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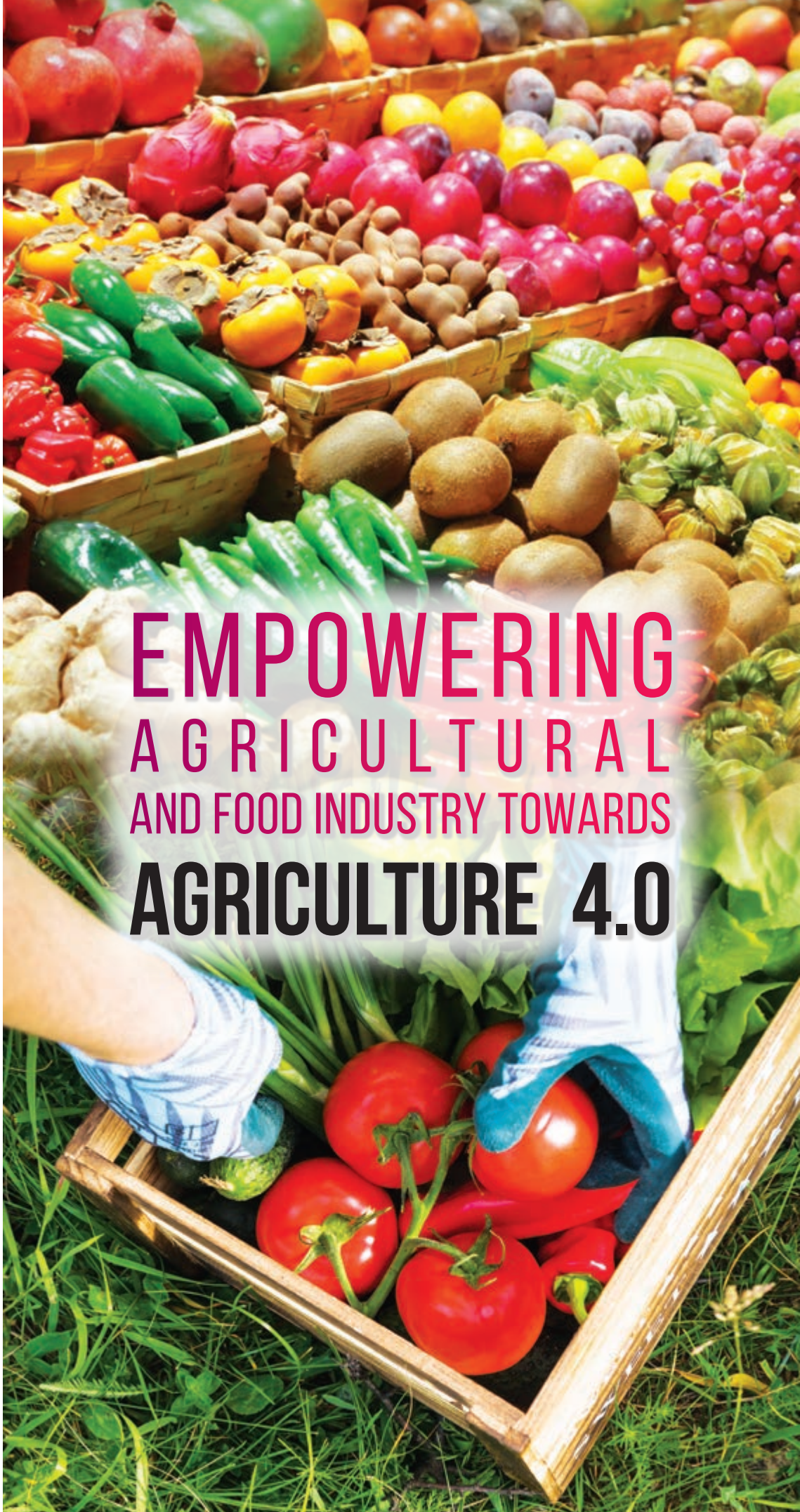

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THE INSTITUTION OF ENGINEERS, MALAYSIA
Bangunan Ingenieur, Lots 60 & 62, Jalan 52/4, P.O. Box 223, (Jalan Sultan), 46720 Petaling Jaya, Selangor Darul Ehsan.
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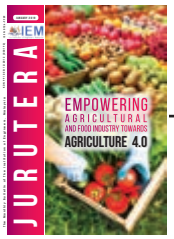

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Joseph How : +6011 1234 8181 Shirley Tham : +6016 283 3013

DIMENSION PUBLISHING SDN. BHD. (449732-T)
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Tel: +(603) 7493 1049 Fax: +(603) 7493 1047
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Chairman ROBERT MEBRUER

CEO/Publisher PATRICK LEUNG

General Manager SHIRLEY THAM
shirley@dimensionpublishing.com

Head of Marketing & Business Development JOSEPH HOW
joseph@dimensionpublishing.com

Production Editor TAN BEE HONG
bee@dimensionpublishing.com

Contributing Writers PUTRI ZANINA & ZOE PHOON
putri@dimensionpublishing.com
zoe@dimensionpublishing.com

Senior Graphic Designer SUMATHI MANOKARAN
sumathi@dimensionpublishing.com

Graphic Designer NABEELA AHMAD
beela@dimensionpublishing.com

Advertising Consultants THAM CHOON KIT
ckit@dimensionpublishing.com

Accounts cum Admin Executive YEN YIN
yenyin@dimensionpublishing.com

For advertisement placements and subscriptions, please contact:

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Tel: +(603) 7493 1049 Fax: +(603) 7493 1047
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Mailer

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Chief Editor
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Lots 60 & 62, Jalan 52/4, P.O. Box 223 (Jalan Sultan),
46720 Petaling Jaya, Selangor.
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cover note

TOWARDS SUCCESS IN AGRICULTURE 4.0

by Ir. Vasan Mariappan
Chairman,
Agricultural & Food Engineering Technical Division

Aimed at increasing productivity of crops with high consideration for environmental sustainability, Agriculture 4.0 comprises the application of automation, smart and independent systems as well as data and machine learning for the agritech sector, much like the 4IR. Large organisations with financial capacity and research facilities are able to implement Agriculture 4.0.

Precision farming – use of advanced sensors, robotics, GPS and drones – may be practical in a controlled environment but it can be a challenge in open agricultural land.

Standards for agricultural fields need to be developed or enhanced and, in certain aspects, be enforced for successful implementation of Agriculture 4.0. Increase in labour costs and scarcity of agricultural land are two main factors, with safety as the prime concern. The government, through bodies like MARDI, has done much in breakthrough findings but interest from private or corporate bodies is still lagging.

The Agricultural & Food Engineering Technical Division (AFETD) finds it timely to highlight these matters and urges all organisations responsible to play their roles towards the successful implementation of Agriculture 4.0. ■

editor's note

by Ir. Razak Yakob
Bulletin Editor

Salam & Hello All IEMers,

Happy New Year! Achieved last year's resolutions? Don't worry if you haven't achieved those made last year because you can give them another try. The beauty of being Malaysians is that each year, we have a number of "New Years" that we can reset our resolution timings to.

This month, the Agricultural & Food Engineering Technical Division is focusing on Agriculture 4.0. Let's find out how hard engineers work to make sure things run smoothly in this industry.

Mark your calendar for 20 April, 2019. It's the IEM-AGM in the morning and the Annual Dinner at night. Just block the whole day and join in the activities. Wonder who the Guest of Honour is? All I can say is, book your seats/tables early.

April 2019 is special because IEM is turning 60, the "warga emas" age. You can submit articles and pictures to share in our special anniversary issue of *JURUTERA*.

The Editorial Board would like to wish all Hindus ***"Happy Thaipusam"*** and, in case you didn't get your February issue of *JURUTERA* on time, ***"Happy Chinese New Year"***!

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

EMPOWERING AGRICULTURE & FOOD INDUSTRY TOWARDS AGRICULTURE 4.0

While the advanced world has moved towards Agriculture 4.0, Malaysia's agriculture sector has remained in Agriculture 2.0, which is largely labour-intensive instead of technology-driven. It is now more crucial for Malaysia to prepare for food sustainability and security, and to leap-frog to Agriculture 4.0 with more efficient, safe and environmentally friendly farming technology.

The buzz word in agriculture today is Agriculture 4.0. According to a report titled Agriculture 4.0 – The Future Of Farming Technology, released after the World Government Summit 2018 in Dubai, UAE on 11-13 February, 2018, Agriculture 4.0 is aimed at meeting global food demands of the future. It said that with demand continuously growing, the world needs to produce 70 per cent more food by 2050. Agriculture's share of global GDP has shrunk to a mere 3 per cent, which is one-third of its contribution decades ago.

The report also states that about 800 million people worldwide suffer from hunger and that 8 per cent of the world's population (or 650 million) will still be undernourished by 2030. To meet these challenges will require a concerted effort by governments, investors and innovative agricultural technologies.

With Agriculture 4.0, farmers will no longer have to apply water, fertiliser and pesticide uniformly across entire fields, for instance. Instead, they will use the minimum quantities required and target very specific areas. The report adds that farms and agricultural operations will be run differently, mainly due to advancements in

technology, such as sensors, devices, machines and information technology.

Future agriculture will use sophisticated technologies such as robots, temperature and moisture sensors, aerial images and GPS technology. These advanced devices and precision agriculture and robotic systems will allow farms to be more profitable, efficient, safe and environmentally friendly.

At the Dubai Summit, governments were urged to play a key role in solving the issue of food scarcity by taking on broader and more prominent roles than their traditional regulatory and facilitating function. The roles identified were:

- Ensuring food security and reducing dependency on imports.
- Becoming a net exporter of products as well as Intellectual Property (IP) and new solutions.
- Increasing productivity and supporting the shift towards an innovation-and knowledge-based economy.

AGRICULTURE 4.0 & INDUSTRIAL REVOLUTION

Agriculture 4.0 is a sub-set of the Industrial Revolution 4.0. IM BizWatch (September 2017 issue) which recounts the beginning of the Industrial Revolution in the 18th Century when the world was first introduced to steam power, mechanisation and factories. These marked the then new era of modernisation.

The British were the enablers who cultivated their growing interest in scientific investigation and invention. As time progressed, the rapid growth of technology sparked the Second Industrial Revolution, taking mankind to the age of electricity. Many new products were invented and significant developments were made in the structure of mass production.

Decades after World War II, the third epoch of the Industrial Revolution (better known as the Digital Revolution) began. This saw the advent of computers and the initial stages of automation that saw robots and machinery beginning to take over from human labour in assembly lines.

The world has now entered the era of Industry Revolution 4.0 (4IR) with the increased use of robotics that are equipped with algorithms. This period is characterised by a fusion of technologies with a blurring of lines between the physical, digital and biological spheres.

The 4IR trend is transforming the production capabilities of all industries, including the agriculture sector. According to the European Commission (EC), in its publication, Digital Transformation Monitor (July 2017 issue: https://ec.europa.eu/growth/tools-databases/), the trend is building on an array of digital technologies: IoT, Big Data, Artificial Intelligence and digital practices which will see the transformation of production infrastructures: Connected farms, new production equipment, connected tractors and machines. The EC also reports that these will enable both an increase in productivity, quality and environmental protection while generating modifications in the value chain and business models with more emphasis on knowledge gathering, analysis and exchange.

IM BizWatch (September 2017 issue) also states that based on research conducted by PwC (UK-based research centre www.pwc.co.uk/pwcresearch), Malaysia is currently still in Industry 2.0.

Since the British colonial era, 70-80 per cent of Malaysian industries are still wedged in the second industrial era with its prevalent labour

INNOVATIVE FARMING METHODOLOGIES UNDER AGRICULTURE 4.0

Under Agriculture 4.0, new farming methodologies are primarily aimed at increasing the productivity of crops while ensuring a higher environmental sustainability… in short, to produce more and better with less. Tools, techniques and technologies identified under Agriculture 4.0 include the following:

1. Drones

The use of drones (unmanned aircrafts) is starting to be developed in the Agritech sector in several ways. One of the most common uses is the capture of images of the crops. These images are then analysed with SW programmes (Software programming environment development) which provide information on how the crops are growing. This way, the farmer will know, for instance, which areas need to be watered more intensively (the analysis here is usually based on the radiation that the vegetables release or reflect in certain bands of the EM spectrum), where there are more weeds to remove or if there is presence of plague.

It is also possible to use drones as remote fertilising vehicles. By placing fertilisers on the aircrafts and defining the route it will have to follow, farmers can fertilise specific areas of the farm or even individual plants.

2. Internet of Things (IoT)

The Agritech sector is considered as one of the areas with bigger growth potential within the IoT industry. Deploying IoT devices in farmlands capable of remotely sending data related with the crops opens a whole new world of possibilities.

These devices may include a number of sensors which measure several parameters affecting the evolution of the crops, such as the soil moisture and the temperature or the electrical conductivity of the ground. Such data allows a real time monitoring of the status of the crops as well as, through statistical models, predicting when watering or fertilising of certain areas is required.

Actuators can be part of IoT deployments as well, for example, to automatically enable watering in a specific area when sensors report that soil moisture is under 30 per cent.

3. Blockchain

In the food industry, one of the initiatives involving Blockchain technology is related to ensuring the origin of food. By using solutions based on Smart Contracts, it is possible to record the transactions in a Blockchain – from the moment the 'raw material' is planted (such as cereal and fruit) and harvested in a farmland to the time it is bought by a consumer.

This can ensure the legitimacy and origin of each transaction. The treatment given to the product itself can be controlled throughout the whole chain and labelling can also be ensured at

intensive phase and the country continues to depend heavily on foreign labour for its production.

A mindset change is needed for Malaysia to embrace new technologies so as to increase efficiency and productivity and to expand markets through digital platforms, including in the agriculture sector, which is also still in the Industry 2.0 phase.

MODERNISING THE AGRO-FOOD SECTOR

Major agro-products that drive the Malaysian economy are palm oil, rubber and cocoa. Besides these commodities, there are also padi, tropical fruit and vegetables. The contribution of the agriculture sector to Malaysia's GDP is still small, at just 8.17 per cent or RM37.4 billion last year.

Malaysia still relies heavily on food imports, despite being blessed with land and natural resources. In a New Straits Times online report (www.nst.com.my/news/nation/2017/08/265748/), Deputy Agriculture and Agro-based Industry Minister Datuk Anthony Nogeh Gumbek said that from January to October last year, food imports were recorded at RM38.1 billion, while exports for the same period were only at RM24.3 billion.

"We are still heavily reliant on imports to feed the population. Therefore, in order to reduce our import, there is a need for us to improve our food production in term of fisheries, rice and poultry," he said, adding that the government and the Ministry have undertaken measures to be more self-sustainable in the future.

One of the measures is to spur the modernisation of the country's agro-food sector, which is the key aim of the National Agro-Food Policy 2021-2030.

Prime Minister Tun Dr Mahathir Mohamad, in a Bernama report dated 22 November, 2018, said that the Malaysian government was in the process of drafting the Agro-Food 2.0 policy. He said the Government will emphasise the development of infrastructure and the use of modern technology, the provision of human capital and commercialisation of agriculture, including innovation in the key sectors.

Apart from managing demand and supply, Tun Dr Mahathir said the new policy will also entail restructuring strategies to expedite modernisation. The policy will also streamline government and private sector investments for infrastructure development, human capital building for agriculture, research and development, commercialisation and innovation.

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4. Autonomous & Robotic Labour

Most aspects of farming are exceptionally labour-intensive, with much of that labour comprised of repetitive and standardised tasks — an ideal niche for robotics and automation.

Agricultural robots (AgBots) can perform tasks ranging from planting and watering to harvesting and sorting. Eventually, this new wave of smart equipment will make it possible to produce more and higher quality food with less manpower.

5. Driverless Tractors

The tractor is the heart of a farm and is used for multiple tasks, depending on the type of farm and the configuration of its ancillary equipment. In the early stages, human effort will still be required to set up field and boundary maps, to programme the best field paths using path planning software and to decide other operating conditions. Humans will also be required for regular repair and maintenance of equipment.

Over time, autonomous tractors will become more capable and self-sufficient, especially with the inclusion of additional cameras and machine vision systems, GPS for navigation, IoT connectivity to enable remote monitoring and operation and radar and LiDAR for object detection and avoidance. All such technological advancements will significantly diminish the need for humans to actively control these machines.

Sources and pictures:

https://medium.com/iot-security-review/agriculture-4-0-what-is-it-9bb654b7fca5

He added that the government will also develop alternative inputs and look into new sources of income such as coconut, watermelon, starfruit and durian, which have a huge demand locally and globally. The new sources will be exploited via various research and development efforts and other measures, including from the aspect of business models, logistical support in terms of collection and distribution, refrigeration facilities and optimisation of transportation machinery.

The Prime Minister reaffirmed that the agriculture sector will remain important and relevant because it is no longer seen as food production per se but is accepted as a vital factor in assuring food security, which is interpreted as sufficient supply of food for each citizen at any one time, whether locally produced or imported.

In the 2017 Economist Intelligence Unit's (EIU) Global Food Security Index, Malaysia ranked 41 out of 113 countries, faring not too ideally in the category of "sufficiency of supply". Some food security challenges that we are facing are the lack of land resources, idle land and shortages in the agricultural workforce. Although there are many factors and approaches to solve them, an immediate means is to use science and technology to not only increase productivity but also to value-add. Both science and technology, coupled with a sustainable business model, will benefit the economy and, at the same time, help improve food security.

AGRICULTURE & 11TH MALAYSIA PLAN

Under the 11th Malaysia Plan (11MP), the country's current development programme which runs from 2016 until 2020, the agriculture sector is set to undergo a major modernisation drive. This scheme involves a seven-pronged strategy, starting with improving productivity and ending with the intensification of performance-based incentives and certification programmes.

Between these two, there will be efforts to promote the training and development of youth entrepreneurs in the agriculture sector, the strengthening of institutional support, capacity building for agricultural associations, the improvement of market access and logistical support as well as a scaling-up of access to agricultural financing. The aim is for these measures to create a sector showing 3.5% annual growth through to 2020, contributing 7.8 per cent of GDP, or RM519 billion and employing 1.6 million people. By value, the sector will be split into 57.6 per cent industrial crops – such as palm oil and rubber – and 42.4 per cent agro-food by the end of the plan period.

In terms of productivity, emphasis will be given to the increased use of ICT in plantations and agriculture, boosting more efficient management and mechanisation, while agricultural land is to be gazetted by state governments and incentives given to boost construction of farm roads. Existing research and development and commercialisation projects will also be directed towards boosting efficiencies in combating pests and diseases, the production of new seeds and animal feeds as well as the development of more green products.

MOVING FORWARD

It is now far more urgent than ever for Malaysia to invest in the right education to develop the country's talents. Both the young and old generation must truly be ready to shift towards a knowledge-based economy. Government and policies must gear toward the implementation of technological engineering advancements in order to move towards a more sustainable and promising future. Looking ahead to the advent of Industry 4.0, the trend toward increasing automation of jobs and the use of data, policies concerning education and technology must be put in place immediately. Malaysia marching forward to Agriculture 4.0! ■

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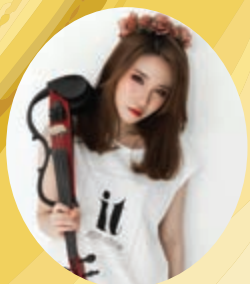

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FEATURE

NON-THERMAL PASTEURISATION OF LIQUID FOODS

Dr Nor Nadiah Abdul Karim Shah

Consumers around the world are demanding safe, healthy and almost natural-like products with desirable appearances. This can be achieved by monitoring the process that changes the nutritional and qualitative characteristics, particularly the pasteurisation process.

Fruit juices are usually flash pasteurised; in fact, 98% of all juices are heat pasteurised (NFPA, 1999). This is a type of high-temperature-short-time (HTST) pasteurisation method that utilises rapid heating and cooling steps. Thermal pasteurisation process of fruit juices typically involves heating to 90-95°C for 15-20 seconds (Torlak, 2014). This conventional process is designed to inactivate pertinent microorganisms and unwanted endogenous enzymes that may degrade the fruit juice.

Pasteurisation effectively produces products that are safe and have a longer shelf-life; the synergistic effect of treatment time and temperature is also proportional to the amount of quality and nutritional loses (*Dolatowki et al., 2007*). The high energy treatment involved in thermal pasteurisation usually diminishes vitamins, essential nutrients and food flavours in the product (Barbosa-Canovas & Bermudez-Aguirre, 2011). Various studies prove that thermal pasteurisation causes detrimental effects on the juice quality. Nutritional content, chemical, antioxidant and sensory attributes have been reported to be directly affected by the heat. However, thermal treatments still dominate the industry as these are relatively stable and efficacies are guaranteed. So, any new technology to replace the thermal pasteurisation technique should be able to offer additional advantages, in terms of cost, product quality and value-added functional properties that are not available via thermal treatment alone (*Coutinho et al., 2018*).

This has led to increasing interests in various non-thermal technologies (Figure 1). Ultraviolet (UV-C), pulsed electric field (PEF), ozone (O_3), and cold plasma are the ones chosen for their suitability for liquid food pasteurisation. These technologies have been extensively researched and applied to various fruit juice samples in order to comply with United States Food & Drug Administration (FDA, 2004) regulations that that liquid food processors must achieve a minimum of 5-log reduction of pertinent

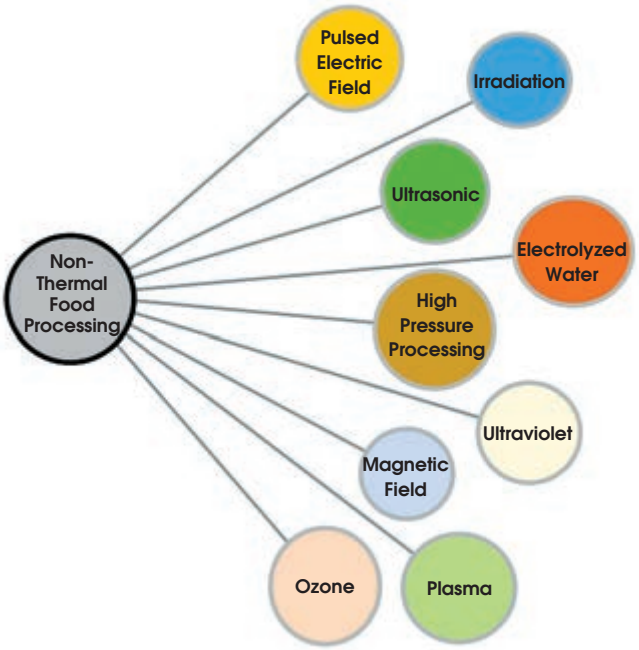

Figure 1: Novel food processing techniques adopted by the food industry in recent times (from Khan et al., 2017)

microorganisms to market their products to the masses. An added advantage is the ability to deactivate spoilage and pathogenic microorganisms, while prolonging shelf-life without compromising the fresh-like quality.

Ultraviolet (UV-C) utilises light with intense and short-duration pulses of electromagnetic spectrum from 200 to 280 nm with a radiant exposure of at least 400 J/m^2 to inactivate pertinent microorganisms in liquid foods (Li & Farid, 2016). Its bactericidal mechanism is based on the absorption of UV-C light by microbial DNA or RNA structures. The primary mechanism is the creation of pyrimidine dimers to damage microorganism DNA, thus preventing microorganisms from replicating, further rendering them inactive and unable to cause food-borne illness.

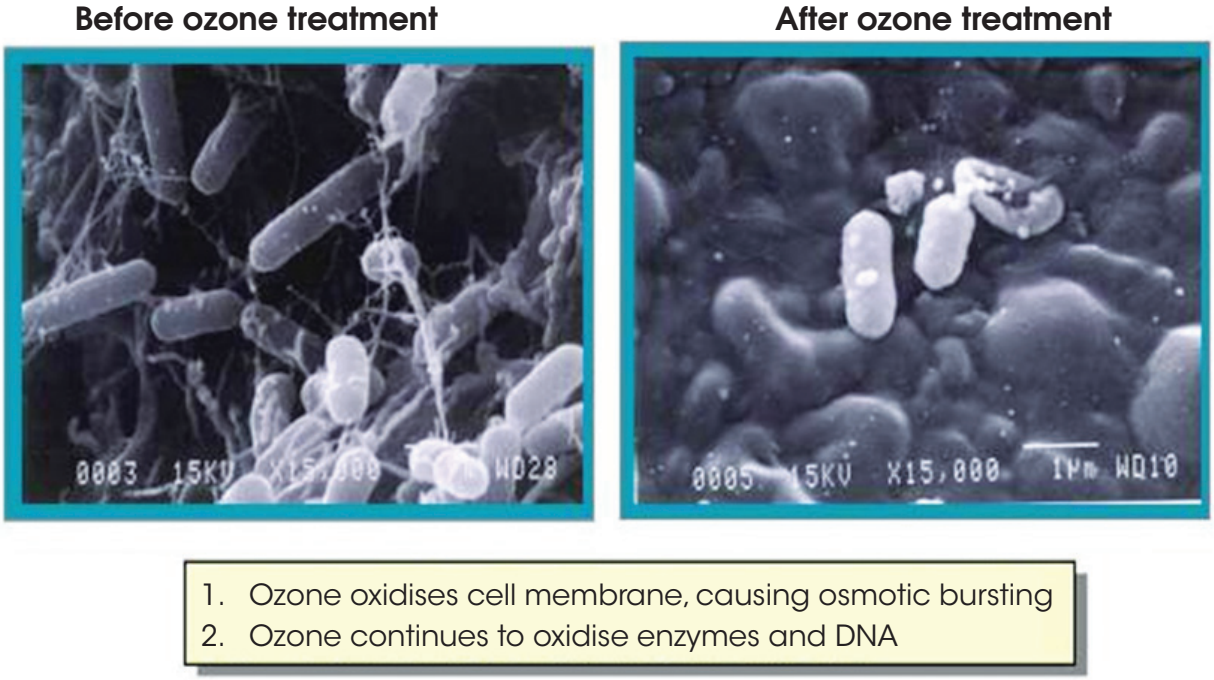

Figure 2: Microbial inactivation via ozone treatment (Yuan et al., 2000)

With the positive consumer image and low processing cost, the use of UV-C light for water treatment is well established and is currently in use to treat and kill pathogens in drinking water. However, its application in liquid foods presents a relatively new challenge to beverage producers, based on complexities posed by liquid foods which often lead to complications during pasteurisation using non-thermal technologies. This slows down the progress of the use of UV-C in food industry.

Unlike water, liquid foods have a range of optical and physical properties and diverse chemical compositions which may influence UV-C light transmittance, dose delivery, momentum transfer and consequently microbial inactivation (*Shah et al., 2016*). The intrinsic factors of liquid food – its opacity and solid components – are often the barriers to achieving microbial inactivation efficacy. Hence, the ability of juice to absorb the electromagnetic spectrum is important in gauging the technology efficacy against pertinent microbial populations in the juice.

Studies on UV-C are now focused on the development of new reactors with improved hydrodynamics design to induce thin-film flow regime, ensuring full exposure of target microorganisms to UV-C light (Li & Farid, 2016). Furthermore, UV-C does not generate any chemical residue or significant amounts of heat during processing. Positioning UV-C treated juices as premium products with relatively lower investment costs and quicker payback period can be attractive for small scale manufacturers (*Shah et al., 2016*).

Pulsed electric field (PEF) technology has been extensively investigated in recent years for application in food processing. It can be used to process liquids and semi-liquids with minimal qualitative changes.

PEF emits short pulses of high voltage, of between two electrodes (20-80 kV/cm) at short duration (1-100 µs), which causes electroporation in the cell wall of microorganisms, thus inactivating them (Amiali & Ngadi, 2012). When the electric field intensity across the membrane exceeds the threshold, permeabilisation of microbial cells will be irreversible and subsequently result in the leakage of intercellular compounds and cell lysis (*Jaeger et al., 2014*). The efficacy of PEF microbial inactivation depends highly on its process parameters (electric field intensity, power and treatment time), microorganisms parameters (types, growth phase, size and shape of microbes) and medium parameters (pH, solid contents and particle size) – (Li & Farid, 2016).

Its effectiveness in treating high electrical conductivity food products is a concern (Amiali and Ngadi, 2012) because most of the energy input will be converted into heat, thus discounting the advantage of PEF as non-thermal technology. Furthermore, the cost is higher than thermal, since the throughput has a direct effect on the capital cost of the PEF system. According to a study by *Sampedro et al.,* (2014), the total pasteurisation cost of orange juice using PEF is US$3.7 cent per litre or 2.5 times higher than thermal treatment (US$1.5 cent per litre). But despite the high initial cost, PEF is popular and is currently used for commercial scale juice production in The Netherlands and other European countries (*Jermann et al., 2015*).

Meanwhile, ozone (O_3) is a triatomic molecule consisting of three oxygen atoms. It is an allotrope of oxygen that is far less stable than the diatomic O_2. Ozone has attracted great interest with regards to food safety as it is 1.5 times stronger than chlorine and is effective over a wider spectrum of microorganisms (Patil & Bourke, 2012). Figure 2 illustrates the effect of ozone treatment on microbial survivality in water.

Ozone also leaves no chemical residue and it degrades to molecular oxygen upon reaction or due to natural

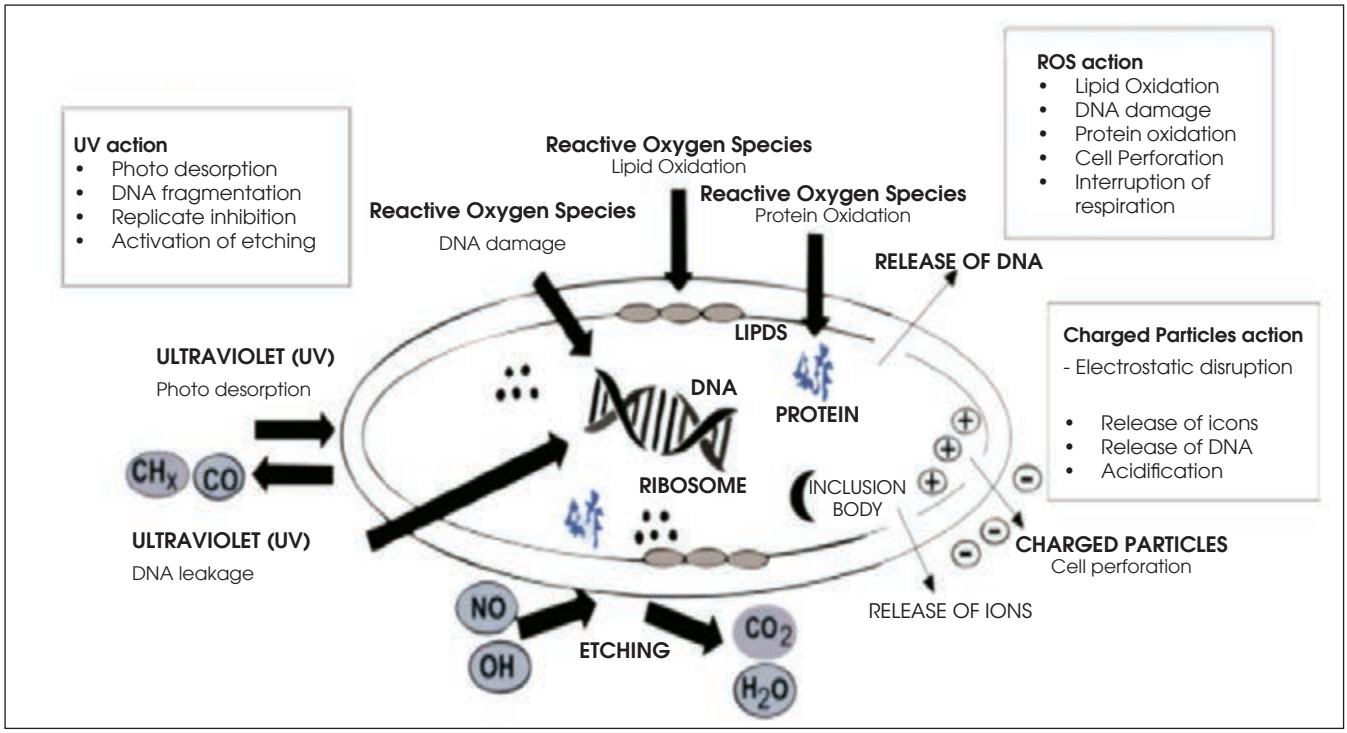

Figure 3: Overview of cold plasma bactericidal mechanisms (Schluter & Frohling, 2014)

degradation. It is a colourless gas that is readily detectable at the range of 0.01 to 0.05 ppm (Patil & Bourke, 2012). When ozone is produced, it will decay rapidly because it is an unstable compound with a relatively short half-life. It quickly degrades to oxygen in pure water and even more rapidly in impure solutions such as fruit juice which contains various soluble and insoluble solids (*Guzel-Seydim et al., 2004*).

In 2001, the USFDA approved the use of ozone in gaseous and aqueous phases as an antimicrobial agent for the treatment, storage and processing of foods (*Khadre et al., 2001*). Ultraviolet radiation (188nm wavelength), corona discharge and cold plasma methods can be used to initiate free radical oxygen formation and thereby generate ozone. The corona discharge method is the most popular type of ozone generator for most industrial and personal uses. It is very cost-effective and does not require an oxygen source other than air. However, due to the highly reactive nature of ozone, it is necessary to understand the key parameters in order to optimise its application for sterilising liquid food products. In a study, *Restaino et al.*, (1995) stated that the effectiveness of ozone against microorganisms depends not only on the concentration of ozone used but also on the residual ozone in the medium and various environmental factors such as medium pH, temperature, humidity, additives such as sugar and the amount of organic matter surrounding the cells. The impact of different compounds such as sugar, fibre, ascorbic acid and other organic matter in the dissolution rate and availability of ozone can create a protective effect in some components.

Meanwhile, cold plasma is a relatively new sterilisation method which has caught the attention of food scientists. It is considered to be a unique "pure" non-thermal method that combines the synergistic effects of UV radiation and oxidation caused by ozone which have been proven to effectively kill microorganisms. The bactericidal effects caused by the mixture of electrons, ions, atomic species, UV photons and charged particle of cold plasma treatment can be achieved through direct or indirect method of food exposure (Li & Farid, 2016).

Cold plasma is generated under atmospheric or reduced pressures which controls its low temperatures of 30-60°C (*Coutinho et al., 2018*). Plasma jets, Dielectric Barrier Discharges (DBD), corona discharges and microwave discharges are common sources for the generation of cold plasma at atmospheric pressure. Cold plasma has great advantages, such as lower water consumption, lower operating temperatures and lower costs, compared to conventional thermal processing. The ability to inactivate spores by cold plasma mainly depends on the types of feed gas. Gas plasma is generated by ionising feed gases through external electric field or other energy sources.

Figure 3 presents an overview of cold plasma microbial inactivation. Three basic mechanisms are triggered by the plasma which contribute to cell death, including etching of cell surfaces induced by reactive species formed during plasma generation, volatilisation of compounds and intrinsic photodesorption of UV photons and destruction of genetic material (*Coutinho et al., 2018*).

CONCLUSION

Novel non-thermal pasteurisation techniques have proved to have significant advantages over thermal treatment. The application of emerging technologies is aimed at

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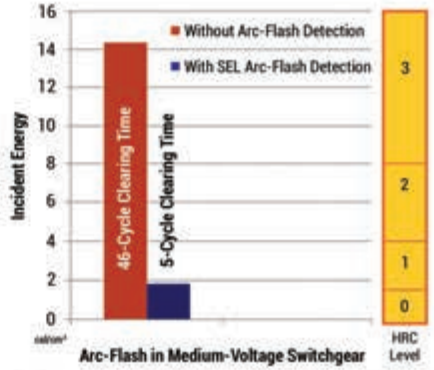

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preservation with minimal qualitative changes, in addition to the promise to deliver foods which are safe with "fresh-like" quality and a longer shelf-life. A number of issues have been identified which has delayed the commercial/ industrial implementation, especially in Malaysia. High capital cost, lack of expertise, products uniformity and safety regulations, warrants extensive studies to encourage the use of non-thermal technologies in food industries. Active collaborations between scientists and engineers can foster rapid developments to reduce the cost of equipment, while establishing proper standard operating procedures as well as increasing efficiencies with lower operating costs.

Furthermore, a better understanding of the complex physicochemical mechanisms of action of non-thermal processing technologies and their effects on the functional and nutritional properties of liquid foods will also contribute towards reinforcing the presence of these emerging technologies at industrial scales. ■

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Dr Nor Nadiah Abdul Karim Shah *is senior lecturer at the Department of Process & Food Engineering, Faculty of Engineering, Universiti Putra Malaysia.*

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FEATURE

2nd Ir. CHIAM TEONG TEE MEMORIAL LECTURE

CHINGFORD RESERVOIR FAILURE AND EFFECTIVE STRESS: FROM TERZAGHI TO BISHOP

Ir. Dr Ooi Teik Aun

Ir. Dr Wang Hong Kok

The speaker, Prof. Dr Laurence D. Wesley has 50 years' working and teaching experience in Indonesia, Malaysia and New Zealand. He was consulted in foundation building designs in Kuala Lumpur, the Sungai Layang Earth Dam in Johor Baru, KL-Karak Highway, and Kuala Krai-Gua Musang Highway. He has also written four books.

The second Ir. Chiam Teong Tee Memorial Lecture held at Wisma IEM Chin Fung Kee Auditorium on 23 June, 2018, was titled "Application of Effective Stress – From Terzaghi to Bishop". The lecture was supported by Geotechnical Engineering Technical Division and managed by IEM Academy Sdn. Bhd. This report relates the application of effective stress in dams, particularly the Chingford Reservoir failure.

Man started building masonry dams as early as 4,000 BCE in the Black Desert of modern Jordan for irrigation of agricultural products (Brown and Jackson, 2018). Over time, as population expanded, more dams were built for water consumption, generating hydroelectric power and recreational purposes. However, building dams can incur high costs, require high technical skills and, above all, invite high risks. Zhang, Xu and Jia (2009) compiled a list of around 900 dam failures since 1800 – some 65.5% are earth dams. According to the report, there was a particularly high failure rate in the 1880-1979 period.

On 23 July, 2018, the earth-filled Saddle Dam D in the Champasak Province of Laos collapsed while still under construction. It resulted in 40 people dead, 100 missing, and 6,600 others being displaced as well as great suffering to the affected villagers (BBC News, 24 July, 2018). More accounts of dam failures may be found in Foster, Fell & Spannagle (2000), and Sharma & Kumar (2013)'s articles.

In the London BOROUGH of Enfield, United Kingdom, work began on Chingford Reservoir in 1936. A major slip appeared during the construction when the 20m-wide embankment fill height reached 7m. The slip caused a 71cm drop, pushing forward the embankment by 4m (Figures 1 and 2). Soon after the incident, Dr Herbert Chatley and Prof. Karl von Terzaghi were appointed to find out the causes and to suggest ways to avoid future ocurrences.

Figure 1: Chingford Slip, London
Source: Tedd (2015)

During a British Dam Society talk on 5 October, 2015, Paul Tedd said at least three factors could have contributed to the Chingford slip: "The presence of soft weak clay in the foundation, undrained shear strengths of 10 to 14kPa, development of high pore pressure due to rapid construction and little dissipation of pore water pressure."

During the lecture, Prof. Laurence also discussed the soil properties of the Chingford Reservoir. He noted that the construction of a nearby reservoir went on smoothly by adopting one-third the rate to infill, compared to the Chingford Reservoir's fast speed via modern bulldozers,

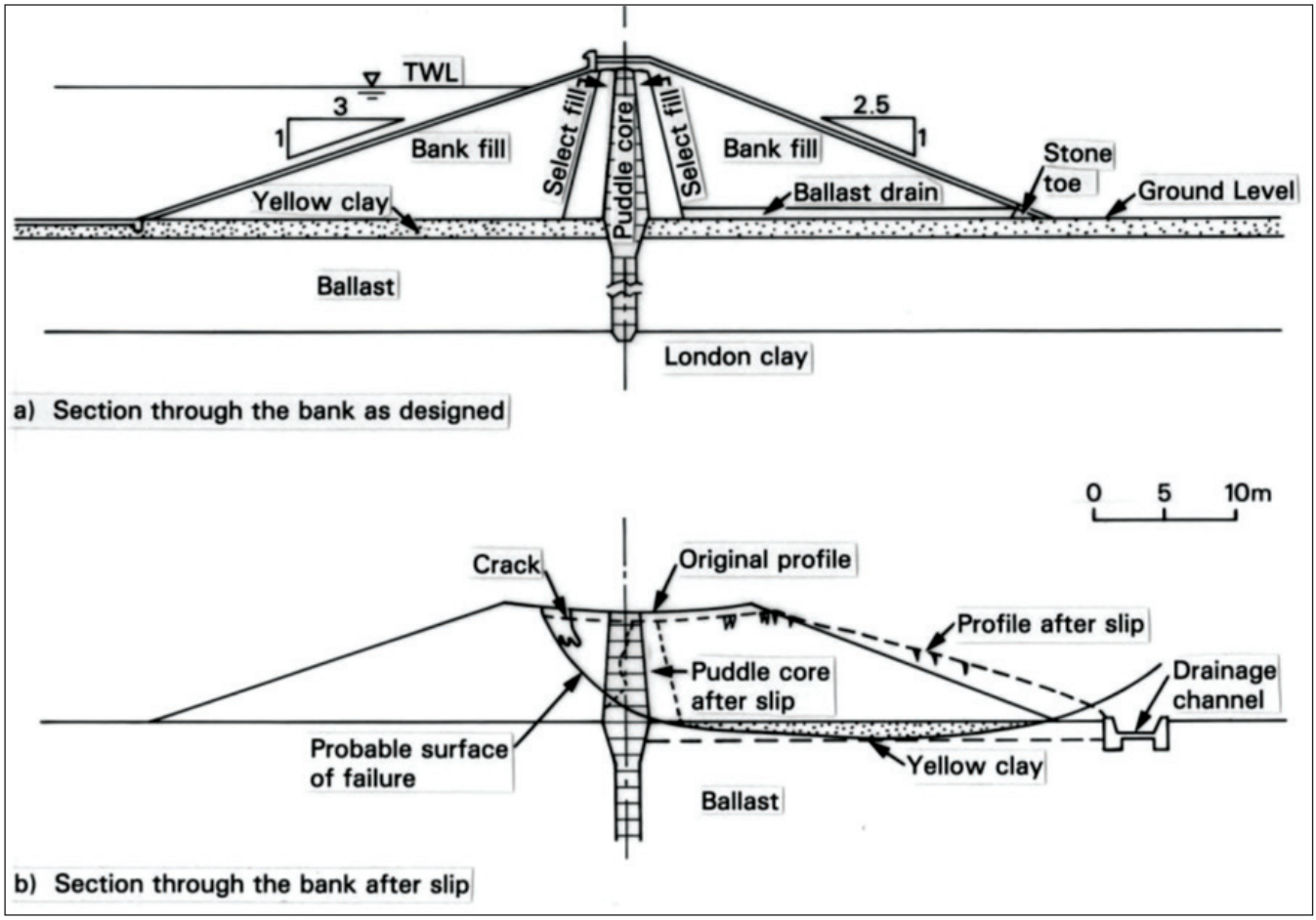

Figure 2: Shear failure during construction, Chingford Reservoir, London
Source: Tedd (2015)

which accelerated the embankment construction. The principle of effective stress was also referenced in his talk.

The aim of this short article is to appraise the role of effective stress in embankment stability analysis. Three questions were raised: What are Karl von Terzaghi's contributions to soil mechanics? What are Alan W. Bishop's contributions to the principle of effective stress? How can the concept of effective stress be used in practical situation? The following is an excerpt taken from Prof. Laurence's lecture.

KARL VON TERZAGHI

Prof. Laurence observed that the earliest understanding of dry sand soil properties came from Coulomb's work, as seen in the formula:

$$s = c + \sigma \tan \phi$$

Where s is shearing resistance, c is the cohesion, ϕ is angle of internal friction, and σ is the normal stress on the shear surface. Shearing resistance refers to a measure of shear stress, where shear stress is the average normal intergranular contact force per unit area. Shear stress is a function of effective stress, drainage conditions, density of the particles, the rate of strain, and the direction of the stress (Wikipedia, 2018).

Sand and clay are different in many aspects. Prof. Laurence explained that moving from sand to clay can pose challenges since clay consists of two major elements, water and solid particles, which could act both independently and interdependently. The nature of solid particles can be hard or soft. "It was Terzaghi who first came out with the basic principle at the heart of modern soil mechanics, known widely as the principle of effective stress" said Prof. Laurence.

Terzaghi was born in Prague, Austria, in 1883. He studied at Graz Technical University and worked in Vienna and Istanbul. He taught in Harvard University after World War 2 and established an impressive career till his death in 1963.

Prof. Laurence noted that Terzaghi was famous for two contributions: First, Terzaghi investigated vigorously soil properties in field settings. Second, he conducted laboratory tests to develop theories to explain field performance of soil. Terzaghi co-authored with Ralph B. Peck, a widely used text book, "Soil Mechanics in Engineering Practice" in 1948. See also GeoStructure (2015)'s article for further information about Terzaghi.

ALAN W. BISHOP

Bishop was born in 1920 in Canterbury, England and grew up in Whitstable. He was educated in Cambridge University. Bishop worked briefly for the London Metropolitan Water Board in 1943 and established a "rigorous procedure

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for applying the results of triaxial tests to the analysis of practical stability situations".

In 1946, he and his colleague, Skempton, moved to Imperial College which they helped develop into a worldwide famous centre of the learning for soil mechanics.

"Though Bishop was well known for pioneering his slip circle, Bishop Method, he was better recognised for establishing the relevance of the principle of effective stress to practical situations," said Prof. Laurence.

THE PRINCIPLE OF EFFECTIVE STRESS: BISHOP

In a landmark article on "The relevance of the triaxial test to the solution of stability problem", Bishop & Bjerrum (1960) defined the role of effective stress which can be used under different condition sets.

Basically, $\sigma' = \sigma - u$ where σ' is effective stress, σ is total stress, and u is pore water pressure. σ' of soil is affected by change in effective stress, but change in soil volume/strength is due to change in effective stress.

Table 1 is a summary of the formula calculations for shear strength and volume change.

Table1: Shear Strength and Effective Stress

VOLUME CHANGE	SHEAR STRENGTH
$\Delta V/V = m_v (\Delta\sigma - \Delta u) = m_v\Delta\sigma'$	$r = c' + (\sigma - u)\tan\phi'$ $= c' + \sigma'\tan\phi'$ 1
Where mv = one dimensional coefficient	In the equation 1, r is shear strength, c' is cohesion intercept, ϕ' is angle of shearing resistance. c' and ϕ' are in terms of effective stress

Source: Prof. Laurence's Lecture

There is another way to determine shear strength: Direct measurement without any change in water content. Prof. Laurence said: "For fully saturated soils, this means that no change in effective stress is occurring. This strength is thus a constant, known as the undrained shear strength, (not the cohesion) usually denoted C_u or S_u."

Figure 3 shows the results of undrained triaxial tests on fully saturated soil. "With such tests, the strength measured is independent of the cell pressure, which is the total normal stress acting on the sample," Prof. Laurence added.

Table 2 gives a summary of Bishop & Bjerrum (1960)'s observations on choices of geotechnical engineers in analysing a stability situation. Readers may read more about triaxial tests in Bishop & Henkel (1957)'s article.

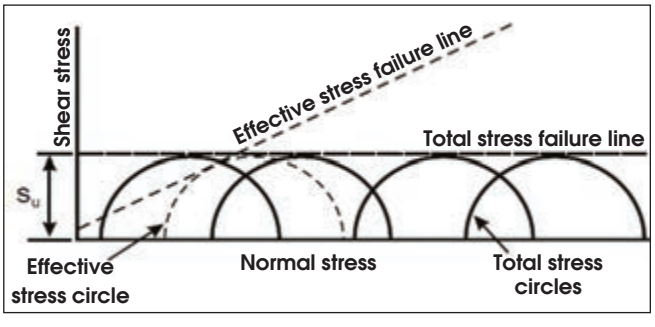

Figure 3: Undrained Triaxial Tests on a Fully Saturated Sand
Source: Prof. Laurence's Lecture

Table 2: Choices available in analysing a stability situation

	METHODS	CASES
Undrained condition	An undrained (or total stress) analysis based on undrained shear strength S_u (originally called $\phi = 0$).	The "End of construction" or "Immediate" case stability estimate using total stress analysis based on low permeability of clay. Undrained strength does not change during construction.
Drained condition	A drained analysis based on effective stress, based on c' and ϕ'.	The 'Long term" case. Stability estimate using an effective stress analysis.

Source: Prof. Laurence's Lecture

EFFECTIVE STRESS IN PRACTICAL SITUATION

Through a self-explanatory diagram (Figure 4), Prof. Laurence drove home his argument on how to select the correct method in the design analysis.

First case (Figure 4): As a building is built sitting on a surface foundation, the building load increases the confining stress on the soil. As water is being squeezed out of the soil, the strength increases. Herein, the foundation design should be based on the initial strength of the soil — that is, the undrained shear strength (S_u). See Table 2. Through time the margin of safety increases.

Second case (Figure 4): If excavation is needed to make way for a highway, it reduces the load and the confining stress on the soil, causing reduction in pore pressure in the soil. Water then seeps towards the excavation area which will decrease soil strength and lower the safety margin. Herein effective stress is recommended in the design analysis (Table 2).

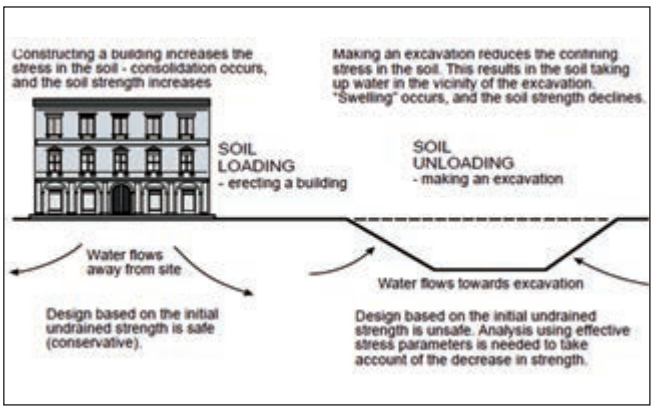

Figure 4: Different Stress Applications Requiring Different Methods of Analysis
Source: Prof. Laurence's Lecture

CONCLUSION

This article discusses the contributions made by Terzaghi to soil mechanics, Bishop's contributions to the principle of effective stress and the concept of the effective stress used in practical situations.

Prof. Laurence closed his lecture with a cautionary remark referring to Terzaghi's observations delivered in the first international soil mechanics conference in 1936, herein reproduced:

"However, as soon as we pass from steel and concrete to earth, the omnipotence of theory ceases to exist. In the first place, the earth in its natural state is never uniform. Second, its properties are too complicated for rigorous theoretical treatment. Finally, even an approximate mathematical solution of some of the most common problems is extremely difficult". ■

Ir. Dr Ooi Teik Aun *Hon. FiEM, FICE graduated with BE and ME from Auckland University and PhD from Sheffield University. He was Superintendent of Research and Laboratory while in JKR. He is founder Chairman of TUSTD, Organising Chairman WTC2020, Deputy Chairman TUSTD, Director of TAO Consult, Director of IEMTC and IEM Academy.*

Ir. Dr Wang Hong Kok *is the Principal Lecturer of Tunku Abdul Rahman University College since 2014. He is an IEM Council Member, Honorary Treasurer (2016-2018), Founding Chairman of Urban Engineering Development Special Interest Group (UEDSIG), Founding Chairman of Tan Sri Yusuff Final Year Project Competition Committee. He is also a member of IEM JURUTERA Editorial Board.*

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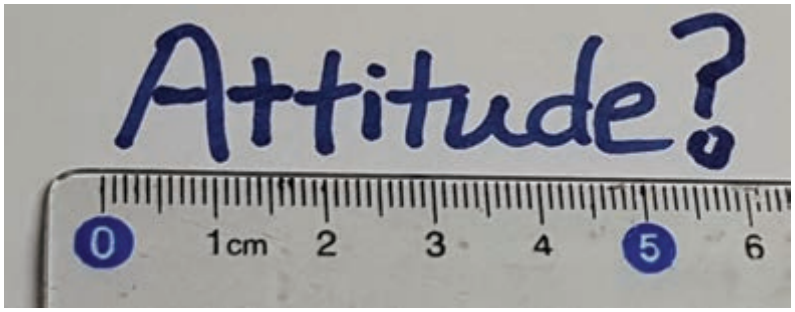
IT'S NOT ALL IN THE MIND

by Ir. Shum Keng Yan

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

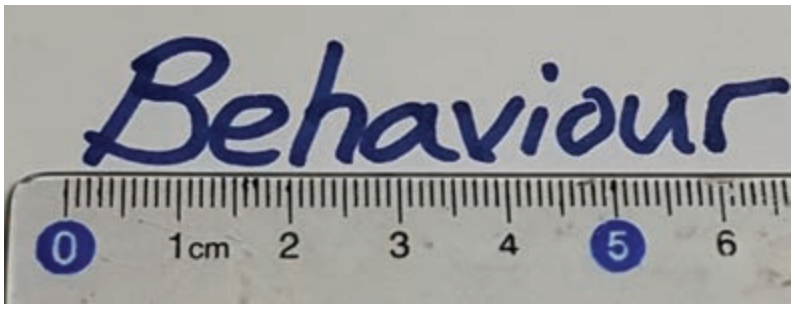
If we are able to measure behaviour, is it really possible to change behaviour by setting a number? Does the old adage, "What can be measured can be improved", ring true for behaviour? We will explore these questions in this series on the evolution of behavioural observation and modification.

In the journey to build a culture, we are, in fact, influencing values and attitudes in the workplace. Why do we observe behaviour rather than attitude?.



Attitude is not directly observable. Attitude is in the mind. It is how we think and feel. However, attitude influences behaviour in a positive or negative way.

Thus, behaviour is the closest way to observe the demonstration of a person's attitude. Natural behaviour is a visualisation of our attitude.



I use the word "natural" as some people are pretty good at masking their own natural behaviour.

So are we ready to observe behaviour in order to measure them? If you observe anything, just drop me a note at: pub@iem.org.my. ■

"The question isn't who is going to let me; it's who is going to stop me," paraphrased from "The Fountainhead" by Ayn Rand.

ENGINEER'S LENS

ISTANA AMPANG TINGGI, NEGERI SEMBILAN

Ir. Dr Oh Seong Por

Istana Ampang Tinggi in Seremban was built during the reign of the 5th Yamtuan Udin, also known as Yamtuan Imam (1861-1869). Built between 1865 and 1870, it was originally located in Kampung Ampang Tinggi, Kuala Pilah, and overlooked a rice field.

Yamtuan Imam later gave the palace to his daughter, Tunku Cindai, when she married Tunku Muda Chik, the son of the 4th Yamtuan Radin. This was in accordance with the unique tradition of adat perpatih which favours daughters. The royal families stayed in this palace until 1930. It was left vacant after that.

In 1953, the 8th Yamtuan, Tuanku Abdul Rahman, granted permission for the old palace to be dismantled and relocated to Seremban. In 1980, the palace was again moved to the present location in the state museum.

Istana Ampang Tinggi is 20.2m long and 7.1m wide. It was built using timber joinery technique, i.e. without nails. This allowed the building to be disassembled easily, transported to the new location and reassembled.

The palace was made with hard and tough cengal wood. The design of the roof is known as bumbung panjang (long roof) and dominates the low walls with an open stilted bottom. This design promotes good air flow into the roof space, keeping the interior cool and well ventilated. Unique carved artworks found on the walls, windows and staircases, reflect Minangkabau culture.

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FORUM

SRI JELUTONG AND SAWIRA BIOGAS POWER PLANT

AGRICULTURAL AND FOOD ENGINEERING TECHNICAL DIVISION

reported by

Ir. Hor Kok Luen

Group photos of participants, the biogas plant engineers and Mr. Eric Wong, the head of Renewable Energy of Cenergi SEA

Under the National Key Economic Areas (NKEA) plan by the Government in the 10th Malaysia Plan (2010-2015), the importance of biogas trapping is evident from its inclusion as one of the Eight Entry Point Projects (EPPs) of the palm oil sector.

The biogas capturing project from Palm Oil Mill Effluent (POME) is a good source of renewable energy for various utilisations and applications, inclusive of but not limited to, power generation.

Two technical visits were organised on 21 July, 2018, to Sri Jelutong biogas power plant in Pekan and Sawira biogas plant in Muadzam Shah, Pahang, with a total of 37 participants.

These are green energy power plants integrated with palm oil mills to process oil palm Fresh Fruit Bunches (FFB) and produce Crude Palm Oil (CPO) and Palm Kernels (PK).

Sri Jelutong biogas plant has a capacity of 1.5 MW and has achieved its commercial operation date on 5 October, 2017, whilst Sawira biogas plant has capacity of 1.0 MW and has achieved its commercial operation date on 8 April, 2016.

The power generated is mainly for grid connection Feed-in-Tariff (FiT) purpose. This is a positive move for environmental concerns as greenhouse gas (methane) is captured and prevented from escaping into the atmosphere. As we are aware, the greenhouse effect of methane gas is 25 times greater than that of carbon dioxide. So methane should be captured and converted into something commercially beneficial.

Sawira biogas power plant 1.0 MW (grid connection)

The 2 palm oil mill biogas plants were constructed and managed by Cenergi SEA, a subsidiary company owned by Khazanah. Mr. Eric Wong, the head of Cenergi SEA RE (Renewable Energy), has been actively involved in most of the biogas plants' SEDA application and approval, biogas plant design, set up, commissioning, operation and maintenance. According to him, the setup of a biogas plant comprises three stages: Biogas capturing, biogas treatment and biogas utilisation.

Biogas capturing refers to the intake of raw material or POME. Biogas treatment refers to the de-sulphurisation and de-humidification of the raw biogas. Lastly, biogas utilisation refers to the FiT grid connection. The control and monitoring systems are brief and accurate as well as supported by the SCADA system, to ease daily operations and maintenance.

During the technical trips, participants raised many curious and technical questions since the setup of the plants was so simple and yet presentable and operationally friendly. The plant engineers and supporting staff answered all the questions patiently.

Participants gained more knowledge about POME biogas power plants after the technical site visits. From the biogas capturing stage, the beauty of the biogas capturing plant was that along with the capturing of methane gas, the wastewater treatment of the POME significantly reduced the BOD and COD by 85% and 90% respectively. ■

FORUM

THE NEXT CATALYST FOR AGRICULTURE: SMART FARMING

AGRICULTURAL AND FOOD ENGINEERING TECHNICAL DIVISION

reported by

Ir. Vasan Mariappan

On 21 November, 2018, the Agricultural & Food Engineering Technical Division (AFETD) organised a technical talk titled "The Next Catalyst for Agriculture: Smart Farming" by Ir. Dr Tan Chee Fai, who has over 18 years' experience in the manufacturing industry.

The world is moving at a fast pace. According to the Food & Agriculture Organisation (FAO) of the United Nations, world population will reach 10 billion in 2050. Of this number, 2/3 will be living in urban areas, so the demand for food will grow drastically. This will be made worse with the increased competition for natural resources, deforestation and land degradation. Climate change will jeopardise crop and livestock production, fish stock and fisheries. The report also said that some 700 million people living in rural areas today are still extremely poor. There are 2 billion people who suffer from micronutrient deficiencies and 800 million who are chronically hungry. Globally, about one-third of all food produced is lost or wasted, resulting in losses for farmers and unnecessary pressures on natural resources.

The world needs to improve agriculture productivity sustainably to meet demand, to ensure a sustainable natural resource base and to address climate change. In addition, we also need to eradicate extreme poverty and reduce inequality.

The food systems need to be more efficient, inclusive and resilient. The concept of agriculture has also grown. A decade or two ago, it was associated solely with the production of basic crops but today, agriculture includes forestry, bee-keeping, fruit cultivation, poultry and even dairy farming. Webster's Dictionary defines agriculture as "the art or science of production of crops and livestock on farms".

Agriculture has seen many revolutions, whether it's the domestication of animals and plants thousands of years ago, the systematic use of crop rotations and other improvements in farming practice a few centuries ago or the "green revolution" with systematic breeding and the widespread use of man-made fertilisers and pesticides a few decades ago.

Today, the 4th Industrial Revolution (4IR) means technological advancement with higher productivity and higher competitive approaches. To overcome the current issues in agriculture, the 4IR can be adopted. Agriculture is undergoing its own revolution, triggered by the exponentially increasing use of Information and Communication Technology (ICT).

Autonomous, robotic vehicles are being developed for farming purposes such as weeding, applying fertilisers or harvesting fruit. The development of unmanned aerial vehicles with autonomous flight control, together with the development of lightweight and powerful hyper spectral snapshot cameras can be used to calculate biomass development and fertilisation status of crops.

Smart farming can be the solution to the global food and economy problems. Smart farming can maximise agriculture yields while using minimum resources such as water, fertiliser, seed, etc. It is able to deliver high quality crop production with cost effective methods. Besides, smart farming technology may also be able to overcome problems caused by climate change. ■

Introduction by session chairman Ir. Ooi Ho Seng

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FORUM

ENSURING AUTHENTICITY AND INTEGRITY OF HALAL PRODUCTS

AGRICULTURAL AND FOOD ENGINEERING TECHNICAL DIVISION

reported by

Ir. Assoc. Dr Yus Aniza Yusof

The Agricultural & Food Engineering Technical Division (AFETD) invited Prof. Dr Russly A. Rahman from Halal Products Research Institute (HPRI), Universiti Putra Malaysia (UPM), to give a talk on "Ensuring the Authenticity and Integrity of Halal Products: Malaysian Experience" on 13 October, 2018. There were 24 IEM members present.

Prof. Dr Russly was the former 2nd Director of HPRI, UPM. His research interests include halal food processing, convenience foods, packaging of food products, post-harvest handling of fruit, supercritical fluid extraction, minimal processing and drying. He is also a consultant for several food companies, developing new products such as development of halal systems, halal central kitchen, thermal processing, dehydration of fruits, coconut processing, etc.

His talk was in 5 parts:

1. Halal Concept (ordainment, halal and toyyib, supply chain, way of life).
2. Halal Issues (pig, alcohol, slaughtering, safety).
3. Global and Malaysian Halal Markets (Muslim population, global halal industry, Malaysian halal industry).
4. Control of Halal in Malaysia.
5. Ensuring Integrity and Authenticity (legislations, certification, standards, authentication, system).

First, participants learnt about the basic terms of halal in Islam, which means permitted or lawful (Syariah); Haram means prohibited or unlawful. There is also another term that Muslims usually use, Syubhah, which means doubtful. If the halal or haram status of a certain food is unknown, then that food is considered syubhah and should be avoided.

Then, participants learnt about the concept of Halal and Toyyib, which means wholesome (safe, hygienic, clean, nutritious, quality and authentic).

Elements of the halal supply chain (locally and globally) were discussed. There are various critical points in the supply chain, such as:

- Raw materials – animal or plant origin.
- Slaughtering – according to Syariah/stunning and thoracic sticking issues.
- Processing operations/equipment.
- Packaging/Storage/Logistics (containers and vessels).
- Food ingredients and additives.
- Pig and its by-products (e.g. pork, lard, gelatin).
- Enzymes (e.g. rennet, pepsin).
- Emulsifiers (e.g. E471/E472).
- Alcohol.
- Biotechnology and GMF (genetically modified food).
- Safety and quality aspects.

The Halal industry can be divided into three main components:

1. Food.
2. Non-Food: Pharmaceuticals, Health Products, Medical Devices, Cosmetics and Toiletries.
3. Services: Logistics, Packaging, Branding, Marketing, Printing, Electronics Media, Travel and Tourism.

The demand for halal food is common. However, the demand for halal in components of non-food and services is growing in the global market. In Malaysia, Halal certification is given by the Department of Islamic Development Malaysia (JAKIM) and there are several laws and acts that are relevant to halal such as:

- Trade Description Act 2011, Trade Description Order (Definition of Halal) 2011 and Trade Description Order (Certification and Marking of Halal) 2011.
- Food Act 1983 and Food Regulations 1985 which relate to labelling, hygiene and food safety, which is enforced by the Ministry of Health, Malaysia.
- Custom Act 1967 (Prohibition of Import 1998): Importation of halal meat.
- Animals Act 1953 (2006 revision), Abattoir Act (Corporatisation)1993 and Akta Lembaga Kemajuan Ternakan Negara (Pembubaran), 1983 (Jabatan Perkhidmatan Haiwan) regarding breeding of animals and control of disease.
- Syariah Criminal Offence Act (Federal Territory)

Ir. Vasan Mariappan presenting a token of appreciation to Prof. Dr Russly A. Rahman. Looking on is session chairperson Assoc. Prof. Ir. Dr Yus Aniza Yusof

1997 – Halal Food Marking by State Islamic Religious Department.

- Local Government Act 1976 and Local Authority by Law.
- Trade Mark Act 1976.

Among Malaysian standards related to halal include:

1. Ms 1500:2009 Halal Food - Production, Preparation, Handling and Storage - General Guidelines (Second Revision).
2. Ms 2200: Part 1:2008 Islamic Consumer Goods - Part 1: Cosmetic and Personal Care - General Guidelines.
3. Ms 1900:2005 Quality Management Systems - Requirements from Islamic Perspectives.
4. Ms 2300:2009 Value-Based Management System - Requirements from an Islamic Perspective.
5. Ms 2400-1:2010 (P) Halalan-Toyyiban Assurance Pipeline - Management System Requirements for Transportation of Goods and/or Cargo Chain Services.
6. Ms 2400-2:2010 (P) Halalan-Toyyiban Assurance Pipeline - Management System Requirements or Warehousing and Related Activities.
7. Ms 2400-3:2010 (P) Halalan-Toyyiban Assurance Pipeline - Part 3: Management System Requirements for Retailing.

Prof. Dr Russly concluded the talk by emphasising on the need to safeguard the integrity of halal products to create trust among consumers locally and globally. This is particularly important as awareness and demand for halal products are increasing worldwide. He urged engineers to contribute to the halal sector such as developing halal processing machinery, halal slaughtering machinery, cleansing machinery, etc.

After the talk, there was a Q&A session. Participants showed a lot of interest in halal certification and related issues. Then Ir. Vasan Mariappan, Chairman of AFETD, presented a token of appreciation to Prof. Dr Russly. ■

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FORUM

TEE OFF AT IEM GOLF TOURNAMENT 2018

BUILDING SERVICES TECHNICAL DIVISION

reported by

Ir. Cha Hoong Kum

Group photo session taken at Kelab Rekreasi Tentera Udara (KRTU)

The Institution of Engineers Malaysia Golf Tournament 2018 was held on 7 July, 2018, at Kelab Rekreasi Tentera Udara in Subang, Selangor. The response was overwhelming, with 124 participants comprising members and corporate business associates. IEM President Ir. David Lai was invited to play in the tournament but he declined due to a slight shoulder injury. However, he came to show his support and to give away the prizes to the winners.

On the day of the tournament, the weather was fine with an occasional breeze blowing and all the participants had a chance to network while enjoying the game.

Unique Fire Industry Sdn. Bhd. and Program Hi-Tech Sdn. Bhd. were the main sponsor and co-sponsor respectively. The other sponsors were:

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Hole 7 was selected for the Hole-In-One, with a cash prize of RM1,000 sponsored by Azeeta Pipe System Sdn. Bhd. As there was no winner, it was divided into 10 lucky draw prizes of RM100 each.

Based on System 36, the winners of the tournament were:

IEM Member Category

Champion	:	Dato Ir. Mohd Shukri	36-points	Handicap-17
1st Runner Up	:	Ir. Cha Hoong Kum	36-points	Handicap-18
2nd Runner Up	:	MD Zaim	36-points	Handicap-20

Non-IEM Member Category

Champion	:	Dennis Chong	38-points	Handicap-14
1st Runner Up	:	Eric Chin	37-points	Handicap-10
2nd Runner Up	:	Chai Kim Choy	37-points	Handicap-14

The organising committee would like to thank the sponsors, in particular Unique Fire Industry Sdn. Bhd., participants and the secretariat staff who helped make the event a success. ■

FORUM

SHE-EO! IN THE MAKING

WOMEN ENGINEERS SECTION

reported by

Elizah Samat

Michelle Lau

Group photo sessions

"If you're always trying to be normal, you will never know how amazing you can be." – Maya Angelou.

This inspirational quote by activist Maya Angelou pretty much sums up the key take away based on what was gathered from an event titled "Breaking the Ceiling – Women Empowerment Session". Organised by NACE Founding Malaysia Section in collaboration with IEM Women Engineers Section, the inaugural session was held on 12 July, 2018, at the NACE EAP office in Kuala Lumpur.

Professional women (and men) came together for a three-hour breakaway programme designed to help participants reflect on their respective career paths and to become women leaders of the future. There were engagement sessions with three prominent speakers – Elaine Bowman and Helena Seelinger (NACE International, USA) and Anita Ahmad (Senior VP of Yayasan Hasanah, Malaysia) – in an informal, interactive set up.

As I had been raised by a single mother, I could personally relate to the topic of women empowerment. Under certain circumstances, women can stand up and independently navigate their lives to nurture the future generation. Empowered women can do wonders. Feminist G.D. Anderson said: *"Feminism isn't about making women strong. Women are already strong. It's about changing the way the world perceives that strength."*

However, in Malaysia, and to some extent Asia Pacific, there is a significant gender gap in the current management scenario of the corporate world. Based on a US study shared by Helena Seelinger, "1 out of 3 girls are afraid to lead while 46% of girls do not want to speak up because they want to be liked".

This was somewhat true as most of the women participants at the event admitted to being a part of the statistics in some way or another. Born and raised in Asian cultures, my women colleagues and I had been taught that our roles would be merely as backbench supporters of our spouse/male counterparts and that we should stay in the shadows. The term "househusband" is relatively new in our society although statistics show an increase in women enrolment in universities, outnumbering male enrolment by more than 25% [Ref.1].

In Malaysia, since 2010, the FLPR (Female Labour Force Participation Rate) has steadily risen from 46.8% in 2010 to 54.1% in 2015; this translates to an additional 750,000 women in our workforce, which is estimated to contribute an additional 0.3% growth in gross domestic product in our economy. Yet, as of June 2016, women accounted for only 15.2% of director positions in the top 100 listed companies on Bursa Malaysia (Kuala Lumpur Stock Exchange) [Ref.1].

The perception persists that if a woman manager is outspoken and an extrovert, she will be labelled as aggressive or bossy; the office environment too does not usually facilitate excellence in her work delivery. If we look specifically at the STEM field, as presented in the recent WiSET conference, female graduate engineers add up to approximately 32% of graduates, yet there are only 6.34% female professional engineers [Ref. 2].

Indeed, women are significantly under-represented in the boardroom and as chief executive officers but it has been observed that there is an increase in the number of women in top management, given recent progresses in strengthening the pipeline of female talent. Anita talked about the trials and tribulations of her career with numerous NGOs, a field dominated by males.

The key highlights shared by the three speakers were intimate insights into their own journeys to top positions in their organisations. Elaine Bowman, who comes from Texas, is the only female president of her organisation in its 75 years of existence. In IEM, we have yet to elect a woman as president.

Policies and practices of having a career sponsor, mentor mentee and quota system do help set the focus right in promoting more women leaders. It is also promising to see that more corporate sectors are implementing work-life balance and flexi-working arrangements to leverage career retention and development for career women. We must continue to persevere in creating greater awareness and to advocate all key stakeholders. It starts with you and me; as a whole women community, we have to help each other. Together, we can expand our network so that this issue will remain at the top of the agenda for the corporate sector and policy makers. ■

Ref. 1: www.leadersononomics.com -Article dated 6/10/2017 Women in Leadership Positions: Where is Malaysia at? by Johan Merican and Shareen Ghani.
Ref. 2: Board of Engineers, Malaysia, March 2018

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Updated May 2018

HIKING TO EVEREST BASE CAMP

Weeser Tan

Weeser Tan *is a power plant engineer working with high voltage switchgears, transformers and generators. He is a proponent of safe and sustainable energy.*

Celebrating at Everest Base Camp with fellow Malaysians

With experience gained on a hike to Nepal's Annapurna Base Camp with some school friends in 2013, I confidently signed up for a hike to Everest Base Camp (EBC) in May 2018.

I left Johor Bahru for Nepal 4 days after the historical 14th General Election. I met my 7 teammates in Kathmandu where we gathered for our flight to Lukla (2,286m asl), one of the world's most dangerous airports. Apart from myself, the team comprised of 4 Brits, 2 Aussies, 1 American and 2 Nepali guides.

Lukla is the gateway for all hikers headed for Mt Everest. The journey to Lukla was an adventure itself. First, our flight was delayed and then cancelled due to bad weather in Lukla. As a result, we had to spend an extra night of anxiety in Kathmandu. The next morning, we had no choice but to hire a helicopter for the trip which took about an hour. As we were a day behind in schedule, we had to skip one of the acclimatisation days (in Dingboche) in order to catch up.

Hiking in Nepal is quite established and tourism remains an important industry. We would hike from village to village and spent nights in guesthouses or lodges. We usually set off at around 8.00 a.m. and trekked 7-8 hours daily.

After 3 days, we reached one of the most famous villages in the Himalayas, Namche Bazaar (3,440m). This is an impressive settlement. Though it's in the middle of nowhere, there are pubs, bakeries, restaurants, shops and even an ATM machine! This is also the last frontier of stable electricity and internet connection via wi-fi.

Like most hikers, we would stay an extra day in Namche Bazaar to allow us to acclimatise to the thin air as we had covered a vertical ascend of over 1,200m in the past few days. This is done by climbing to higher ground and then retreating back to lower altitudes to spend the night.

On Day 9, as per schedule, we reached Gorak Shep (5,180m), where the old Base Camp was located. After lunch and a short rest, we left for the ultimate 2-hour hike to EBC (5,486m). As Nepal is a predominantly Buddhist country, Tibetan Buddhist flags can be seen lining monasteries, stupas as well as pathways and bridges. There was an air of calmness, serenity and spirituality, more so as we were away from pollution, computers and modern age gadgets.

In the Himalayas, I met 3 groups of Malaysian hikers. It felt great to be speaking Malay and discussing Malaysian cuisine after more than a week in the mountains. Malaysians are true globe-trotters who can converse in different languages.

The real challenge was hiking from Gorak Shep to Kala Patthar (5,545m) the next day. While six members of my team slept on, my roommate and I woke up at the ungodly hour of 4.00 a.m. for a 2-hour hike in pitch-dark conditions (headlamps required).

Our reward was watching the sun rise on Mt. Everest and that was, for me, a once-in-a-lifetime experience.

As I gazed at Mt. Everest (8,848m) from Kala Patthar, I felt the urge to attempt a climb to the summit. The highest point on earth may look within reach but in reality, climbing and scaling the summit poses substantial health risks and requires 2 months of acclimatisation and training at the Base Camp as well as a hefty tour package price.

Humans are not built to survive at heights of 8,000m above sea level, which is deemed to be the "death zone" as the air is extremely thin and there is only 30% oxygen as compared to sea level. The risk of hyperthermia and acute mountain sickness can easily claim lives.

However, modern hiking gear, facilities and experienced guides have made conquering Mt. Everest a reality and over 4,000 people have reached the peak since Tenzing Norgay and Sir Edmund Hillary first did so on 12 May, 1953, using only rather primitive equipment.

It was an honour even to be at Everest Base Camp, to see mountaineers, professional climbers and Sherpas making preparations to climb the summit. I was also fortunate to have met the fantastic, helpful and selfless members of my team. ■

TEMUDUGA PROFESSIONAL

Tarikh: 10 Disember 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
(Sessi 2018/2019)

PERMOHONAN BARU

Nama	Kelayakan
KEJURUTERAAN AWAM	
ABDUL HADI BIN ABDULLAH	BE HONS (UTM) (CIVIL, 2011)
AIEZA BINTI MOHD YUSOP	BE HONS (UiTM) (CIVIL, 2002)
AZLI BIN MOHD HASHIM	BE HONS (UTM) (CIVIL, 2007) MSc (UTM) (CONSTRUCTION MANAGEMENT, 2012)
CHEW CHOON AIK	BE HONS (QUEENSLAND UNIVERSITY OF TECHNOLOGY) (CIVIL, 2001)
DACHORD J. MOUJING	BE HONS (UMS) (CIVIL, 2005)
FARAH EYANI BINTI ZAINAL ABIDIN	BE HONS (UiTM) (CIVIL, 2007)
FARHANA BINTI JAMIL	BE HONS (UiTM) (CIVIL, 2008) MSc (UiTM) (GEOTECHNIC, 2014)
MAHADIR BIN MASIHAT	BE HONS (UTM) (CIVIL, 2006)
MOHD FAIQ BIN MOHD FAUZI	BE HONS (UiTM) (CIVIL, 2008)
MOHD RAFIQ IZZAT BIN MOHD ROSLI	BE HONS (UiTM) (CIVIL, 2010)
MUHAMAD RUZI BIN YAAKUB	ADV. DIP (UiTM) (CIVIL, 1995)
MUHAMMAD SYAMIL BIN DZULFIDA	BE HONS (MALAYA) (CIVIL, 2014)
NIK RABIHAH ZAHRAH BINTI NIK SULAIMAN	BE HONS (MALAYA) (CIVIL, 2006)
NOR FARAH AZURA BINTI ABD. KADIR	BE HONS (UKM) (CIVIL & STRUCTURE, 2007) ME (UTHM) (CIVIL, 2014)
NORAINI BINTI SULIMAN	BE HONS (UiTM) (CIVIL, 2006)
NORKHAIRULNISA BINTI MAT SAH	BE HONS (UTM) (CIVIL, 2003) ME (UTM) (TRANSPORTATION & HIGHWAY, 2005)
NORMALINA BINTI SHAMSUDDIN	BE HONS (UiTM) (CIVIL, 2010)
SALIM BIN MAT ISA	BE HONS (UTM) (CIVIL, 1994)
SYARANAZ BINTI MOHD IZAM	BE HONS (UTHM) (CONSTRUCTION, 2006)
WAN SITI FAEZA BINTI WAN ISMAIL	BE HONS (UKM) (CIVIL & STRUCTURAL, 2008) MSc (UiTM) (GEOTECHNICAL, 2016)
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NURUL AZREENA BINTI KU AZIZAN	BE HONS (UiTM) (ELECTRICAL, 2009)
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SAIFUL AMIN BIN KAMARUDDIN	BE HONS (UTeM) (INDUSTRIAL POWER, 2012)
SHARAL AIDA BINTI IBRAHIM	BE HONS (UiTM) (ELECTRICAL, 2009)
YEE WEN JYE	BE HONS (SWINBURNE) (ELECTRICAL & ELECTORNIC, 2012)
ZIYAYAZID BIN ABDUL BAHRIN	BE HONS (UPM) (ELECTRICAL & ELECTRONICS, 2009)
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ZAINUDIN BIN JUSOH	BE HONS (UTM) (ELECTRICAL-MECHATRONICS, 2000)
KEJURUTERAAN LEBUHRAYA	
NUR SYAHRIZA BINTI MUHAMAD NOR	BE HONS (UTM) (CIVIL, 2005)
KEJURUTERAAN MEKANIKAL	
MOHD SYAHRIL BIN MOHD SAIT	BE HONS (UTM) (MECHANICAL, 2007)

PERPINDAHAN AHLI

No. Ahli	Nama	Kelayakan
KEJURUTERAAN AWAM		
74110	BUJANG ANAK KANANG	BE HONS (UTM) (CIVIL, 1997)
79569	CHAI MEI HWA	BE (BRADFORD) (CIVIL & STRUCTURAL, 2007) ME (UKM) (CIVIL, 2014)
38346	DAYALAN A/L RAINOO RAJ	BE HONS (UTM) (CIVIL, 2007)
24333	JAFFRI BAHAN	BE HONS (USM) (CIVIL, 2003)
26635	JALINA KASSIM	BE HONS (UTM) (CIVIL-ENVIRONMENTAL, 2006) MSc (UiTM) (CIVIL-ENVIRONMENTAL, 2008)
47914	MOHAMAD ISMAN KHAIRI BIN ISMAIL	BE HONS (UiTM) (CIVIL, 2011)
95968	MOHD IRAHAJ BIN ISMAIL	BE HONS (UTM) (CIVIL, 2012)
41314	NUR AIN SHAARI	BE HONS (UiTM) (CIVIL, 2008)
93782	RAHMAT ZULHAIRI BIN MOHAMED	BE HONS (UTM) (CIVIL, 2010)
26380	RAJA FAUZI RIZAL BIN RAJA SABARRADIN	BE HONS (UiTM) (CIVIL, 2003)
14962	RICHARD ANAK TAJAN	BE HONS (UiTM) (CIVIL, 1992)
26289	SCOTT SIMON BOSUIN	BE HONS (UiTM) (CIVIL, 2005)
35916	SEAH WEI CHENG	BE HONS (UTM) (CIVIL, 2010) ME (UPM) (STRUCTURAL & CONSTRUCTIONS, 2013)
21112	TERENCE E WONG	BE HONS (UKM) (CIVIL & STRUCTURAL, 1999)
38612	TIE KING BANG	BE HONS (USM) (CIVIL, 2006)
39204	WAI SOON HAN	BE HONS (UTM) (CIVIL, 2008) MSc (UTM) (CONSTRUCTION MANAGEMENT, 2009) PhD (UTM) (CIVIL, 2013)
17861	YUSLINA BINTI MOHD SANI	BE HONS (UiTM) (CIVIL, 1999) MSc (UiTM) (WATER RESOURCES, 2010)
KEJURUTERAAN ELEKTRIKAL		
87323	AINON SHAKILA BINTI SHAMSUDDIN	BE HONS (UTM) (ELECTRICAL, 1999) ME (UiTM) (ENGINEERING MANAGEMENT, 2010)
58722	ALIAS BIN KHAMIS	BE HONS (UiTM) (ELECTRICAL, 2003) MSc (UPM) (ELECTRICAL POWER, 2007)
72713	EVENDY CHONG	BE HONS (UMS) (ELECTRICAL & ELECTRONIC, 2008)
61143	MOHD FIRDAUS BIN MOHAMAD IDRIS	BE HONS (UTM) (ELECTRICAL, 2012)
56495	MOHD SYAFREN EFFENDY BIN MOHD YUSOFF	BE HONS (UniMAP) (ELECTRICAL SYSTEM, 2007)
28530	NOR AISYA BINTI ZAKARIA	BE HONS (UTHM) (ELECTRICAL, 2009)
90058	SYAKIB ARSALAN BIN KAMARUDIN	BE HONS (UiTM) (ELECTRICAL, 2013)
43090	TEO SIN TIONG	BE HONS (UNIVERSITY OF LONDON) (ELECTRICAL & ELECTRONIC, 2003)
45915	WONG KOK NIAN	BE HONS (USM) (ELECTRICAL, 2014)
KEJURUTERAAN ELEKTRONIK		
85921	CHOW VOON YANG	BE HONS (AUSTRALIAN NATIONAL UNIVERSITY) (ELECTRONIC & COMMUNICATION SYSTEMS, 2012)
34906	TAY CHING EN, MARCUS	BE HONS (UTM) (ELECTRICAL - TELECOMMUNICATIONS, 2012) PhD (UTM) (ELECTRICAL, 2015)

PERMOHONAN BARU / PERPINDAHAN MENJADI AHLI KORPORAT

No. Ahli	Nama	Kelayakan
KEJURUTERAAN MEKANIKAL		
58659	TAN WAI HONG	BE HONS (UTAR) (MECHANICAL, 2011)

IEM DIARY OF EVENTS

Title: Technical Visit to SMART Fertigation Chili Satellite Farm, PPK Kuala Langat

24 January 2019

Organised by: Agricultural and Food Engineering Technical Division
Time : 9.00 a.m. - 1.00 p.m.
CPD/PDP : 3

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 DECEMBER JURUTERA 2018 ISSUE

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KEJURUTERAAN KIMIA		
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100856	CHONG CHU HIONG @ CAROLYN	B.Sc.(THE UNI. OF OKLAHOMA)(CHEMICAL, 1996) M.Tech.(MALAYA) (ENVIRONMENTAL MANAGEMENT, 2005)
KEJURUTERAAN MEKANIKAL		
100859	MOHD SHERWANI BIN ABU BAKAR	B.E.HONS.(UNISEL) (MECHANICAL, 2008) M.E.(UNISEL)(2012)
100710	LIM PEI YIN	B.E.HONS.(UTM) (MECHANICAL, 2002)
100711	TEO HAN FUI	B.E.HONS.(UTM) (MECHANICAL, 2005)
101003	ZALINA BINTI ALI	B.Sc.(UNI. OF ARIZONA) (MECHANICAL, 1988)
100712	KAM CHENG HONG, HARRY	B.Sc.Hons.(UNI. OF MANCHESTER) (MECHANICAL, 1978)
KEJURUTERAAN TELEKOMUNIKASI		
100857	MOHD AZRUL BIN OSMAN	B.E.HONS.(MALAYA) (TELECOMMUNICATIONS, 2000)

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72541	LEONG HOONG SUM	B.E.HONS.(UTAR KAMPAR) (ENVIRONMENTAL, 2018)
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72558	CHENG SHIH KHOON	B.E.HONS.(UTAR KAMPAR) (ENVIRONMENTAL, 2018)
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71171	DR. DEEPAK TIRUMISHI JADA	B.E.(KUVEMPU UNI.)(CIVIL, 1999) M.Sc.(UPM)(SOIL & WATER ENGINEERING, 2003) PhD.(UPM)(SOIL & WATER ENGINEERING, 2011)
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69167	NUR FARAH HANUM BINTI HUSAIN	B.E.HONS.(UiTM)(CIVIL, 2016)
41736	FONG KIN YEW	B.E.HONS.(UKM)(CIVIL & STRUCTURAL, 2011)
47534	MUHAMAD FAUZAN BIN MUHAMAD FADZIL	B.E.HONS.(UKM)(CIVIL & STRUCTURE, 2012)
81593	LOH HUANG MING	B.E.HONS.(UMP)(CIVIL, 2017)
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64924	LEE WAI HONG	B.E.HONS.(UTHM)(CIVIL, 2016)
55000	ONG MEN JIE	B.E.HONS.(UTHM)(CIVIL, 2016)
55051	TANG WAI SENG	B.E.HONS.(UTHM)(CIVIL, 2016)
64061	NG JAC LYN	B.E.HONS.(UTHM)(CIVIL, 2017)
27920	WONG HANN CHYN	B.E.HONS.(UTM)(CIVIL, 2007)
33009	CHONG CHEE SIEW	B.E.HONS.(UTM)(CIVIL, 2010)
32966	SITI AISHAH BINTI ABDULLAH	B.E.HONS.(UTM)(CIVIL, 2010)
38563	DYMPHNA BALANGKIT	B.E.HONS.(UTM)(CIVIL, 2011)
85103	LIM CHONG SHIEN	B.E.HONS.(UTM)(CIVIL, 2017)
93740	SHARIL BIN CHE ISMAIL	B.E.HONS.(UTM)(CIVIL, 2018)
62074	MUHAMMAD SHAMEER B. MOHD SHARIL	B.E.HONS.(UTP)(CIVIL, 2017)
KEJURUTERAAN ELEKTRIKAL		
60860	HONG MEE SONG	B.E.(UMP)(ELECTRICAL-POWER SYSTEMS, 2013)
84879	JACKY VONG LIEW	B.E.HONS.(MMU) (ELECTRICAL, 2015)
88889	SIA KEE CHENG, JACKSON	B.E.HONS.(SWINBURNE UNI. OF TECH.)(ELECTRICAL & ELECTRONIC, 2017)
64908	CHIENG LIE YANG, JOSHUA	B.E.HONS.(TAYLOR'S UNI.)(ELECTRICAL & ELECTRONIC, 2015)
78373	FATHUDDIN JUAANI BIN SHAMSUDDIN	B.E.HONS.(UiTM) (ELECTRICAL, 2017)
29271	MOHAMAD FAZLI BIN ALIAS	B.E.HONS.(UMP) (ELECTRICAL-POWER SYSTEM, 2008)
89346	KANG SHIEN NEN	B.E.HONS.(UTAR SG LONG)(ELECTRICAL & ELECTRONICS, 2018)
89287	PHANG KAM PING	B.E.HONS.(UTAR SG LONG)(ELECTRICAL & ELECTRONICS, 2018)
89240	WONG WEN HUEI	B.E.HONS.(UTAR SG LONG)(ELECTRICAL & ELECTRONICS, 2018)
87001	TING SIE KUN	B.E.HONS.(UTAR) (ELECTRICAL & ELECTRONIC, 2017)
64896	MUHAMAD SYAKIR B. KAMIS	B.E.HONS.(UTeM) (ELECTRICAL-INDUSTRIAL POWER, 2015)
54655	NAZAMIL ARIFIN BIN IDRIS	B.E.HONS.(UTHM) (ELECTRICAL, 2016)
68365	PANG JIA SHIM	B.E.HONS.(UTHM) (ELECTRICAL, 2017)
57294	MOHD KHAIRI B. MAT KIMI	B.E.HONS.(UTHM) (ELECTRONIC, 2015)
26216	AHMAD SYURKI BIN RAMLI	B.E.HONS.(UTM) (ELECTRICAL, 2007)
44760	MURSYIDUL 'IZWAN BIN SABRAN	B.E.HONS.(UTP) (ELECTRICAL & ELECTRONICS, 2011)
62096	NUR AFIFAH BT. GHAZALI	B.E.HONS.(UTP) (ELECTRICAL & ELECTRONICS, 2016)
KEJURUTERAAN ELEKTRONIK		
85963	WONG SOON KHEN	B.E.HONS.(UCSI UNI.) (COMMUNICATIONS & ELECTRONIC, 2016)

27945	LATIFAH BINTI NOH	B.E.HONS.(UiTM) (ELECTRICAL, 2009) M.Sc.(UiTM) (TELECOMMUNICATION & INFORMATION, 2011)
72552	GOH CHAN KIT	B.E.HONS.(UTAR KAMPAR, ELECTRONIC, 2018)
74726	KIEW GUIBIN	B.E.HONS.(UTAR KAMPAR, ELECTRONIC, 2018)

KEJURUTERAAN KIMIA

85371	DEBORAH ANNE A/P JOHN PHILIP	B.E.HONS.(MIU)(CHEMICAL, 2016)
85392	YOGINI A/P GUNASEKARAN	B.E.HONS.(MIU)(CHEMICAL, 2017)
62237	LIM KA YEAN, IAN	B.E.HONS.(MONASH UNI.) (CHEMICAL, 2017)
87940	GEOW CHIN HONG	B.E.HONS.(UCSI UNI.) (CHEMICAL, 2018)
85611	EGBERT ANAK AWEL	B.E.HONS.(UiTM)(CHEMICAL, 2017)
78605	NOOR SYAHIRA BT ABD RAZAK	B.E.HONS.(UMP)(CHEMICAL, 2016)
86222	MAHATDIR BIN MOHAMAD	B.E.HONS.(UMP)(CHEMICAL, 2016)
81827	NAZURUL EZZATI BT MOHD IDRIS	B.E.HONS.(UMP)(CHEMICAL, 2016)
78587	NORIDAYU BINTI ZULKIFLI	B.E.HONS.(UMP)(CHEMICAL, 2016)
74437	HOOI JUN XIAN	B.E.HONS.(UTAR KAMPAR, PETROCHEMICAL, 2018)
75195	KHAW HOOI CHING	B.E.HONS.(UTAR KAMPAR, PETROCHEMICAL, 2018)
74719	LAU TIEM EE	B.E.HONS.(UTAR KAMPAR, PETROCHEMICAL, 2018)
81015	LEONG WENG LI	B.E.HONS.(UTAR KAMPAR, PETROCHEMICAL, 2018)
85539	LIM CHIEN HUI, BENJAMIN	B.E.HONS.(UTAR KAMPAR, PETROCHEMICAL, 2018)
93720	MOEY JIN WEI	B.E.HONS.(UTAR KAMPAR, PETROCHEMICAL, 2018)
74730	NAGARATHANAM A/P RAMADAS	B.E.HONS.(UTAR KAMPAR, PETROCHEMICAL, 2018)
81014	ONG SENG HEE	B.E.HONS.(UTAR KAMPAR, PETROCHEMICAL, 2018)
74721	SIOW KUAI QING	B.E.HONS.(UTAR KAMPAR, PETROCHEMICAL, 2018)
75196	TAN WUAN CHIEN	B.E.HONS.(UTAR KAMPAR, PETROCHEMICAL, 2018)
89389	CHAI YONG SE NIAN	B.E.HONS.(UTAR SG LONG) (CHEMICAL, 2018)
80343	CHOOI CHEE YOONG	B.E.HONS.(UTAR SG LONG) (CHEMICAL, 2018)
89334	LAU JING EN	B.E.HONS.(UTAR SG LONG) (CHEMICAL, 2018)
89237	LEONG CHEE KEEN	B.E.HONS.(UTAR SG LONG) (CHEMICAL, 2018)
94781	MEI JUN QUEN	B.E.HONS.(UTAR SG LONG) (CHEMICAL, 2018)
89364	TAN WEI TUNG, CRYSTAL	B.E.HONS.(UTAR SG LONG) (CHEMICAL, 2018)
94756	YU ANG GAUN	B.E.HONS.(UTAR SG LONG) (CHEMICAL, 2018)
77956	NG KAY LUP, ANDREW	B.E.HONS.(UTAR) (CHEMICAL, 2016)
68062	CHEAH KHAI CHUN	B.E.HONS.(UTAR) (CHEMICAL, 2018)

KEJURUTERAAN MEKANIKAL

36582	MUHAMAD HANIF BIN MUHAMAD	B.E.(UMP)(MECHANICAL, 2012)
80777	KWEK LOO YEE	B.E.HONS.(CURTIN UNI.) (MECHANICAL, 2017)
85470	YONG SHERN HUA	B.E.HONS.(MMU) (MECHANICAL, 2017)
62207	LIM WAN QIN	B.E.HONS.(MONASH UNI.) (MECHANICAL, 2017)
89041	PHUN KUI MING	B.E.HONS.(SEGi) (MECHANICAL, 2018)
88466	PUI SE RENE	B.E.HONS.(TAR UC) (MECHANICAL, 2016)
30227	MOHD IMRAN BIN AHMAT SUHAIMI	B.E.HONS.(UiTM) (MECHANICAL, 2011)
35129	MOHD FAKHRULLAH BIN ZAKARIA	B.E.HONS.(UiTM) (MECHANICAL, 2011)
35376	MUHAMMAD ANDHAR BIN RAMLAN	B.E.HONS.(UiTM) (MECHANICAL, 2012)
38120	MOHD FAHMI BIN MD SALLEH	B.E.HONS.(UiTM) (MECHANICAL, 2013) M.Phil. (UTM)(MECHANICAL, 2017)
50583	NURUL HAKIMI HAQUE BIN FAZLUL HAQUE	B.E.HONS.(UiTM) (MECHANICAL, 2014)
50645	AHMAD NAKHAIE BIN AHMAD NAZRI	B.E.HONS.(UiTM) (MECHANICAL, 2016)
77220	HAZIMAN BIN ZAKARIA	B.E.HONS.(UiTM) (MECHANICAL, 2017)
61324	MOHD AMIRUL HAQIM B. AHMAD SHAFIEI	B.E.HONS.(UiTM) (MECHANICAL, 2017)
59704	RASYIDAH BT. KADIS	B.E.HONS.(UiTM) (MECHANICAL, 2017)
75665	WAN AHMAD HAFIFUDDIN B WAN SABRI	B.E.HONS.(UiTM) (MECHANICAL, 2017)
37509	MUHAMMAD BIN AB HALIM @ MAT SOH	B.E.HONS.(UKM) (MECHANICAL, 2009)
47183	CHAI MEEI TYNG	B.E.HONS.(UKM) (MECHANICAL, 2012)
88913	MUHAMMAD IRFAN BIN ABU SOFIAN	B.E.HONS.(UMP) (MECHATRONICS, 2017)
51896	MICHEAL CLINSMAN ANAK ANDY	B.E.HONS.(UNIMAS) (MECHANICAL & MANUFACTURING, 2015)
71658	MURGESHVARAN A/L MANIMARAN	B.E.HONS.(UNITEN) (MECHANICAL, 2016)
72756	PRAVEEN NAIR A/L RAVINDRAN	B.E.HONS.(UNITEN) (MECHANICAL, 2017)
89385	CHAN WENG KIT	B.E.HONS.(UTAR SG LONG) (MECHANICAL, 2018)
89368	CHOO MOON KIT	B.E.HONS.(UTAR SG LONG) (MECHANICAL, 2018)
89299	NG SEE LOON	B.E.HONS.(UTAR SG LONG) (MECHANICAL, 2018)
89347	YAP YUEN SHENG, JUSTIN	B.E.HONS.(UTAR SG LONG) (MECHANICAL, 2018)
89238	YONG JIA JUN	B.E.HONS.(UTAR SG LONG) (MECHANICAL, 2018)
63428	NIK MUHAMMAD HAZWAN B. MOHAMED ABDUL GHANI	B.E.HONS.(UTeM) (MECHANICAL-THERMAL FLUIDS, 2017)
55923	FARAH DANIRA BINTI MUHAMAD AFANDI	B.E.HONS.(UTHM) (MECHANICAL, 2016)
81325	CAROLYNA CYRIL JOSUE	B.E.HONS.(UTM) (MECHANICAL PRECISION, 2017)
35765	ABU HASSAN BIN MOKSEN	B.E.HONS.(UTM) (MECHANICAL-AERONAUTICS, 2012)
35793	VIGNESWARAN A/L GANASEN	B.E.HONS.(UTM) (MECHANICAL-MATERIALS, 2010)
23368	REMY AZRAI BIN MOHD AMIN	B.E.HONS.(UTP) (MECHANICAL, 2005) M.Sc.(UTM)(PETROLEUM, 2012)

KEJURUTERAAN MEKATRONIK

57356	AHMED ADAM OMER NIMIR	B.E.HONS.(APU) (MECHATRONIC, 2017)
40742	ASMARANI BINTI AHMAD PUZI	B.E.HONS.(IIUM) (MECHATRONICS, 2011) M.E.(UPM)(ENVIRONMENTAL, 2015)
61025	MOHD AZIZUL B. MOHD ZAINAL ABIDIN	B.E.HONS.(UMP) (MECHATRONICS, 2015)
74598	WONG YEE CHER	B.E.HONS.(UTAR SG LONG) (MECHATRONICS, 2018)

KEJURUTERAAN PEMBUATAN

85009	CHONG YEONG LIN	B.E.HONS.(UTAR SG LONG)(MATERIALS & MANUFACTURING, 2018)
89291	OOI WEY KHOON	B.E.HONS.(UTAR SG LONG)(MATERIALS & MANUFACTURING, 2018)
94754	WONG HAN JUN, BRYAN	B.E.HONS.(UTAR SG LONG)(MATERIALS & MANUFACTURING, 2018)

Note: *Continuation of the Transfer Graduate, Graduate, Incorporated, Affiliate and Associate would be published in February 2019. 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-123

SENARAI PENDERMA KEPADA WISMA DANA BANGUNAN IEM

Institusi mengucapkan terima kasih kepada semua yang telah memberikan sumbangan kepada tabung Bangunan Wisma IEM. Ahli-ahli IEM dan pembaca yang ingin memberikan sumbangan boleh berbuat demikian dengan memuat turun borang di laman web IEM http://www.iem.org.my atau menghubungi secretariat di +603-7968 4001/5518 untuk maklumat lanjut. Senarai penyumbang untuk bulan Oktober 2018 adalah seperti jadual di bawah:

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4	10383	MD. NASIR BIN BAHAROM
5	01167	TAN KHENG CHIONG
6	07537	TIONG HONG HEE
7	12239	SOH CHOR CHIEW
8	14181	CHENG KEE HAUT
9	36838	TE CHOON CHIAM
10	13639	ZAINAL BIN MOHD
11	19291	WAN ALWI BIN WAN MUSTAPHA
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13	17991	HANIFF BIN ISA
14	18436	WONG KIM HUNG
15	15913	ZAINAL FITHRI BIN MAT ZAHARI
16	05018	TAN GIM FOO
17	53091	WAN HASSAN BIN WAN MAMAT
18	70431	KIEW YAU FEE
19	10908	CHANG CHOOI FOONG
20	97485	MOHAMAD NAZRIN BIN MOHAMAD NAJIB
21	62186	MOHD ZUBIR BIN MAT DAHAN
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27	07431	OTHMAN BIN ABDUL KADIR
28	27138	ROSMADI BIN ZAMRI
29	76055	LO CHAO HAO, ROGER
30	62058	TAN LAI WAI
31	11684	NOORUL KHAIRI BIN MOHD NOR
32	14639	SAIFUL BAHRI BIN SHARIF
33	29154	MUHD ABDAI RATHOMY BIN ROMELI
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35	78457	MOHD FAIRUZ BIN MUHAMMAD PILOS

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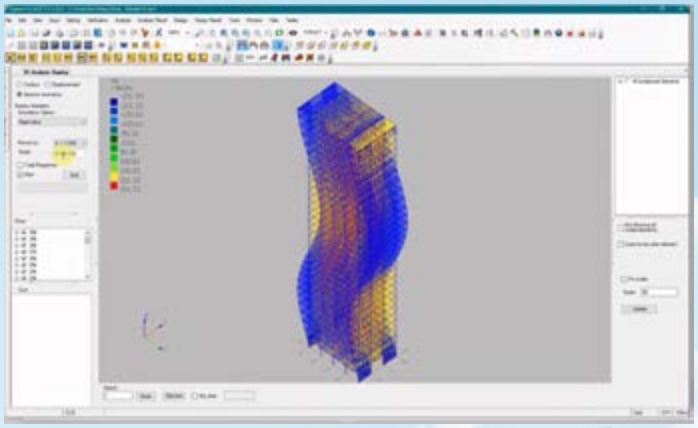

SEISMIC MODEL

WALL BIAXIAL

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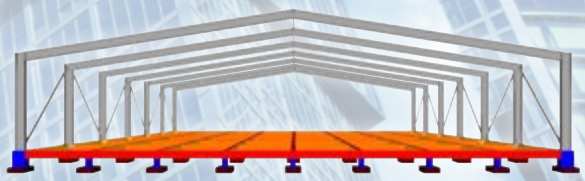

STEEL MODEL

Speaker : Ir. John Tiong
Time : 9.00am to 5.00pm
Date : 5th March 2019 (Tuesday)
Venue : Four Points by Sheraton, Puchong, Selangor.

Synopsis

This seminar will train and equip you with the"Seven Habits of Highly Effective Structural Engineers" as listed below.

1. **Customisation:** Finite Element modeling and analysis for structural engineers including dual global stiffness-loading matrices for patterned load transfer from slab to beam/column/wall. Stage Construction loading, modeling and analysis will also be covered.
2. **Simplification:** Comprehensive modeling, analysis, design and detailing including seismic to EC8 will be simplified for understanding.
3. **Integration:** Integrated Total Solution concept in processes, features, input and output results including multi-materials such as steel section design according to EC3 will be explained.
4. **Accuracy:** Usage of results as proven in benchmark for Slab, Beam, Column, Wall, Pad and Piles Footings Design according to EC2 with textbook examples will be shared. Safe-proof, self-verifications and validations of loadings at every stage of software run will be tested.
5. **Improvement:** Programmable design platform for instantaneous interactive integrated input, analysis, design and detailing can be applied. A column biaxial design surface diagram will be demonstrated.
6. **Automation:** Automated features such as wind load assignment, punching shear design and detailing, rational band-width contour design, Revit import/export compatibility and overlapping beam-slab self-weight loading will be highlighted.
7. **Optimisation:** Cost-savings and productivity through iterative and interactive design process of selected structural members such as slab, beam, column, wall and footings will be shown.

Do come to keep up to date with the latest innovations and to network with others in the industry. This seminar will be especially beneficial to structural engineers, drafting designers, project managers, property developers, civil/structural engineering academicians, quantity surveyors, architects and BIM champions.

Registration Fee: RM 300 or RM 200 for early bird who registers before 15th February 2019.
Breakfast, morning/afternoon tea refreshment and buffet lunch will be provided.
Counter registration and breakfast will start at 8:00 am.

Please download the Registration Form from www.esteemsoft.com
Call 03-80762788 (Mon-Fri) for more information.
Email: sales@esteemsoft.com

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For more information, please call Mr. Richard : +6012-216 9507

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