imaging equipment, such as X-ray and MRI scanners, will be placed here. In residential houses, it may be the place to keep old furniture and cars or turned into a wine cellar or gaming/entertainment room with high-tech audio-visual equipment. In major cities, MRT lines will have underground sections, so there will be tunnel openings and underground stations.

Water flooding into the basement causes not only damage to equipment but also economic loss and short/long-term damage to reputation. For example, if the basement of a mall is flooded, the chiller plant and electrical rooms will be wet when submerged. Not only will the equipment be damaged, but without chilled water and electricity, the mall simply cannot operate. Furthermore, news of customer vehicles affected by the flood waters and shoppers trapped in the dark, stuffy mall will spread quickly on social media.

The primary step in preventing flood in basement spaces is to keep the water out with watertight construction. But basements need openings for people and vehicular access. Usually, these are kept open but yet, they should be able to be closed quickly in the event of a flood as water will flow through any gap or opening. As water follows the fluid mechanics law, it will fill the basement over time.

Entrances need to be blocked before flood water can enter. The use of sandbags is not effective and is time consuming as it will, ergonomically, be a challenge to move hundreds of sandbags, each weighing tens of kilogrammes. The placement and stacking of sandbags can also be a technical challenge, as the sandbag wall must be stable, with minimal water seepage through it. Then, after the water recedes, much time is needed to remove and store those sandbags.



Wave testing in progress. On the right side is a demountable flood panel being the flood gate

Self-engineered gates may do the job, but there is no guarantee of performance and long-term durability. Certified flood gates will have to undergo several engineering tests and evaluations. These may be full-scale water flow simulation tests as well as individual component tests. These include hydrostatic strength, leakage, cyclical, vibration, impact and wear resistant, salt spray corrosion, tensile and elongation, accelerate aging, compression, environment corrosion resistant, extreme conditions, abrasion resistant, tear and puncture. A deployable gate has to meet deployment time, wave-induced hydrodynamic load, overtopping, debris impact and current.

The hydrostatic strength of the gate should be tested in a workshop, as field testing will not be able to generate the required pressure on the retaining parts such as seals and bladder. The acceptable leakage test by the American National Standards is 3 litres per minute per metre length as higher leakage may overwhelm the pumps in the protected area. As the gates will be in contact with water, a salt spray corrosion testing will ensure metal parts will not deteriorate prematurely.

Conversely, compression and accelerate ageing tests are crucial for plastic and rubber parts. The environment corrosion resistant extreme condition simulates storage

Flap gate for drain outlet

Flood barrier for rail tracks

Residential building protection

conditions, where the gate parts are subjected to moist carbon dioxide/ sulfur dioxide mixture for several days and at elevated temperatures.

Deployment time varies with gate designs and the manufacturer must state the time, manpower, tools and resources to get the barrier installed. Since flood water is not still, the barrier has to withstand waves without significant deflection and additional leaks as well as water current flow at 2 m/s. An overtopping condition happens when a barrier floats, overturns or a catastrophic failure occurs when water flow over it. Debris impact is a rigorous test too as the barrier has to withstand impact by a simulated log measuring 43cm in diameter, weighing 358kg and moving at 8km per hour.

As water seepage is expected around the gates and infiltration through the basement structure, this water must be removed. Flood abatement pumps are used to pump water into appropriate drains. Backwater valves will be needed on any discharge line from the building. This may be rain water, floor drains, sewers or sanitary lines. Otherwise back flow or water head in sewer lines will let water into the basement. Floor or perimeter drains may require sluice gates as well.

The flood plan should be documented as an emergency response plan. This plan should detail in order the first steps to be taken as well as subsequent steps and resources needed. Otherwise, time may be spent on unnecessary measures or less important steps. Having a checklist will ensure that all flood barriers are erected or in place, pumps and backwater valves are checked and sluice gates closed. The plan should be triggered if there is flood warning from the authorities, local flood detection system or long periods of heavy rainfall. ■

Author's Biodata

Ir. Loo Chee Kin *is Chairman of Mechanical Engineering Technical Division (METD) and Chairman of Disaster Risk Reduction Advisory Board (DRRAB). He has conducted natural hazard assessments and risk management with various clients and industries.*

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Tower Crane Safety

Ir. Tajul Ariffin bin Mohamed Nori

The upgrading of city liveability and urbanisation draw people to live in the city. Apart from that, government initiative in the affordable home market has raised the demand for high rise residential buildings.

The construction of high rises is not possible without hoisting machineries such as the tower crane, a piece of iconic engineering machine in the industry. This vital tool is very important for ease of construction activity and productivity, especially in the vertical transportation of construction material.

The safety aspects of tower cranes have voluntary and mandatory requirements. The voluntary requirement stipulated in standards and codes, should be adhered to by the industry to make sure that any fabrication of the tower crane, from design stage to operations at site, is integrated with safety elements that have been recommended as best practice.

The mandatory requirement, such as laws imposed by government authorities (Acts, Regulations and Code of Practice) must be complied with to protect the safety of the public as well as the workers.

In Malaysia, tower crane handling and management demand both voluntary and mandatory requirements to be practiced by the stakeholders. Through SIRIM, the Department of Standard Malaysia has provided some pointers in standards *(MS 1803:2008 - Cranes - Safety - Tower Crane and MS ISO 4310:2014 Cranes-Test Code and Procedures)* on tower crane safe handling that the construction industry can follow.

As for legal obligation, the Department of Occupational Safety and Health (DOSH), is the government agency enforcing mandatory requirements on tower crane safety framework in Acts such as Factory and Machinery Act 1967 (FMA), Occupational Safety and Health Act 1994 (OSHA) and other related regulations. To ensure the safety of workers and the public, DOSH also provides additional guidelines and an Industrial Code of Practice, such as Public OSH in Construction Site Guidelines, 2007, and Risk Assessment Guidelines, HIRARC, 2008. We will go through some safety requirements related to the safe handling of tower cranes, including that specified in FMA, some OSHA needs and to highlight a new directive, the Chief Inspector Special Order 2017.

APPROVAL & AUTHORISATION

To operate a tower crane in Malaysia, one needs approval and authorisation from DOSH. A tower crane is classified as hoisting machinery in category D (hoisting machinery come in 4 categories: A, B, C and D). The tower crane design must be submitted to the Chief Inspector of Factory & Machinery for approval via SKUD online system *(skud.dosh.gov.my:88)*. The application will be reviewed by the DOSH Hoisting Machinery Unit, under the Industrial Safety Division,

prior to fabrication, installation and operation.

The local fabricator of hoisting machinery such as a tower crane must be registered with DOSH as a Competent Firm. The applicant must submit a design approval request in a formal application letter to the department along with related documents such as technical specifications (crane design, technical design drawings, design calculations, catalogue or technical specifications, load charts and operating manuals and maintenance), certifications and test report, safety devices and details of safety features as well as additional supporting documents such as Import Licence according to the respectively code or standard.

REGISTRATION & CERTIFICATE OF FITNESS

Section 19 of FMA and Regulation 10 of Factory and Machinery (Notification, Certificate of Fitness and Inspection) Regulations stipulates that the owner of every hoisting machinery shall hold a valid Certificate of Fitness in respect thereof so long as such machinery remains in service and that any illegal use of certified machinery will result in a penalty fine amounting to not more than RM150,000 or jail for a maximum period of three (3) years or both.

Furthermore, hoisting machinery that needs a Certificate of Fitness (COF) must be registered with DOSH via its online system, MyKKP *(mykkp.dosh.gov.my)*. At this stage, an applicant must apply through the DOSH regional office where the tower crane will be operated. When the machinery is successfully registered, the submission will be reviewed by the state DOSH officer.

If the information provided is satisfactory, DOSH will arrange for a first inspection of the tower crane to ensure that its foundation design is in accordance with the design document approved by the professional engineer and as submitted in the application. At the site inspection, DOSH inspectors may give approval for the owner/contractor to initiate the erection of the crane structure, provided everything is in accordance with the document submissions. When the height reaches approximately 10m, the competent firm and DOSH will do a joint crane inspection to verify that machinery is in accordance with the approved design. At this point, the inspection of safety devices function tests and crane load tests should be carried out. If the inspection is successful, DOSH will issue a COF for the machinery, which is valid for up to 15 months. The COF should be renewed after that period and periodical inspection conducted in accordance to Section 40 of the FMA.

ERECTION, MAINTENANCE & DISMANTLING

Risk activity such as erection, jacking up or dismantling of the tower crane must be conducted by a competent firm registered with DOSH. The owner/occupier of the tower crane must also ensure that it is periodically maintained (provision of section 21 of the FMA) by a registered Competent Firm.

Competence in the context of tower cranes is a legal obligation. As stipulated in Section 29A of the FMA, *"no person shall manufacture, fabricate, test, install, maintain, dismantle or repair any machinery which is prescribed unless a written authority has been issued by the chief inspector"*. Competent firms in tower crane management need to be recognised as those with the skills, knowledge, experience and understanding of technical requirements related to tower crane operations. The recognition of competence in a firm is determined by DOSH, based on certain requirements.

ALTERATION OF STRUCTURE, RE-ENGINEERING, MODIFICATION & REPAIR

When it comes to the cost and process of getting a new tower crane, the owner has the option to repair/refurbish rather than replace. Occasionally, replacement parts are not available, so a crane owner has no choice but to do necessary repair work. Severe damage can usually be fixed but there are cases which

are beyond repair and required modifications.

Before or during its life cycle, a tower crane may require changes or modifications in structure/components and the resubmission of modified designs must get the appraisal of DOSH. The previously approved COF will be automatically revoked.

A registered competent firm or the crane manufacturer will be required to do the modification works. DOSH must be notified of major modifications such as re-engineering the hoisting machine, in order to get approval for the work. The crane must be re-evaluated, a new design drawing required and the new design calculations done by a registered competent tower crane firm.

This requirement does not apply to part replacement (Original Equipment Manufacturer, OEM) which does not involve structure or capacity change but it must be recorded.

OPERATIONS & HANDLING

Most cases of tower crane accidents occur during operation and handling. Crane movements increase the probability of an accident. To ensure safety during use, consider the following:

1. **Safe System of Works –** Section 15 (1) of Occupational Safety and Health Act (OSHA) 1994, outlines the general duties of employers and self-employed persons to their employees against risks to safety or health in relation with the activity of a workplace.

   In a construction site, lifting works is usually a daily activity and this includes use of hoisting machinery. There are risks that need to be addressed in operating tower cranes and it is compulsory to conduct a risk assessment before work can be carried out. Any relevant risk must be properly managed and control measures implemented to ensure that work to be performed is safe.
2. **Lifting Plan –** Lifting works require a lifting plan which must be provided by those with the necessary knowledge and experience. The lifting plan shall be documented and communicated effectively to all the workers involved in the operation of the tower cranes. It is important that the lifting plan be clearly understood and implemented by all those involved.

   A lifting plan should contain safety and control elements, lifting procedures to be implemented, lifting layouts, material positions, crane operation radius, position and the number of signalman and riggers. It should also state the means of protection for those not involved with the tower crane operation.

   The supervision of lifting works should also be included in lifting plans, such as requirements for supervisors to ensure that the plan is adhered to. The supervisor should have sufficient knowledge, experience and the authority to control operations, including stopping operations in case of unsafe conditions.

   The lifting plan should also clearly state the communication method used between the crane operator and the signalman and the safe working load (SWL) to be lifted by the crane to avoid overloading which may cause an accident. Also to be included is the main reference for operating cranes such as load chart, boom angle, load radius and lifting capacity. Requirements for competent operators should be clearly stated to avoid illegal operators handling the crane.
3. **Permit to Work & Daily Inspection Checklist –** It is important to ensure that important requirements are in place before the lifting operation starts. The construction management team can ensure that all the essential elements are checked completely by practising a work permit system. First, the involved parties need to check and fill out the checklist pertaining to the safe lifting and approvals by those authorised before work starts. Prior to the operation, a permit will be issued.

   Such a system will ensure that crane operators are legitimate, the lifting equipment is in good condition, all safety devices are functioning properly and the cranes are in good condition.

   Lifting equipment is a main component of a tower crane. The condition of the wire rope, hook block and safety latch must be checked daily and any damage rectified immediately. Those who fail to stop operations if there is any defect that may cause bodily injury to any person or damage to properties (Section 40 of the FMA), can be fined a maximum of RM250,000 or jail of not more than five (5) years or both.
4. **Personnel Involved With Tower Crane Operation –** Tower crane operators require a sufficient level of competency to ensure that lifting work can be carried out safely. To ensure that qualifications, experience, knowledge and expertise in tower cranes operations are as required by Acts and regulations, DOSH issues a certificate of competence to eligible individuals and firms. Crane operators need to have this competence certificate but before they can obtain this, they must attend training conducted at a centre approved by DOSH. A valid Crane Operator Licence will only be issued to those who have passed the tower crane assessment examination. Signalmen, riggers and lifting supervisors are also required to attend lifting operation training although they are not required to obtain the certificate of competency.

SAFETY DEVICES & FEATURES

All tower cranes must have safety features to avoid accidents or failures that may occur due to human error or negligence, weather, material durability or any circumstance that may increase accident risk. These safety devices are extremely important and tower cranes should be properly equipped with Safety Limit Switch, Operator Warning and Guided Device, Weather and Aircraft Safety Device, Safety Features when the operator is outside the cabin, Fail-Safe

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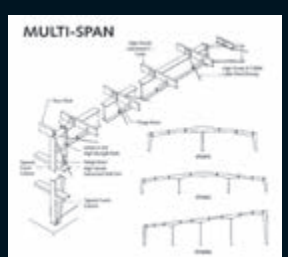

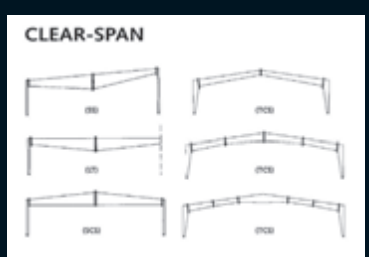

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(TCMSS)	Tapered Column Multi - Span Single Slope	20m - 160m	3.5m - 12m and over
	Clear-Span		
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(LT)	Straight Column Lean To	3m - 22m	2.4m - 9m
(SCS)	Straight Column Clear Span	6m - 22m	3m - 9m
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TOWER CRANE ACCIDENTS

Any accident or dangerous occurrence related to the workplace should be reported immediately to the nearest DOSH office. This is outlined under Section 31 of the FMA, Section 32(1) of the OSHA, Regulation 8 of *Factory and Machinery (Notification, Certificate of Fitness and Inspection) Regulations 1970*, and Regulation 5(1) of *Occupational Safety and Health (Notification of Accident, Dangerous Occurrence, Occupational Poisonous and Occupational Disease) Regulations 2004*.

There have been many cases of crane accidents reported in the local media. Some involve fatalities and even the public. In one extremely shocking case in 2016, a woman who was driving past the site of a hotel construction in Jalan Raja Chulan, Kuala Lumpur, was crushed by a one-tonne hook block that fell from a tower crane at approximately 20-storeys high. She died at the scene due to the impact.

This is an example of a case with several factors that should not be allowed by the management in charge of the crane. According to media reports, the tower crane safety device had been tampered with, allowing the crane operating radius to go beyond the boundary of the construction site and construction hoarding onto public road. Even worse, the crane operator was reported to have disappeared immediately after the accident and the authorities had to seek help from Interpol because he had fled the country.

The absence of a proper, safe working system such as Permit-to-Work by the contractor involved and an effective supervisory system allowed the tower crane boom to be operated beyond the construction site perimeter. Punitive action was taken against the contractors involved and a fine of RM40,000.00 was imposed. The accused was convicted under Section 17 of OSHA (maximum fine of up to RM50,000.00 or jail of not more than two (2) years or both).

CHIEF INSPECTOR SPECIAL ORDER 2017

DOSH has been carrying out enforcement and promotional activities at construction sites on revisions to the Act and Regulations, the enhancement of enforcement policies to promote and ensure compliance at construction sites, the promoting of preventive measures through Hazard, Risk and OSH management system but still, there are reports of tower crane related accidents.

After OSHA was introduced in 1994, employers were supposed to take a voluntary proactive approach to ensure effective accident preventive action rather than wait for the government to take legal action. A high level of compliance will reduce the number of accidents at construction sites. The aim of self-regulation is far better than compliance to descriptive FMA.

However, the lack of awareness in the industry with regards to self-regulation and an increase in tower crane accidents have forced DOSH to regulate more firm directives to individuals rather than take traditional approaches or punitive action against the organisations.

To ensure that worksites adhere to all necessary requirements, DOSH has ordered all Construction Project Managers (PM) to hold responsibility for safe handling and operation of tower cranes. In any construction site, the PM is the one with overall responsibility for all activities, project progress, control and who can halt a project.

The Chief Inspector of Factory & Machinery is given the power to direct special orders, spelt out under sub-section 27(1) of FMA, for factory and machinery. The directive, made on 5 June, 2017, to all Construction PMs, can be found on the DOSH webpage (www.dosh.gov.my). The order is split into 3 parts and includes the penalty.

The first part requires the PM to ensure that the tower crane has all the approvals necessary, including a permit to install and that it complies with DOSH requirements to install and has the COF. The second part states that the PM's duty includes handling and the maintenance of the tower crane during operations, appointing a valid crane operator registered with DOSH, appointing a trained lifting supervisor, signalman and riggers, the implementation of Permit-to-Work system, daily inspection of lifting gear and safety device functionality as well as keeping a record of usage, inspection and maintenance.

The third part states that PMs should ensure that any crane service provider should have a contract with the occupier to manage the erection, jacking, maintenance, repair and dismantling of the tower crane in accordance with the law requirement. The PM should also pay serious attention to the penalty that may apply upon conviction. The maximum amount of the fine imposed is RM200,000.00 or jail not exceeding 5 years or both. Violation of any provision in the order and the accused may be punished individually.

CONCLUSION

The operation of machinery such as tower cranes involves broad aspects of safety, from design and built-in security features to operations and ensure that safety requirements as described are fully complied with. Failure to identify the shortcomings of tower crane operations will hurt the users and may jeopardise the safety of construction workers. The Chief Inspector Special Order to Project Manager (2017) is intended to ensure that parties dealing with the tower cranes comply with safety and related laws. The penalty sentences show that DOSH is very serious about ensuring that stakeholders pay serious attention to worker safety and health of construction industry especially tower crane operation. It is hoped that such a requirement will reduce the number of occupational accidents involving tower cranes. All Construction PMs must be aware of current rules and play a vital role in tower crane safety and operations. ■

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Author's Biodata

Ir. Tajul Ariffin bin Mohamed Nori *is a sub-committee member of the Mechanical Engineering Technical Division in IEM. He is a Factory and Machinery Inspector (Senior Assistant Director) at Department of Occupational Safety and Health Selangor.*

IEM COUNCIL ELECTIONS 2019/2020

NOTICE ON NOMINATION PAPERS FOR COUNCIL ELECTION SESSION 2019/2020

A notice inviting nominations for the Election of Council Members for Session 2019/2020 will be posted on the IEM Notice Board and IEM website from **16 November 2018** for the information of all Corporate Members of IEM. Thereafter, following the close of nominations on **20 December 2018**, the election exercise will proceed. All Corporate Members residing overseas are requested to take note of the requirements of the Bylaw, Section 5.12, as shown below.

> *The voting paper shall, not less than twenty eight (28) clear days before the date of the Annual General Meeting, be sent by post to all Corporate Members residing in Malaysia and to any other Corporate Members who may, in writing, request to have the paper forwarded to him. The voting paper shall be returned to the Honorary Secretary in a sealed envelope so as to reach him by a specified date not less than seven (7) days before the Annual General Meeting.*

Voting papers will be posted out by **25 February 2019**.

Corporate Members residing outside Malaysia, who wish to receive voting papers, are advised to write to the Honorary Secretary on or before 10 January 2019.

Thank you.

Election Officer, IEM

Signalling System in Railway Transportation

Mok Zhen Yick

In this era of advanced technology, signalling is very important. In fact, signalling is a huge part of our daily commuting. One example is the traffic light at road intersections. With its red, amber and green coloured lights, it is a signalling device designed to control, ease and ensure the safety of motor vehicles.

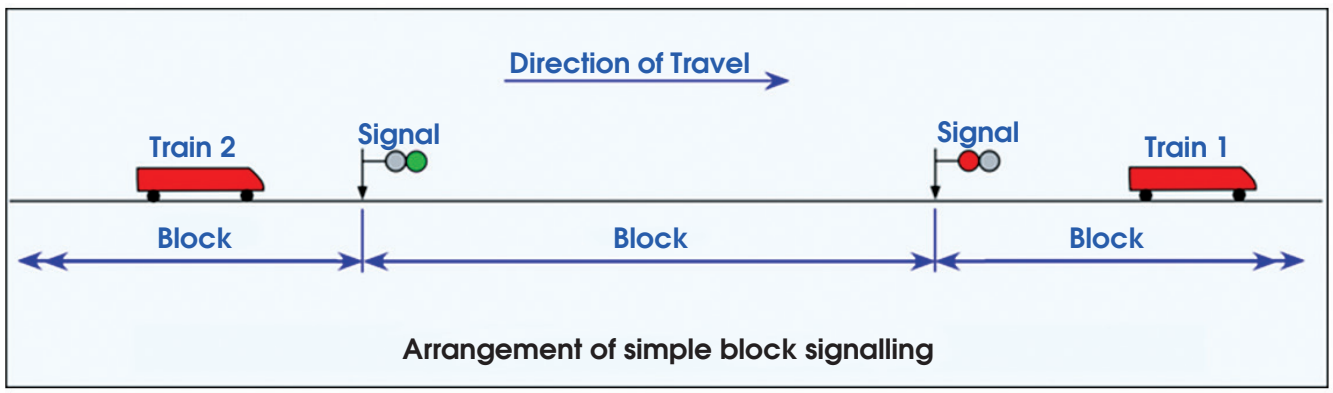

Figure 1: Fixed Block System

So what is signalling? In his book, *Introductory Signal Processing*, author Ronald Priemer defined a signal as "a function that conveys information about the behaviour of a system or attributes of some phenomena".

In the railway industry, signalling has 7 main safety functions:

1. Providing a safety margin distance between moving trains on the same track.
2. Protecting trains that pass through crossings or switches.
3. Protecting trains moving in the opposition direction.
4. Protecting trains at level crossings.
5. Ensuring that a driver obeys the speed limit to prevent derailment.
6. Assisting in traffic regularity.
7. Preventing a collision.

Besides the above safety features, signalling can also improve train transit speed and efficiency which will, indirectly, improve passenger handling capacity.

There have been lots of changes and advancements in railway signalling. At the start, railway signalling used track circuits and wayside signals to detect the presence of trains and to provide movement indications to train operator. The first generation signalling was also called Fixed Block System (Figure 1) as, at any one time, each block only allowed one train to move.

Therefore the train operator had to obey the traffic semaphore. When the traffic semaphore turned red, the train could not proceed to the following block and had to wait until the block ahead was cleared and the light had changed to green. The limitation of the Fixed Block System was that train throughput and operational flexibility were restrained.

In the next generation signalling, track circuits were used, based on in-cab signals instead of wayside signals. The coded track was developed and introduced at this time. This development was important because, with the speed codes transmitted from the wayside through the running rails to the train, the train speed could be monitored. In the event of speeding, an Automatic Train Protection (ATP) subsystem would initiate emergency braking to prevent derailment or collision with the train ahead. This generation permitted automatic driving modes with onboard equipment that was capable of detecting and reacting to the speed codes. But train throughput and operational flexibility were still limited by track circuit layout and number of available speed codes.

The next advancement in the signalling control system provided for more precise control of train movements. The train was supervised and controlled to follow a speed-distance profile. Unlike previously, the train no longer responded or reacted to individual speed codes. The wayside processor generated a coded message (permitted line speed, train target speed and distance-to-go to the target speed) to each track circuit. The onboard train equipment then calculated the speed-distance profile based on this information received, for the train to follow. This generation of signalling control could support automated driving modes and improved train throughput.

The fourth generation of signalling uses radio signals instead of track circuits as a communication medium between the train and the wayside. It is also referred to as Communication-Based Train Control (CBTC) signalling.

It permits a train to travel in moving block operation which separates trains based on a train's absolute position and the speed is based on the distance between trains. CBTC can support automated driving modes and offers maximum train throughput and greatest operational flexibility compared to the previous generation. In Malaysia, both LRT (Ampang Line) and MRT (Klang Valley) use CBTC signalling technology.

In conclusion, signalling technology plays an important role in railway systems as it maintains safety as well as increases the efficiency of the train throughput and passenger handling capacity. ■

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Author's Biodata

Mok Zhen Yick *is a Sub-Committee member of the Mechanical Engineering Technical Division of IEM Session 2017/2018. He graduated with a bachelor's degree with honours in Mechanical and Manufacturing Engineering from Universiti Malaysia Sarawak in 2011.*

IEM DIARY OF EVENTS

Title: 2-Day Course on "Design of Sprinkler Systems Reference to MS 1910 Covering Professional Competency Examination (PCE) Syllabus"

24-25 October 2018

Organised by: Building Services Technical Division
Time : 8.30 a.m. - 5.15 p.m.
CPD/PDP : 13.5

Title: 5-Day Course on PMP Exam Prep Combo (2nd Series)

25-26 October 2018

Organised by: Seniors Special Interest Group & Project Management Technical Division
Time : 9.00 a.m. - 5.30 p.m.
CPD/PDP : 30

Kindly note that the scheduled events are subject to change. Please visit the IEM website at www.myiem.org.my for more information on the upcoming events.

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ENGINEER'S

Lens

Contributed by
Ir. Yee Thien Seng

Soaring High

A Brahminy Kite or Helang Merah (*Haliastur indus*), soaring high in the sky, and carrying its trophy, a "dressed chicken" in its talons. This picture was shot in the neighbourhood of Section 17 in Petaling Jaya, Selangor, using a 400 mm focal length lens and a DSLR camera mounted on a sturdy gimbal. It was the result of immense patience on the part of the photographer. The reddish-brown back, white head and breast, make it easy to distinguish the beautiful raptor from other birds of prey. ■

Measure for Measure

by Ir. Shum Keng Yan

Ir. Shum Keng Yan is a chemical engineer and a certified accident prevention and safety practitioner.

Behaviour is not really Shakespearean but behaviour can be measured! Or can it? In this series, we will start by looking at some fundamentals of behavioural safety measures and how these will become increasingly less reliable.

"What can be observed can be measured!" That was the premise when safety professionals were first inducted into measuring behaviour. Let us take the idea and put it into a simplified situation.

SCENARIO

Imagine that you have set up a camera at a traffic junction on a quiet street without telling anyone. How often do you think someone will drive through a red light on a quiet street? The most cliché answer is: "it depends".

You begin to count.... 1, 2, 3, ... and it all adds up – either safe (people who observe the red light) or unsafe (people who go through the red light).

Each time a person decides to drive past a red light is an unsafe behaviour. So by observing and counting safe and unsafe behaviours over a certain period will give a picture of how "safe" the collective behaviour of the people in the area is. Sounds simple enough.

Let us assume the unsafe behaviour continues.... there really is very little chance of an accident since the person will glance left and right before driving through, the street is quiet, the oncoming traffic is cautious and so on. Thus, unsafe behaviours can continue for a long time without any consequence.

Then one day, a combination of inattentiveness, speed and so on, brings about an incident that may be minor or serious. Sounds familiar? The level of compliance is brought about by the perceived Consequence (recall Significance, Timing and Consistency – December 2017 – August 2018 Safe Tea Time).

So the next cliché is: "What can be measured can be improved"! Is behaviour so mathematical that by measuring behaviour, we can set targets that will lead to improved safety performance? More of this in the next article.

For good measure, you are invited to weigh in at: *pub@iem.org.my.* ■

> *"Condemn the fault, and not the actor of it."*
>
> *(Angelo, Act II, Scene II), Measure For Measure, William Shakespeare*

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Vehicle Safety Regulations & Ratings

MECHANICAL ENGINEERING TECHNICAL DIVISION

reported by

Ir. Yeoh Jit Shiong

On 24 July, 2018, Ir. Mohd Hafzi Md Isa was at Wisma IEM to talk about *Vehicle Safety Regulations & Ratings*. With over 10 years' experience in road safety and vehicle safety, Ir. Mohd Hafzi is head of Crash Safety Engineering, a unit under the Vehicle Safety & Biomechanics Research Centre, Malaysian Institute of Road Safety Research (MIROS). He holds various positions in technical committees and is a certified ASEAN NCAP Inspector.

Information from MIROS shows a daily average of 20 road deaths in the country! Our Road Safety Index per 100,000 population is at a staggering 22.6. In comparison, Sweden is only 2.65. The mode of transportation involved in the highest number of road accidents is motorcycles at 60%, followed by cars at 20%. The rest comprises pedestrian at less than 10% and other modes.

The owner of a vehicle is responsible for maintaining the vehicle in good condition and, most importantly, to drive it safely. Both factors are equally important to minimise the risk of vehicular crashes and human injuries.

All implemented counter measures in road safety must be treated as equally important though some may not serve the intended purposes. For instance, airbags can help reduce injury severity but in many studies, data shows that some vehicle occupants ignore seatbelts and this defeats the intended benefit of airbags. Since human factor can be tricky, other avenues to raise the bar in minimum safety standard of vehicles, can be achieved through Vehicle Type Approval (VTA) process and the New Car Assessment Programme (NCAP). Improved VTA and the introduction of NCAP are perhaps the new paradigm in the country's automotive layout, since previous efforts have merely focused on establishing and strengthening the car industry.

General Road Accident Data in Malaysia (1997-2016)

Year	Registered Vehicles	Population	Road Crashes	Road Deaths	Serious Injury	Slight Injury	Index per 10,000 Vehicles	Index per 100,000 Population	Indeks per billion VKT
1997	8,550,469.00	21,665,600.00	215,632.00	6,302.00	14,105.00	36,167.00	7.37	29.10	33.57
1998	9,141,357.00	22,179,500.00	211,037.00	5,740.00	12,068.00	37,896.00	6.28	25.80	28.75
1999	9,929,951.00	22,711,900.00	223,166.00	5,794.00	10,366.00	36,777.00	5.83	25.50	26.79
2000	10,598,804.00	23,263,600.00	250,429.00	6,035.00	9,790.00	34,375.00	5.69	26.00	26.25
2001	11,302,545.00	23,795,300.00	265,175.00	5,849.00	8,680.00	35,944.00	5.17	25.10	23.93
2002	12,068,144.00	24,526,500.00	279,711.00	5,891.00	8,425.00	35,236.00	4.90	25.30	22.71
2003	12,819,248.00	25,048,300.00	298,653.00	6,286.00	9,040.00	37,415.00	4.90	25.10	22.77
2004	13,828,889.00	25,580,000.00	326,815.00	6,228.00	9,218.00	38,645.00	4.52	24.30	21.10
2005	15,026,660.00	26,130,000.00	328,264.00	6,200.00	9,395.00	31,417.00	4.18	23.70	19.58
2006	15,790,732.00	26,640,000.00	341,252.00	6,287.00	9,253.00	19,885.00	3.98	23.60	18.69
2007	16,813,943.00	27,170,000.00	363,319.00	6,282.00	9,273.00	18,444.00	3.74	23.10	17.60
2008	17,971,907.00	27,730,000.00	373,071.00	6,527.00	8,868.00	16,879.00	3.63	23.50	17.65
2009	19,016,782.00	28,310,000.00	397,330.00	6,745.00	8,849.00	15,823.00	3.55	23.80	17.27
2010	20,188,565.00	28,910,000.00	414,421.00	6,872.00	7,781.00	13,616.00	3.40	23.80	16.21
2011	21,401,269.00	29,000,000.00	449,040.00	6,877.00	6,328.00	12,365.00	3.21	23.70	14.68
2012	22,702,221.00	29,300,000.00	462,423.00	6,917.00	5,868.00	11,654.00	3.05	23.60	13.35
2013	23,819,256.00	29,947,600.00	477,204.00	6,915.00	4,597.00	8,388.00	2.90	23.10	12.19
2014	25,101,192.00	30,300,000.00	476,196.00	6,674.00	4,432.00	8,598.00	2.66	22.00	10.64
2015	26,301,952	31,190,000	489,606	6,706	4,120	7,432	2.55	21.5	9.6
2016	27,613,120	31,660,000[e]	521466[a]	7152[a]	NA	NA	2.59	22.6	NA

e = estimated value from from Department of Statistics Malaysia
a = media statement
NA = Not available (The official figures are not available yet)

This factsheet summarises some facts and figures to highlight important statistics and accident characteristics involving motorcycles in Malaysia. For many years, motorcycle has been the most preferable, convenient and affordable mode of transport.

Road accidents statistic from MIROS

VEHICLE TYPE APPROVAL (VTA)

The VTA is granted when a product meets a minimum set of regulatory, technical and safety requirements. It is a homologation process to confirm that the production sample of a vehicle design complies with specified standards or UN Regulations before it can be registered in Malaysia. This consists of Component Type Approval, product compliance (including System Approval) with specified standards or regulations (Malaysian Standards/UN Regulations) and General Requirements which are the requirements listed under Road Transport Act 1987, Environmental Quality Act 1974 and Road Transport Rules.

There are some 10 agencies involved in the VTA process: MOT, MOF, MITI, MOSTI, KPDNKK, JAS, KASTAM, Standards Malaysia, DOSH, SPAD, SIRIM, MIROS, PUSPAKOM and MAI. These agencies have a representative each in the National Committee for Type Approval & Homologation, chaired

Gazette Year	Number of UN Regulation	Department/Agencies Involved
1997	3	Department of Environment (D.O.E.)
2007	12	Ministry of Transport (MOT) and Road Transport Department (JPJ)
2010	4	
2011	35	
2012	1	
2013	23	
2016	22	
Total	**100**	

UN Regulations & Agencies involved

by the Director General of Road Transport.

The establishment of the VTA Committee is to ensure that every aspect of vehicle construction is in line with current implemented Acts, Rules and Regulations. It is noted that all the agencies are from the government and IEM has volunteered its expertise to contribute to the committee.

To get the VTA, a vehicle has to abide by 100 gazetted UN regulations. Apart from that, different types of vehicles are subjected to different UN regulations. For example, a motorcycle is subjected to 40 UN regulations, a coach bus is subjected to 55 and a light duty truck is subjected to 60.

NEW CAR ASSESSMENT PROGRAMME (NCAP)

There are 9 NCAPs around the world and ASEAN NCAP is the youngest of them all. The difference between NCAP and Regulations is that Regulations is a mandatory requirement that sets a minimum safety level for all vehicles on the road whereas NCAP is for consumer information and not applicable to all models and versions of cars sold.

NCAP also has a higher requirement than Regulations. For example, frontal impact test speed is 64km per hour (for Regulations, it is 56km per hour). You may be wondering why the speed test is so low. This number actually stems from research done for vehicle impacts. Humans cannot withstand an impact at 70km per hour and, in a normal collision, it rarely hits beyond that as both vehicles will be travelling at different speeds.

Although one car may be moving at 120km per hour, the colliding car may be travelling at 80km per hour, which makes the impact speed at only approximately 40km per hour instead of 120km per hour. Of course, this will be different if the car is crashing into a concrete barrier. In the event of a collision, it is common for the driver to slam on the brakes and this will reduce the impact speed as well.

Prior to the ASEAN NCAP, we had the Malaysian Vehicle Assessment Programme (MyVAP) which conducted non-destructive assessment of vehicles by the use of secondary data from OEMs to assess the safety level. It focused primarily on Malaysian manufacturers to prepare the OEMs for the introduction of NCAP in the country. In June 2011, Malaysia proposed for NCAP in Malaysia to the Global NCAP during the NCAP Meeting. MIROS signed an MOU with Global NCAP in New Delhi in December 2011 and that was the beginning of ASEAN NCAP.

So why do we need the ASEAN NCAP when there are other existing NCAP around the world? This is due to quirks in the different markets. For example, European NCAP testing is designed for their populations which prioritise human-vehicle collision. For cars assessed in Europe, the emphasis is more on protection at the front of the car during a collision. This is because pedestrian traffic in Europe is higher than that in Malaysia. ASEAN NCAP focuses more on motor-vehicle collision and as such, the rating obtained in a European NCAP may not be suitable for us. A 5-Star NCAP rating in Japan may only get 3-Star rating in ASEAN NCAP. Likewise, a 5-Star ASEAN NCAP rating may only achieve a 4-Star rating in Latin NCAP.

Presenting a token of appreciation to Ir. Mohd Hafzi Md Isa (right)

ASEAN NCAP has such a huge influence in the market that a 5-Star rating is very much sought after by car buyers. This has driven the industry to get the highest possible rating in order to appease the consumer. Car companies will usually boast the NCAP rating as part of their marketing strategies.

This has no less an impact in Malaysia where Proton and Perodua are involved as car manufacturers. One good example of how this has driven the car manufacturer to improve on safety can be seen in the production of Perodua MyVi. In 2013, MyVi obtained a 3-Star ASEAN NCAP rating. With improvements made by Perodua, it achieved a 4-Star rating in 2015 and two years later, with even more improvements and enhanced safety features, MyVi finally achieved a 5-Star rating in 2017. From this example, we can see improvements being made, year after year, to ensure that cars are above the standards set by Regulation and manufacturers striving for a 5-Star ASEAN NCAP rating.

Participants at the talk showed a lot of interest in the tests carried out by MIROS and ASEAN NCAP and there was close engagement between the participants and the speaker on the subject matter. IEM then presented Ir. Mohd Hafzi with a token of appreciation. ■

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Professor on Duty @ Bijak Matematik in Masjid Nurul Iman, Kampung Batu 10 Kebun Baharu

ENGINEERING EDUCATION TECHNICAL DIVISION

reported by

Ir. Assoc. Prof. Dr Mohamed Thariq bin Haji Hameed Sultan

The E2TD Division conducted a community services programme, Professor on Duty @ Bijak Matematik, in Masjid Nurul Iman, Kampung Batu 10 Kebun Baharu and Sekolah Agama Menengah Sungai Merab Luar, Sepang, recently.

The universities involved were Universiti Putra Malaysia (UPM) and Universiti Kebangsaan Malaysia (UKM) and the 4 senior academics cum trainers were Assoc. Prof. Ir. Dr Mohamed Thariq Hameed Sultan (Head of Project, UPM), Prof. Ir. Dr Mandeep Singh Jit Singh (UKM), Dr Ahmad Hamdan bin Ariffin (UPM) and Assoc. Prof. Dr Zulkifli Mohd Nopiah (UKM). Those who also contributed significantly to the event were 15 undergraduate students from the two universities.

The aim was to teach students in rural schools to effectively answer exam questions related to mathematics. The programme targeted those from underprivileged families. The undergraduate students who took part in the programme did so on a volunteer basis. The programme also acted as a medium for the students to play an effective role as leaders and to enhance the techniques or mathematical solving skills of both mentors and mentees.

The Bijak Matematik Programme applied the National Blue Ocean Strategy (NBOS) concept by using existing resources at a very low cost. Existing sources included the energy and time of volunteers who comprised

Details of Professor on Duty @ Bijak Matematik

DATE	VENUE	TIME	TARGETED GROUP
31 March, 2018	Masjid Nurul Iman, Kampung Batu 10 Kebun Baharu Teluk Panglima Garang, Selangor	8.30 a.m. – Noon	Standard 4, 5 and 6 (preparation for UPSR examination) **200 students attended**
7 April, 2018	Masjid Nurul Iman, Kampung Batu 10 Kebun Baharu Teluk Panglima Garang, Selangor	8.30 a.m. – Noon	Form 1, 2 and 3 (preparation for PT3 examination) **120 students attended**
12 April, 2018	Surau Al-Azhar, Sekolah Agama Menengah Sungai Merab Luar, Sepang Selangor	8.30 a.m. – 10.30 a.m.	Form 5 (preparation for SPM examination) **87 students attended**
14 April, 2018	Masjid Nurul Iman, Kampung Batu 10 Kebun Baharu Teluk Panglima Garang, Selangor	8.30 a.m. – Noon	Form 4 and 5 (preparation for SPM examination) **90 students attended**

Assoc. Prof. Ir. Dr Mohamed Thariq Hameed Sultan delivering his talk

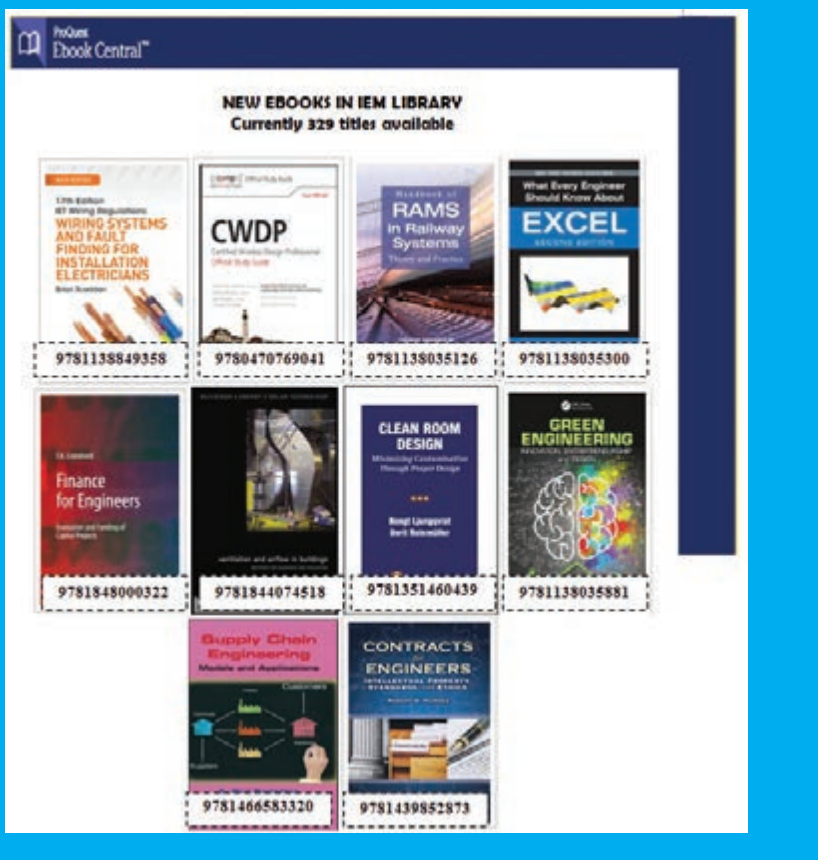
Form Five students of Sekolah Agama Menengah, Sungai Merab Luar

female students from UPM and UKM. Through this mentor system, the school children had the opportunity to study in a new learning environment instead of the more formal learning environment in the classroom. Through this "tutor/mentor" approach, they were exposed to a new approach in learning.

The programme inculcates creativity and innovative thinking in school children to improve their level of education. The result of knowledge sharing between students is applied when answering mathematical questions. Furthermore, analytical and logical thinking skills can be honed through continuous mathematical training.

It is a dynamic strategy that involves schools and universities voluntarily to develop a higher level of education and to enable the Malaysian government to achieve its aspiration to become a developed nation. ■

IEM LIBRARY ANNOUNCEMENT



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6th IEM Design Competition 2017/2018

CHEMICAL ENGINEERING TECHNICAL DIVISION

reported by

Ir. Dr Chong Chien Hwa

The 6th IEM Design Competition was held from July 2017 to May 2018. Taking part were 24 teams from Chemical Engineering programmes of various universities.

The competition title was "Monetisation of Associate Gas (AG) from Offshore Operations for Sustainable Chemical Production". Table 1 shows the feed composition of AG from brown field.

The design submitted had to be original and should not have been previously submitted or published. It should exclude GTL (Gas to Liquid), GTP (Gas to Power) and GTS (Gas to Solid) technologies. The competition was divided into two stages.

Stage 1: Participants were required to submit two reports consisting of a process flow diagram, equipment selection, process demonstrated sustainability concept and mass and energy balances (validated using professional software), equipment design, process and instrumentation diagram and economic performance. Academicians and industrialists assessed all the reports submitted.

Stage 2: Eight shortlisted teams were required to submit a management report to be presented at the design finale on 12 May, 2018. See Table 2 for names of winners of the 6th IEM design competition 2017/18.

The objective of the competition was to enhance design competency, practically and methodologically. It was also an excellent opportunity for students to meet and exchange ideas with practising engineers. To achieve this objective, Prof. Ir. Dr Dominic Foo, Ir. Razmahwata and Ir. Dr Chan Tuck Leong conducted a half-day seminar on HAZOP (Hazard & Operability Study) and sustainable design with process integration as well as a talk on the basis of design and managing FEED competition. ■

Table 1: Data sheet

	SPECIFICATIONS	COMPOSITION	MOL%
Field life (minimum)	10 years	Methane	70-80
Gas production		Ethane	5-10
Min	< 1 MMSCFD	Propane	1-5
Mid	1-10 MMSCFD	Iso-butane	1-3
Max	>10 MMSCFD	N-butane	0.5-2
Gas temperature	25 to 35°C	Iso-Pentane	<1
		N-Pentane	<1
		N-Hexane	<1
Gas pressure	5 bar	Nitrogen	<1
		Carbon dioxide	5-15
		Water	0.5-5

Table 2: Winners of 6th IEM design Competition 2017/18

RANKING	TEAM MEMBERS	UNIVERSITY
1st Place	Alice Wong, Sia Meng Zher, Simreth Kaur Dhalywal A/P Ajit Singh and Yeong Kar Fai	Universiti Kebangsaan Malaysia
2nd Place	Sylvia Tan Yen Chuen, Vera Tanzil, Misalini A/P K. Karunakaran, Ong Meng Hong and Dzakwan Al-ammar bin Othman	University of Nottingham, Malaysia Campus
3rd Place	Teoh Shi Rui, Cheng Yoi Ying, Cheong Chin Ying, Ong Xin Rou and Sze Shin Jie	University Malaysia Sabah
4th Consolation	Yip Yew Hong, Hua Zai Heng, Mohamed Mostafa Elsayed Elnegihi, Sam Ying Bin, Shane Soong Wern Hou	University of Nottingham, Malaysia Campus
5th Consolation	Tan Chee Shing, Wong Yong Yuen, Yap Tsui San, Revathi A/P Kuppusamy and Edzmiera Salfena bt Mohd Sukrie	Taylor's University
6th Consolation	Mohammed Saleh Taher, Ranawaka Lekamge Sudesh Dilan Dias, Khoo Zhi Sheng and Liew Kiat Fei	University of Nottingham, Malaysia Campus
7th Consolation	Ho Jo Yee, Tang Yi Hui, Sharwin Raj, Vinosyah Palaniandy, Alawi Nasser	Taylor's University
8th Consolation	Chew Shee Jia, Lim Jing Xiang, Paula Verdasco Pino and Gurpreet Singh	Heriot-Watt University Malaysia Campus

Upcoming Activities

OCTOBER - DECEMBER 2018

2-Day Course on "*Design of Sprinkler Systems Reference to MS 1910 Covering Professional Competency Examination (PCE) Syllabus*"

Date:	24 - 25 October 2018 (Wednesday - Thursday)
Time:	9.00am to 5.00pm
Venue:	Wisma IEM
Approved CPD:	13.5
Speaker:	**Ir. Gary Lim Eng Hwa**

5-Day Course on *"PMP Exam Prep Combo (1st Series)"* continued

Date:	25-26 October 2018 (Thursday - Friday)
Time:	9.00am to 5.00pm
Venue:	Wisma IEM
Approved CPD:	12
Speaker:	**Ir. Frankie Chong**

1-Day Seminar on *"Ground Improvement"*

Date:	29 October 2018 (Monday)
Time:	9.00am to 6.00pm
Venue:	Four Points by Sheraton
Approved CPD:	7.5
Speaker:	**Mr. Serge Varaksin** **Mr. Michael Dobie** **Ir. Lee Peir Tien** **Dr Leong Kam Weng** **Mr. Richard Ong** **Mr. Sergei Terzaghi**

1-Day Short Course on *"Deep Excavation"*

Date:	2 November 2018 (Friday)
Time:	9.00am to 5.00pm
Venue:	Armada, PJ
Approved CPD:	7.5
Speaker:	**Professor Ou Chang-Yu**

1-Day Course on *"LiDAR Technology With A Case Study in Flood Risk Assessments & Mitigation And Its Application In Engineering"*

Date:	22 November 2018 (Thursday)
Time:	8.30am to 4.15pm
Venue:	Wisma IEM
Approved CPD:	7
Speaker:	**Ms. Trudy Ganendra** **Dr GS Ebrahim Taherzadeh**

2 - Day Course on *"Fundamentals for Managing Project Successfully"*

Date:	3-4 December 2018 (Monday - Tuesday)
Time:	9.00am to 5.00pm
Venue:	Wisma IEM
Approved CPD:	Applying
Speaker:	**Ir. Dr Ahmad Anuar Othman**

IEM-Standards Malaysia-Suruhanjaya Tenaga ASEAN Electrotechnical Symposium & Exhibition 2018

Date:	4-5 December 2018 (Tuesday-Wednesday)
Time:	9.00am to 5.00pm
Venue:	Connexion, Bangsar
Approved CPD:	Applying
Speaker:	**Various Presenters**

1-Day Course on *"Empower Your Brand for Success"*

Date:	5 December 2018 (Wednesday)
Time:	9.00am to 1.00pm
Venue:	Wisma IEM
Approved CPD:	Applying
Speaker:	**Ms. Evelyn Ch'ng**

Awareness Talk & PI Workshop on Enhanced Process

Date:	15 December 2018 (Saturday)
Time:	9.00am to 1.00pm
Venue:	Wisma IEM
Approved CPD:	3
Speaker:	**Ir. Chen Harn Shean**

For further details on the various events, please visit our website at www.myiem.org.my or call IEM Secretariat at 03-79684001

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Final-Year Project 2 Poster Competition

YOUNG ENGINEERS SECTION – PERAK BRANCH

reported by

Bryan Ng

First prize winner Ong Wei Ting (Environmental Engineering) and other participants with representatives from IEM Perak Branch

In collaboration with the Faculty of Engineering & Green Technology (FEGT) of UTAR, Kampar, the UTAR IEM Student Section organised the biannual Final-Year Project 2 (FYP 2) Poster Competition on 11 April, 2018. This was the second time that the Student Section had organised this event with the faculty. The event was judged by faculty lecturers, Ir. Simon Yeong Chin Chow (IEM Perak Branch's Vice Chairman II) and Bryan Ng Horng Heng (IEM YES Perak Branch Chairman).

Representatives from IEM Perak Branch were given the honour to pick the top 5 FYP presentations by final-year students. The 5 winners and their project titles are listed as follow:

1. **Ong Wei Ting (Environmental Engineering)** – Treatment of stabilised leachate (SLL) by absorption using palm oil fuel ash (POFA).
2. **Tan Shao Qi (Petrochemical Engineering)** – Sonophotocatalytic degradation of phenol over magnetic separable three dimensional ZnO/Fe3O4 hierarchical heterostructure under fluorescent light radiation.
3. **Khong Dewitt (Industrial Engineering)** – Design and construct discrete compound parabolic concentrator integrated collector storage solar water heater (CPC ICSSWH).
4. **Ng Jian Tong (Electronic Engineering)** – Analysis of cognitive flexibility on different stress groups using EEC in the presence of a background music.
5. **Tan Ming Wei (Construction Management)** – Performance of cement kiln dust as cement replacement material in mortar.

All in all, the students demonstrated their utmost commitment to their final-year project as demonstrated in their presentation. ■

Tan Shao Qi (Petrochemical Engineering) presenting his project to Simon Yeong and Bryan Ng

Ng Jian Tong (Electronic Engineering) presenting his project to Simon Yeong and Bryan Ng

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- ☐ Others (please specify) _____

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- ☐ Public utilities (electricity, gas, water, deck and harbour, other)
- ☐ Manufacturer
- ☐ Distributor/importer/agent
- ☐ Construction department of large industrial/Commercial concern
- ☐ Association/education establishment/research
- ☐ Construction equipment hire/rental company
- ☐ Project/construction management consultancy
- ☐ Others (please specify) _____

What are the main activities of your organisation? *(Tick all that apply)*

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- ☐ Pipelines/refineries
- ☐ Structures/steel work
- ☐ Building (commercial, industrial)
- ☐ Housing
- ☐ Construction management
- ☐ Deep mining

Manufacturer of:

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- ☐ Cement
- ☐ Other construction materials
- ☐ Distribution
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Updated May 2018

Tracing the Viking's Voyage to Faroe Islands

Ir. Chin Mee Poon | *www.facebook.com/chinmeepoon*

Ir. Chin Mee Poon *is a retired civil engineer who derives a great deal of joy and satisfaction from travelling to different parts of the globe, capturing fascinating insights of the places and people he encounters and sharing his experiences with others through his photographs and writing.*

We used London as a stepping stone for our visit to Iceland. By "we" I mean my wife and I as well as my younger brother and his wife. We could have easily flown from London to Iceland in 2.5 hours, but we wanted to experience how the Vikings sailed across the North Atlantic Ocean from Norway to Iceland in the late 9th century AD, so we took a flight from London to Aalborg in northern Denmark to catch a ferry for Iceland from the port of Hirtshals 65km further north.

According to history, the sailors who risked their lives to cross vast oceans in long boats in search of new lands in the later part of the first millennium after Christ, were mainly Norwegians. There were also other Scandinavians. They were collectively known as the Vikings. Some of them did cause terror by raiding villages on their way, but most were peaceful people looking for new territories to start a new life. They eventually settled down in many different places, including Iceland and Faroe Islands.

Faroe Islands is an archipelago of 18 closely-packed rocky islands situated about midway between Scotland and Iceland. The islands are interconnected by bridges, causeways, undersea tunnels or ferries, and so it is pretty easy to travel to every nook and corner of the archipelago in a motor vehicle. With a small population of about 50,000 people, Faroe Islands is an autonomous region of the Kingdom of Denmark. It has its own laws.

I first got to know about Faroe Islands some years ago when my attention was drawn to a piece of news about this tiny speck on the world map where scores of pilot whales were herded into a bay and killed, turning the sea red with the cetacean's blood. This apparently barbarous act, repeated several times a year in different parts of the islands and carried out year after year, is widely condemned by the international community, but the Faroese government describes whaling as a natural part of Faroese life and whale meat and blubber have always been a valued part of its people's diet.

I too condemned the killing of whales, but my curiosity was aroused and I wanted to visit Faroe Islands and to get to know its people. So I included Faroe Islands in the itinerary when I planned a trip to Iceland.

The four of us boarded the ferry, MS Norröna, at about 1p.m. on 19 May 2018. This ferry belongs to the Faroese ferry company, Smyril Line. It sails between Denmark and Iceland, with a stopover at Faroe Islands. Before the peak travel season starts on 10 June every year, Norröna makes the voyage from Hirtshals to Iceland and back once a week, so when we disembarked at Faroe Islands, we would have one week to explore the islands before hopping into the next ferry for Iceland.

MS Norröna was built in Germany and launched in 2003. It is 165m long, 30m wide and has 8 decks with a capacity for 1,482 passengers and 118 crew members. It can also carry 800 passenger cars or 130 cargo trailers. Other facilities include several restaurants, a small cinema, a fitness centre, a swimming pool, children's playroom, a gaming room and a shop. The four of us shared a tiny cabin with 6 couchettes in two levels.

The distance from Hirtshals to Torshavn, the capital of Faroe Islands, is 570 nautical miles or 1,056km. The ferry was scheduled to depart at 3p.m. on 19 May and arrive at Torshavn at 8a.m. on 21 May, both local time. As Denmark time was one hour ahead of Faroe time, the voyage was expected to take 42 hours; most of the time, the ferry would be sailing on the open sea. We spent a lot of time on the sundeck, hoping to catch sight of a passing whale or two, but it was quite windy and cold up there and we only saw northern fulmar, some gannets and a few occasional puffin.

What could the Viking explorers have seen in their slow boats?

Tarikh: 12 September 2018

Kepada Semua Ahli,

SENARAI CALON-CALON YANG LAYAK MENDUDUKI TEMUDUGA PROFESIONAL TAHUN 2018

Berikut adalah senarai calon yang layak untuk menduduki Temuduga Profesional bagi tahun 2018.

Mengikut Undang-Undang Kecil IEM, Seksyen 3.8, nama-nama seperti tersenarai berikut diterbitkan sebagai calon-calon yang layak untuk menjadi Ahli Institusi, dengan syarat bahawa mereka lulus Temuduga Profesional tahun 2018.

Sekiranya terdapat Ahli Korporat yang mempunyai bantahan terhadap mana-mana calon yang didapati tidak sesuai untuk menduduki Temuduga Profesional, surat bantahan boleh dikemukakan kepada Setiausaha Kehormat, IEM. Surat bantahan hendaklah dikemukakan sebulan dari tarikh penerbitan dikeluarkan.

Ir. Mohd Khir bin Muhammad FIEM, PEng
Setiausaha Kehormat, IEM
(Sesi 2018/2019)

PERMOHONAN BARU

Nama	Kelayakan
KEJURUTERAAN AWAM	
AFFANDI BIN AHMAD	BE HONS (UTM) (CIVIL, 1996)
AHMAD AZHAN BIN ISMAIL @ SUHAILI	BE HONS (UiTM) (CIVIL, 2003)
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66801	ALMIZAN BIN MOHASEN	BE HONS (UiTM) (CIVIL, 2007)
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93770	RAFIDAH BINTI ITHNIN	BE HONS (UiTM) (CIVIL, 2007)
17095	ROSLAN BIN MOHAMED	BSc (ALABAMA) (CIVIL, 1988)
28332	SAFRINA BINTI MOHD AZIZ	BE HONS (UiTM) (CIVIL, 2007)
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40481	MUHAMMAD HAFFIZ BIN ZAMIDI	BE HONS (UTM) (ELECTRICAL, 2013)
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32638	SALSABILA BINTI AB AZIZ	BE HONS (MALAYA) (CIVIL, 2005) ME (UTM) (CIVIL-GEOTECHNICS, 2010)
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KEJURUTERAAN MEKANIKAL		
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IEM DIARY OF EVENTS

Title: 1-Day Seminar on Ground Improvement

29 October 2018

Organised by: Geotechnical Engineering Technical Division
Time : 9.00 a.m. - 5.30 p.m.
CPD/PDP : Applying

Title: Technical Talk on "Engineer as Manager"

31 October 2018

Organised by: Engineering Education Technical Division
Time : 5.30 p.m. - 7.30 p.m.
CPD/PDP : 2

Title: 1-Day Short Course on Deep Excavation

2 November 2018

Organised by: Geotechnical Engineering Technical Division
Time : 8.30 a.m. - 6.30 p.m.
CPD/PDP : Applying

Kindly note that the scheduled events are subject to change. Please visit the IEM website at www.myiem.org.my for more information on the upcoming events.

CONTINUATION LIST FROM SEPTEMBER JURUTERA 2018 ISSUE

PEMINDAHAN KEPADA AHLI SISWAZAH

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48007	AIMUNI IZZATI BINTI MOHAMMAD YATIM	B.E.(UMP)(CHEMICAL, 2012)
70207	ANG SIE KIAN	B.E.HONS.(TAYLOR'S UNI.)(CHEMICAL, 2017)
70206	ANG SIE KIONG	B.E.HONS.(TAYLOR'S UNI.)(CHEMICAL, 2017)
26689	DR. MOHD SHARIZAN BIN MD. SARIP	B.E.(UMP)(CHEMICAL, 2009) M.E.(UTM)(CHEMICAL, 2013) PHD.(UTM)(2017)
29428	DR. NOR ILIA ANISA BINTI ARIS	B.E.(UMP)(CHEMICAL, 2009) PHD.(UTM)(2016)
69439	JANAK PREET KAUR	M.E.HONS.(UNI. OF NOTTINGHAM)(CHEMICAL WITH ENVIRONMENTAL, 2017)
70023	KU MOHAMAD AFIQ BIN KU ARSHAD	B.E.HONS.(UTM)(CHEMICAL, 2017)
27696	LAI JIA CHI	B.E.HONS.(CURTIN UNI. OF TECH.)(CHEMICAL, 2010)
77966	LEONG WENG FAI	B.E.HONS.(UTAR SG LONG)(CHEMICAL, 2018)
72539	LIM YEE LI	B.E.HONS.(UTAR KAMPAR)(CHEMICAL, 2018)
66971	LOW KOK WEI	B.E.HONS.(USM)(CHEMICAL, 2017)
75408	LOW MEI FONG	B.E.HONS.(UTAR SG LONG)(CHEMICAL, 2018)
81743	MOHAMAD HAKIM BIN SEZALI	B.E.HONS.(UMP)(CHEMICAL, 2016)
47144	MUHAMMAD HAFIZ BIN JOHARI	B.E.HONS.(UNIMAS)(CHEMICAL, 2014)
59329	PUI CHIEW LING, ELAINE	B.E.HONS.(UMP)(CHEMICAL, 2016)
70051	TAN CHUAN HENG	B.E.HONS.(UTM)(CHEMICAL, 2017)
72549	WONG LIN ONN, JOHN	B.E.HONS.(UTAR KAMPAR)(CHEMICAL, 2018)
KEJURUTERAAN AWAM		
68677	ALMANDO BIN ABBIL	B.E.HONS.(UTM)(CIVIL, 2017)
23579	AZRUL BIN MD DIN	B.E.HONS.(UITM)(CIVIL, 2005) M.SC.(UITM)(CIVIL-STRUCTURES, 2015)
45555	CHENG JUO IN	B.E.HONS.(USM)(CIVIL, 2014)
53036	CHIA TAI HAW	B.E.HONS.(UMS)(CIVIL, 2015)
41735	DR. MUHAMAD AZRY BIN KHOIRY	B.E.HONS.(UKM)(CIVIL & STRUCTURAL, 2011) PHD.(UKM)(CIVIL & STRUCTURAL, 2015)
44707	FONG YEAN SEK, EMILY	B.E.HONS.(SWINBURNE UNI. OF TECH.)(CIVIL, 2013)
32143	IRWAN SHAMSUDDIN BIN YATIM MUSTAFA	B.E.HONS.(USM)(CIVIL, 2008)
27281	IVAN LASANUL TSEN SAM PAK	B.E.HONS.(USM)(CIVIL, 2006)
63928	IZUAN BIN MUSA	B.E.HONS.(UTHM)(CIVIL, 2016)
45553	KONG SHIN LIN	B.E.HONS.(USM)(CIVIL, 2014)
81247	KONG SING BENG, GABRIEL	B.E.HONS.(IUKL)(CIVIL, 2016)
68687	LAHAMAN BIN DAHING	B.E.HONS.(UTM)(CIVIL, 2017)
68093	LAW CHIA WEN	B.E.HONS.(UTHM)(CIVIL, 2017)
63951	LEW CHUN SIANG, KELVIN	B.E.HONS.(UTHM)(CIVIL, 2017)
75246	LO YI BANG	M.E.HONS.(TH EUNI. OF NOTTINGHAM)(CIVIL, 2018)
78724	LOW YEE HWA	B.E.HONS.(UMP)(CIVIL, 2015)
68971	MOHAMAD AIZAT BIN MOHD YUSOFF	B.E.HONS.(UITM)(CIVIL, 2016)
54826	MOHD ALIFF BIN MOHD ANUAR	B.E.HONS.(UTHM)(CIVIL, 2015)
37354	MOHD FAUZI BIN MAZUKI	B.E.HONS.(UTM)(CIVIL, 2009)
72255	MOHD MUZZAMILL BIN MUSTAFFA	B.E.HONS.(IUKL)(CIVIL, 2016)
41654	MOHD SHAIFUL ANWAR BIN YUNUS	B.E.HONS.(UTHM)(CIVIL, 2012)
21726	MOHTAR BIN SHAARI	B.E.HONS.(UTM)(CIVIL, 2003)
52206	MUHAMMAD ASYRAF BIN MOHD ZAIDEEN	B.E.HONS.(UNIMAS)(CIVIL, 2015)
72271	MUHAMMAD FAIZ BIN KAMARUDDIN	B.E.HONS.(IUKL)(CIVIL, 2016)
78431	MUHAMMAD FAIZ BIN ZAHARUDDIN	B.E.HONS.(UNISEL)(CIVIL, 2015)
74494	MUHAMMAD FIQRY BIN SELAMAT	B.E.HONS.(UTM)(CIVIL, 2016)
65801	MUHAMMAD KAMIL B. MD KHAIRI	B.E.HONS.(UITM)(CIVIL, 2014)
52144	NAZMI AINUDDIN BIN JOHAN	B.E.HONS.(UNIMAS)(CIVIL, 2016)
72928	NOOR AMIRA BINTI NORIZAN	B.E.HONS.(UKM)(CIVIL & ENVIRONMENTAL, 2016)
41428	NOR HIDAYAH BINTI SARI	B.E.HONS.(UTHM)(CIVIL, 2011)
40296	NORFARAHSHILA BINTI ROSLAN	B.E.HONS.(UTM)(CIVIL, 2011)
21182	NORZETI AKHTAR BINTI AWANG ABU	B.E.HONS.(MALAYA)(CIVIL, 2004) M.E.(UPM)(ENVIRONMENTAL, 2011)
44659	NUR AINI BINTI ROSLI	B.E.HONS.(UPNM)(CIVIL, 2013)
54947	NUR AYUNI ATHIRAH BT ABDUL RASHID	B.E.HONS.(UTHM)(CIVIL, 2016)
47450	NUR FARAHAIN BINTI MOHD IDRUS	B.E.HONS.(UTP)(CIVIL, 2015)
68628	NUR HISYAM BIN TAJUL AURUS	B.E.HONS.(UITM)(CIVIL, 2017)
69237	NURUL NASUHA BT. MD ZIN	B.E.HONS.(UITM)(CIVIL, 2016)
64153	ONG LEE YEN	B.E.HONS.(UTHM)(CIVIL, 2016)
69350	PHANG HAN XIANG	M.E.HONS.(THE UNI. OF NOTTINGHAM)(CIVIL, 2017)
58306	SANJAY BOSS	B.E.HONS.(IUKL)(CIVIL, 2013) M.E.(UTM)(CIVIL-GEOTECHNICS, 2015)
69352	SHARVIN SIVAKUMAR	M.E.HONS.(UNI. OF NOTTINGHAM)(CIVIL, 2017)
33170	SITI SARAH BINTI RAMLI	B.E.HONS.(UITM)(CIVIL, 2010)
44893	SURAYA BINTI ZAZALE	B.E.HONS.(UTM)(CIVIL, 2014) M.SC.(HERIOT-WATT UNI.)(CONSTRUCTION PROJECT MANAGEMENT, 2015)
81773	THEN KANG JIN	B.E.HONS.(UMP)(CIVIL, 2017)
67878	TUAN SAFWAN BIN TUAN MOOD	B.E.HONS.(UITM)(CIVIL, 2016)
81488	VOON LEE SEE	B.E.HONS.(UNI. OF PLYMOUTH)(CIVIL, 2007) M.SC.(HERIOT-WATT UNI.)(CIVIL WITH CONSTRUCTION MANAGEMENT, 2017)
68704	WERSON BIN JERRY	B.E.HONS.(UTM)(CIVIL, 2017)
53628	WONG LUNG FEI	B.E.HONS.(UKM)(CIVIL & STRUCTURAL, 2013) B.SC.(UNI. OF DUISSBURG ESSEN)(CIVIL, 2013)
28267	YOW CHEE YEN	B.E.HONS.(USM)(CIVIL, 2009)
KEJURUTERAAN ELEKTRIKAL		
85459	DARNESH A/L PANNIRSELVAM	B.E.HONS.(APU)(ELECTRICAL & ELECTRONIC, 2016)
81255	DEVINDRAN A/L MUNANDY	B.E.HONS.(APU)(ELECTRICAL & ELECTRONIC, 2017)
66616	DIBAN A/L PANNEERSELVAN	B.E.HONS.(UNITEN)(ELECTRICAL POWER, 2015)
64698	DINEIS A/L MANI	B.E.HONS.(UNITEN)(ELECTRICAL & ELECTRONICS, 2016)
64703	KUMARESEN GOVINDASAMY	B.E.HONS.(UNITEN)(ELECTRICAL POWER, 2015)
68058	LIM YIREN	B.E.HONS.(UTAR SG LONG)(ELECTRICAL & ELECTRONIC, 2018)
34704	MD NAZMI BIN HASSAN	B.E.HONS.(UTEM)(ELECTRICAL-INDUSTRIAL POWER, 2009)
78160	MOHAMAD AKMAL BIN YAZAID	B.E.HONS.(UITM)(ELECTRICAL, 2016)
67968	MOHAMAD SHAMSUL ARIF BIN ENDI RAHMAN	B.E.HONS.(UITM)(ELECTRICAL & ELECTRONIC, 2017)
85292	MOHAMMAD ZYZERULL BIN SAAD	B.E.HONS.(UTEM)(ELECTRICAL-CONTROL, INSTRUMENTATION & AUTOMATION, 2016)
34661	MOHD FAHMI SOBRIE BIN FAUDZI	B.E.HONS.(UTEM)(ELECTRICAL-POWER ELECTRONIC & DRIVE, 2009)
75416	MOOY CHI HO, BRIAN	B.E.HONS.(APU)(ELECTRICAL & ELECTRONIC, 2017)
67137	MUHAMMAD FATHIR RAHMAN B. MOHAMAD SABRI	B.E.HONS.(UITM)(ELECTRICAL, 2016)
45141	MUHAMMAD FIRDAUS BIN SUID	B.E.HONS.(UTP)(ELECTRICAL & ELECTRONICS, 2011)
74395	MUHAMMAD NURHANUDIN BIN BAHARUDIN	B.E.HONS.(UTM)(ELECTRICAL, 2016)
32290	NORAIDAH BINTI MOHD SHARIFF	B.E.HONS.(UNIMAP)(ELECTRICAL SYSTEMS, 2008) M.E.(MALAYA)(POWER SYSTEM, 2013)
72766	SURENDRAN A/L M GOBI	B.E.HONS.(UNITEN)(ELECTRICAL POWER, 2015)
41875	W. NURUL ALIAA BINTI W. MAZLAN	B.E.HONS.(UTEM)(ELECTRONICS-TELECOMMUNICATION ELECTRONICS, 2010)
60516	YEE KANG YUNG	B.E.HONS.(UTP)(ELECTRICAL & ELECTRONICS, 2015)
KEJURUTERAAN ELEKTRONIK		
89116	AMSYAR KHALIS BIN NAZARI	B.E.HONS.(UMP)(ELETRICAL-ELECTRONICS, 2017)
45112	ANIS BINTI BADRI	M.E.HONS.(THE UNI. OF NOTTINGHAM)(ELECTRICAL & ELECTRONIC, 2011)
81925	HEH WHIT NEY	B.E.HONS.(UMP)(ELECTRICAL-ELECTRONICS, 2016)
72544	LEE JUN YI	B.E.HONS.(UTAR KAMPAR)(ELECTRONIC, 2018)
61433	WAN KIN MUN	B.E.HONS.(UTAR)(ELECTRONIC, 2018)
KEJURUTERAAN ALAM SEKITAR		
84731	CHEAH JIN XUN	B.E.HONS.(MALAYA)(ENVIRONMENTAL, 2016)
58816	LOH LING	B.E.HONS.(UTAR)(ENVIRONMENTAL, 2016)
KEJURUTERAAN INDUSTRI		
69611	JASPER CHAN	B.E.HONS.(UTAR KAMPAR)(INDUSTRIAL, 2018)
KEJURUTERAAN PEMBUATAN		
32245	AHSANA AQILAH BINTI AHMAD	B.E.HONS.(IIUM)(MANUFACTURING, 2009) M.SC.(UITM)(MECHANICAL, 2014) MBA.(IIUM)(FINANCE, 2011)
43057	HASNORSYAHIZAN BINTI NORIZAN	B.E.HONS.(UITM)(MECHANICAL-MANUFACTURING, 2013)
KEJURUTERAAN MEKANIKAL		
58876	ABABUZEH B. RAMLI	B.E.HONS.(UTHM)(MECHANICAL, 2016)
59391	AMEER ZHARIFF B. ABDULLAH	B.E.HONS.(UITM)(MECHANICAL, 2016)
79497	AVINESH ANBALAGAN	B.E.HONS.(UNITEN)(MECHANICAL, 2017)
23477	AZIZULFAIZEI BIN MOHD ARIFF	B.E.HONS.(UITM)(MECHANICAL, 2005)
53973	AZLAN BIN ABD RAHMAN	B.E.HONS.(UNITEN)(MECHANICAL, 2013)
70482	HENG CHIA JIE, ELWIN	B.E.HONS.(NILAI)(MECHANICAL, 2017)
61254	LOGESWARAN A/L SUNDARASEKAR	B.E.HONS.(UTHM)(MECHANICAL, 2015)
53500	MAHASSAN BIN ABDUL MANAF	B.E.HONS.(UITM)(MECHANICAL, 2016)
35085	MOHAMAD FAISAL BIN MOHAMAD TAIB	B.E.HONS.(UITM)(MECHANICAL, 2013)
39404	MOHAMAD HAZWAN BIN ESTIAR	B.E.HONS.(UITM)(MECHANICAL, 2013)
65090	MOHAMAD ZAIDILAMIR BIN MOKHTAR	B.E.HONS.(UTHM)(MECHANICAL, 2014)
42931	MOHD ARIF BIN AHMAD	B.E.HONS.(UITM)(MECHANICAL, 2013)
31425	MOHD ZAKARIA BIN MOHD SAHAR	B.E.HONS.(UITM)(MECHANICAL, 2011)
46525	MOHD ZIHIRI IRFAM BIN ZAKI HUSSAIN	B.E.HONS.(UITM)(MECHANICAL, 2013) M.SC.(UNI. OF MANCHESTER)(ENGINEERING PROJECT MANAGEMENT, 2014)
39834	MUHAMAD AMALUDIN BIN ROSMAN	B.E.HONS.(UITM)(MECHANICAL, 2013)
67566	MUHAMAD AZRUL AZIM B. RAMLI	B.E.HONS.(UITM)(MECHANICAL, 2017)
61242	MUHAMAD HISYAM BIN RAI	B.E.HONS.(UTM)(MECHANICAL, 2016)
80208	MUHAMMAD AZZUAN BIN ZAINUDDIN	B.E.HONS.(UTHM)(MECHANICAL, 2015)
31441	MUHAMMAD HANIF BIN ASROR	B.E.HONS.(UITM)(MECHANICAL, 2011) M.SC.(UTM)(MECHANICAL, 2017)
78426	MUHAMMAD IDRIS SYAFIQ BIN SAHIBIN	B.E.HONS.(UNI. OF SURREY)(MECHANICAL, 2015) M.SC.(UNI. OF SURREY)(ADVANCED MATERIALS, 2016)
50406	MUHAMMAD IZREL BIN ISMAIL	B.E.HONS.(UITM)(MECHANICAL, 2016)
86950	NG ZI KENT	B.E.HONS.(UTAR)(MECHANICAL, 2018)
50471	NUR ATIRA BINTI SHARIFF	B.E.HONS.(UITM)(MECHANICAL, 2016)
71571	PANG NENG ING, JONATHAN	B.E.HONS.(CURTIN UNI OF TECH.)(MECHANICAL, 2016)

67729	REDZA B. AMIN SUGGUN	B.E.HONS.(UITM) (MECHANICAL, 2017)
80613	SIVAHARI A/L MUTHUSAMY	B.E.HONS.(NILAI UNI.) (MECHANICAL, 2018)
43010	SUHAIRI BIN ABU SUHOR	B.E.HONS.(UTM) (MECHANICAL, 2017)
46439	SYAHRIL NIZAM BIN SUHAIMI	B.E.HONS.(UITM) (MECHANICAL, 2014)
68499	WOO CHIEH CHIENG	B.E.HONS.(MONASH UNI.) (MECHANICAL, 2018)

KEJURUTERAAN MEKATRONIK

67082	KISNAN A/L RAMAYA	B.E.HONS.(USM) (MECHATRONIC, 2017)

PERMOHONAN MENJADI AHLI SISWAZAH

No. Ahli	Nama	Kelayakan

KEJURUTERAAN AEROANGKASA

97500	NUR FITRI BIN SALEHUDDIN	B.E.HONS.(IIUM)(AEROSPACE, 2017)
99295	AWANG RAISUDIN BIN AWANG SAIFUDIN	B.E.HONS.(USM)(AEROSPACE, 2014)

KEJURUTERAAN AERONAUTIK

99417	KHAIRUL AZHAR BIN MOHAMMAD	B.E.HONS.(UPM)(AEROSPACE, 2006)
97567	TAN YONG JIE, KEVIN	M.E.HONS.(UNI. OF BRISTOL) (AERONAUTICAL, 2014)

KEJURUTERAAN AWAM

99151	LEW HANG CHUEN	B.E.(QUEENSLAND)(CIVIL, 2014)
98423	CHUNG SU WAI	B.E.(QUT)(CIVIL, 2017)
99198	DR. SEYED JAMALALDIN SEYED HAKIM	B.E.(SHAHID CHAMRAN UNI.)(CIVIL, 1996) M.SC.(UPM) (STRUCTIRAL, 2007) PHD.(MALAYA)(STRUCTURAL ENGINEERING & MATERIALS, 2015)
97565	ROSMANIRA BINTI MOHD AB GHANI	B.E.(UMP)(CIVIL WITH ENVIRONMENTAL, 2012)
99161	MUHAMMAD AIZUDDIN BIN RAMLY	B.E.(UMP)(CIVIL-ENVIRONMENTAL, 2013)
97429	SIAW KOK SENG	B.E.HONS.(CURTIN UNI. OF TECH.)(CIVIL & CONSTRUCTION, 2015)
99377	HII HAU HAO	B.E.HONS.(CURTIN UNI. OF TECH.)(CIVIL & CONSTRUCTION, 2016)
99426	LOH MING CHONG	B.E.HONS.(INTI INT. UNI.) (CIVIL, 2017)
99371	LEE MUN KIN	B.E.HONS.(IUKL)(CIVIL, 2014)
97499	ONG KEE SEONG	B.E.HONS.(KLIUC)(CIVIL, 2010)
99399	WAN ZURINA BINTI WAN JAAFAR	B.E.HONS.(MALAYA)(CIVIL, 2003)
97553	AHMAD FIRDAUS BIN MD NOR	B.E.HONS.(MALAYA)(CIVIL, 2007)
97418	SASHITHREN A/L G. DARAMALINGAM	B.E.HONS.(MALAYA)(CIVIL, 2011)
99170	TAN TENG HAU	B.E.HONS.(MALAYA)(CIVIL, 2012)
97550	MIKE SAMUEL A/L MURUGAN	B.E.HONS.(MALAYA)(CIVIL, 2014)
99374	LEE KOK SOON	B.E.HONS.(MONASH UNI.) (CIVIL, 2017)
99396	TAN KAR YOW	B.E.HONS.(MONASH UNI.) (CIVIL, 2017)
99429	LAU HUI CHEK, VINCENT	B.E.HONS.(SWINBURNE UNI. OF TECH.)(CIVIL, 2011) M.E.SC.(UNIMAS) (ENVIRONMENTAL SCIENCE-LAND USE & WATER RESOURCE MANAGEMENT, 2013)
99395	ALASTAIR TIMOTHY ANG MING ZHENG	B.E.HONS.(SWINBURNE UNI. OF TECH.)(CIVIL, 2017)
99147	DR. JOHNSON OLUFEMI ADEBAYO	B.E.HONS.(THE FEDERAL UNI. OF TECHNOLOGY)(CIVIL, 2003) M.E.(UTM)(CIVIL-TRANSPORT & HIGHWAY, 2012) PHD.(UTP)(CIVIL, 2016)
99201	NURUL FAIIZIN BINTI ABDUL AZIZ	B.E.HONS.(UITM)(CIVIL, 2010)
98414	ABDULRAHMAN ABDULWAHAB MURSHED NAHSHAL	B.E.HONS.(UITM)(CIVIL, 2011) M.E.(UPM)(STRUCTURAL ENGINEERING & CONSTRUCTIONS, 2015)
97430	MUHAMMAD FIRDAUS BIN MOHD HATTA	B.E.HONS.(UITM)(CIVIL, 2013)
99277	MOHD AFIQ FAHMI BIN RUSLI	B.E.HONS.(UITM)(CIVIL, 2014)
97414	MOHD FAUZI BIN MOHD ROHAIZAD	B.E.HONS.(UITM)(CIVIL, 2014)
97417	NORKHASIFAH BINTI ABD RAHMAN	B.E.HONS.(UITM)(CIVIL, 2014)
97486	MOHAMAD EFFANDY BIN ANUAR GAN	B.E.HONS.(UITM)(CIVIL, 2015)
99283	FARAH NABILAH BINTI MAZELAN	B.E.HONS.(UITM)(CIVIL, 2017)
99275	MUHAMMAD FATHI BIN ILIAS @ ZAHARI	B.E.HONS.(UITM)(CIVIL, 2017)
99389	SITI HIJRAN BINTI ZAINAL	B.E.HONS.(UITM)(CIVIL, 2017)
97421	TUAN 'AFIF BIN TUAN AZMAN	B.E.HONS.(UITM)(CIVIL, 2017)
98418	DR. RIZATI BINTI HAMIDUN	B.E.HONS.(UKM)(CIVIL & STRUCTURAL, 2001) M.SC.(UPM)(HIGHWAY & TRANSPORT, 2006) PHD.(UITM)(TRANSPORT & LOGISTICS, 2015)
99428	JULIANA BINTI MARTIN	B.E.HONS.(UKM)(CIVIL & STRUCTURAL, 2004)
97437	CHUA PENG YANG	B.E.HONS.(UMP)(CIVIL, 2013)
99450	SIEW PHUI MOON	B.E.HONS.(UMP)(CIVIL, 2014)
99278	MUHAMMAD HAZIQ BIN AWAZHAR	B.E.HONS.(UMP)(CIVIL, 2015)
99195	MOHD LUTFIL HADI BIN MOHD HAMZAH	B.E.HONS.(UMP)(CIVIL, 2016)
99286	CHEONG PECK HENG, DARREL	B.E.HONS.(UNI. OF AUCKLAND)(CIVIL, 2012)
99204	LEE WEE KIANG, MICHAEL	B.E.HONS.(UNIMAS)(CIVIL, 2011)
99165	FOO CHIN YEN, KELVIN	B.E.HONS.(UNIMAS)(CIVIL, 2012)
99150	NG LAN ENG	B.E.HONS.(UNIMAS)(CIVIL, 2014)
97415	KIU PEY ING	B.E.HONS.(UNIMAS)(CIVIL, 2014)
97490	AHMAD HUZAIRIE BIN JOHAR	B.E.HONS.(UNITEN)(CIVIL, 2010)
97438	AHMAD FAUZAN BIN AHMAD MUSTAFFA MUSTAAL	B.E.HONS.(UNITEN)(CIVIL, 2011)
97566	YUGAVARATHAN A/L GANESH	B.E.HONS.(UNITEN)(CIVIL, 2015)
97559	REMINGTON RAJIV RICHARD HENDRICKS	B.E.HONS.(UNITEN)(CIVIL, 2016)
99162	LOO KOK FAI	B.E.HONS.(UNITEN)(CIVIL, 2017)
97555	SHO ZHI CHIN	B.E.HONS.(UNITEN)(CIVIL, 2017)
99364	TEO YOW YANG	B.E.HONS.(UNITEN)(CIVIL, 2017)
99306	MOHD HAFIZ IZRAN BIN CHE ROSLI	B.E.HONS.(UPM)(CIVIL, 2012)
99308	CHEONG SUET MAE	B.E.HONS.(UPM)(CIVIL, 2016)
97556	ZULKIFLI BIN SALLEH	B.E.HONS.(USM)(CIVIL, 2005)
97568	CHAN JIA JIAT	B.E.HONS.(UTAR SG LONG) (CIVIL, 2018)
99382	TANG SENG HOE	B.E.HONS.(UTAR)(CIVIL, 2013)
99282	LUI CHEN CHEONG	B.E.HONS.(UTAR)(CIVIL, 2015)
97563	YAP WOEI SHYONG	B.E.HONS.(UTAR)(CIVIL, 2016)
98417	CHONG LAI MUN	B.E.HONS.(UTAR)(CIVIL, 2016)
99427	AHMAD FIRDAUS BIN FADZIL	B.E.HONS.(UTHM)(CIVIL, 2008)
97495	ANANDAN A/L ARUMUGAM	B.E.HONS.(UTHM)(CIVIL, 2011)
97570	MAXWEL BETI ANAK PIT	B.E.HONS.(UTHM)(CIVIL, 2011)
99168	STEPHENIE WILSON	B.E.HONS.(UTHM)(CIVIL, 2014)
99268	MOHD FARID BIN LEMAN	B.E.HONS.(UTM)(CIVIL, 2002)
99164	MOHAMAD NIZAR BIN SAIDIN	B.E.HONS.(UTM)(CIVIL, 2009)
99281	HANIN BINTI ABDUL HAMID	B.E.HONS.(UTM)(CIVIL, 2014)
99292	LUKMAN KHIDIR BIN ZAINAL ABIDIN	B.E.HONS.(UTM)(CIVIL, 2015)
99279	ANNI SUHANA BINTI ABD RAHMAN	B.E.HONS.(UTM)(CIVIL, 2016)
97484	MOHAMAD IKMAL BIN ZULKIFLI	B.E.HONS.(UTM)(CIVIL, 2016)
99136	MUHAMMAD NABIL BIN ABU BAKAR	B.E.HONS.(UTM)(CIVIL, 2016)
97491	VANESSA JANE BINTI ZAINIP	B.E.HONS.(UTM)(CIVIL, 2016)
99370	WAN NOOR AFIQ AFANDY BIN WAN ISMAIL	B.E.HONS.(UTP)(CIVIL, 2016)
99368	CHEOK YU HUA	B.SC.(STATE UNI. OF NEW YORK) (CIVIL, 2016)
99309	DR. WONG NGIE HING	B.SC.(TENNESSEE TECHNOLOGICAL UNI.)(CIVIL, 1997) M.SC.(TENNESSEE TECHNOLOGICAL UNI.)(CIVIL, 1998) PHD.(TENNESSEE TECHNOLOGICAL UNI.)(CIVIL, 2004)
99189	CHRISTOPHER DONOVAN DURIN AJOI	BAPPSC.(BRITISH COLUMBIA) (CIVIL, 2015)
99431	LEE CHIN CHUAN, KELVIN	M.E.(UNI. OF MELBOURNE) (CIVIL, 2016)
99369	TANG WEI KAI	M.E.HONS.(CARDIFF UNI.) (CIVIL, 2016)
99191	AHMAD AMIR ZAKI BIN MASHKURI	M.E.HONS.(IMPERIAL COLLEGE LONDON)(CIVIL, 2015)
99388	EIK JIA WEI	M.E.HONS.(NOTTINGHAM) (CIVIL, 2017)
99187	LAI CHIONG SUN, ROBIN	M.E.HONS.(NOTTINGHAM) (CIVIL, 2018)
97492	ONG LIONG SIK, TERENCE	M.E.HONS.(NOTTINGHAM) (CIVIL, 2018)
99196	MOHAMED ASYRAF BIN AHMAD DZAHIRI	M.E.HONS.(TH EUNI. OF MANCHESTER)(CIVIL & STRUCTURAL, 2015)
99169	LIM YI SERN	M.E.HONS.(THE UNI. OF NOTTINGHAM)(CIVIL, 2016)
99142	LIM ZHUAN LIK	M.E.HONS.(THE UNI. OF NOTTINGHAM)(CIVIL, 2017)
99458	CHAI KUM ZHUN	M.E.HONS.(UNI. OF LEEDS) (ARCHITECTURAL, 2017)
99401	WILFRID CHANG ZESENG	M.E.HONS.(UNI. OF NOTTINGHAM)(CIVIL, 2013)
99384	LOKE YI KEAN	M.E.HONS.(UNI. OF NOTTINGHAM)(CIVIL, 2017)

KEJURUTERAAN BAHAN

99425	DR. NG SOO AI	B.E.HONS.(UNIMAP) (MATERIALS, 2010) M.SC.(USM)(MATERIALS, 2011) PHD.(USM)(ADVANCED MATERIALS, 2016)
99394	TEOH KING LONG	B.E.HONS.(USM)(MATERIALS, 1996) M.SC.(USM) (MECHANICAL, 2002)
99138	WAN MOHD ARIF BIN W. IBRAHIM	B.E.HONS.(USM)(MATERIALS, 2002) M.SC.(UNIMAP)(2017)
99381	TEE DEE IN	B.E.HONS.(USM)(MATERIALS, 2005) M.SC.(USM)(MATERIALS, 2006)

KEJURUTERAAN BIOKIMIA

99403	LIYANA BT YAHYA	B.E.HONS.(IIUM) (BIOCHEMICAL-BIOTECHNOLOGY, 2008) M.SC.(IIUM) (BIOTECHNOLOGY, 2011)

KEJURUTERAAN BIOPERUBATAN

99422	DR. NOORANIDA ARIFIN	B.E.HONS.(MALAYA) (BIO-MEDICAL, 2006) M.SC.(EASTERN MICHIGAN UNIVERSITY)(2009) PHD.(MALAYA)(2016)
97558	ABDUL RAUF BIN ABU BAKAR	B.E.HONS.(MALAYA) (BIOMEDICAL-PROSTHETIC & ORTHOTIC, 2014) M.E.SC. (MALAYA)(BIOMEDICAL, 2017)

KEJURUTERAAN ELEKTRIKAL

99166	TEOH HOE CHUAN, ALCENT	B.E.HONS.(AIMST UNI.) (ELECTRICAL & ELECTRONIC, 2017)
99409	MUHAMMAD LUQMAN BIN ABDULLAH	B.E.HONS.(MALAYA) (ELECTRICAL, 2016)
97432	MAHMUD HUZAIFI BIN MOBARAK	B.E.HONS.(MMU) (ELECTRICAL, 2014)
99180	TANG SWEE SENG, ALAN	B.E.HONS.(MMU) (ELECTRICAL, 2015)
99179	YONG SHENG SHIENG, COLIN	B.E.HONS.(SWINBURNE UNI. OF TECH.)(ELECTRICAL & ELECTRONIC, 2013) MBA. (SWINBURNE UNI. OF TECH. (INTERNATIONAL, 2015)
99404	TSAI SIEW ZOO	B.E.HONS.(SWINBURNE UNI. OF TECHNOLOGY) (ELECTRICAL & ELECTRONIC, 2013)
99460	KOH CHONG FUNG	B.E.HONS.(TAYLOR'S UNI.) (ELECTRICAL & ELECTRONIC, 2016)
97569	OH WEI SZIN	B.E.HONS.(TAYLOR'S UNI.) (ELECTRICAL & ELECTRONIC, 2017)
99367	KHO CHUN JIE	B.E.HONS.(THE UNI. OF NOTTINGHAM)(ELECTRICAL & ELECTRONIC, 2015) M.E.SC.(CURTIN UNI.) (ELECTRICAL, 2017)
99437	MOHD IDRIS BIN ABDUL RAHMAN	B.E.HONS.(UITM) (ELECTRICAL, 2005)
99134	MOHAMMAD SAIFULLAH BIN NORIZAN	B.E.HONS.(UITM) (ELECTRICAL, 2010)

97485	MOHAMAD NAZRIN BIN MOHAMAD NAJIB	B.E.HONS.(UITM) (ELECTRICAL, 2013)
99183	SOPHIAN FIKRI BIN SAZALI	B.E.HONS.(UITM) (ELECTRICAL, 2014)
99172	MANIMEHALA NADARAJAN	B.E.HONS.(UMS)(ELECTRICAL & ELECTRONIC, 2012) M.E.(UMS)(ELECTRICAL & ELECTRONIC, 2016)
99181	THARMASWARAN SIVAPRAGASAM	B.E.HONS.(UNI. OF NORTHUMBRIA)(ELECTRICAL & ELECTRONIC, 2005) M.E.(MALAYA)(POWER SYSTEMS, 2017)
99154	NUR FARINA BINTI ABD HALIM	B.E.HONS.(UNIKL) (ELECTRICAL, 2017)
97498	NURUL FARHANA BINTI AZIS @ AZIZ	B.E.HONS.(UNIKL-BMI) (ELECTRICAL, 2017)
99171	ANG ENG HUAT	B.E.HONS.(UNIMAP) (ELECTRICAL SYSTEMS, 2017)
99280	KALAISELVI ARAMUGAM	B.E.HONS.(UNISEL) (ELECTRICAL, 2008) M.E.(MALAYA)(POWER SYSTEM, 2014)
99135	SEMREET KAUR A/P BHAJNIK SINGH	B.E.HONS.(UNITEN) (ELECTRICAL & ELECTRONIC, 2007)
98411	NG KAH JUN	B.E.HONS.(UNITEN) (ELECTRICAL & ELECTRONIC, 2013)
97423	JAYASELAN A/L KRISHNAN	B.E.HONS.(UNITEN) (ELECTRICAL & ELECTRONICS, 2017)
99408	ERNI BINTI ABDUL GHANI	B.E.HONS.(UNITEN) (ELECTRICAL POWER, 2005)
99157	YUVARAJA GOKULABALAJI	B.E.HONS.(UNITEN) (ELECTRICAL POWER, 2011)
99149	HARZLIENA SHAZLEEN BTE HAHI	B.E.HONS.(UNITEN) (ELECTRICAL POWER, 2012)
97487	MUHAMAD AFIQRI BIN IBRAHIM	B.E.HONS.(UNITEN) (ELECTRICAL POWER, 2013)
99436	ZULFADLIZAN BIN MOHD	B.E.HONS.(UNITEN) (ELECTRICAL POWER, 2015)
99366	SYED AKHBAR BIN SYED MUBARAK ALI	B.E.HONS.(UNITEN) (ELECTRICAL POWER, 2016)
99421	YVONNE STEPHEN	B.E.HONS.(UNITEN) (ELECTRICAL POWER, 2016)
99407	EALAN TAMIL VELAN A/L SANDER	B.E.HONS.(UNITEN) (ELECTRICAL POWER, 2017)
99433	HAZRUL HELMI BIN KHALID	B.E.HONS.(UNITEN) (ELECTRICAL POWER, 2017)
99465	AMIR RAHIMI BIN MUHAMAD ALI	B.E.HONS.(UPM)(ELECTRICAL & ELECTRONICS, 2016)
99457	ONG WEE CHIEK	B.E.HONS.(UPM)(ELECTRICAL & ELECTRONICS, 2017)
99137	MOHD NIZAMMUDIN BIN HAMDAN	B.E.HONS.(UPNM) (ELECTRICAL & ELECTRONIC-POWER, 2014)
99405	NUR SYUHADA BINTI AZIZAN	B.E.HONS.(USM) (ELECTRICAL, 2016)
99387	CHOY CHEE KHONG	B.E.HONS.(UTAR) (ELECTRONIC, 2008)
99155	MUHAMMAD NA'IM BIN MOHD NAFI	B.E.HONS.(UTEM) (ELECTRICAL-ELECTRONICS & DRIVES, 2016)
99446	CECILIA CONTESSA BALAKRISHNAN	B.E.HONS.(UTEM) (ELECTRICAL-INDUSTRIAL POWER, 2013) MBA.(CARDIFF METROPOLITAN UNI.)(2017)
0	MOHAMAD HAFIZAN BIN BAHARUM	B.E.HONS.(UTEM) (ELECTRICAL-POWER ELECTRONICS & DRIVE, 2010)
99188	JANIFAL BIN ALIPAL	B.E.HONS.(UTHM) (ELECTRICAL, 2012)
97501	PAD KHAIRUL ANUAR BIN RAMLI	B.E.HONS.(UTHM) (ELECTRICAL, 2012)
99373	TAI LIH JIAN	B.E.HONS.(UTHM) (ELECTRONIC, 2015)
99294	MOHD FARIZAL BIN ISA	B.E.HONS.(UTM)(ELECTRICAL, 2005)
99296	MOHAMAD NAZMI BIN DAMAN HURI	B.E.HONS.(UTM)(ELECTRICAL, 2007)
97420	NORASYIDAH BINTI OMAR	B.E.HONS.(UTM)(ELECTRICAL, 2011)
99302	SARAVANAN A/L ALAM CHENTIRAN	B.E.HONS.(UTM)(ELECTRICAL, 2012)
0	RAFZAN BIN RAMLI	B.E.HONS.(UTM)(ELECTRICAL, 2017)
99303	MOHD SALLEHHUDIN BIN ISMAIL	B.E.HONS.(UTP)(ELECTRICAL & ELECTRONICS, 2008)
97419	LOH JUI BOON	B.E.HONS.(UTP)(ELECTRICAL & ELECTRONICS, 2011)
99139	SITI NATASHA BINTI ANAN	B.EHONS.(UMS)(ELECTRICAL & ELECTRONIC, 2016)
99466	EA JIA GEN	B.SC.(UNI. OF IOWA) (ELECTRICAL, 2013)
99203	LIM SENG JU	M.E.HONS.(THE UNI. OF NOTTINGHAM)(ELECTRICAL & ELECTRONIC, 2014)
99432	EMY ZAIRAH AHMAD	M.E.HONS.(THE UNI. OF SHEFFIELD)(ELECTRICAL, 2009)
97413	ONG TING YU	M.E.HONS.(UCL)(ELECTRONIC & ELECTRICAL, 2012)
99420	ANG CHEE KEONG	M.E.HONS.(UNI. OF NOTTINGHAM)(ELECTRICAL & ELECTRONIC, 2016)

KEJURUTERAAN ELEKTRONIK

99445	MOHD RIDHWAN BIN BAHAROM	B.E.(HIROSHIMA UNI.) (CLUSTER II-ELECTRICAL, COMPUTER & SYSTEMS, 2010)
97549	AMIRULLAH BIN ARIES	B.E.(UMP)(ELECTRONIC, 2012)
99193	THIEN CHENG YII	B.E.HONS.(CURTIN UNI. OF TECH.)(ELECTRONIC & COMMUNICATION, 2013)
98412	DR. NURUL ARFAH BINTI CHE MUSTAPHA	B.E.HONS.(IIUM) (ELECTRONICS-COMPUTER & INFORMATION, 2008) M.SC.(IIUM) (ELECTRONICS, 2011) PHD.(IIUM)(ENGINEERING, 2017)
97554	ROZMIE RAZIF BIN OTHMAN	B.E.HONS.(MMU) (ELECTRONICS- COMPUTER, 2006)
97425	FAIRUZ RIZAL BIN A RASHID	B.E.HONS.(MMU) (ELECTRONICS-MULTIMEDIA, 2001) M.SC.(UITM)(QUANTITATIVE SCIENCES, 2005)
99444	MOHD REZAL BIN MOHD DAUD	B.E.HONS.(MMU) (ELECTRONICS-TELECOMMUNICATIONS, 2012)
99462	LUM SOONG LIT	B.E.HONS.(QUEEN'S UNI. OF BELFAST)(ELECTRICAL & ELECTRONIC, 2004) M.SC.(QUEEN'S UNI. OF BELFAST) (TELECOMMUNICATIONS, 2005)
99143	FAUZI BIN ABDUL WAHAB	B.E.HONS.(SHEFFIELD HALLAM UNI.)(ELECTRONIC SYSTEMS & INFORMATION ENGINEERING, 1997) M.E.(KUITTHO)(ELECTRICAL, 2005)
99202	ELHAM BUDI BIN MOHD ROZALI	B.E.HONS.(UITM) (ELECTRICAL, 2009)
99449	RAHMAT HIDAYAT BIN BASRAN	B.E.HONS.(UITM) (ELECTRONIC-INSTRUMENTATION, 2016)
0	NURSYUHAIDA BINTI CHE PAZIN	B.E.HONS.(UITM) (ELECTRONICS-COMMUNICATION, 2013)
0	AHMAD IZHAR BIN CHE OM	B.E.HONS.(UITM) (ELECTRONICS-INSTRUMENTATION, 2013)
99363	TAY LEE CHOO	B.E.HONS.(UNI. OF ESSEX) (ELECTRONIC SYSTEMS ENGINEERING-COMPUTER & COMMUNICATIONS, 1990) M.E.(UNITEN) (ELECTRICAL, 2017)
99464	LOW KAH KIN JUSTIN	B.E.HONS.(UNI. OF LEEDS)(ELECTRONIC & ELECTRICAL, 2011) M.SC.(UNI. OF LEEDS) (ELECTRICAL ENGINEERING & RENEWABLE ENERGY SYSTEMS, 2012)
97431	MOHD HAFIZ BIN MUKHTAR	B.E.HONS.(UNIMAP) (INDUSTRIAL ELECTRONIC, 2009)
99378	TAN KOK LONG	B.E.HONS.(UNIMAS) (ELECTRONICS-COMPUTER, 2016)
99414	DR. NOOR HAFIDZAH BINTI JABARULLAH	B.E.HONS.(USM) (ELECTRONIC, 2006) M.SC.(UNI. OF HULL) (ELECTRONIC, 2011) PHD.(UNI. OF HULL)(PHYSICS, 2014)
0	MOHD SHAHID BIN RAHIM	B.E.HONS.(UTEM) (ELECTRONICS-WIRELESS COMMUNICATION, 2012)
99459	HAZIZI BIN SARMIN	B.E.HONS.(UTM)(ELECTRICAL, 2002)
98413	WAN AFIQ HAFIZUDIN BIN WAN ABDUL HALIM	B.E.HONS.(UTM)(ELECTRONIC SYSTEMS, 2015)
99276	DR. WAHEB ABDULJABBAR SHAIF ABDULLAH	B.SC.(UNI. OF BASRAH) (ELECTRICAL, 2001) M.E.(UKM)(COMMUNICATION & COMPUTER, 2011) PHD.(UKM)(ELECTRICAL, ELECTRONIC & SYSTEM ENGINEERING, 2015)
99173	LHOBNA A/P SUBRAMANIAM	B.SC.(VIRGINIA POLYTECHNIC INS. & STATE UNI.) (ELECTRICAL, 2016)
99463	GOH ZENENG	M.E.HONS.(UNI. OF BIRMINGHAM)(ELECTRONIC & ELECTRICAL, 2011)
99467	TAN ENG YUAN	M.E.HONS.(UNI. OF BRISTOL) (ELECTRICAL & ELECTRONIC, 2014)

KEJURUTERAAN KIMIA

99148	CHOY MUN FONG	B.E.(UMP)(CHEMICAL, 2016)
99190	MUJAHID AZFAR BIN ABDUL RAHMAN	B.E.(UNI. OF ADELAIDE) (CHEMICAL, 2012)
99152	BEH JIA WEI	B.E.HONS.(MALAYA) (CHEMICAL, 2017)
99376	FIRNAAZ AHAMED	B.E.HONS.(TAYLOR'S UNI.) (CHEMICAL, 2014)
99284	BAWAANII SHANMUGARAJAH	B.E.HONS.(UCSI UNI.) (CHEMICAL, 2013) M.SC.(UPM)(CHEMICAL, 2017)
99438	DR. TAN JIAN PING	B.E.HONS.(UKM) (BIOCHEMICAL, 2013) PHD.(UKM)(CHEMICAL & PROCESS, 2017)
99393	MOHAMAD NADZRIE BIN LARY	B.E.HONS.(UMP)(CHEMICAL-GAS TECHNOLOGY, 2014)
99298	MOHD RIZAL BIN MOHD TAJUDDIN	B.E.HONS.(UPM)(CHEMICAL, 2001)
0	NORSYAZWIN FAIZA BINTI MOHAMAD	B.E.HONS.(UPM)(CHEMICAL, 2017)
98416	YOON LI WAN	B.E.HONS.(USM)(CHEMICAL, 2009) PHD.(MALAYA)(2015)
97483	YONG WAI YEE	B.E.HONS.(USM)(CHEMICAL, 2012)
97560	WONG KEE SEN, LOUIS	B.E.HONS.(UTAR KAMPAR) (CHEMICAL, 2018)
97488	P.PRAKAS A/L S.PALANYCHAMY	B.E.HONS.(UTAR) (CHEMICAL, 2012) M.E.SC.(UTAR)(2016)
99293	WONG ENG CHEONG	B.E.HONS.(UTAR)(CHEMICAL, 2018)
99410	DR. SITI MUNIRA BINTI JAMIL	B.E.HONS.(UTM)(CHEMICAL, 2007) M.E.(UTM)(CHEMICAL, 2011) PHD.(UTM)(GAS, 2017)
97427	DR. HAZLINI BINTI DZINUN	B.E.HONS.(UTM) (CHEMICAL, 2009) M.E.(UTM)CIVIL-ENVIRONMENTAL MANAGEMENT, 2012) PHD.(UTM)(GAS, 2016)
99301	CHUA CHENG LEE	B.E.HONS.(UTM)(CHEMICAL, 2010)
99434	AHMAD DZUHRI BIN JAAFAR	B.E.HONS.(UTM)(CHEMICAL-BIOPROCESS, 2008)
99285	HARVIN KAUR A/P GURCHRAN SINGH	B.E.HONS.(UTP) (CHEMICAL, 2012) M.SC.(UTP)(MECHANICAL, 2014)
99199	GAN WEI SIM	M.E.HONS.(TH EUNI. OF NOTTINGHAM)(CHEMICAL WITH ENVIROMNMENTAL, 2017)

KEJURUTERAAN KOMPUTER

97561	MOHAMMAD NASSEER BIN SAAD	B.E.HONS.(UTM)(COMPUTER, 2009)

KEJURUTERAAN MARIN

97552	MOHAMMAD ZAREEF BIN ARSAD	B.E.HONS.(UTM) (MECHANICAL-MARINE TECHNOLOGY, 2014)
99461	MUHAMMAD AMIR RAHIMI BIN ABDUL KADRI	B.E.TECH.(SAINT PETERSBURG STATE MARINE TECHNICAL UNI.) (SHIPBUILDING & OCEAN ENGINEERING, 2014)

KEJURUTERAAN MEKANIKAL

97496	MOHD KAMIL BIN HASAN	B.E.(TAKUSHOKU UNI.) (MECHANICAL SYSTEMS, 2011)
99406	AHMAD NASRULLAH BIN NORAZAMAN	B.E.(UMP)(MECHANICAL-AUTOMOTIVE, 2012) M.E.(UMP)(MECHANICAL, 2016)
97571	MOHD DZULKIFLI BIN ISMAIL	B.E.HONS.(IIUM) (MECHANICAL-AUTOMOTIVE, 2013)
99400	MIOR MUHAMMAD SIDDIQ BIN NOOR AZAM	B.E.HONS.(IIUM) (MECHANICAL-AUTOMOTIVE, 2017)
99365	KHOO SONG HENG	B.E.HONS.(LOUGHBOROUGH UNI. OF TECH.)(MECHANICAL & MATERIALS, 1993)
98420	LEE YI YONG	B.E.HONS.(MMU) (MECHANICAL, 2013)

99386	TEOH YI	B.E.HONS.(MONASH UNI.) (MECHANICAL, 2016)
97494	FOO TZEH YIANG, GABRIEL	B.E.HONS.(MONASH) (MECHANICAL, 2017)
99411	MUHAMAD ADIB BIN CHE JAFRI	B.E.HONS.(NOTTINGHAM) (MECHANICAL, 2015) M.E.(UKM)(MECHANICAL, 2017)
97557	LIEW WUI SEN	B.E.HONS.(SWINBURNE UNI. OF TECH.)(MECHANICAL, 2011)
98422	TEO YING MIN	B.E.HONS.(TAR UNI. COLLEGE)(MECHANICAL, 2016)
0	MOHD HAFIZI BIN ABDUL RAHMAN	B.E.HONS.(THE UNI. OF WESTERN AUSTRALIA) (MECHANICAL, 2014)
0	AZWAN FADZLI BIN MUSAH	B.E.HONS.(UITM) (MECHANICAL, 2015)
99290	AILI HATMAL BIN IDRIS	B.E.HONS.(UKM) (MECHANICAL & MATERIALS 1996)
98419	MUHD. HAFEEZ BIN ZAINULABIDIN	B.E.HONS.(UMIST) (MECHANICAL, 2002) PHD.(STRATHCLYDE GLASGOW)(MECHANICAL, 2008)
99200	NUR SHAMIMI BINTI SHAHIROL	B.E.HONS.(UMP) (MECHANICAL, 2016)
97422	NEO WEI QI, ADELINE	B.E.HONS.(UMP) (MECHANICAL, 2016)
99402	HANAFIAH BIN YAKOB	B.E.HONS.(UMS) (MECHANICAL, 2007)
99291	LIEW CHEE YOONG	B.E.HONS.(UMS) (MECHANICAL, 2016)
99398	MOHD HANAFEE BIN ZIN	B.E.HONS.(UNI. OF CANTERBURY)(MECHANICAL, 2009)
99447	RAJESWARAN VAITHYLINGAM	B.E.HONS.(UNI. OF SHEFFIELD) (MECHANICAL, 2007) M.E.(UNITEN)(MECHANICAL, 2018)
99299	SAKTHIVELAN KHODANDAN	B.E.HONS.(UNI. OF SUNDERLAND) (MECHANICAL, 2015) M.E.(MALAYA)(MECHANICAL, 2017)
99397	THARANIDARAN A/L VASUTHEVAN	B.E.HONS.(UNI. OF SUNDERLAND) (MECHANICAL, 2015) M.E.(MALAYA)(MECHANICAL, 2017)
99423	NUR SHAZILA BINTI BAHARUDIN	B.E.HONS.(UNIKL-MFI) (MECHANICAL, 2017)
99392	VIJAYAGANT LADCHUMIGANDAN	B.E.HONS.(UNISEL) (MECHANICAL, 2008)
97416	VENGKATA GIRI A/L ENGKANNAH	B.E.HONS.(UNISEL) (MECHANICAL, 2012)
97551	MOHAMAD RIDZUAN BIN JAMLI	B.E.HONS.(UNITEN) (MECHANICAL, 2003)
99383	HOR ZHENG HONG	B.E.HONS.(UNITEN) (MECHANICAL, 2012)
99185	MUHAMMAD ZAIDI FAHMI BIN MOHD NOORDIN	B.E.HONS.(UNITEN) (MECHANICAL, 2012)
99391	DR. TEH YEE CHING	B.E.HONS.(UNITEN) (MECHANICAL, 2012) PHD.(MALAYA) (MANUFACTURING PROCESSES, 2017)
99205	JIVITHAN A/L KANDEEBAN	B.E.HONS.(UNITEN) (MECHANICAL, 2013)
99448	PRAVIN A/L GUNASEGRAN	B.E.HONS.(UNITEN) (MECHANICAL, 2013)
99192	CHEN JINN SHIUAN	B.E.HONS.(UNITEN) (MECHANICAL, 2014)
99167	MOHAMAD EZWAN BIN ZAINUDIN	B.E.HONS.(UNITEN) (MECHANICAL, 2016)
99140	RAJA MUHAMMAD IKHWAN ASYRAF BIN RAJA YAHYA	B.E.HONS.(UNITEN) (MECHANICAL, 2016)
99307	ARVIND A/L RAMAKERISHNAN	B.E.HONS.(UNITEN) (MECHANICAL, 2017)
99413	NOR AIDA BINTI ALI	B.E.HONS.(UNITEN) (MECHANICAL, 2017)
99424	HARMAN BIN RAMLI	B.E.HONS.(UPM) (MECHANICAL, 2006)
99197	MUHD RAMZAN BIN ABD RAZAK	B.E.HONS.(USM) (MECHANICAL, 2004)
99182	CHEN CHI PIN	B.E.HONS.(UTAR) (MECHANICAL, 2017)
99186	AMAR RIDZUAN BIN ABD HAMID	B.E.HONS.(UTEM) (MECHANICAL-AUTOMOTIVE, 2011) M.E.M.(UPM)(ENGINEERING, 2015)
99304	MOHD NASHRUL ASHRAF BIN MOHD NASRIN	B.E.HONS.(UTEM) (MECHANICAL-AUTOMOTIVE, 2016)
99305	MUHAMMAD SYAFIQ BIN M RADZALI	B.E.HONS.(UTEM) (MECHANICAL-PLANT & MAINTENANCE, 2015)
99297	MOHD HASRUL HAZRIN BIN MOHAMMAD HUSSAIN	B.E.HONS.(UTEM) (MECHANICAL-STRUCTUR E& MATERIAL, 2016)
97424	RASIDIN BIN SENAWI	B.E.HONS.(UTEM) (MECHANICAL-STRUCTURE & MATERIAL, 2009)
99412	MOHD AUDI AIZAT BIN MOHD ZIM	B.E.HONS.(UTEM) (MECHANICAL-STRUCTURE & MATERIAL, 2012)
97434	ADAM HARIZ BIN AUGUSTINE	B.E.HONS.(UTHM) (MECHANICAL, 2008)
98415	MUHAMMAD FADZLI BIN NUH	B.E.HONS.(UTHM) (MECHANICAL, 2011)
0	NUR AQILAH BT LILA ZAM ZAM	B.E.HONS.(UTHM) (MECHANICAL, 2014)
99159	MUHAMMED HARITH KHAN BIN AKTAR KHAN	B.E.HONS.(UTHM) (MECHANICAL, 2015)
99390	ABDULLAH AFFAN BIN KHALID	B.E.HONS.(UTM) (MECHANICAL PRECISION, 2015)
99194	SEE HAU YEE	B.E.HONS.(UTM) (MECHANICAL PRECISION, 2017)
99160	YAP KIAN KUN	B.E.HONS.(UTM) (MECHANICAL PRECISION, 2017)
97426	HAFIZ BIN SHAMSULHUDA	B.E.HONS.(UTM) (MECHANICAL, 2004)
99435	MOHD HASNI BIN MOHD TAMIN	B.E.HONS.(UTM) (MECHANICAL, 2016)
99385	MUHAMMAD AZMAN BIN AB GHANI	B.E.HONS.(UTM) (MECHANICAL, 2017)
99289	MUHAMMAD SYAHMI BIN SULAIMAN	B.E.HONS.(UTM) (MECHANICAL-AUTOMOTIVE, 2008)
0	ZULHELMI BIN MOHD ALI	B.E.HONS.(UTM) (MECHANICAL-INDUSTRIAL, 2008)
99141	ASHLEY LIMAN	B.E.HONS.(UTM) (MECHANICAL-INDUSTRIAL, 2011)
99163	DAUD SAIK MARICAN BIN ZAKARIA	B.E.HONS.(UTM) (MECHANICAL-INDUSTRIAL, 2013)
99184	DR. NIK MOHD RIDZUAN BIN SHAHARUDDIN	B.E.HONS.(UTM) (MECHANICAL-MARINE TECH., 2011) PHD.(MECHANICAL, 2015)
99146	LOW HUEI MING	B.E.HONS.(UTP) (MECHANICAL, 2013)
99288	MOHD ASEANAZANI BIN KAMARUDIN	B.SC.(KETTERING UNI.) (MECHANICAL, 2001)
99287	MARZUKI BIN MUSTAFFA	B.SC.(KOREA UNI.) (MECHANICAL, 2013)
97435	AHMAD SYAFIQ AIMAN ZULKIPLI	B.SC.(RENSSELAER POLYTECHNIC INST.) (MECHANICAL, 2008) M.SC.(UITM)(CIVIL-CONSTRUCTION, 2014)
99156	MOHAMMAD ZAMZAMI BIN ISMAIL	B.SC.(SYRACUSE UNI.) (MECHANICAL, 2003)
99145	MUHAMMAD SYAFIQ HANIFFAH BIN ROSLAN	B.SC.(UNI. OF ALBERTA) (MECHANICAL, 2017)
99158	MOHAMMAD FAKHRI BIN NORDIN	M.E.HONS.(BRUNEL UNI. LONDON)(MECHANICAL, 2017)
99430	NG TECK CHUAN	M.E.HONS.(NOTTINGHAM) (MECHANICAL, 2011)
98421	NAH WEI LOON	M.E.HONS.(UNI. OF LEEDS) (MECHANICAL, 2015)

KEJURUTERAAN MEKATRONIK

99300	MUHAMAD FARUQI BIN ZAHARI	B.E.(UMP)(MECHATRONICS, 2013) M.E.(UMP) (INSTRUMENTATION, 2016)
97497	THEENGAHARAN A/L MUTHUSAMY	B.E.HONS.(APU) (MECHATRONIC, 2012)
97428	DR. FATANAH MOHAMAD SUHAIMI	B.E.HONS.(IIUM) (MECHATRONICS, 2008) PHD.(UNI. OF CANTERBURY) (MECHANICAL, 2013)
0	MUHAMMAD HARIS BIN AHMAD FAUZI	B.E.HONS.(IIUM) (MECHATRONICS, 2014)
99416	MUHAMMAD IKMAL HAKIM BIN SHAMSUL BAHRIN	B.E.HONS.(IIUM) (MECHATRONICS, 2017)
99415	ZUL FADLI BIN RUSLI	B.E.HONS.(IIUM) (MECHATRONICS, 2017)
97436	MUHAMMAD AFIF BIN MANSOR	B.E.HONS.(UNISEL) (MECHATRONICS, 2011)

KEJURUTERAAN PEMBUATAN

97493	CHEONG JAN XI	B.E.HONS.(BRADFORD) (INDUSTRIAL, 2010) M.E.M.(UPM)(2016)
97489	MUHAIMIN MUSTAQIM BIN JAMALUDIN	B.E.HONS.(UITM) (MECHANICAL-MANUFACTURING, 2017)
99418	ZULIANI BINTI ZULKOFFLI	B.E.HONS.(UKM) (MANUFACTURING, 2007) M.SC.(UKM)(MECHANICAL & MATERIALS, 2010)
97564	MUSFIRAH BINTI ABDUL HADI	B.E.HONS.(UKM) (MANUFACTURING, 2008)
99372	AIMAN BIN ABDUL HAI	B.E.HONS.(UTEM) (MANUFACTURING-MANUFACTURING DESIGN, 2012)
99375	NUR SYAFIQAH BINTI RAYME	B.E.HONS.(UTEM) (MANUFACTURING-MANUFACTURING MANAGEMENT, 2016)
99419	JAILANI BIN JAMALUDIN	B.E.HONS.(UTEM) (MANUFACTURING-ROBOTICS & AUTOMATION, 2012) M.SC. (UTEM)(MANUFACTURING, 2015)

KEJURUTERAAN PERTANIAN

97562	YAP CHORNG SHIN	B.E.HONS.(UPM)(BIOLOGY & AGRICULTURAL, 2002)

KEJURUTERAAN PETROLEUM

99144	KHAIRUL BIN ANUAR	B.E.HONS.(UTP)(PETROLEUM, 2017)

KEJURUTERAAN PROSES MAKANAN

99153	AIRULMI BIN MOKHTAR	B.E.HONS.(UPM)(FOOD & PROCESS, 2002)
99178	CLARENCE BILLY ANAK BIJUG	B.E.HONS.UPM)(FOOD & PROCESS, 2017)

KEJURUTERAAN TELEKOMUNIKASI

97433	SEE BEE LOON	B.E.HONS.(MALAYA) (TELECOMMUNICATION, 2012)

PERMOHONAN MENJADI AHLI 'INCORPORATED'

No. Ahli	Nama	Kelayakan
KEJURUTERAAN AWAM		
99177	TAN YII TA, GERALD	B.E.HONS.(THE UNI. OF LEEDS)(CIVIL & STRUCTURAL, 2007)
KEJURUTERAAN BIOPERUBATAN		
99133	CELESTINE SELVARETNAM GASTON RAVIN DIAS	B.E.HONS.(BIRMINGHAM CITY UNI.)(BIO-MEDICAL, 2016)

Note: *Continuation of the Transfer Graduate, Graduate, Incorporated, Affiliate and Associate would be published in November 2018. For the list of approved "ADMISSION TO THE GRADE OF STUDENT", please refer to IEM web portal at http://www.myiem.org.my.*

Pengumuman yang ke-120

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NO.	NO. AHLI	NAMA
1	22916	CHAN CHEE KIT
2	22704	IRMAN JOHAN BIN AZMI
3	14355	KADRISMAN BIN SARAJOOL
4	08165	TAI FONG NG

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JURUTERA has an estimated readership of **168,000** professionals. Our esteemed readership consists of certified engineers, decision making corporate leaders, CEOs, government officials, project directors, entrepreneurs, project consultants, engineering consulting firms and companies involved with engineering products and services.

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Our business partners can be assured that their products and services will be given the circulation and exposure they deserve, thus maintaining a sustained advertising presence to our core readers of decision-making engineers and technical experts. Our website offers an even wider market reach, with added international presence, aided by our international affiliation with official engineering bodies all over the world. Our online and offline advertising features such as banner advertising, article sponsorship and direct e-mail announcements have proven to be successful marketing strategies that will set the businesses of our partners apart from their competition.

ADVERTISING RATES

	PRICES PER INSERTION IN RINGGIT MALAYSIA (RM)				
SPECIFIED POSITION (Full Colour Ad)	**1 INSERTION**	**3 INSERTIONS**	**6 INSERTIONS**	**9 INSERTIONS**	**12 INSERTIONS**
Outside Back Cover (OBC)	7,800	7,050	6,750	6,450	6,150
Inside Front Cover (IFC)	7,250	6,650	6,350	6,050	5,750
Inside Back Cover (IBC)	6,750	6,250	5,950	5,650	5,350
Page 1	6,650	6,150	5,850	5,550	5,250
Facing Inside Back Cover (FIBC)	6,150	5,850	5,550	5,250	4,950
Facing Cover Note (FCN)	5,850	5,300	5,100	4,900	4,700
Facing Contents Page (FCP)	5,700	5,150	4,950	4,750	4,550
Centre Spread	11,200	9,500	9,000	8,500	8,000
ROP Full Page	4,900	4,500	4,300	4,100	3,900
ROP Half Page	2,900	2,650	2,550	2,450	2,350
ROP 1/3 Column	2,200	2,000	1,900	1,850	1,800
ROP 1/4 Page	1,950	1,750	1,650	1,600	1,550

Special Position: +15%
Overseas Advertiser: +25% (Full Advance Payment Required)
All prices shown above exclude Computer to Plate (CTP) charges

****From 1 September 2018, the prices listed above will be subjected to SST***
****Advertising rates displayed do not include 15% advertising agency commission***

For advertising enquiries, please contact:

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