

THE DEVELOPMENT OF STUDENTS' LEARNING ACHIEVEMENT AND IRRIGATION SYSTEMS IN FARM SHOP SKILLS BY THE GROUP INVESTIGATION MODEL

SUTTHIPORN BOONSONG^{1,*}, A. ANA²,
DOWROONG WATCHARINRAT¹

¹Rajamangala University of Technology Thanyaburi, Thailand

²Universitas Pendidikan Indonesia, Indonesia

*Corresponding Author: sutthiporn_b@rmutt.ac.th

Abstract

This study aimed to compare the learning achievement of crop production students and irrigation systems in farm shop skills of crop production between students who study by the Group Investigation and students who study by the Traditional Model. The samples participating in this study were 48 students gathered by a cluster random sampling divided into two sections consist of four groups. The researchers employed examination, assessment abilities, and observation to collect the data. The result showed the GI model improved the students' learning achievement indicated by the examination score (Mean equals 27.01 and highly significant difference to the TM at level 0.01 (Mean equals 24.21)). The GI model enhanced irrigation systems in farm shop skills from the students' abilities assessment showing that the students in the GI group. The mean value in each irrigation system was 3.44, 3.54, and 3.67 respectively which was significantly higher than the TM group with 3.24, 3.30, and 3.40 mean values respectively. Moreover, the GI model developed students' social skills obtaining from their communication and collaboration in teamwork under teacher observation.

Keywords: Group investigation, Irrigation systems, Learning achievement.

1. Introduction

Farm shop skills are becoming an essential part of every farm with the numerous influences that are so greatly changing in agriculture [1]. This subject area being introduced and taught to Crop Production students in the Faculty of Agricultural Technology at Rajamangala University of Technology Thanyaburi (RMUTT), causing the students to learn new operations and to acquire necessary skills in the Farm Shop subject.

Moreover, the irrigation system is an important role in this subject that the researchers take priority as water is very essential in crop growing [2]. To design and choose irrigation systems or watering plants to grow and give high compensation, some problems are often encountered: when we should water the plant and the amount of water that should be distributed to the plant [3]. Hence, choosing an appropriate irrigation system should consider the soil, water, and types of crops. It will be the use of water with maximum efficiency and reflecting the actual production cost in the condition that water for agriculture is limited [4].

There are many applications in the irrigation system. In this study, the researchers explored three main applications as it is commonly used in farming such as sprinkler irrigation, drip irrigation, and mists spray irrigation. Sprinkler irrigation is an application of watering which is similar to natural rainfall which requires high pressure to distribute the water through a system of pipes, water breaks up into small water drops, sprays into the air, and drops down to the ground in the area where needs watering. Drip irrigation is a watering system that water distributes particularly to the crop and around soil in which plants can flourish. The key advantage of this method is the very high efficiency of watering, less weeds grow and can supply fertilizer along with being opened for watering [5].

Furthermore, mists spray irrigation spreads mist and requires high pressure to distribute water through a system of pipes and spread it into the air through fogger to produce water at lower volumes. The low water volume combined with the high pressure creates a mist effect. Mist spray irrigation is primarily popular in the greenhouse and nursery.

Each system selection is tailored to the needs and conditions of the land for farming. Teachers should improve and adjust the learning method to be appropriate with the new context in the world of technology [6]. There is a need for implementing a proper strategy to encourage students to target searching for knowledge, collaborative learning, satisfaction on the outcome, exchange ideas and social behavior, and comprehended on themselves and others by allowing students to train themselves to be responsible for teamwork. The members can exchange their thinking and collaborative working method to other equally in the concept of learning, causing learner thinkable, skilful, and can overcome all problem in every situation [7].

Various learning strategies have been developed to improve the student's ability. Group investigation is a potential strategy because it is related to the activities of gathering, analysing, and synthesizing information to solve a multi-task problem. Students can research information from inside and outside the classroom [8]. One strategy that can be done as a solution to this problem is by implementing the group investigation model (GI). GI is an effective learning approach to develop students with various skills such as investigation, participation, interaction, critical thinking, collaboration, teamwork, leadership, logical thinking, problem-solving, and decision

making ultimately improving their speaking skills [8]. The researchers implemented the GI model as an activity in the practical part including sprinkler irrigation, drip irrigation, and mists spray irrigation.

2. Methods

This study is an experiment with randomized posttest only control group design using paired samples statistics to compare pretest and independent samples test to analyse the different methods of instruction between experimental group students who studied by GI and control group students who studied by the TM. Then student's abilities assessments were compared on irrigation systems in farm shop skills of crop production students.

The participants of this study were 48 third-year students in crop production, faculty of agricultural technology enrolled at RMUTT, Thailand. The population distributed into two sections and each section was gathered by their registration in the academic study. A section consisted of 24 students with mixed-gender in it. The group gathering was a cluster random sampling, consisting of six participants in a group and four groups in a section. Section 1 is a control group applied with the TM model and section 2 is an experimental group applied with the GI model.

In this study, there were three main instruments used by the teacher to collect data with the learning process and student activities to evaluate learning. There were three stages, namely examination, assessment of student abilities, and observation. The first examination, before participating in practical skills, the students obtained a test-sheet as a pretest to evaluate their knowledge on that practical skill and their skill in the irrigation system to assess what they have learned from the lecture part. At the end of the practical part, the teacher examined the students in each section with the QCM sheet to evaluate their skills and knowledge after applying each teaching method (TM and GI) and to acquire the data to identify the development of the students' learning achievement and to compare the learning achievement between the TM and GI model. The data collection was obtained from the examination score.

In the student's ability assessment, the instrument was adopted for the students to evaluate their skills in the irrigation system practice in the class. The teacher provided a checklist sheet to all students that contained 5 items for each category including irrigation system design, equipment selection, irrigation installation, irrigation maintenance, and application to agriculture. The score uses to range from 1 to 4 in which 1 = poor, 2 = fair, 3 = good, and 4 = very good. The collected data was to compare the irrigation system skills of the students between TM and the GI models. This instrument was designed to gain data that hardly acquires through other instruments especially on the student's behavior [9].

3. Results

The results of data analysis were obtained from students' learning achievement and the student's irrigation skills in the farm shop after participating in the learning process and to measure the difference achievement between TM and GI model [10].

The statistical analyses of the examination score to compare the learning achievement between the TM and GI using an independent sample t-test can be seen in Table 1. As shown, Table 1 represents the comparison of two teaching

methods, regardless of the examination scores, the mean score of TM's score was 24.21 with a standard deviation of 0.75 and the mean score of GI was 27.01 with a standard deviation of 0.82. Consider its mean value, the score of GI was significantly higher than the TM's score with a statistically significant difference at the 0.01 level. Thus, the students who studied by GI have improved the learning achievement higher than students who studied by the TM model. The statistical analyses of the students' abilities assessment to compare irrigation systems in farm shop skills between the TM and GI using an independent sample t-test can be seen in Table 2.

Table 1. Comparing learning achievement of the examination score to between TM and GI.

	\bar{X}	S.D.	t-value	Probability*
Traditional Model	24.21	0.75	12.34	0.00
Group Investigation	27.01	0.82		

*significant 0.01

Table 2 shows the collected data through students' abilities assessment revealed that from the score of the range from 1-4, both teaching models obtained a good score on all categories (Mean>3). It indicates that either taught by TM or GI students' skills in each irrigation system were developed but when comparing the irrigation skills between both teaching methods found that in every irrigation skill in the GI group (with the mean value and the standard deviation 3.44/0.26, 3.54/0.30, and 3.67/0.29 respectively) were statistically significantly different to the TM group (with the mean value and standard deviation 3.24/0.28, 3.30/0.33, and 3.40/0.32 respectively). It indicates that the students in GI have significantly developed their skills in the irrigation system higher than the students in TM.

Table 2. Comparing students' farm shop skills score to between TM and GI.

Assessment	\bar{X}	S.D.	t-value	Probability*
Sprinkler Irrigation				
Traditional Model	3.24	0.28	2.60	0.013
Group Investigation	3.44	0.26		
Drip Irrigation				
Traditional Model	3.30	0.33	2.67	0.01
Group Investigation	3.54	0.30		
Mist Spray Irrigation				
Traditional Model	3.40	0.32	3.02	0.004
Group Investigation	3.67	0.29		

*significant 0.01

4. Discussion

Regarding the statistical analysis on the examination scores, it shows that either the TM model or GI model students have remarkably increased their learning achievement on the test score. With a full mean score of 30, when compared to the GI group with TM group based on the means score, it revealed that the GI was a highly significant difference to TM (GI's mean score equals 27.01 and TM's mean score equal 24.21) (see Table 1). This agrees with the mean score of students' assessments finding in this study released that students who participated in GI

distributed 3.55 on the total mean score out of full mean score 4 and TM's students gave 3.31 on the total mean score. And if comparing the mean score of each kind of irrigation system between the TM and GI, it was found that the students in the GI group have highly significantly developed their skills in every irrigation system than the students in the TM group. The GI's mean value and the standard deviation 3.44/0.26, 3.54/0.30, and 3.67/0.29 respectively, and the TM's mean value and standard deviation 3.24/0.28, 3.30/0.33, and 3.40/0.32 respectively (see Table 2).

Moreover, compared to the mean score of each category, it was found that the mean scores were increased from one category to one category in both teaching models and it agreed with the students' abilities assessment in Table 2 (mean value equal 3.24, 3.30, and 3.40 respectively in TM group and mean value equal 3.44, 3.54, and 3.67 respectively in GI group) as the teacher used the same teaching principle on each practical skill. This caused the students easily to understand from one practical skill to one practical skill. On the other hand, an irrigation system is a common application in Crop Production and students get used to it as it is applied in the greenhouse, nursery, and planting field that they worked on.

Besides, upon the observation by the teacher from the first week of participation to the end of the study, it was found that students in the GI group enjoyed their learning. They worked independently in their group for obtaining the topic and presenting it to the class. The students said, "Working in a group reduced the anxiety in learning and presentation". Depending on the observation, students in the GI group developed the social skills: communication skills, collaboration skills, teamwork that is indicated from the study activity in their group and class, their collaboration with the teammate, their research and evaluation on the topic, and their presentation [11].

The GI technique was divided into several groups that study in a different phase of a general issue. The study issue was then divided into working sections among the members of the groups. Students paired up the information, arrangement, analysis, planning, and integration of the data with the students in other groups. In this process, the teacher must be the leader of the class and ensure that students comprehend the explanations. This technique is suitable in science lessons because it encourages students to learn and attracts them to scientific research [12].

5. Conclusion

From the finding of this study, it can be concluded that the GI model developed students' learning achievement as shown on the examination scores. It revealed that the learning model based on students working in a group to achieve the desired result or group investigation is a remarkable effective model to develop students' learning achievement. Findings of this study show a significant raise in students' examination scores of the GI model and the scores were highly different from the traditional model. Further, the GI model developed the irrigation system in farm shop skills. It showed that in every irrigation system, the students in the GI group had a high score significantly different from the TM group. In addition, the GI model enhanced the students with the essential social skills: communication skills, collaboration skills, teamwork that is important in their work.

Acknowledgements

We would like to extend sincere gratitude to all participants in the Faculty of Agricultural Technology and Faculty of Technical Education, Rajamangala University of Technology Thanyaburi (RMUTT), and Mr. Seyha Khin for assisting this study.

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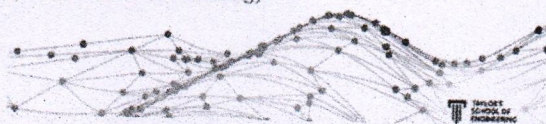
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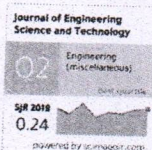
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Taylor's University
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No. 1 Jalan Taylor's, 47500 Subang Jaya
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Malaysia
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School of Engineering
Mechanical Engineering
The University of Birmingham
Edgbaston
Birmingham, B15 2TT
United Kingdom
E-mail: D.W.Hukins@bham.ac.uk

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Professor
Shizuoka University
Graduate School of Science and Engineering
3-5-1 Johoku
Hamamatsu
Shizuoka 432-8561
Japan
E-mail: tsaito@ipc.shizuoka.ac.jp

• **Stephen B M Beck**, Ph.D. (Mechanical Engineering)
Professor in Mechanical Engineering
Faculty Director of Learning and Teaching - Engineering
Department of Mechanical Engineering
The University of Sheffield
Mappin Street
Sheffield
S1 3JD
United Kingdom
E-mail: s.beck@sheffield.ac.uk

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Associate Professor
Chemical and Petroleum Engineering Department
Faculty of Engineering
UAE University
P.O. Box 17555
AlAin, U.A.E.
E-mail: alzuhair72@yahoo.com

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Professor and Dean, Faculty of Science Engineering & Technology
Director, Amity Institute of Food Technology
Amity University Uttar Pradesh, Noida (UP)
India
E-mail: manojkul@gmail.com

• **Yousif Abdall Abakr**, Ph.D. (Mechanical Engineering)
School of Mechanical Engineering
The University of Nottingham, Malaysia Campus
Jalan Broga, 43500 Semenyih, Selangor
Malaysia
E-mail: yousif.abakr@nottingham.edu.my

- **Marwan Alrubaye**, Ph.D. CEng MChemE (Chemical Engineering)
Research and Development Director
Executive Mat Service Ltd.
#6, 115 28 Street S.E.
Calgary, AB, T2A 5K4
Canada
E-mail: marwanmalik@yahoo.com
- **Lester Ingber**, Ph.D. (Theoretical Physics)
Professor
Lester Ingber Research
USA
E-mail: lester@ingber.com
- **Kartini Kamaruddin**, B.Eng [Hons], MSc [Construction], PhD [Concrete Technology]
Professor Ir Dr
Lecturer
PEPC, MIEM, FCSM, AAE
Faculty of Civil Engineering
Universiti Teknologi MARA
40450 Shah Alam, Selangor
MALAYSIA
E-mail: kartini@uitm.edu.my
- **Rita Moura Fortes**, Ph.D. (Civil Engineering)
Professor
Mackenzie Presbyterian University
Engineering School
Civil Engineering,
Brazil
E-mail: rita.fortes@mackenzie.br
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Defence Science and Technology Organisation
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E-mail: Ronny.Widjaja@dsto.defence.gov.au
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University Malaya
E-mail: mk_aroua@um.edu.my
- **Hussain H. Al-Kaylem**, Ph.D. (Mechanical Engineering)
Professor
Mechanical Engineering Department, block 17
Universiti Teknologi PETRONAS
31750 Tronoh
Perak
Malaysia
E-mail: hussain_kaylem@utp.edu.my
- **Suhana binti Koting**, Ph.D. (Civil Engineering)
Senior Lecturer, Department of Civil Engineering
Faculty of Engineering University of Malaya
50603 Lembah Pantai,
Kuala Lumpur,
Malaysia
E-mail: suhana_koting@um.edu.my
- **Sucharita Srirangam**, PhD in Architecture (Edinburgh, UK)
Senior Lecturer
School of Architecture, Building & Design
Taylor's University Lakeside Campus
No. 1 Jalan Taylor's
47500 Subang Jaya
Selangor Darul Ehsan
Malaysia
E-mail: Sucharita.Srirangam@taylors.edu.my
- **Ko Choong Woo**, Ph.D. (Mechanical Engineering)
School of Mechanical Engineering
The University of Nottingham, Malaysia Campus
Jalan Broga, 43500 Semenyih, Selangor
Malaysia
E-mail: woo.ko-choong@nottingham.edu.my
- **Ansam Nazar Younis Al_Nuaimi**, MSc. (Artificial Intelligence and Image Processing)
Assistance Literature, Computer Science Department
College of Computer Science and Mathematics
University of Mosul
Mosul
Iraq
E-mail: anyma8@uomosul.edu.iq
- **Siti Aslina Hussain**, Ph.D. (Chemical Engineering)
Department of Chemical & Environmental Engineering
Faculty of Engineering
University Putra Malaysia
Malaysia
E-mail: aslina@eng.upm.edu.my
- **Ashfaque Ahmed Chowdhury**, (Energy Engineering and Management)
College of Engineering and Built Environment
Faculty of Sciences,
Engineering and Health Central Queensland University
Rockhampton, Qld 4702
Australia
E-mail: a.chowdhury@cqu.edu.au

- **Collin G. Joseph**, Ph.D. (Chemical Engineering)
Senior Lecturer, School of Science & Technology
Universiti Malaysia Sabah
Kampus Tetap Teluk Sepanggar
Beg Berkunci No.2073
88999 Kota Kinabalu,
Sabah,
Malaysia
E-mail: collin@ums.edu.my
- **P. Chandrasekar**, Ph.D. (Surface Engineering)
Room 323, Engineering faculty block,
School of Engineering and Science,
Swinburne University of Technology (Sarawak Campus),
Jalan Simpang Tiga, 93350 Kuching,
Sarawak, Malaysia.
E-mail: cpalanisamy@swinburne.edu.my
- **Ahmad Baharuddin B. Abdullah** (Metal Forming)
School of Mechanical Engineering
Universiti Sains Malaysia, Engineering Campus
14300 Nibong Tebal, Penang, Malaysia
E-mail: mebaha@eng.usm.my
- **Mohanad El-Harbawi**, Ph.D. (Chemical Engineering)
Department of Chemical Engineering,
King Saud University,
P. O. Box 800, Riyadh, 11421,
Saudi Arabia
E-mail: melharbawi@ksu.edu.sa
- **Ah Heng You**, Ph.D. (Electronic Engineering)
Multimedia University,
Jalan Ayer Keroh Lama,
75450 Melaka
Malaysia
E-mail: ahyou@mmu.edu.my
- **Ekachai Chukeatirote**, Ph.D. (Biochemistry and Biotechnology)
School of Science,
Mae Fah Luang University,
Chiang Rai 57100 Thailand
Tel. 66-53-916778
Fax. 66-53-916776
E-mail: ekachai@mfu.ac.th
- **Daniel Lepadatu**, Ph.D. (Civil Engineering)
Associate Professor, Faculty of Civil Engineering and Building Services
Civil Engineering Department
Gheorghe Asachi Technical University of Iasi
Bd. Mangeron No. 1
700050, Iasi
Romania
E-mail: dlepadat@tuiasi.ro
- **Ahmad Yusairi Bani Hashim**, Ph.D. (Biomedical Engineering)
Department of Robotics & Automation
Faculty of Manufacturing Engineering
Universiti Teknikal Malaysia Melaka
Tel. 06-3316498
Fax. 06-3316431
E-mail: yusairi@utem.edu.my
- **P. Dhanapal Durai Dominic**, Ph.D. (Management)
Senior Lecturer
Universiti Teknologi PETRONAS
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Assistant Professor, Computer and Information Engineering Department
College of Electronics Engineering
Ninevah University
Mosul
Iraq
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Department of computer science,
Faculty of Information Technology and Computer Sciences,
Yarmouk University,
Irbid,
Jordan
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- **K. Duraiswamy**, Ph.D. (Static State Estimation)
K.S.Rangasamy College of Technology,
Tiruchengode 637215
India
E-mail: drkduraiswamy@yahoo.co.in
- **Jian Ma**, Ph.D. (Electrical Engineering)
Senior Electrical Engineer
Burns & McDonnell
9400 Ward Parkway
Kansas City, MO 6

USA

E-mail: jma@burnsmcd.com

- **S. Hariharan**, B.E., M.E., Ph.D. (Computer Science and Engineering)
Professor
Department of Computer Science and Engineering
Saveetha Engineering College,
Chennai, Tamil Nadu- 602105
India
E-mail: mailtos.hariharan@gmail.com
- **Arif A. Al-Qassar**, Ph.D. (Aerodynamics)
Control and Systems Department
University of Technology,
P.O. Box: 35010, Baghdad
Iraq
E-mail: arifqassar@yahoo.com
- **B. F. Yousif**, Ph.D. (Mechanical Engineering)
Faculty of Engineering,
University of Southern Queensland,
Toowoomba, QLD,
Australia.
E-mail: Belal.Yousif@usq.edu.au
- **P. Chandramohan**, Ph.D. (Metal forming and quality related)
Professor
Department of Mechanical Engineering
Sri Ramakrishna Engineering college
Coimbatore-641022
India
E-mail: pcmohu@yahoo.co.in
- **Laith K. Abbas**, Ph.D. (Aeroelasticity)
Nanjing University of Sciences and Technology,
NO.5 Xinnofan Road, Nanjing,
China
E-mail: laithabbass@yahoo.com
- **Muhsin J. Jweeg**, Ph.D. (Dynamics and Vibrations)
Al-Nahrain University - College of Engineering
Baghdad,
Iraq
E-mail: muhsinij@yahoo.com
- **George Papadakis**, Ph.D. (Mechanical Engineering)
King's College London
Strand, London WC2R 2LS, England
United Kingdom
E-mail: george.papadakis@kcl.ac.uk
- **Hjh Siti Hawa Hamzah**, Prof Ir Dr. (Civil Engineering)
P.Eng, FIEM, Hon. MAFEO ASEAN Engr, ASM Assoc, MPWI, MRM, PSWM
Faculty of Civil Engineering, UITM,
40450 Shah Alam, Selangor
Malaysia
E-mail: shh@salam.uitm.edu.my
- **Balasubramanian Ravisankar**, Ph.D. (Metallurgical Engineering)
National Institute of Technology,
Tiruchirappalli - 620 015
India
E-mail: r_shankar2002@yahoo.com
- **Arkan Kh. Husain Al Taie**, Ph.D. (Mechanical Engineering)
Dept. of Machines and Equipment, University of Technology,
Street no. 52, Baghdad
Iraq
E-mail: arkanaltaie@yahoo.com
- **Shivaprasad Kumar Vijayalakshmi**, Ph.D. (Thermal Engineering)
Department of Engineering,
Durham University,
Durham, DH1 3LE
United Kingdom
E-mail: spkvnitk@gmail.com
- **Shibly Ahmad Al-Samarraie**, Ph.D. (Mechanical Engineering)
Control and System Dept., University of Technology,
Al-Sina'ah Street, P.O. Box 35010, Baghdad
Iraq
E-mail: shiblyhameed@yahoo.com
- **Sorabh Gupta**, Ph.D. (Industrial Engineering)
Haryana Institute of Engineering and Technology,
Ambala Road, City-Kaithal, State-Haryana
India
E-mail: Sorabh_gupta123@rediffmail.com
- **Sanjay Marwaha**, Ph.D. (Electrical Machines)
SLIET Longowal, District-Sangrur, Punjab
India
E-mail: marwaha_sanjay@yahoo.co.in
- **Neelam Srivastava**, Ph.D. (Optical Communication)
B 1/291 Sector G, Jankipuram,
Lucknow-226021
India
E-mail: neelam.srivastava@ietlucknow.edu

- **Omar Amer Abouabdalla**, Ph.D. (Computer Science)
National Advanced IPv6 Centre (NAV6),
6th Floor, School of Computer Sciences,
Universiti Sains Malaysia,
11800 Penang,
Malaysia
E-mail: omar@nav6.org
- **Suraya Abdul Rashid**, Ph.D. (Chemical Engineering)
Department of Chemical and Environmental Engineering,
Faculty of Engineering, UPM,
43400 Serdang, Selangor
Malaysia
E-mail: suraya@eng.upm.edu.my
- **Abd Rahim Abu Bakar**, Ph.D. (Mechanical Engineering)
Faculty of Mechanical Engineering,
Universiti Teknologi Malaysia,
Malaysia
E-mail: arahim@fkm.utm.my
- **Hamidah Mohd. Saman**, Ph.D. (Civil Engineering/ Concrete Technology)
Faculty of Civil Engineering,
Universiti Teknologi MARA
40450 UTM Shah Alam, Selangor D. Ehsan
Malaysia
E-mail: hmohdsaman@yahoo.com
- **Mazin Z. Othman**, Ph.D. (Electrical and Electronic Engineering)
Electrical and Computer Engineering Department,
College of Engineering,
Dhofar University,
Salalah, Sultanate of Oman
E-mail: mothman@du.edu.om
- **Sivarao Subramonian**, Ir. P.Eng. (Manufacturing Engineering)
Faculty of Manufacturing Engineering,
Universiti Teknikal Malaysia Melaka (UTeM)
76100 Durian Tunggal, Melaka
Malaysia
E-mail: sivarao@utem.edu.my
- **Mandeep Singh Jit Singh**, Ph.D. (Electronic Engineering)
Department of Electrical, Electronic, and System,
Faculty of Engineering and Built Environment
Universiti Kebangsaan Malaysia,
43600 Selangor
Malaysia
E-mail: mandeep@eng.ukm.my
- **Rendy Thamrin**, Ph.D. (Structural Engineering)
Civil Engineering Department,
Faculty of Engineering Andalas University
Kampus Limau Manis, Padang (25163),
West Sumatera
Indonesia
E-mail: rendy@ft.unand.ac.id
- **S. Sundaram**, Ph.D. (Mechanical Engineering)
Professor
K.S.R. College of Engineering,
Tiruchengode - 637 215,
Tamil Nadu
India
E-mail: Sundaram1160@yahoo.co.in
- **T. Sekar**, Ph.D. (Mechanical Engineering)
Associate Professor of Mechanical Engineering
Thanthai Periyar Government Institute of Technology
Vellore-632 002, Tamil Nadu,
India
E-mail: drtsekar76@gmail.com
- **Yarub Al-Douri**, Ph.D. (Material Science)
Institute of Nano Electronic Engineering,
University Malaysia Perlis, Lot 110, 1st Floor,
Block A, Taman Pektivi Indah, Seriab,
Jalan Kangar-Alor Setar, 01000, Kangar, Perlis,
Malaysia
E-mail: yaldouri@yahoo.com
- **Pakharuddin Mohd Samin**, Ph.D. (Automotive Engineering)
Department of Automotive Engineering,
Universiti Teknologi Malaysia,
81310 Skudal, Johor
Malaysia
E-mail: pakhar@fkm.utm.my
- **Mohammad Aktarul Islam Chowdhury**, Ph.D. (Civil and Environmental Engineering)
Department of Civil and Environmental Engineering,
Shahjalal University of Science and Technology,
Sylhet -3114,
Bangladesh
E-mail: aic_cee@yahoo.com
- **M. Senthil Kumar**, Ph.D. (Mechanical Engineering)
Department of Mechanical Engineering,
PSG College of Technology,

Coimbatore 641 004
India

E-mail: msenthil_kumar@hotmail.com

- **Anand Kumar**, Ph.D. (Computer Science)
MCA Department,
AMC Engineering College
18TH KM, Bannerghatta Road Bangalore
PIN 560083, Karnataka,
India
E-mail: kumaranandkumar@gmail.com
- **Abdullateef A. Jadallah**, Ph.D. (Aerothermodynamics)
Department of Electromechanical Engineering,
University of Technology
Baghdad
Iraq
E-mail: abdullateef@uotechnology.edu.iq
- **Ahmed Kadhim Hussein**, Ph.D. (Mechanical Engineering)
Professor
College of Engineering
Department of Mechanical Engineering
Babylon University
Babylon City, Hilla
Iraq
E-mail: ahmedkadhim7474@gmail.com
- **Wong Yee Wan**, (Electrical and Electronic Engineering)
Faculty of Engineering
The University of Nottingham Malaysia Campus
Jalan Broga, 43500 Semenyih
Selangor Darul Ehsan
Malaysia
E-mail: YeeWan.Wong@nottingham.edu.my
- **Mohammad M. Kadhum**, Ph.D. MIEEE (Computer Science)
Visiting Professor
Queen's Telecommunications Research Lab
School of Computing
Queen's University
Kingston, Ontario K7L 2N8
Canada
E-mail: kadhum@cs.queensu.ca
- **Mohammad Hosseini Fouladi**, Ph.D. (Mechanical Engineering)
School of Engineering
Taylor's University
Taylor's Lakeside Campus
No. 1 Jalan Taylor's, 47500 Subang Jaya
Selangor DE
Malaysia
E-mail: Hosseini@taylors.edu.my
- **Noaman Mohammad Noaman**, Ph.D. (Electrical and Electronic Engineering)
Head of Electrical and Electronic Department
Gulf University
Villa 1964, Road 4363, SANAD 743
Kingdom of Bahrain
E-mail: dr.noaman@gulfuniversity.net
- **Djwantoro Hardjito**, Ph.D. (Civil Engineering)
Civil Engineering Department
Petra Christian University
Jalan Siwalankerto 121-131
Surabaya 60236
Indonesia
E-mail: djwantoro.h@peter.petra.ac.id
- **Hitesh N. Panchal**, Ph.D. (Mechanical Engineering)
Assistant Professor,
L C Institute of Technology, Bhandu.
Mehsana-Unjha Highway,
At & Po. Bhandu.
Ta: Visnagar,
Dist. Mehsana. Gujarat,
India
E-mail: Engineerhitesh2000@gmail.com
- **Obai Younis Taha Elamin**, Ph.D. (Mechanical Engineering)
College of Engineering - Wadi Addwasir
Prince Sattam Bin Abdulaziz University
KSA
E-mail: o.elamin@psau.edu
- **Ta Yeong Wu**, Ph.D. (Biochemical Engineering)
Chemical and Sustainable Process Engineering Research Group,
School of Engineering,
Monash University,
Jalan Lagoon Selatan,
Bandar Sunway, 46150,
Selangor Darul Ehsan,
Malaysia
E-mail: wu.ta.yeong@eng.monash.edu.my
- **S. Rajaram**, Ph.D. (Electronic Engineering)
Department of Electronics and Communication Engg.,
Thiagarajar College of Engineering,
Madurai-625015,

Tamilnadu,
India
E-mail: rajaram_siva@tce.edu

• **Hussein A. Mohammed**, Ph.D. (Mechanical Engineering)
Department of Mechanical Engineering,
College of Engineering,
Universiti Tenaga Nasional (UNITEN),
Km7, Jalan Kajang-Puchong, 43009 Kajang,
Selangor,
Malaysia
E-mail: Hussein@uniten.edu.my

• **Sunil Kumar Gupta**, Ph.D. (Computer and Science Engineering)
Computer Science and Engineering
Beant College of Engineering and Technology,
Gurdaspur,
India
E-mail: skgbcet@yahoo.co.in

• **Mohamed Hussien Mohamed Nerma**, Ph.D. (Communication Engineering)
Department of Electronics Engineering,
Sudan University of Science and Technology,
Sudan
E-mail: mohamed_hussien@ieee.org

• **Subramaniam Prakash**, Ph.D. (Mechanical Engineering)
Sathyabama University
Chennai 600119
India
E-mail: prakash_s1969@yahoo.com

• **Firas Ahmed Salman**, Ph.D. (Civil Engineering)
Department of Civil Engineering,
Faculty of Engineering,
University of Malaya,
50603 Kuala Lumpur
Malaysia
E-mail: frsas@um.edu.my

• **Srinivas Ganapathyraju**, Ph.D. (Industrial and Manufacturing Engineering)
Sheridan Institute of Technology,
7899 McLaughlin Road, Box 7500,
Brampton, On L6V 1G6,
Canada
E-mail: sganapathyraju@gmail.com

• **Syahrul Fithry Bin Senin** (MSc in Structural Engineering)
Professional Technologist
(Building & Construction Technology)
Faculty of Civil Engineering, Universiti Teknologi MARA (UITM)
Cawangan Pulau Pinang, Kampus Permatang Pauh
13500 Permatang Pauh
Pulau Pinang
Malaysia
Email: syahrul573@uitm.edu.my

• **N. Darga Kumar**, Ph.D. (Civil Engineering)
Department of Civil Engineering
J.N.T.U.H College of Engineering
Kukatpally, Hyderabad - 500 085, A.P.,
India
E-mail: ndkumar@jntuh.ac.in

• **R. Bensraj**, Ph.D. (Electrical engineering)
Department of Electrical and Electronic Engineering,
Annamalai University,
Annamalainagar-608 002,
Tamil Nadu,
India
E-mail: bensraj_au@rediffmail.com

• **Alaa Taqa**, Ph.D. (Computer Science)
Education college-Computer Science Department,
University of Mosul,
Iraq
E-mail: alaa.taqa@gmail.com

• **Ibrahima Faye**, Ph.D. (Mathematics)
Fundamental and Applied Sciences Department,
Universiti Teknologi PETRONAS
Malaysia
E-mail: Ibrahima_faye@petronas.com.my

• **Edwin Chung Chin Yau**, Ph.D. (Electrical Engineering)
Taylor's University
Taylor's Lakeside Campus
No. 1 Jalan Taylor's, 47500 Subang Jaya
Selangor DE
Malaysia
Tel: ++603-56295000- ext. 5453
Fax: ++603-56295001
E-mail: Edwin.Chung@taylors.edu.my

• **Hardeep Singh**, Ph.D. (Computer Science)
Department of Computer science and Engineering,
Guru Nanak Dev University
Amritsar, Punjab, 143005

India

E-mail: hardeep_gndu@rediffmail.com

- **Debojyoti Mitra**, Ph.D. (Mechanical Engineering)
Associate Professor & Head, Department of Mechanical Engineering
Sir Padampat Singhania University,
Udaipur, Rajasthan,
India
E-mail: debojyoti.mitra@spsu.ac.in
- **Kurian Y. John**, Ph.D. (Structural Engineering)
Professor, Department of Mechanical Engineering,
University Technology Petronas,
Malaysia
E-mail: kurian_johne@petronas.com.my
- **Napsiah Ismail**, Ph.D. (Mechanical Engineering)
Associate Professor, Department of Mechanical and Manufacturing Engineering,
University Putra Malaysia,
Malaysia
E-mail: napsiah@eng.upm.edu.my
- **Amit Kumar Garg**, Ph.D. (Electronics and communication Engineering)
Professor, Electronics & Communication Engineering Department,
Deenbandhu Chhotu Ram University of Science & Technology
MURTHAL-131039,
Sonapat (HR.),
India
E-mail: garg_amit03@yahoo.co.in
- **R. Manisekar**, Ph.D. (Structural Engineering)
Senior Scientist, CSIR-Structural Engineering Research Centre
Chennai-600113,
India
E-mail: mani@serc.res.in
- **Ghanim Magbul Alwan**, Ph.D. (Chemical Engineering)
Assistance Professor, Chemical Engineering Department,
University of Technology,
Baghdad,
Iraq
E-mail: Dr_gm@uotechnology.edu.iq
- **Fadzli Mohamed Nazri**, Ph.D. (Structural & Earthquake Engineering)
School of Civil Engineering,
Engineering Campus,
Universiti Sains Malaysia,
14300 Nibong Tebal, Seberang Perai Selatan,
Pulau Pinang,
Malaysia
E-mail: cefmn@usm.my
- **Saurabh Kumar Mukerji**, Ph.D. (Electrical Engineering)
Senior Professor, Managalayatan University,
3/286 Durgabari, Marris Road,
Aligarh-202001,
India
E-mail: sk.mukherji@mangalayatan.edu.in
- **Sergej Hloch**, Ph.D. (Manufacturing Engineering)
Fakulta výrobných technológií so sídlom v Prešove
(Faculty of Manufacturing Technologies with a seat in Prešov)
Technická univerzita v Košiciach (Technical University of Košice),
Slovakia
E-mail: sergej.hloch@tuke.sk
- **R. Rajesh @ Nithyanandam**, Ph.D. (Chemical Engineering)
Taylor's University
Taylor's Lakeside Campus
No. 1 Jalan Taylor's, 47500 Subang Jaya
Selangor DE
Malaysia
E-mail: Rajesh.Rajasekaran@taylors.edu.my
- **Sanjeevkumar Padmanaban**, Ph.D. (Electrical Engineering)
Associate Professor, School of Electrical Engineering (SELECT)
VIT University
Vandalur Kelambakkam Road, Chennai - 600 127.
India
E-mail: sanjeevi_12@yahoo.co.in
- **Mehdi Amouei Torkmahalleh**, Ph.D. (Chemical Engineering)
Visiting Assistant Professor
Chemical Engineering Program
Middle East Technical University,
Northern Cyprus Campus (METUNCC),
S-Bol Kat 2 (Bn Akdogan veya Harmanli) Kalkanli,
Güzelyurt, Mersin 10,
Turkey
E-mail: tmehdi@metu.edu.tr
- **Chong Perk Lin**, Ph.D., CEng MIMechE (Mechanical Engineering)
Senior Lecturer
School of Science and Engineering
Teesside University
Middlesbrough
TS1 3BA
United Kingdom
E-mail: P.Chong@tees.ac.uk

- **Taghreed H. Al-Noor**, Ph.D. (Chemical Engineering)
Professor, Ibn Al-Halham Education for pure Science College,
Department: Chemistry
University of Baghdad
Iraq
E-mail: drtaghreed@yahoo.com
- **Lyes Bennamoun**, Ph.D. (Chemical Engineering)
Department of Mechanical Engineering
University of New Brunswick,
Fredericton,
Canada
E-mail: lyes.bennamoun@unb.ca
- **D. J. ABDULRAZAK**, Ph.D. (Mechanical Engineering)
Pionjargatan 8,
58734 Linköping,
Sweden
E-mail: dja5544@yahoo.com
- **Mahmoud I. Abbas**, Ph.D. (Radiation Physics)
Professor, Physics Department
Faculty of Science, Alexandria University
2151 Alexandria
Egypt
E-mail: Mahmoud.abbas@alexu.edu.eg
- **Mohamed Ahmed Mahmoud Gomaa**, Ph.D. (Radiation Physics)
Professor,
Atomic Energy Authority of Egypt
Egypt
E-mail: mamgomaa@gmail.com
- **Mohamed Salem Badawi**, Ph.D. (Radiation Physics)
Radiation Physics Laboratory
Physics Department
Faculty of Science
Alexandria University
21511 Alexandria
Egypt
E-mail: ms241178@hotmail.com
- **Krzysztof Nadolny**, Ph.D. (Mechanical Engineering)
Assistant Professor,
Department of Production Engineering
Koszalin University of Technology
Poland
E-mail: krzysztof.nadolny@tu.koszalin.pl
- **Miloš Madić** (Mechanical Engineering)
Department of Production Engineering
Faculty of Mechanical Engineering,
University of Niš
Serbia
E-mail: madic@masfak.ni.ac.rs
- **Lee Keat Teong** (Chemical Engineering)
School of Chemical Engineering, Engineering Campus,
Universiti Sains Malaysia,
14300 Seri Ampangan,
Nibong Tebal, Penang,
Malaysia
E-mail: ktlee@usm.my
- **Keith Case** (Computer Aided Engineering)
Professor
Mechanical and Manufacturing Engineering,
Loughborough University, Loughborough,
Leicestershire, LE11 3TU,
UK
E-mail: K.Case@lboro.ac.uk
- **C. Senthilpari** (Applied Electronics)
Senior Lecturer
Faculty of Engineering & Technology,
Multimedia University,
Jalan Ayer Keroh Lama,
75450 Melaka
Malaysia
E-mail: c.senthilpari@mmu.edu.my
- **Sarfraz N. Brohi**, Ph.D. (Software Engineering, Cloud Computing)
Lecturer
School of Computing and IT
Taylor's University Lakeside Campus
No. 1, Jalan Taylor's,
47500 Petaling Jaya,
Selangor Darul Ehsan,
Malaysia.
E-mail: sarfraz_brohi@hotmail.com
- **Wael A. Salah**, PhD (Electrical and Electronic Engineering)
Assistant Professor,
College of Engineering and Technology
Palestine Technical University - Kadoorie
P.O. Box: 7, Yafa Street,
Tulkarm,
Palestine

E-mail: wael_sal@yahoo.com

- **Hai Chen Tan**, PhD (Construction Project Management)
Faculty of Engineering and Science,
Universiti Tunku Abdul Rahman, UTAR Complex,
53300 Kuala Lumpur,
Malaysia
E-mail: tanhc@utar.edu.my
- **K. Srinivasan**, PhD (Electrical and Electronic Engineering)
Professor and Head
Department of Electronics & Instrumentation Engineering
Sri Ramakrishna Engineering College
Coimbatore- 641 022
Tamilnadu
India
E-mail: srineekvasan@gmail.com
- **Jianjia Yu**, PhD (Petroleum Engineering)
Research Scientist
Petroleum Recovery Research Center (PRRC),
New Mexico Institute of Mining and Technology
3305 New Mexico Tech,
801 Leroy P.L., Socorro
New Mexico 87801
USA
E-mail: yu@nmt.edu
- **K. Kumar Naik**, Ph.D. (Electronics and Communication Engineering)
Professor
Department of Electronics & Communication Engineering,
K L University, Vaddeswaram,
Guntur, A.P.,
India
E-mail: drkumarkn@hotmail.com
- **Varun Perumalla**, M.S. (Electrical and Computer Engineering)
Enterprise Information Modeling Engineer
California Independent System Operator
Folsom, CA
USA
E-mail: varun.perumalla@gmail.com
- **Rashmi G. Walvekar**, Ph.D. (Chemical Engineering)
Chemical Engineering Department
School of Engineering
Taylor's University
Taylor's Lakeside Campus
No. 1 Jalan Taylor's, 47500 Subang Jaya
Selangor DE
Malaysia
E-mail: RashmiGangasa.Walvekar@taylors.edu.my
- **Bujang B.K. Huat**, Ph.D. (Soil Mechanics/Geotechnical Engineering)
School of Graduate Studies,
Universiti Putera Malaysia
Malaysia
E-mail: huatbbk@yahoo.com
- **Rebecca Lim Xiao Yien**, Ph.D. (Chemical Engineering)
Assistant Professor
School of Engineering and Physical Sciences
Heriot-Watt University Dubai Campus
Dubai International Academic City
P.O.Box 294345, Dubai,
UAE
E-mail: l.xiao_yien@hw.ac.uk
- **Vijay Kumar Kambila**, Ph.D. (Nanotechnology)
K L University, Guntur-522 502 (A.P.)-
INDIA
E-mail: vijaynanopklu@gmail
- **Akram S. Mahmoud**, Ph.D. (Civil Engineering)
Civil Engineering Department,
Engineering College,
Anbar university,
Ramadi, Anbar Province
IRAQ
E-mail: Akramsh1@yahoo.com
- **Meor Othman Hamzah**, Ph.D. (Civil Engineering)
School of Civil Engineering, Engineering Campus,
Universiti Sains Malaysia,
14300 Nibong Tebal,
Penang,
Malaysia
E-mail: cemeor@yahoo.com
- **Yamuna Prasad Yadav**, Ph.D. (Civil Engineering)
Departments of Physics, Chemistry, Mathematics & Humanities
Department of Physics, National Institute of Technology (NIT),
Jamshedpur
INDIA
E-mail: ypvadvrit@hotmail.com
- **Mohd Khalid Mohd Nor**, Ph.D. (Mechatronics)
Research Fellow
Brunel University,

UK

E-mail: mkhalid1806@yahoo.co.uk

- **N. NALLUSAMY**, Ph.D. (Mechanical Engineering)
Professor and Head, Department of Mechanical Engineering,
Sri Venkateswara College of Engineering,
Sriperumbudur - 602 105, Tamil Nadu,
INDIA
E-mail: nnalls@gmail.com
- **Paritosh Bhattacharya**, Ph.D. (Mechanical Engineering)
Department of Basic science & Humanities
College of Engineering & Management, Kolaghat
KTPP Township
Dist east Midnapore
PIN 721171
INDIA
E-mail: p_bhattacharya2001@yahoo.co.in
- **Mohd Sapuan Salit**, Ph.D. (Mechanical Engineering)
Department of Mechanical and Manufacturing Engineering
Universiti Putra Malaysia,
43400 UPM Serdang,
Selangore
Malaysia
E-mail: drsapuan@yahoo.com
- **Ramachandran K. P.**, Ph.D. (Mechanical Engineering)
Caledonian College of Engineering
P.O.Box: 2322,
CPO Seeb - 111,
Sultanate of Oman
E-mail: ramkp@caledonian.edu.om
- **Saim Rachid**, Ph.D. (Convection in complex geometry)
Département de Génie Mécanique,
Faculté de Technologie (ex F.S.I)
Université ABOU BEKR Belkaid-
Tlemcen BP 230- Chetouane -13000-
Tlemcen
Algérie
E-mail: saimrachid@yahoo.fr
- **Raghad Sabah Kamel**, M.Sc. (Mechanical Engineering)
6080 fatherhead Cres. Mississauga,
ON, L5N 2B6
CANADA
E-mail: raghadadnan@yahoo.com
- **Samir N. Y. Gerges**, Ph.D. (Acoustics, Noise and Vibration)
Rua Das Amendoeiras 21-
Canto da Lagoa - Florianopolis
- SC - 89062.290
BRAZIL
E-mail: samir@emc.ufsc.br
- **Masataka Shirakashi**, Ph.D. (Mechanical Engineering)
Professor
Malaysia-Japan International Institute of Technology
Universiti Teknologi Malaysia (UTM) Kuala Lumpur
Jalan Semarak,
54100
Kuala Lumpur
Malaysia
E-mail: shirakashi@ic.utm.my
- **P. Victor Paul**, Ph.D. (Computer Science and Engineering)
Associate Professor
Department of Information Technology,
Sri Manakula Vinayagar Engineering College,
Madagadipet, Puducherry - 605 107,
INDIA
E-mail: victorpaul@gmail.com
- **Muna Hadi Saleh**, Ph.D. (Computer & Information Technology Engineering)
Associate Professor
Electrical Department
Engineering Collage
University of Baghdad
Iraq
E-mail: drmunah4@yahoo.com
- **Azura Che Soh**, Ph.D. (Electrical Engineering)
Department of Electrical & Electronic Engineering
Faculty of Engineering
University Putra Malaysia
Malaysia
E-mail: azuracs@upm.edu.my
- **Douglas K.T. Tong**, M.Eng (Manufacturing Engineering), CEng, MIMechE
Senior Lecturer, School of Engineering
Taylor's University
Lakeside Campus
No.1, Jalan Taylor's
47500 Subang Jaya
Selangor Darul Ehsan
Malaysia
E-mail: DouglasKumTien.Tong@taylors.edu.my

- **Wong Wai Yin**, Ph.D. (Fuel Cell Engineering)
 Fuel Cell Institute,
 Universiti Kebangsaan Malaysia,
 43600 UKM Bangi,
 Selangor DE
 Malaysia
E-mail: waiyin.wong@ukm.edu.my

- **Mohamed H. Nassir**, Ph.D. (Physics/Thin films)
 Malaysia
E-mail: mohamoski@yahoo.com

- **Salam K. Al-Dawery, PhD, M.Phil.**, BSc. (Chemical Engineering)
 Associate Professor, Assistant Dean for Research
 College of Engineering,
 University of Nizwa,
 Birkat Al Mouz, P.O. Box 33, PC: 616, Nizwa,
 Sultanate of Oman
E-mail: salam@unizwa.edu.om

- **Mervat Adib Bamiah**, Ph.D. (Software Engineering)
 Assistant Professor
 Prince Sultan University,
 Collage of Computer and Information Sciences
 Riyadh,
 Saudi Arabia
E-mail: mbamiah@psu.edu.sa

- **Zairi Ismael Rizman**, M.Sc. (Electrical Engineering)
 Department of Research,
 Industry Linkage & Alumni (PJIA)
 Universiti Teknologi MARA (Terengganu)
 23000 Dungun,
 Terengganu
 Malaysia
E-mail: zairi576@tganu.uitm.edu.my

- **Tan Yie Hua**, Ph.D. (Chemical Engineering)
 Lecturer, Department Chemical Engineering
 Faculty of Engineering and Science
 Curtin University Malaysia
 CDT 250, 98009 Miri,
 Sarawak,
 Malaysia
E-mail: tanyiehua@curtin.edu.my

- **Siow Chun Lim**, Ph.D. (Electrical Engineering)
 Faculty of Engineering,
 Multimedia University,
 Persiaran Multimedia,
 63100 Cyberjaya,
 Selangor, Malaysia
E-mail: clsiew@mmu.edu.my

- **Ch'ng Shiau Ying**, Ph.D.
 University of Southampton Malaysia Campus (USMC)
 No.3, Persiaran Canselor 1
 Kota Ilmu Educity @ Iskandar
 79200 Iskandar Puteri
 Johor,
 Malaysia
E-mail: s.y.ch'ng@soton.ac.uk

- **S. Palanivel Rajan**, Ph.D. (Electrical Engineering)
 Assistant Professor
 Department of ECE,
 M. Kumarasamy College of Engineering,
 Karur, TN,
 India
E-mail: palanivelrajanme@gmail.com

- **Yee Hooi Min**, Ph.D. PEng. (Civil Engineering)
 Senior Lecturer, Faculty of Civil Engineering
 Universiti Teknologi MARA (Pulau Pinang)
 13500 Permatang Pauh,
 Pulau Pinang,
 Malaysia
E-mail: minyh@ppinang.uitm.edu.my

- **Coelho, José Gustavo**, Ph.D. (Mechanical Engineering)
 Adjunct Professor
 Federal University of Triangulo Mineiro
 Department of Mechanical Engineering
 38064-200 Univerdecidade
 Uberaba,
 Brazil
E-mail: josegustavo@icte.ufcm.edu.br

- **S. Rajakumar**, Ph.D. (Manufacturing Engineering)
 Assistant Professor & UGC- Research Awardee
 Department of Manufacturing Engineering,
 Annamalai University,
 Annamalai Nagar-608002
 Chidambaram, Tamilnadu
 India
E-mail: srkcmajor@yahoo.com

- **Shamzani Affendy Mohd Din**, Ph.D. (Civil Engineering)

Senior Lecturer
Kulliyah of Architecture & Environmental Design,
International Islamic University Malaysia,
P.O.Box 10,
50728 Gombak,
Kuala Lumpur
Malaysia
E-mail: shamzani@iiu.edu.my

- **P. Sivakumar**, Ph.D. (Information and Communication Engineering)
Professor
Department of Electronics and Communication Engg
SKP Engineering College
Thiruvannamalai-606611
Tamilnadu,
India
E-mail: drpsivakumar@skpec.in

- **Ng Kok Shien**, Ph.D. (Civil Engineering)
Senior Lecturer
Faculty of Civil Engineering
Universiti Teknologi MARA
Kampus Pulau Pinang
Jalan Permatang Pauh
13500 Permatang Pauh
Pulau Pinang
Malaysia
E-mail: nkokshien@ppinang.uitm.edu.my

- **B T P Madhav**, MSc., MBA., M. Tech., Ph.D. (Electronics and Communication Engineering),
MIEEE, MISTE, MIACSIT, MIRACST, MUACEE, MIAEME, MIAENG, MIAES, MIIRJC
Professor & Sub-Editor IJST
Communication Systems Research Group Head
LCRC-R&D, DST-FIST Sponsored ECE Department
K L University
India
E-mail: btprmadhav@kluniversity.in

- **Nurfadhilina Mohd Sharef**, Ph.D. (Artificial Intelligence)
Senior Lecturer
Department of Computer Science
Faculty of Computer Science and Information Technology
Universiti Putra Malaysia,
Malaysia
E-mail: nurfadhilina@upm.edu.my

- **Haider M. Hamzah**, Ph.D. (Microbial Biotechnology & Bioinformatics)
Assistant Professor
Department of Biology,
School of Science & Science Education
University of Sulaimani
Kurdistan region of Iraq
Iraq
E-mail: haider.hamzah@univsul.edu.iq

- **Lau Woei Jye**, Ph.D. (Chemical Engineering)
Senior Lecturer
Advanced Membrane Technology Research Center
Universiti Teknologi Malaysia
Malaysia
E-mail: lwoeijye@utm.my, M. Tech., Ph.D. (Electronics and Communication Engineering),

- **HK Govindaraju**, Ph.D. (Mechanical Engineering)
Professor and Head
BMS Institute of Technology
Department of Mechanical Engineering
Avalahalli,
Doddaballapura Main Road
Bangalore - 64
India
E-mail: anchithoraj@gmail.com

- **V. C. Sathish Gandhi**, Ph.D. (Mechanical Engineering)
Assistant Professor,
University College of Engineering Nagercoil,
(A Constituent College of Anna University Chennai)
Konam, Nagercoil - 629 004,
Tamilnadu,
India
E-mail: vcsgandhi@gmail.com

- **Lee Chia Ping**, Ph.D. (Electrical and Electronics Engineering)
Lecturer, School of Engineering
Taylor's University,
No. 1 Jalan Taylor's,
47500, Subang Jaya,
Selangor,
Malaysia
E-mail: ChiaPing.Lee@taylors.edu.my

- **Noé Cheung**, Ph.D. (Mechanical Engineering)
Associate Professor in Metallurgy
Department of Manufacturing and Materials Engineering,
University of Campinas,
Mendeleev St, 200,
13083-860 - Campinas, São Paulo

Brazil

E-mail: cheung@fem.unicamp.br

- **R. Surendran**, Ph.D. (Computer Science and Engineering)
Professor, Department of Computer Science and Engineering,
Chennai Institute of Technology,
Kundrathur, Chennai,
Tamil Nadu 600069,
India
E-mail: surendranr@citchennai.net
- **Purnomo**, Dr, M.Eng. ST. (Mechanical Engineering)
Senior Lecturer,
Department of Mechanical Engineering, Faculty of Engineering,
Universitas Muhammadiyah Semarang (UNIMUS),
Jl. Kedungmundu Raya No. 18, Semarang, Jawa Tengah,
Indonesia
E-mail: purnomo@unimus.ac.id
- **Rajiv Srivastava**, Ph.D. (Electrical Engineering)
Ph.d, M.Tech, IITKanpur, M.Sc.(Gold Medalist)
Director, Scholartech Education
Kanpur, Uttar Pradesh
India
E-mail: rajivsrivastava0@iitkalumni.org
- **Akash Saxena**, Ph.D. (Power System Engineering)
Associate Professor,
Department of Electrical Engineering,
Swami Keshvanand Institute of Technology Management & Gramothan Jagatpura,
Jaipur, Rajasthan, India 302017,
India
E-mail: akash@skit.ac.in
- **Gurjot Singh Gaba**, (Cryptography & Network Security)
Asst. Prof., School of Electronics & Communication Engineering
Lovely Professional University
Jalandhar - Delhi G.T. Road,
Phagwara, Punjab - 144411
India
E-mail: er.gurjotgaba@gmail.com
- **C.R. Balamurugan**, Ph.D. (Electrical Engineering)
Associate Professor, Department of EEE,
Arunal Engineering College,
Velu Nagar, Mathur,
Tiruvannamalai,
606 603, Tamil nadu,
India
E-mail: crbalain2010@gmail.com
- **Zaini Ahmad**, Ph.D. (Structural Engineering)
Associate Professor Ir.
Senior Lecturer, Faculty of Mechanical Engineering,
Universiti Teknologi Malaysia
81310 UTM Johor Bahru,
Johor,
Malaysia
E-mail: azaini@mail.fkm.utm.my
- **Ashwani Kumar**, Ph.D. (Mechanical Engineering)
Officer Academics,
Department of Mechanical Engineering,
Directorate of Technical Education (DTE)
Campus GP Bareilly
Uttar Pradesh,
India
E-mail: kumarashwani.geu@gmail.com
- **Nataraj J.R.**, Ph.D. (Mechanical and Materials Science Engineering)
Associate Professor,
Department of Mechanical Engineering
R.V.College of Engineering Mysore Road,
Bengaluru 560059 Karnataka State,
India
E-mail: natarajjr@rvce.edu.in
- **Suresh P M**, Ph.D. (Noise & Vibrations) (Mechanical Engineering)
Professor PG Studies
Dept. of Mech. Engg.
ACS College of Engineering
Kambipura, Mysuru Road,
Bengaluru - 560074
Karnataka,
India
E-mail: spm_dvg@yahoo.co.in
- **S. M. Anisuzzaman**, Ph.D. (Chemical Engineering)
Senior Lecturer, Chemical Engineering Programme
Fellow, Energy Research Unit (ERU)
Head, Chemical Hazard Safety Unit (ChSU)
Advisor, Chemical Engineering Students Club (ChESC)
Faculty of Engineering, Universiti Malaysia Sabah
Jalan UMS 88400, Kota Kinabalu, Sabah,

Malaysia
Tel: (+6) 088 320000 ext 3222
Fax: (+6) 088 320348
E-mail: anis_zaman@ums.edu.my

- **Ali Ahmed Mohammed**, Ph.D. (Civil Engineering)
Senior Lecturer,
School of Transportation Engineering
Faculty of civil and Environmental engineering (UTHM)
83000 Batu Pahat,
Johor,
Malaysia
E-mail: aliukm@yahoo.com
- **Don. S.**, Ph.D. (Computer Science)
Professor
GITAM Institute of Technology
Rushikonda, Gandhi Nagar Campus
Visakhapatnam - 530 045
India
E-mail: dsasikum@gitam.edu
- **Vincent Chieng-Chen Lee** PhD CSci CEng PMP FHEA
Faculty of Engineering, Computing and Science
Swinburne University of Technology Sarawak Campus
Jalan Simpang Tiga, 93350 Kuching,
Sarawak,
Malaysia
E-mail: vclee@swinburne.edu.my
- **R. Selvarasu**, Ph.D. (Electrical Engineering)
Professor
Sri Vidyankethan Engineering College,
Tirupathi, 517102
India
E-mail: selvarasunaveen@gmail.com
- **Maedeh Delavar**, Ph.D. (Chemical Engineering)
Babol University of Technology
Faculty of Chemical Engineering
Shariati Street, Babol
Mazandaran,
Iran
E-mail: maedeh_delavar@yahoo.com
- **Poulami Dutta**, Ph.D. (Chemistry)
Senior Chemist, R&D
Dow Chemical Company
Freeport
TX-77541
USA
E-mail: poulami.dutta1804@gmail.com
- **Saad MOTAHHIR**, Dr., Engineer (Electrical Engineering)
Higher school of technology,
SMBA University of Fez,
Morocco
E-mail: saad.motahhir@usmba.ac.ma
- **D. Ambika**, Ph.D. (Computer Science)
Assistant Professor, Department of Commerce
Avinashilingam Institute for Home Science and Higher Education for Women
Coimbatore - 641043
Tamil Nadu
India
E-mail: ambika.avinuty16@gmail.com
- **Sidnei Alves de Araújo**, Ph.D. (Electrical Engineering and Computer Science)
Associate Professor
Informatics and Knowledge Management Graduate Program
Universidade Nove de Julho - UNINOVE
São Paulo - SP
Brazil
E-mail: saraujo@uni9.pro.br
- **J. Lilly Mercy**, (Mechanical Engineering)
Assistant Professor
Department of Mechanical and Production Engineering,
Sathyabama University,
Old Mahabalipuram Road,
Chennai-600119, South India
India
E-mail: lillymercy.prod@sathyabamauniversity.ac.in
- **Dave Mangindaan**, Ph.D. (Chemical Engineering)
Deputy Head of Department of Food Technology
Bina Nusantara University,
BINUS Alam Sutera Main Campus,
Jalan Jalur Sutera Barat Kav. 21,
Alam Sutera, Tangerang 15143,
Indonesia
E-mail: dmangindaan@binus.edu
- **M. Gopi Krishna**, Ph.D. (Metallurgy-AU)

Assistant Professor & Head,
Member BOS
Dept of Mechanical Engineering
University College of Engineering,
Acharya Nagarjuna University
India
E-mail: mgopi.anu@gmail.com

- **K. Nehru**, Ph.D. (Information and Communication Engineering)
Professor,
Department of Electronics and Communication Engineering
Institute of Aeronautical Engineering
Hyderabad - 500043
Telangana
India
E-mail: nnehruk@gmail.com
- **Josephine Lai Chang Hui**, Ph.D. (Chemical Engineering)
Lecturer, Department of Chemical Engineering and Energy Sustainability
Faculty of Engineering
Universiti Malaysia Sarawak
94300 Kota Samarahan,
Sarawak,
Malaysia
E-mail: ichjosephine@unimas.my
- **Yong Leng Chuan**, Ph.D. (Engineering), CEng, MIMechE
Mechanical Engineering, School of Engineering
Faculty of Built Environment, Engineering, Technology & Design
Taylor's University Lakeside Campus
No. 1 Jalan Taylor's, 47500 Subang Jaya,
Selangor Darul Ehsan,
Malaysia
E-mail: LengChuan.Yong@taylors.edu.my
- **Hoo Choon Lih**, Ph.D. (Mechanical Engineering)
Assistant Professor, School of Engineering and Physical Sciences
Heriot-Watt University Malaysia
No 1 Jalan Venna P5/2, Precinct 5,
62200 Putrajaya,
Wilayah Persekutuan Putrajaya,
Malaysia
E-mail: c.hoo@hw.ac.uk
- **Y. Thiagarajan** (Electrical and Electronics Engineering)
Assistant professor & Research scholar
Department of Electrical and Electronics Engineering
Excel college of engineering & Technology
Tamilnadu-637303,
India
E-mail: thiagu2517@gmail.com
- **M. Prabukumar**, Ph.D. (Information Technology & Engineering)
Associate Professor &
Head of the Department of Computer Applications and Creative Media,
School Of Information Technology & Engineering (SITE),
VIT, Vellore-632014,
India
E-mail: mprabukumar@vit.ac.in
- **Sunil K. Sansaniwal** (Energy Engineering)
Energy Researcher,
Centre for Energy and Environment
Malaviya National Institute of Technology, Jaipur 302017,
India
E-mail: sansani4u@yahoo.com
- **Saad Farhan Ibrahim AlAbdullah**, Ph.D. (Civil Engineering)
Professor of Geotechnical and Foundation Engineering,
Civil Engineering Department, Faculty of Engineering
Isra University, Amman,
Jordan
E-mail: saad.alabdullah@iu.edu.jo
- **Amor GAMA**, Ph.D. (Solar Concentrating systems)
Senior Researcher and Head of Solar Thermodynamic Power Plant Team
Unité de Recherche Appliquée en Energies Renouvelables, URAER
Centre de Développement des Energies Renouvelables, CDER
47133, Ghardaia
Algeria
E-mail: gama_amor@uraer.dz; gama.amor@gmail.com
- **M. PremKumar**, Ph.D. (Electronics and Communication Engineering)
Professor in Electronics and Communication Engineering
Panimalar Institute of Technology,
391, Bangalore Trunk Road,
Varadharajapuram, Nazarethpet,
Poonamallee,
Chennai- 600 123,
Tamil Nadu,
India
E-mail: ermpremkumar@yahoo.co.in, prema_nirmala@yahoo.com
- **U. Vignesh** (Computer Science and Engineering)
Assistant Professor,
Department of Computer Science and Engineering,

KL University,
Vaddeswaram,
Andhra Pradesh - 522502,
India
E-mail: vigneshbun@gmail.com

- **Vinoth Babu Kumaravelu**, B.E; M.Tech; Ph.D. (Communication Engineering)
Associate Professor,
School of Electronics Engineering
Vellore Institute of Technology
Vellore Campus
Vellore-632014, Tamil Nadu,
India
E-mail: vinothbab@gmail.com
- **Asep Bayu Dani Nandiyanto**, Ph.D. (Chemical Engineering)
Associate Professor,
Departemen Kimia
Universitas Pendidikan Indonesia
Jl. Dr. Setiabudi no 229
Bandung 40154
Indonesia
E-mail: nandiyanto@upi.edu
- **Muji Setiyo**, Dr., ST., MT. (Automotive Engineering)
Senior Lecturer & Researcher,
Department of Automotive Engineering
Universitas Muhammadiyah Magelang
Jl. Bambang Sugeng Km. 05 Magelang, 56172
Indonesia
E-mail: setiyo.muji@ummql.ac.id
- **Ahmed Meri**, BEng, Ph.D. (Health Informatics, Information Technology)
Researcher, Artificial Intelligence and Technology Research Center (CAIT),
Faculty of Information Science and Technology (FTSM),
University Kebangsaan Malaysia (UKM)
43600 UKM Bangi,
Selangor,
Malaysia
E-mail: amk@siswa.ukm.edu.my
- **P. Murali Krishna Prasad**, Ph.D. (Electronics & Communication Engineering)
Associate Professor
Department of Electronics & Communication Engineering
GVP College of Engineering for Women
Visakhapatnam-530048
Andhra Pradesh
India
E-mail: pmkp70@gmail.com
- **Al-Amshawee Sajjad Khudhur Abbas**, Ph.D. (Chemical Engineering)
Faculty of Chemical and Natural Resources Engineering
Pahang University of Malaysia
26300 Gambang
Pahang,
Malaysia
E-mail: sajjad.hillawi@hotmail.com
- **Felicia Wong Yen Myan**, Ph.D. (Engineering)
Lecturer,
School of Engineering,
Taylor's University Lakeside Campus
No.1, Jalan Taylors,
47500 Subang Jaya,
Malaysia
E-mail: feliciayenmyan.wong@taylors.edu.my
- **Sajjad Ali Mangi**, M.E (Environmental Engineering)
Assistant Professor, Department of Civil Engineering
Mehran University of Engineering and Technology
Shaheed Z.A Bhutto Campus,
Khairpur Mir's 66020,
Sindh,
Pakistan
E-mail: sajjad.nec@muetkhp.edu.pk
- **Ir. Moey Lip Kean**, Ph.D. (Mechanical Engineering), P.Eng, MIEM, CEng. (UK), MIMechE (UK)
Senior Lecturer, Faculty of Engineering and The Built Environment
SEGi University
Jalan Teknologi, Kota Damansara,
47810 Petaling Jaya,
Selangor,
Malaysia
E-mail: moeylipkean@segi.edu.my
- **Mohd. Hardie Hidayat bin Mohyi**, M.Eng (Mechanical Engineering)
Lecturer, School of Engineering,
Taylor's University,
1, Jalan Taylors,
47500 Subang Jaya,
Selangor,
Malaysia
E-mail: hardie.hidayat@taylors.edu.my
- **Belarbi Moussaab**, Ph.D. (Physics/ Renewable Energies/ Computer Science)
Senior Lecturer & Researcher,

Department of Preparatory Formation in Science and Technology,
Laboratory of Micro and Nanophysics — LaMiN,
Ecole Nationale Polytechnique d'Oran-Maurice Audin —ENPO-MA.
P.O. Box : 1523,
Oran 31000,
Algeria
E-mail: moussaab.belarbi@enp-oran.dz

- **K. Senthil Kumar**, Ph.D. (Electronics and Communication Engineering)
Associate Professor,
Department of Electronics and Communication Engineering
Rajalakshmi Engineering College
Thandalam-602 105
Tamil Nadu,
India
E-mail: senthilkumar.kumaraswamy@rajalakshmi.edu.in
- **Ajao Lukman Adewale**, M.Eng. MNATE, MIAENG, MIREd (Computer Engineering)
Senior Research Technologist,
School of Electrical Engineering & Technology
Federal University of Technology,
Gidan-Kwano Campus,
Bida-Road,
Minna, Niger State
Nigeria
E-mail: ajao.wale@futminna.edu.ng
- **Munish Vashishath**, Ph.D. (Electronics and Communication Engineering)
Professor, Department of Electronics Engineering,
YMcA University of Science and Technology
Sector 06, Mathura Road, Faridabad
Haryana
India
E-mail: munish.vashishath@gmail.com
- **Younes Menni**, Ph.D. (Renewable Energies)
Unité de Recherche on Materials and Renewable Energies - URMRE -
Department of Physics, Faculty of Sciences, Abou Bekr Belkaid University
P.O. Box 119-13000-Tlemcen
Algeria
E-mail: menniyounes.cfd@gmail.com
- **Adel S. Aldalbahi**, Ph.D. (Electrical Engineering)
Assistant professor
Vice President for Academic Affairs
School of Engineering, Electrical Engineering Department
King Faisal University
P.O. 380
Ahssa 31982
Saudi Arabia
E-mail: aaldalbahi@kfu.edu.sa
- **Ihsan H. Dakhil**, M.Sc. (Chemical Engineering)
Assistant Professor
Faculty of Chemical Engineering Department
Engineering College
Al-Muthanna University
Al-Samawa City
Iraq
E-mail: em2ihsan@mu.edu.iq
- **Dora Siva Prasad**, Ph.D. (Mechanical Engineering)
Associate Professor
Department of Mechanical Engineering
GIT,
GITAM (Deemed to be University)
Visakhapatnam
India
E-mail: dorasivaoprasad@gmail.com
- **Carmen Mateescu**, Ph.D. (Environmental Engineering)
Senior Researcher,
Laboratory of Biochemistry and Bioresources,
National Institute for Research and Development in Electrical Engineering ICPE-CA
Splaiul Unirii No. 313,
030138 Bucharest,
Romania
E-mail: carmen.mateescu@icpe-ca.ro
- **Mohammad Ali Asaad**, Ph.D. (Civil Engineering)
Visiting Researcher, UTM Construction Research Centre,
Institute for Smart Infrastructure and Innovative Construction,
School of Civil Engineering
Faculty of Engineering, Universiti Teknologi Malaysia
81310 Skudai, Johor Bahru, Johor,
Malaysia
E-mail: mohamadalsaad@gmail.com
- **Romy Budhi**, Dr. Eng. (Computer Engineering and Mechatronics)
Assoc. Prof., Faculty of Science and Technology
Ma Chung University
Jalan Villa Puncak Tidar N-01
Malang, 65151
Indonesia
E-mail: romy.budhi@gmail.com
- **Nabian. Nima**, Ph.D. (Chemical Engineering)
Assistant professor, Department of Chemical Engineering
Faculty of Chemical and Industrial Engineering

Mazandaran University of Science and Technology
Behshahr,
Iran
E-mail: nimanabian@mazust.ac.ir

- **Mohammed Abdulateef Mahmoud Al-Neami**, Ph.D. (Geotechnical Engineering)
Assistant Professor
Civil Engineering Department
University of Technology
Iraq
E-mail: 40008@Uotechnology.edu.iq
- **Ab Rashid Dar**, BCA, MCA, M. Phil (Computer Science)
Research Scholar
Department of Computer Science
St. Joseph's College (Autonomous),
(An Affiliated College of Bharathidasan University)
Tiruchirappalli-620002, Tamil Nadu,
India
E-mail: phd_cs_aamirrashid894@mail.sjctni.edu
- **Javad Khamisabadi**, Ph.D. (Industrial Management (Production & Operation))
Researcher - Consultant - Expert, Logistics & Operation Engineering
Faculty of Management
Islamic Azad University
Tehran
Iran
E-mail: javad.khamisabadi<javad_khamisabadi@yahoo.com>
- **Vikas R. Khalkar**, Ph.D. (Mechanical Engineering)
Associate Professor, Gharda Institute of Technology (Mumbai University),
Mechanical Engineering Department, A/p- Lavel,
Taluka- Khed, District: Ratnagiri, Pin- 415708,
State: Maharashtra,
India
E-mail: vikas_khalkar@rediffmail.com
- **Noor Zaman Jhanjhi**, Ph.D. (Information Technology)
Senior Lecturer, School of Computing & Information Technology
Taylor's University,
Subang Jaya, 47500,
Selangor,
Malaysia
E-mail: noorzaman.jhanjhi@taylors.edu.my
- **S. Muthubalaji** M.E., PhD. (Electrical Engineering)
Professor,
CMR College of Engineering & Technology,
Kandlakoya
Hyderabad, Telangana,
India
E-mail: muthusa15@gmail.com
- **Vijayakumar Varadarajan**, Ph.D. (Computer Science and Engineering)
Professor & Associate Dean, School of Computing Science and Engineering,
Vandalur Kelambakkam Road,
VIT University, Chennai-600127,
Tamilnadu,
India
E-mail: vijayakumar.v@vit.ac.in
- **Prakhar Jindal**, Ph.D. (Aerospace Engineering)
Assistant Professor, Amity School of Engineering & Technology,
Amity University Haryana,
Amity Education Valley,
Panchgaon, Manesar, Gurgaon - 122413
Haryana,
India
E-mail: prakharjindal@gmail.com
- **S V Ranganayakulu**, Ph.D. FIETE; FASEI; FUSI (Ultrasonic Engineering)
Dean (Research & Development)
Guru Nanak Institutions Technical Campus (Autonomous) Ibrahimpatnam;
Hyderabad;
Telangana State;
India
E-mail: svrnayakulu@gmail.com
- **Ola Adel Qasim**, Ph.D. (Structural Engineering)
Lecturer, Civil Engineering Department
AL-Mansour University College
Baghdad
Iraq
E-mail: ola.adel@muc.edu.iq
- **Aditya Kumar Sahu**, M. Tech. (Department of Computer Science and Engineering)
Assistant Professor
GMRIT, Rajam,
Andhra Pradesh 532127,
India
E-mail: adityasahu.cse@gmail.com
- **Msomi Velaphi**, DTech (Mechanical Engineering)
Lecturer, Faculty of Engineering and Built Environment
Cape Peninsula University of Technology
Bellville Campus

P.O. Box 1906
Bellville, 7535
South Africa
E-mail: msomiv@cput.ac.za

- **Basim Hussein Khudair Al-Obaidi**, Ph.D. (Sanitary and Environmental Engineering)
Associate Professor
Senior Environmental, Sanitary and Plumbing Designer and Consultant
University of Baghdad /Engineering College- Civil Department
Jadriya complex, Baghdad
Iraq
E-mail: dr.basimal-obaigy@coeng.uobaghdad.edu.iq
- **P. H. V. Seshatapa Sai**, Ph.D. (Mechanical Engineering)
Professor & Director (R & D)
Malla Reddy College of Engineering & Technology (UGC Autonomous Institution)
Secunderabad - 500 100,
India
E-mail: directormrccet@gmail.com
- **Nahla N. Hilal**, Ph.D. (Civil Engineering)
Faculty member, Department of Scholarships & Foreign Relation
University Of Fallujah,
Anbar
Iraq
E-mail: nahla.naji@uofallujah.edu.iq
- **Siamak Hoseinzadeh**, Ph.D. (Mechanical Engineering)
Postdoctoral Researcher, Department of Mechanical and Aeronautical Engineering
University of Pretoria,
Faculty of Engineering, Built Environment and Information Technology
Pretoria,
South Africa
E-mail: hoseinzadeh.siamak@gmail.com
- **M. Prasanna**, Ph.D. (Computer Science)
Associate Professor,
Department of Computer Applications & Creative Media,
School of Information Technology and Engineering,
Vellore Institute of Technology,
[Deemed to be University]
Vellore 632 014
India
E-mail: prasanna.m@vit.ac.in
- **Ritesh Ramakrishna Bhat**, M. Tech. (Production Management)
Assistant Professor - Sr. Scale, Manipal Institute of Technology, Manipal
Manipal Academy of Higher Education
Manipal
Udupi District
Karnataka
India
E-mail: ritesh.bhat@manipal.edu
- **Shafiq Ul Rehman**, Ph.D. (Cyber Security)
Postdoctoral Research Fellow,
SUTD Cyber Security Laboratory
Singapore University of Technology and Design (SUTD)
8 Somapah Road, 487372, Singapore
Singapore
E-mail: shafiq_rehman@sutd.edu.sg
- **Praveena Nair**, Ph.D. (Mechanical Engineering)
Lecturer, School of Engineering,
Level 2, KDU University College,
Jalan Kontraktor U1/14,
40150, Utropolis, Glenmarie,
Seksyen U1, Shah Alam,
Selangor Darul Ehsan
Malaysia
E-mail: praveena.s@kdu.edu.my
- **Trinh Luong Mien**, Ph.D. (Control engineering and automation)
Associate Professor, Faculty of electrical and electronic engineering
University of transport and communications
No.3 Cau Giay, Lang Thuong, Dong Da,
Ha Noi,
Vietnam
E-mail: mientl@utc.edu.vn
- **Sankaranarayanan Murugan**, Ph.D. (Computer Science and Engineering)
Professor, School of Computing
Sathyabama Institute of Science and Technology
Chennai, Tamil Nadu - 600 119.
India
E-mail: snmurugan@gmail.com
- **Ali Merdji**, Ph.D. (Mechanical Engineering/Biomechanics)
Professor, Faculty of Science & Technology
University of Mascara
B.P. 305, W. Mascara (29000),
Algeria
E-mail: merdji_ali@yahoo.fr
- **Tariq Rahim Soomro**, PhD (Computer Science)
Professor of Computer Science

Dean College of Computer Science & Information Systems
Institute of Business Management,
Korangi Creek, Karachi-75190
Sindh,
Pakistan
Email: tarig.soomro@iobm.edu.pk

- **Maan A. S. Al-Adwany**, MSc. (Communication Engineering)
Assistant Professor, Department of Computer and Information Engineering,
College of Electronics Engineering
Ninevah University
Mosul
Iraq
Email: maanaladwany@yahoo.com
- **Jaafar S. Maatooq**, Ph.D. (Civil Engineering Hydraulics)
Professor of Hydraulic Structures, IAHR member
University of Technology
Baghdad,
Iraq
Email: 40071@uotechnology.edu.iq
- **Dr. M. Vinod Kumar**, M.E, M.B.A, Ph.D. (Civil Engineering)
Associate Professor, Department of Civil Engineering
Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology,
Avadi, Chennai, Tamil Nadu,
India
Email: drmvinodkumar@veltech.edu.in
- **Ali Othman Mohammed Al Janaby**, Ph.D. (Communications and Computer Networks Engineering)
Lecturer, College of Electronics Engineering
Ninevah University
Mosul University, Mosul University Street
Mosul
Iraq
E-mail: ali.mohammed@uoninevah.edu.iq
- **Ali Fadhil Naser**, Ph. D. (Civil Engineering)
Assistant Professor, Building and Construction Engineering Techniques Department,
Al-Mussaib Technical College, Al-Furat Al-Awsat Technical University,
Babylon City,
Iraq
Email: com.ali3@atu.edu.iq
- **Nabel Kadum Abd-Ali**, Ph.D. (Mechanical Engineering)
Assist.Prof. College of Engineering
University of Al-Qadisiyah
Al-Dewaniyah
Iraq
E-mail: nabel.abdali@qu.edu.iq
- **Esmail Zavvar**, M.Sc. (Marine Structure Engineering)
Faculty of Civil Engineering
University of Tabriz
Iran
E-mail: esmaeil.zavvar92@ms.tabrizu.ac.ir
- **Nabeel Salih Ali**, MSc. (Internetworking Technology)
Lecturer, ECE Dept., Faculty of Engineering
Member, IT- Research Development Center
University of Kufa, Main Campus
Al Najaf -54001, Najaf Governorate,
University of Kufa, Kufa, P.O. Box (21),
Iraq
Email: nabeel@uokufa.edu.iq
- **Kah Chun Ho**, Ph.D. (Chemical Engineering)
Lecturer, Department of Chemical Engineering,
Faculty of Engineering and the Built Environment,
SEGI University, Kota Damansara,
Selangor,
Malaysia
E-mail: hokahchun@segi.edu.my
- **Ammar Abdulkadhim Fathi**, M.Sc. (Mechanical Engineering)
Assistant Lecturer
Air conditioning and Refrigeration Techniques Engineering Department
Al-Mustaqbal University College
Babylon City, Hilla
Iraq
E-mail: AmmarAbdulkadhim@mustaqbal-college.edu.iq
- **Hussein K. Mohmoud Dalfi**, B.Sc. M.Sc. and Ph.D. (Material Engineering)
Lecturer, Department of Mechanical Engineering, College of Engineering
University of Wasit
Wasit,
Iraq
E-mail: hqumar@uowasit.edu.iq
- **Ramkiran B.**, M.Tech (Energy)
Assistant Professor, Department of EEE
Sastra Deemed to be University
Srinivasa Ramanujan Centre
Kumbakonam-612001
TamilNadu
India

E-mail: ramkiran@src.sastra.edu

- **Jyotir Moy Chatterjee**, M. Tech. (Computer Science & Engineering)
Assistant Professor, Department of IT
Lord Buddha Education Foundation
Kathmandu,
Nepal
E-mail: jyotirchatterjee@gmail.com
- **Amando P. Singun**, DIT, MSIT, BSIT, LPT (Information Technology)
Faculty Member / Quality Assurance Coordinator
IT Department, Higher College of Technology, Muscat
Sultanate of Oman
E-mail: Amando-Singun@hct.edu.om
- **Ahthasham Sajid**, PhD(Computer Science)
Assistant Professor
Faculty of ICT, Balochistan University of Information Technology Engineering and Management Sciences,
Quetta, Balochistan,
Pakistan
E-mail: ahthasham.sajid@buitms.edu.pk
- **Turkan Ahmed Khaleel**, Ph.D. (Computer Science/Computer Networks)
Department of Computer Engineering
Engineering College
University of Mosul
Mosul
Iraq
E-mail: turkan@uomosul.edu.iq
- **Amos Orenyi Bajeh**, Ph.D. (Information Technology)
Senior Lecturer, Department of Computer Science
Faculty of Communication and Information Sciences
University of Ilorin,
Ilorin, Kwara state
Nigeria
E-mail: bajehamos@unilorin.edu.ng
- **Ahmed A. Mansor Al-Mashhadani**, Ph.D. (Civil Engineering)
Assistant Professor,
College of Engineering
University of Diyala
Diyala
Iraq
E-mail: aamansor2003@yahoo.com
- **Siddeeq Y. Ameen**, Ph.D, MSc, BSc, SMIEEE, FHEA. (Telecommunication Engineering)
Professor, College of Engineering
Advisor of Quality Assurance
Duhok Polytechnic University
Duhok,
Iraq
E-mail: siddeeq.ameen@dpi.edu.krd
- **Charles Ronald Harahap**, Dr. Eng. (Electrical Engineering)
Associate Professor, Department of Electrical Engineering
Faculty of Engineering University of Lampung
Jalan Prof. Sumantri Brojonegoro No.1
Bandar Lampung, Lampung 35145
Indonesia
E-mail: charles.harahap69@gmail.com
- **Sambit Satpathy**, PhD, (Computer Science & Engineering)
National Institute of Technology,
Agartala
India
Email: sambitmails@gmail.com
- **Rajesh Kaluri**, Ph.D. (Computer Science Engineering)
Associate Professor, School of Information Technology and Engineering
VIT University
Tamil Nadu
India
E-mail: rajeshndk@gmail.com
- **Ali Abdulameer Al-Rammahi**, Ph.D. (Structural Engineering)
Department of Civil Technologies
Najaf Technical Institute
Al-Furat Al-Awsat Technical University
Najaf
Iraq
E-mail: ali_alremahi@yahoo.com
- **P. Sathyaprakash**, Ph.D. (Information and communication engineering)
Assistant professor, School of computing science and engineering
Galgotia's University
Uttar Pradesh
India
Email: sathyapt02@gmail.com
- **Bahaa Al-Abbas**, Ph.D. (Structural Engineering)
Associate Professor, Civil Engineering Department
University of Kerbala
Iraq
Email: bahaa.hussain@uokerbala.edu.iq

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







1 - 50 of 109























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1	Bulletin of the Geological Society of Malaysia	journal	0.529 Q2	10	34	70	812	78	64	1.36	23.88	









Title	Type	↓ SJR	H index	Total Docs. (2019)	Total Docs. (3years)	Total Refs. (2019)	Total Cites (3years)	Citable Docs. (3years)	Cites / Doc. (2years)	Ref. / Doc. (2019)	
2 Malaysian Journal of Library and Information Science	journal	0.414 Q2	21	20	60	926	55	60	0.95	46.30	
3 Journal of Oil Palm Research	journal	0.410 Q2	20	59	173	2666	336	173	2.36	45.19	
4 International Journal of Mechanical and Materials Engineering 	journal	0.366 Q2	21	16	43	637	126	43	2.72	39.81	
5 Malaysian Journal of Learning and Instruction 	journal	0.366 Q1	5	20	67	1052	86	67	1.12	52.60	
6 3L: Language, Linguistics, Literature 	journal	0.347 Q1	10	48	160	1945	137	160	0.87	40.52	
7 Malaysian Journal of Medical Sciences	journal	0.334 Q3	22	84	256	2686	261	225	1.03	31.98	
8 Journal of Mechanical Engineering and Sciences 	journal	0.331 Q2	16	114	202	3440	322	202	1.38	30.18	
9 Journal of Information and Communication Technology	journal	0.325 Q2	8	22	68	727	103	68	1.83	33.05	
10 International Journal of Automotive and Mechanical Engineering 	journal	0.321 Q2	24	73	201	2273	273	201	1.30	31.14	

Title	Type	↓ SJR	H index	Total Docs. (2019)	Total Docs. (3years)	Total Refs. (2019)	Total Cites (3years)	Citable Docs. (3years)	Cites / Doc. (2years)	Ref. / Doc. (2019)	
11 Journal of Construction in Developing Countries 	journal	0.313 Q3	18	30	47	1183	73	46	1.20	39.43	
12 Tropical Life Sciences Research 	journal	0.280 Q2	13	36	100	1190	98	99	0.88	33.06	
13 GEMA Online Journal of Language Studies 	journal	0.275 Q1	14	46	155	1934	91	155	0.53	42.04	
14 International Food Research Journal	journal	0.270 Q3	43	176	1204	7098	1138	1204	0.75	40.33	
15 Journal of Tropical Forest Science 	journal	0.268 Q3	29	46	170	1543	117	166	0.63	33.54	
16 Asian Myrmecology 	journal	0.263 Q3	12	0	39	0	26	39	0.64	0.00	
17 Proceedings of the 5th International Cryptology and Information Security Conference 2016, CRYPTOLOGY 2016	conference and proceedings	0.263	3	0	27	0	9	24	0.00	0.00	
18 Journal of Physical Science 	journal	0.259 Q3	16	46	156	1330	163	155	0.96	28.91	

	Title	Type	↓ SJR	H index	Total Docs. (2019)	Total Docs. (3years)	Total Refs. (2019)	Total Cites (3years)	Citable Docs. (3years)	Cites / Doc. (2years)	Ref. / Doc. (2019)	
19	Malaysian Orthopaedic Journal 	journal	0.250 Q3	4	44	142	701	87	134	0.56	15.93	
20	Sains Malaysiana	journal	0.250 Q2	26	298	860	10913	732	860	0.75	36.62	
21	Journal of Advanced Research in Fluid Mechanics and Thermal Sciences	journal	0.243 Q3	9	288	247	8234	376	247	1.52	28.59	
* 22	Journal of Engineering Science and Technology  *	journal	0.238 Q2	22	289	855	7578	760	855	0.87	26.22	
23	Jurnal Komunikasi: Malaysian Journal of Communication	journal	0.236 Q3	8	106	234	4152	222	232	1.05	39.17	
24	Asian Academy of Management Journal 	journal	0.235 Q3	12	37	57	1843	74	57	1.59	49.81	
25	Tropical Biomedicine 	journal	0.234 Q4	33	110	339	4023	174	330	0.56	36.57	
26	Malaysian Journal of Pathology	journal	0.231 Q3	18	54	137	1219	80	130	0.49	22.57	
27	Medical Journal of Malaysia	journal	0.227 Q3	34	131	320	2161	192	312	0.45	16.50	

Title	Type	↓ SJR	H index	Total Docs. (2019)	Total Docs. (3years)	Total Refs. (2019)	Total Cites (3years)	Citable Docs. (3years)	Cites / Doc. (2years)	Ref. / Doc. (2019)	
28 International Journal of Nanoelectronics and Materials	journal	0.222 Q3	10	47	122	1216	110	122	0.69	25.87	
29 Archives of Orofacial Sciences 	journal	0.220 Q3	1	17	35	529	38	33	1.15	31.12	
30 Journal of Mechanical Engineering	journal	0.220 Q3	9	72	460	1568	297	460	0.66	21.78	
31 Serangga	journal	0.212 Q4	3	31	89	1022	34	89	0.43	32.97	
32 International Journal of Integrated Engineering 	journal	0.199 Q3	7	267	319	6727	271	310	0.87	25.19	
33 International Journal of Business and Society	journal	0.196 Q3	13	91	243	4073	187	243	0.70	44.76	
34 Pertanika Journal of Tropical Agricultural Science	journal	0.192 Q4	13	93	238	3850	132	238	0.47	41.40	
35 SEAISI Quarterly (South East Asia Iron and Steel Institute)	journal	0.192 Q3	7	0	27	0	3	27	0.11	0.00	
36 Malaysian Online Journal of Educational Management	journal	0.191 Q3	2	25	40	1391	15	40	0.38	55.64	

Title	Type	↓ SJIR	H index	Total Docs. (2019)	Total Docs. (3years)	Total Refs. (2019)	Total Cites (3years)	Citable Docs. (3years)	Cites / Doc. (2years)	Ref. / Doc. (2019)	
37 Malaysian Journal of Analytical Sciences	journal	0.189 Q4	11	92	463	2414	285	463	0.60	26.24	
38 Institutions and Economies	journal	0.188 Q3	7	22	61	1092	42	60	0.58	49.64	
39 Asian Journal of Business and Accounting	journal	0.184 Q3	9	20	54	1299	40	48	0.92	64.95	
40 International Journal of Economics and Management	journal	0.184 Q3	17	34	217	1704	111	216	0.41	50.12	
41 Jurnal Teknologi (Sciences and Engineering) 8	journal	0.183 Q2	20	119	1544	4119	842	1544	0.66	34.61	
42 Jurnal Ekonomi Malaysia	journal	0.182 Q3	7	46	118	2412	64	118	0.60	52.43	
43 Jurnal Pengurusan	journal	0.181 Q3	11	43	139	2699	121	139	0.96	62.77	
44 Journal of Design and Built Environment 8	journal	0.180 Q2	3	19	43	742	25	43	0.66	39.05	
45 Malaysian Journal of Nutrition	journal	0.179 Q4	25	49	160	1470	75	158	0.52	30.00	

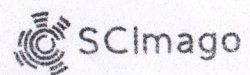
Title	Type	↓ SJR	H index	Total Docs. (2019)	Total Docs. (3years)	Total Refs. (2019)	Total Cites (3years)	Citable Docs. (3years)	Cites / Doc. (2years)	Ref. / Doc. (2019)	
46 Malaysian Journal of Mathematical Sciences	journal	0.177 Q4	11	47	178	899	86	177	0.57	19.13	
47 Food Research 	journal	0.176 Q4	4	111	117	3371	64	117	0.55	30.37	
48 Journal of Technical Education and Training 	journal	0.174 Q4	3	57	52	1854	50	47	0.97	32.53	
49 Journal of Advanced Manufacturing Technology 	journal	0.173 Q3	4	57	172	1160	60	172	0.35	20.35	
50 Malaysian Forester	journal	0.172 Q4	7	40	57	673	24	57	0.50	16.83	

1 - 50 of 109



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