UNIVERSITI SAINS MALAYSIA

APEX™

5-year λeport

(2014 – 2018)

Institute of Nano Optoelectronics Research and Technology (INOR), Universiti Sains Malaysia

INSTITUTE OF NANO OPTOELECTRONICS RESEARCH AND TECHNOLOGY (I.N.O.R)

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5-year λeport

(2014 – 2018)

Institute of Nano Optoelectronics Research and Technology (INOR)

Vision

To become a global centre of excellence in multidisciplinary research field of nanotechnology and optoelectronics.

Mission

To provide high impact research and academic programs for global research prominence and development of local talent and technology for a sustainable nation.

Table Contents

Foreword by Director of INOR

First and foremost, I would like to thank the committee members for their efforts in preparing this report which summarizes the achievements and the activities carried out at Institute of Nano Optoelectronics Research and Technology (INOR) for the year 2014 to 2018. Currently, INOR is fully operationally with 9 academic staff and 12 supporting staff. In addition, INOR also has an Academic Board. The members with different disciplines/expertise were selected from the various schools in USM. Therefore, INOR not only focuses actively on the research and development (R&D) and services, but it also offers postgraduate programmes in the field of Optoelectronics and Nanotechnology. Although INOR started with limited resources and funding, but within these few years, INOR has developed and transformed to become one of the top schools/centres in USM. Here, I would like to take this opportunity to extend my greatest appreciation to everyone for contributing towards INOR's excellent performance.

As a CoE in research, INOR has strategized its research direction where the focus will be given on five niche areas, namely, Nano and Advanced Materials, Light Emitting Diode / Laser, Sensor, Solar Cell, and Power Devices. Based on our research track records, INOR has attracted a number of research collaborations from across the country as well as around the world. INOR is currently one of the principal investigators for GaN on GaN Malaysia National Programme, namely the 5-year Technology Transfer Programme (2015-2020) on LED technology from United States of America to Malaysia. The goals of the programme is to produce high efficiency and high lumen white LEDs based on the GaN on GaN Technology.

Foreword by Director of INOR

Under this programme, INOR has a golden opportunity to collaborate with the 2014 Nobel Laureate in Physics, Prof. Dr. Shuji Nakamura who has been coined as the "Father of the GaN Blue LED". Definitely, this is one of the highest recognitions of our research strength.

As a CoE, we strive even harder to deliver excellence in optoelectronics and nanotechnology research. We also focus on the research which can contribute towards the Sustainable Development Goals. With these efforts, INOR will be able to contribute significantly towards the USM's APEX Agenda as well as to achieve global excellence.

Lastly, I would like to thank everyone for contributing towards the success of INOR as a Centre of Excellence in Research. I also sincerely hope that INOR will be able to sustain their excellent performance for the years to come, and able to achieve the status of Higher Institution Centre of Excellence (HICoE) in the near future.

PROFESSOR DR. ZAINURIAH HASSAN, FASc
Director
Institute of Nano Optoelectronics Research and Technology (INOR),
Universiti Sains Malaysia (USM), MALAYSIA

About INOR

Institute of Nano Optoelectronics Research and Technology (INOR) is a Centre of Excellence (CoE) (Research), officially established at Universiti Sains Malaysia on May 29, 2014. Previously, INOR was known as Nano Optoelectronics Research (NOR) Laboratory which has been officially launched in 2004. The administrative office is located at Science and Arts Innovation Space (SAINS@USM). The SAINS@USM is a Research Campus of USM and is located about 3 km from the USM main campus.

INSTITUTE OF NANO OPTOELECTRONICS RESEARCH AND TECHNOLOGY (INOR)

NANO-OPTOELECTRONICS RESEARCH AND TECHNOLOGY LABORATORY (N.O.R)
SCHOOL OF PHYSICS
UNIVERSITI SAINS MALAYSIA
11800 PENANG

2002
- IRPA (Intensification of Research in Priority Areas) Strategic Research Grant
- RM 22.5 M

2004-2005
- Establishment of NOR Laboratory
- Fully Operational of Equipment and Facilities

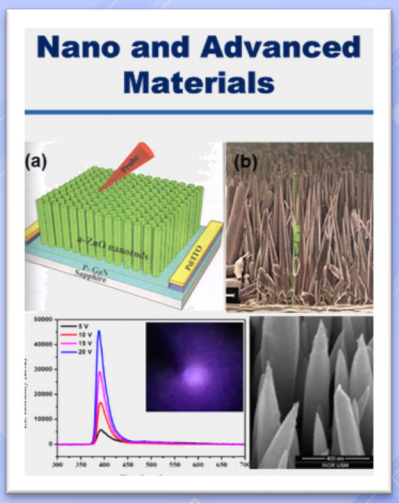
2014
- The birth of INOR
- Centre of Excellence (COE)

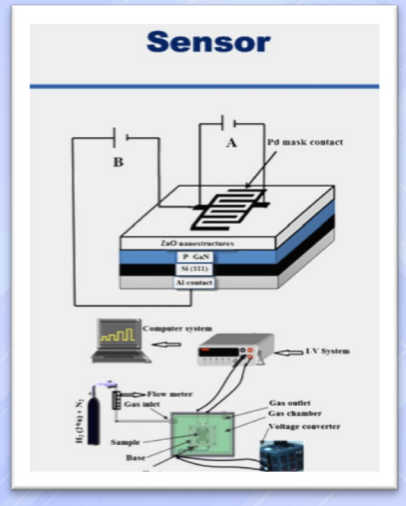
2015
- Establishment of Administration Office at SAINS@USM

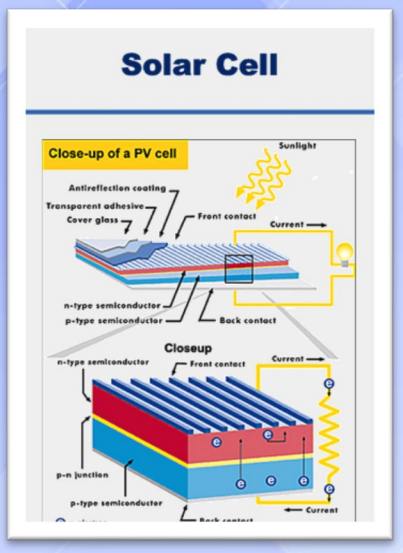
2017
- Readiness of Office and Research Laboratory

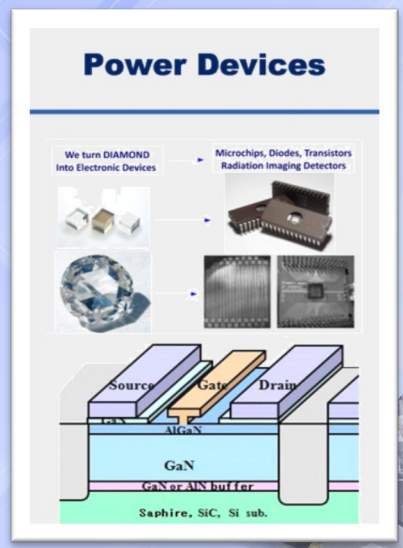
About INOR

INOR focuses on research and development (R&D) from the areas of nanoscience, nanomaterials, nanofabrication and nanoengineering that are collectively building intellectual and technological bridges from nanoscale concepts to practical nano optoelectronic devices and systems. The five research niche areas of INOR are Nano and Advanced Materials, Light Emitting Diode / Laser, Sensor, Solar Cell, and Power Devices.







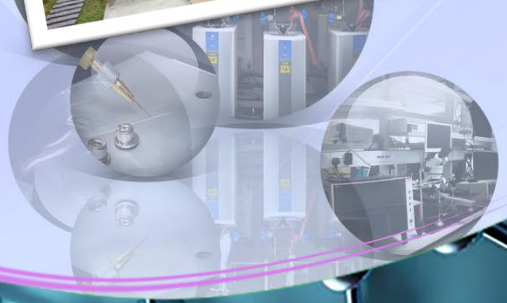


About INOR

At present, INOR has been considered as one of the most modern and innovative research laboratories on optoelectronics and nanotechnology in Universiti Sains Malaysia. INOR has an extensive range of equipment and facilities for growth, fabrication, and characterization of optoelectronic and electronic devices. The equipment and facilities are estimated to be worth RM 15 million. The services offered by INOR include Characterization and Testing, Surface Morphology Characterization, Sample Preparation, MOCVD III-nitrides Epi Wafer Products, Consultation, and Short Courses and Training.

INOR is Malaysia's first CoE that offers postgraduate programmes in the field of Optoelectronics and Nanotechnology. These include Doctor of Philosophy and Master of Science (Optoelectronics) Research Mode programmes as well as Master of Science (Nano-Optoelectronics) Mixed Mode programme. All these programmes are offered in both full time and part time modes.

INOR is also supported by strong collaborations with well-known national and international universities; the latest is with University of California Santa Barbara, in particular with the 2014 Nobel Laureate, Prof. Shuji Nakamura on the technology transfer programme related to GaN on GaN LED research.



Organisational Structure

DIRECTOR

PROFESOR DR. ZAINURIAH HASSAN, FASc

ACADEMIC STAFF

ASSOCIATE PROFESSOR
DR. NG SHA SHIONG

ASSOCIATE PROFESSOR
DR. NORZAINI ZAINAL

DR. LIM WAY FOONG

DR. SABAH M. MOHAMMAD

DR. MOHD SYAMSUL
NASYRIQ SAMSOL BAHARIN

DR. QUAH HOCK JIN

DR. MUNDZIR ABDULLAH

DR. FAEZAH JASMAN

LABORATORY MANAGEMENT & TECHNICAL

MOHD ANAS AHMAD
CHIEF RESEARCH OFFICER Q48

AZRAAI FAHMI HAMZAH
SENIOR SCIENCE OFFICER C44

NUR ATIQAH HAMZAH
RESEARCH OFFICER Q41

RAHIL IZZATI MOHD ASRI
RESEARCH OFFICER Q41

SYED MOHAMAD SYED SAHIL
ASSISTANT ENGINEER JA29

ABDUL ROHIM MANSUR
ASSISTANT ENGINEER JA29

RAHMAWATINI ABDUL RAHMAN
ASSISTANT SCIENCE OFFICER C29

MOHD AIEZAT ZULKEPLY
ASSISTANT SCIENCE OFFICER C29

ADMINISTRATION

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ASSISTANT REGISTRAR N41

SURIANI BASRI
EXECUTIVE SECRETARY N29

SANISAH AHMAD
ADMINISTRATIVE ASSISTANT N19

MOHD NAZRI BAKAR
OPERATIONS ASSISTANT N11

Academic Staff

"Coming together is a beginning. Keeping together is progress. Working together is success."

[Henry Ford]

Administration & Laboratory Staff

Academic Staff

Prof. Dr. Zainuriah Hassan, FASc
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***Notes:**

1. Prof. Dr. Kamarulaziz Ibrahim has retired on 13 March 2017.
2. Prof. Dr. Md. Roslan Hashim has transferred to School of Physics USM on 05 February 2018.

"Talent wins games, but teamwork and intelligence win championships."

[Michael Jordan]

Board Members and Associate Board Members (Years: 2016 – 2018)

Board Members

	NAME	TITLE
	*KAMARULAZIZI IBRAHIM	PROFESSOR DR.
	*LIM WAY FOONG	DR.
	*MD ROSLAN HASHIM	PROFESSOR DR.
	*MOHD SYAMSUL NASYRIQ SAMSOL BAHARIN	DR.
	NG SHA SHIONG	ASSOCIATE PROFESSOR DR.
	NORZAINI ZAINAL	ASSOCIATE PROFESSOR DR.
	*SABAH M. MOHAMMAD	DR.
	*QUAH HOCK JIN	DR.
	ZAINURIAH HASSAN	PROFESSOR DR.

***Notes:**

1. Prof. Dr. Kamarulaziz Ibrahim has retired on 13 March 2017.
2. Dr. Lim Way Foong joined INOR on 13 June 2018.
3. Prof. Dr. Md. Roslan Hashim has transferred to School of Physics USM on 05 February 2018.
4. Dr. Mohd Syamsul Nasyriq Samsol Baharin joined INOR on 01 November 2018.
5. Dr. Sabah M. Mohammad joined INOR on 31 October 2018.
6. Dr. Quah Hock Jin joined INOR on 19 December 2018.

Board Members and Associate Board Members (Years: 2016 – 2018)

Associate Board Members

	NAME	TITLE	SCHOOL/FACULTY
	AZLAN ABDUL AZIZ	PROFESSOR DR.	SCHOOL OF PHYSICS
	CHEONG KUAN YEW	PROFESSOR IR. DR.	SCHOOL OF MATERIALS AND MINERAL RESOURCES ENGINEERING
	CHUAH LEE SIANG	DR.	SCHOOL OF DISTANCE EDUCATION
	FAROOK A/L ADAM	PROFESSOR DR.	SCHOOL OF CHEMICAL SCIENCES
	HASLAN ABU HASSAN	PROFESSOR DR.	SCHOOL OF PHYSICS
	HASNAH OSMAN	PROFESSOR DATO' DR.	SCHOOL OF CHEMICAL SCIENCES
	ISKANDAR SHAHRIM MUSTAFA	DR.	SCHOOL OF PHYSICS
	KHAIRUDIN MOHAMED	ASSOCIATE PROFESSOR DR.	SCHOOL OF MECHANICAL ENGINEERING
	MELATI KHAIRUDDEAN	ASSOCIATE PROFESSOR DR.	SCHOOL OF CHEMICAL SCIENCES
	MOHD HAFIZ MOHD ZIN	DR.	ADVANCED MEDICAL AND DENTAL INSTITUTE

Board Members and Associate Board Members (Years: 2016 – 2018)

Associate Board Members

	MOHD MAHADI HALIM	DR.	SCHOOL OF PHYSICS
	MUTHARASU DEVARAJAN	ASSOCIATE PROFESSOR DR.	SCHOOL OF PHYSICS
	NASER MAHMOUD AHMED	DR.	SCHOOL OF PHYSICS
	NURUL ZAHIRAH NOOR AZMAN	DR.	SCHOOL OF PHYSICS
	ROHANA ADNAN	PROFESSOR DR.	SCHOOL OF CHEMICAL SCIENCES
	SAW KIM GUAN	ASSOCIATE PROFESSOR DR.	SCHOOL OF DISTANCE EDUCATION
	SHAHROM MAHMUD	ASSOCIATE PROFESSOR DR.	SCHOOL OF PHYSICS
	SITI HAWA NGALIM	DR.	ADVANCED MEDICAL AND DENTAL INSTITUTE
	WAN MARYAM WAN AHMAD KAMIL	DR.	SCHOOL OF PHYSICS
	YAM FONG KWONG	ASSOCIATE PROFESSOR DR.	SCHOOL OF PHYSICS
	ZAINI ABDUL HALIM	ASSOCIATE PROFESSOR DR.	SCHOOL OF ELECTRICAL AND ELECTRONIC ENGINEERING

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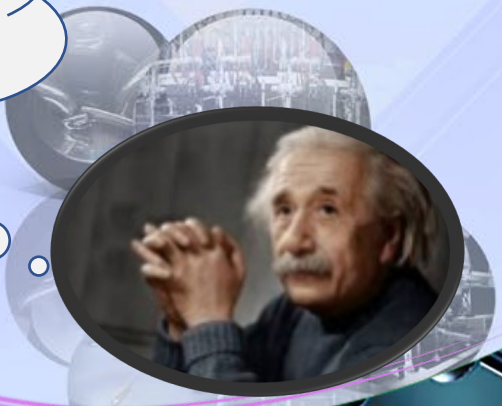
"There are only two ways to live your life. One is as though nothing is a miracle. The other is as though everything is a miracle."



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INOR has excellent human resources and supporting facilities that have promoted its sustainable development as one of the most modern and innovative research laboratories on Optoelectronics and Nanotechnology in Malaysia.

At the moment, INOR offers three types of postgraduate programmes at Master of Science (MSc) and Doctor of Philosophy (PhD) levels by research and mixed modes, namely:

(a) By Research Mode:

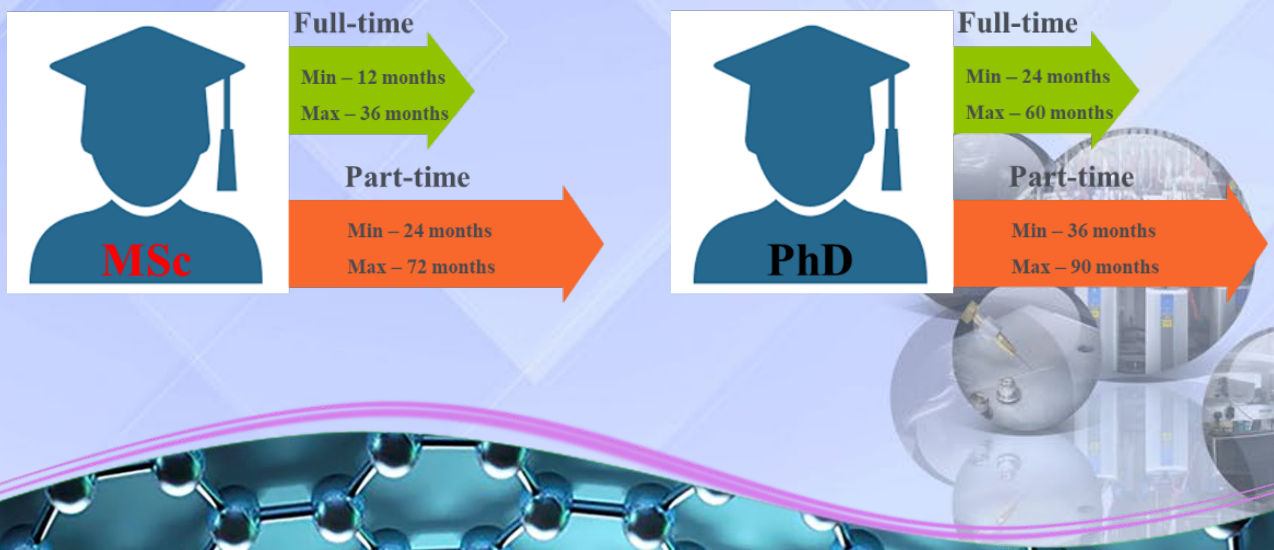
- Master of Science (Optoelectronics)
- Doctor of Philosophy

(b) By Mixed Mode:

- Master of Science (Nano-Optoelectronics)

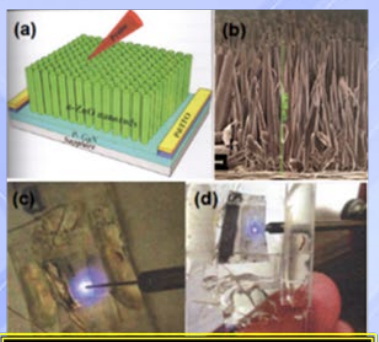
A. Research Mode Programme

INOR offers research programmes at PhD and MSc (Optoelectronics) levels in seven research fields. All these programmes are offered in both full-time and part-time modes. The graduates from these programmes are expected to have high employment prospects in semiconductor electronics industry.

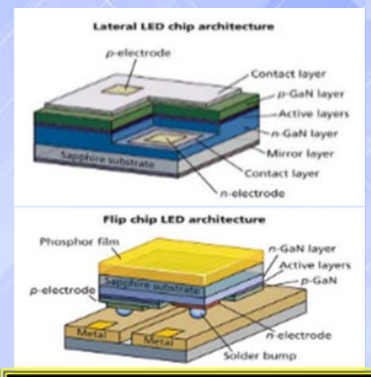


Research fields for PhD and MSc (Optoelectronics) programmes

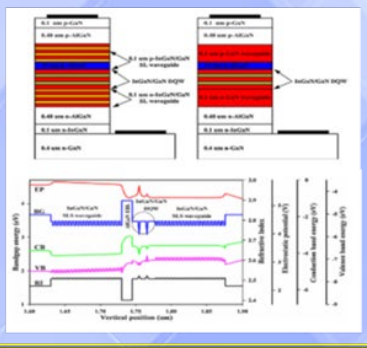
(1) Nano Materials Fabrication & Characterization



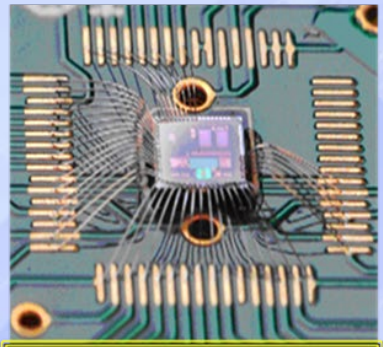
(2) Nano Materials & Devices



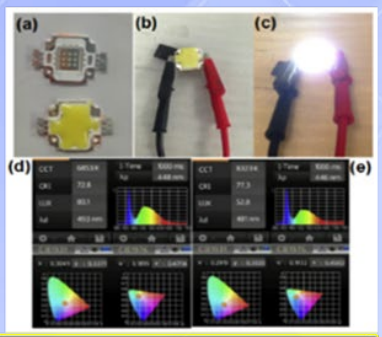
(3) Nano Devices & Packaging



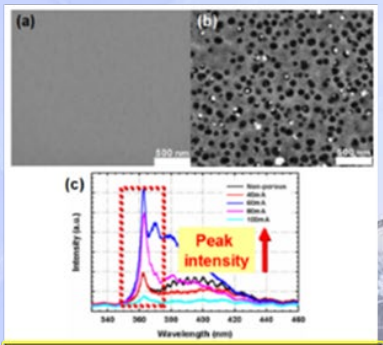
(4) Modelling & Simulation of Nano Optoelectronic Devices



(5) Nano Integrated Systems



(6) Solid State Lighting Solutions



(7) Nano Optics

B. Mixed Mode Programme

For the first time, INOR is offering Master of Science (Nano-Optoelectronics) Mixed Mode programme, comprising of 70% research and 30% coursework beginning September 2019. The programme is unique because of integration of both Nanotechnology and Optoelectronics field in the programme structure, which is very much compatible with the current scenario and trends for sustainable development of our nation, particularly in the Electrical and Electronics (E&E) sector. The programme would serve as a good path for the undergraduates and/or engineers currently working in the industry to pursue their studies within a short period of time at a Master of Science (MSc) degree level in order to obtain the requirement to move up to the next level of study at Doctor of Philosophy (PhD), or for career promotion at their working place. Graduates holding the degree could find themselves working in various disciplines, such as education, research and development, failure analysis, quality control, and/or operations sectors in the E&E industry.

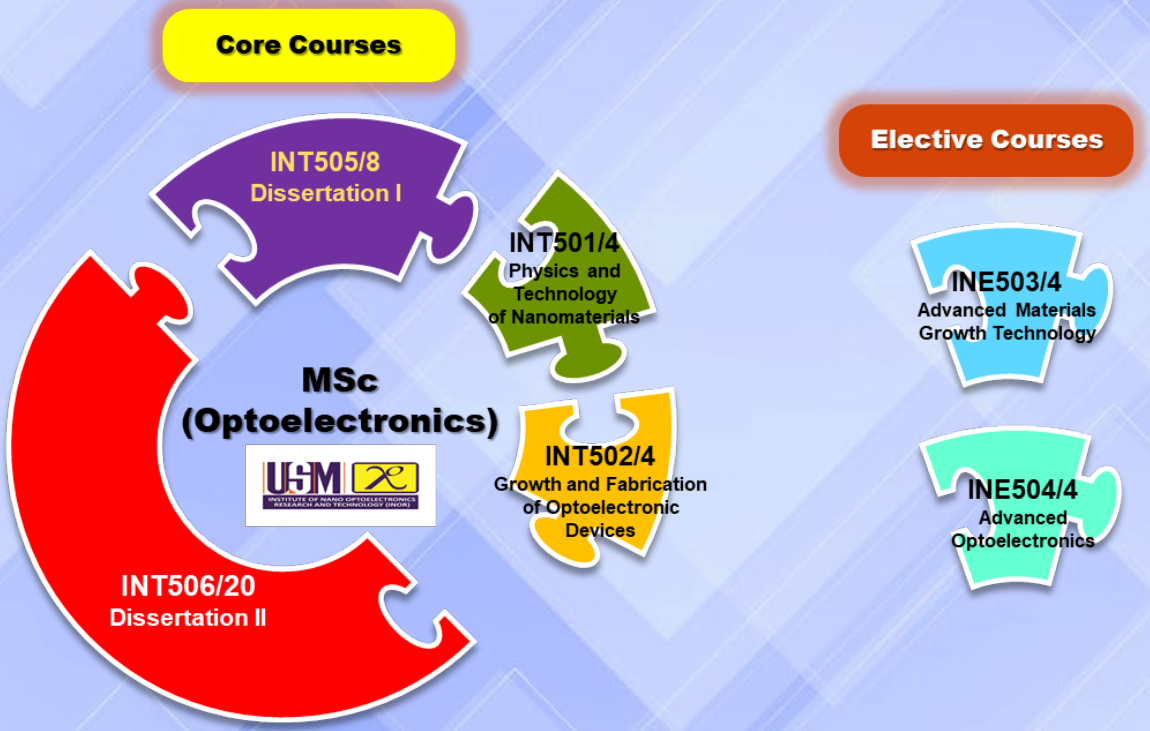
The Master of Science (Nano-Optoelectronics) Mixed Mode Programme will be offered in both full time and part time modes. The purpose of offering the programme in two modes is to attract those engineers, technicians or operators currently working in the industries to continue upgrading themselves by pursuing their studies at MSc level. The minimum and maximum duration of study for full time mode is 1 year and 2 years, respectively; while that for part time mode is 1.5 years and 3 years, respectively. The programme comprises of 40 units.

"Look up at the stars and not down at your feet. Try to make sense of what you see and wonder about what makes the universe exist. Be curious."

[Stephen Hawking]

Master of Science (Nano-Optoelectronics) Mixed Mode Programme:

The programme structure and the duration of study



Equipment and Facilities

INOR has been considered to be one of the most modern and innovative research laboratories on optoelectronics and nanotechnology in Universiti Sains Malaysia. It houses an extensive range of equipment and facilities for growth, fabrication, and characterisation of optoelectronic and electronic materials/devices. In brief, these equipment and facilities can be categorized as follows:

a) Deposition & Coating Equipment:

- Metal Organic Chemical Vapour Deposition System
- E-Beam Evaporator System.
- Spin Coater System

b) Characterisation Tools:

- High Resolution X-ray Diffractometer (HR-XRD) for Epitaxial Films and Powders
- Mini Photoluminescence Spectrometer
- Light-Current-Voltage (LIV) Measurement System
- Electroluminescence (EL) System
- Keithley Instruments (4200 SCS, 2400 SMU, etc)
- Probe Station with Four Micropositioners
- Optical Microscope

c) Equipment for Sample Preparation & Treatment:

- Box Furnace, Single Zone Tube Furnace, 3-Zone Tube Furnace, etc.
- Glove Box
- UV-Ozone Cleaner
- Mixer and Degas Vacuum System
- Hot Plate, Stirring Hot Plate, Weighing Balance, etc

d) Semiconductor Fabrication Facilities and Equipment:

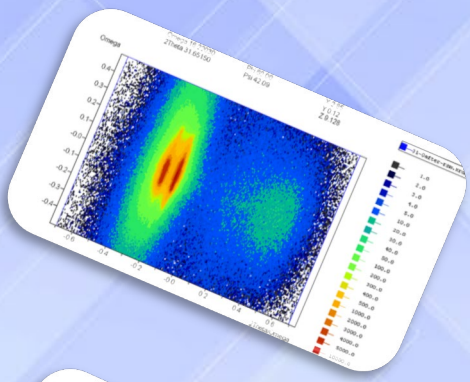
- Fume Cupboards for Acid, Solvents and Developer
- Inductively Coupled Plasma Reactive Ion Etching (ICP-RIE) System
- Maskless Lithography System with Support Facilities
- Laminar Flow Bench
- E-Beam Evaporator System for Metal Contacts
- E-Beam Evaporator System for Metal Oxide Layers

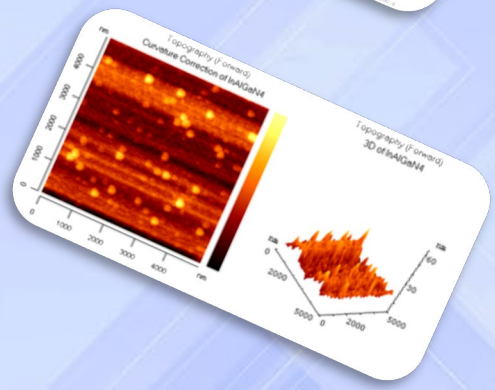
Services Offered

INOR offers a number of services. These include:

a) Characterisation and testing:

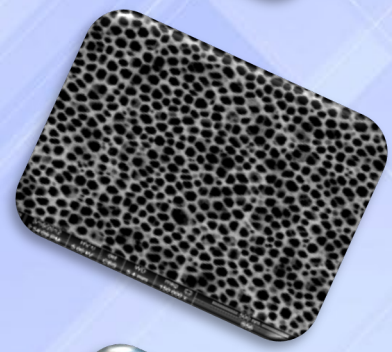
- Surface Morphology Characterisation (FESEM, Metallurgical Microscope)
- Structural Characterisation (HR-XRD).
- Optical Characterisation (Mini PL).
- Electrical Characterisation (Electroluminescence Measurements, Light-Current-Voltage Measurements).





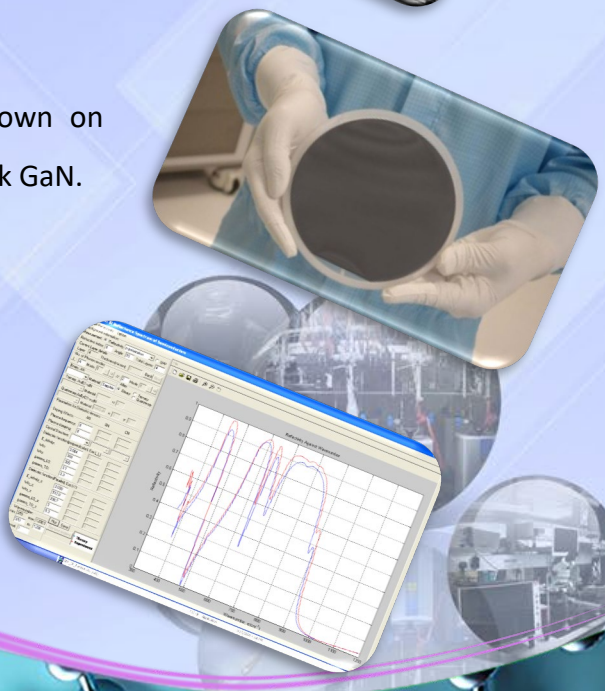
b) Samples preparation:

- Metal Contacts Deposition.
- Metal Oxides Deposition.
- Heat Treatment.-3
- Fabrication of LED, Solar Cell, Photodetector, Power Devices, etc.
- Fabrication of Porous / Nano Structures (such as GaN, ZnO, Si, etc.)



c) MOCVD III-nitrides epi wafer products:

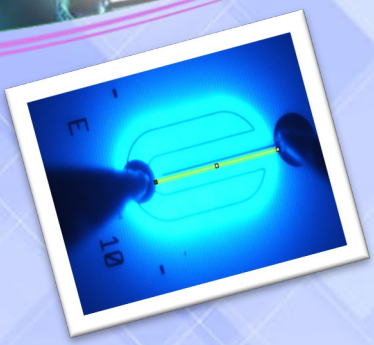
- Undoped/n-type/p-type GaN Epi Wafers Grown on Flat/Patterned c-plane Sapphire Substrate/Bulk GaN.
- III-nitrides Based LED Epi Wafers.
- Other III-Nitrides Epi Wafers.



d) Consultation:

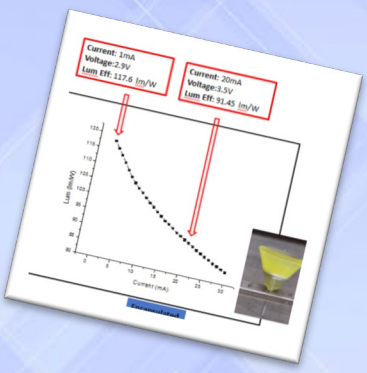
- MOCVD Operation and Growth Recipe.

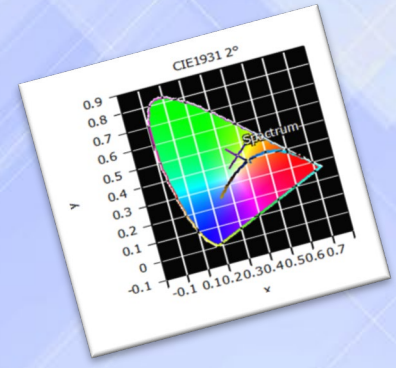
- HR-XRD Data Analysis.
- Mini PL and EL Data Analyses.
- Process Design for Device Fabrication.
- Fabrication of Porous and Nanostructure (such as GaN, ZnO, Si, etc.).



e) Short Course, Training, Workshop, Seminar, Conference:

- Semiconductor Fabrication Technology
- Workshop on Fabrication and Advanced Characterization Methods for Nanomaterials
- Workshop on Advanced Semiconductor Technology: Fabrication, Characterization and Applications
- Workshop on Advanced Materials Technology: Growth and Characterization
- Workshop on Raman and Photoluminescence Spectroscopy
- Scientific Research and Writing, etc.
- Strategies & Ethics in Research Paper Writing and Publishing.
- Meeting of Malaysia Nitrides Research Group (MNRG)





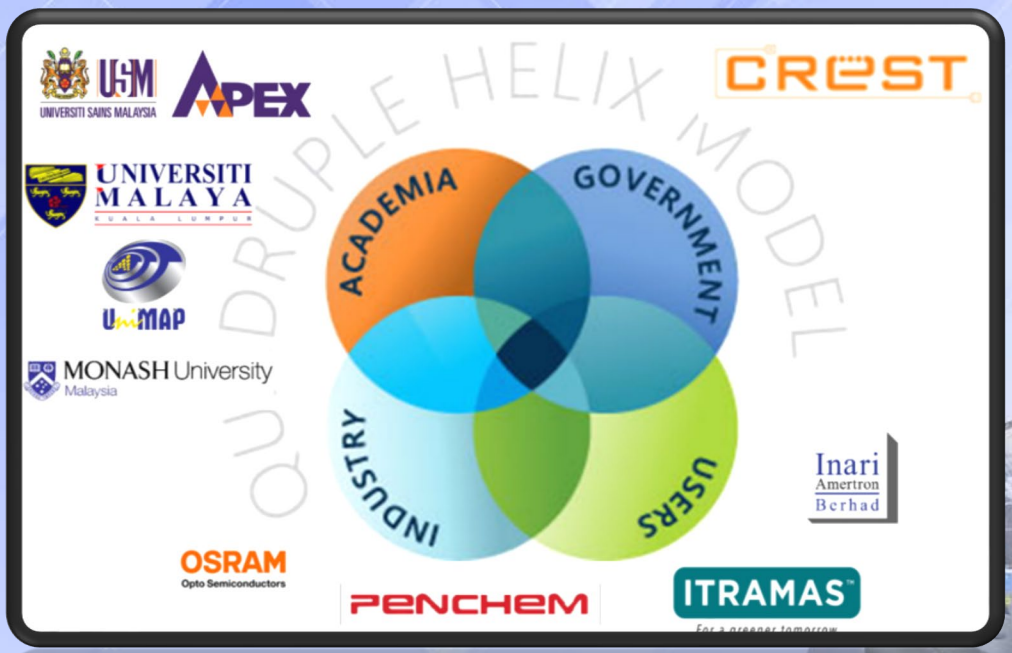
"GaN on GaN" (GoG) program is a five-year (2015-2020) light-emitting diodes (LEDs) technology transfer programme from United States of America to Malaysia through the collaborative research with 2014 Nobel Laureate in Physics, Prof. Dr. Shuji Nakamura from Solid State Lighting and Energy Electronics Center (SSLEEC), University of California, Santa Barbara (UCSB).

The programme is funded by Malaysian government for five years through Economic Planning Unit (EPU) for a total funding of RM 75 million. The goal of this programme is to produce High Efficiency and High Lumen White LEDs based on the GaN on GaN technology. Under this programme, Malaysia will be at the forefront of new technology, i.e. GaN on GaN LED technology, which will revolutionise the current technology based on GaN on sapphire. It will be the first time under this programme to establish upstream LED research capabilities in Malaysia alongside our industry and academic partners, targeting to position Malaysia as the Top 3 LED solution provider in the world by 2020. A full LED ecosystem will be created for Malaysia from front-end to back-end, supply chain and logistic.

The GoG programme involves a scientific collaboration with academia and industry through the involvement of key industrial players in the LED packaging, experts in local universities, and technology transfer of making LEDs from SSLEEC, UCSB to Malaysia. Institutions in Malaysia involved in this collaboration with UCSB include Universiti Sains Malaysia (USM), University Malaya (UM), Universiti Malaysia Perlis (UNIMAP), Monash University at Sunway Campus (MUSC), Collaborative Research in Engineering, Science and Technology Center (CREST), Northern Corridor Implementation Authority (NCIA), and related industries (OSRAM, Penchem, Inari, ItraMAS, etc).

GoG Programme is practicing the "Quadruple Helix Model", with the involvement of government, industry, academia, and users. CREST is representing the government to fund the programme and to build a linkage between academia and industry. The ultimate target of the GoG programme is to produce high luminaire LEDs up to 250 lm/W for 2" and 4" LED chips in Malaysia for the first time.

Quadruple Helix Model



In January 2018, the research laboratory of INOR which housed the Malaysia first 4 inch and high temperature metal organic chemical vapor deposition (MOCVD) reactor was fully commissioned and operated. Few months later (i.e., April and June), INOR research team lighted up their first growth of GaN LED on patterned sapphire substrate (PSS) and bulk GaN, respectively.

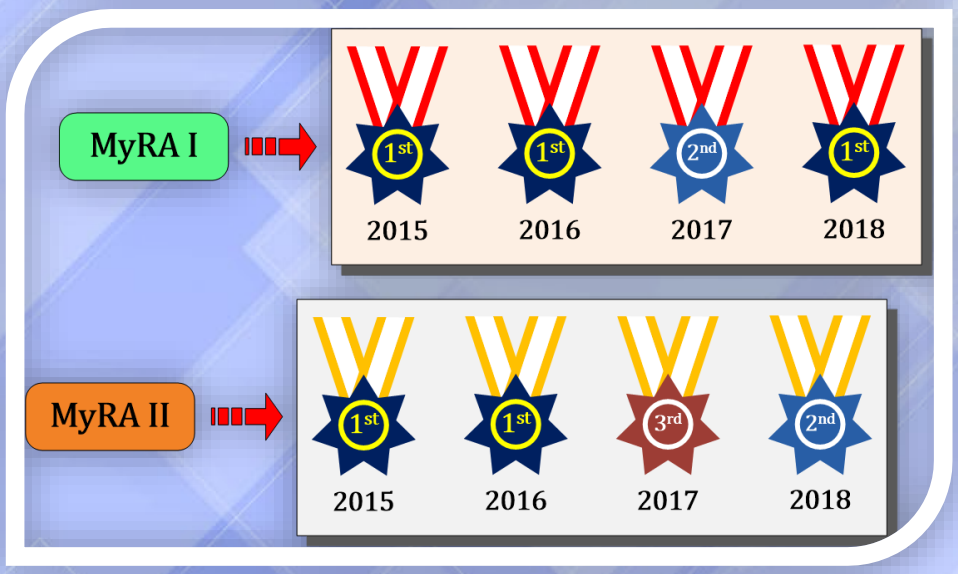
GoG research activities at INOR, USM

"The LED light bulb is more than ten times the efficiency of regular incandescent lighting, so it can save the world hundreds of billions of dollars in electricity costs."

[Shuji Nakamura]

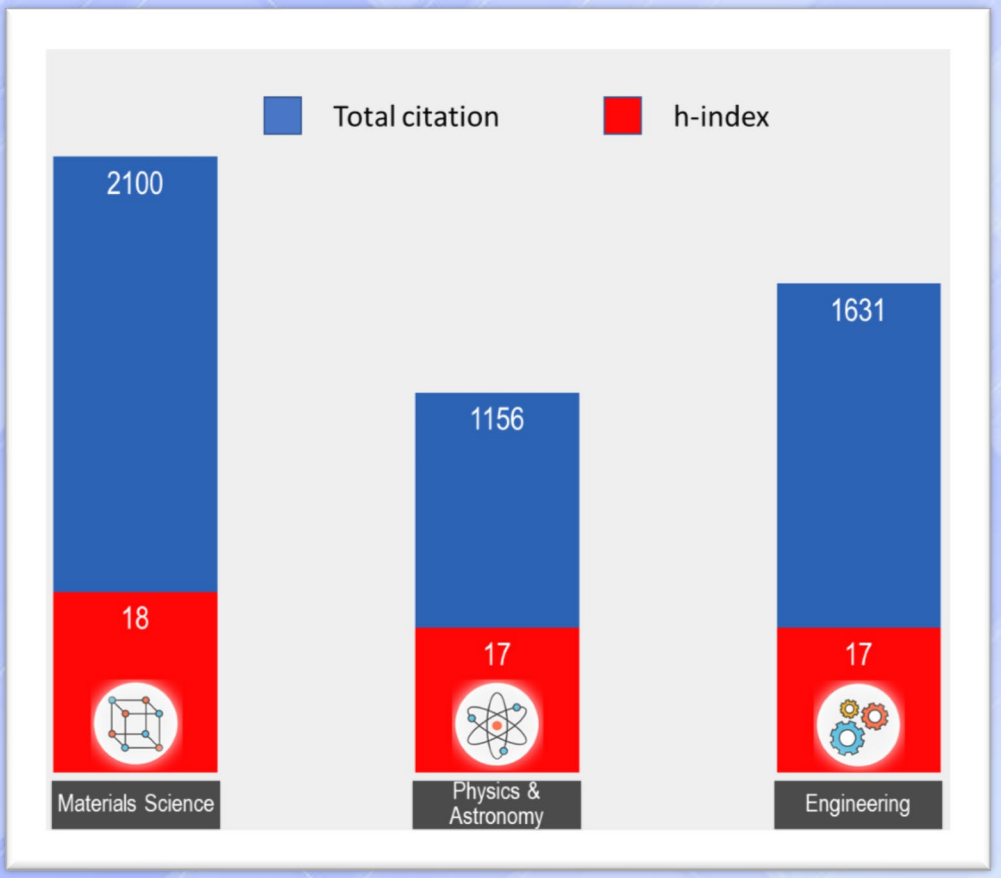
A. Key Performance Index (KPI) Achievements

The ranking of INOR in USM based on the Malaysia Research Assessment I & II (MyRA I & MyRA II) results for the year of 2015-2018



MyRA I and MyRA II marks obtained by INOR in year 2015 to 2018.

Total citation and h-index for three main subject areas of INOR based on the SCOPUS database. Data retrieved from 2014-2018.

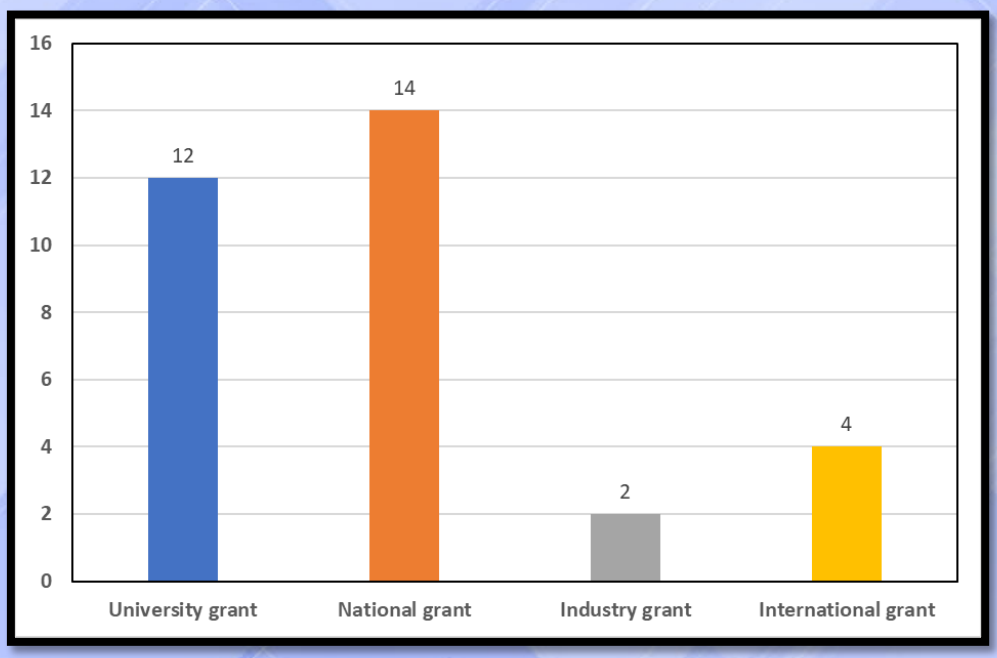


"There are no secrets to success. It is the result of preparation, hard work, and learning from failure."

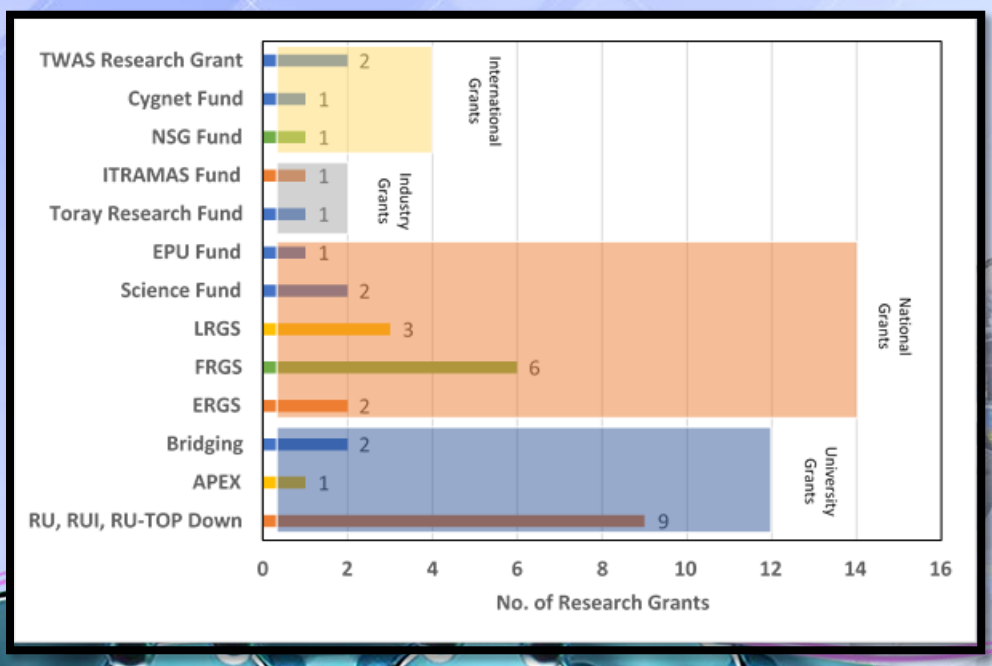
[Colin Powell]

B. Research Grants

Research grants received by the academic staff (i.e., as principal investigator) from year 2014-2018.

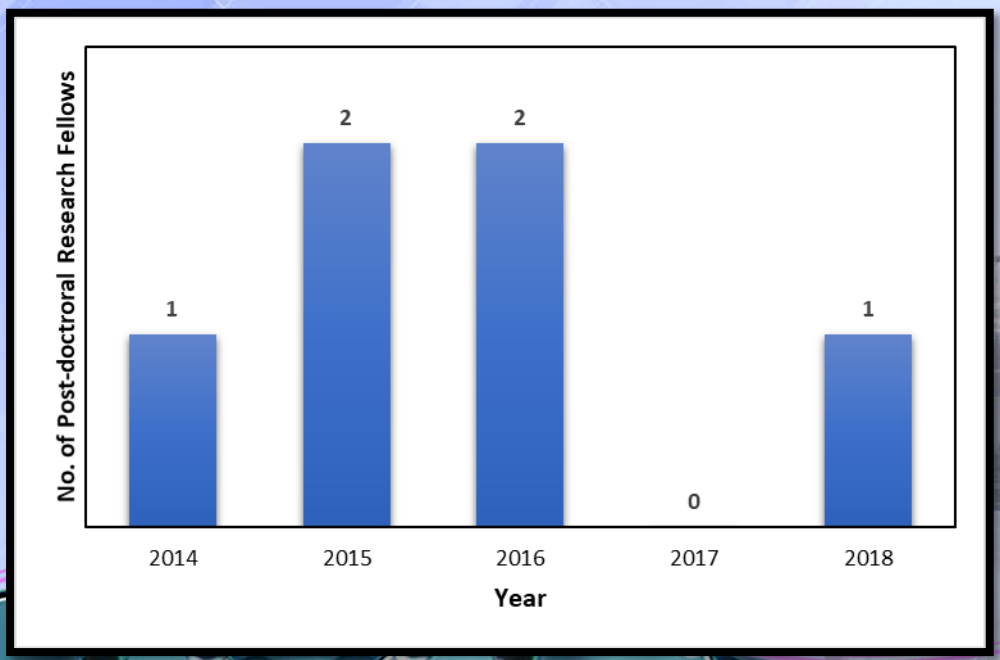


Type of research grants received by the academic staff (i.e., as principal investigator) from year 2014-2018.



Total amount of research funding received and spent from year 2014-2018.

Total number of post-doctoral research fellows appointed over 5 years (2014-2018).



List of international funded research projects. Data retrieved from 2014-2018.

No.	Project Leader	Research Title	Sponsor	Approved Amount (RM)	Period
1.	Assoc. Prof. Dr. Ng Sha Shiong	Experimental and theoretical studies of surface phonon polariton characteristic of $Al_xIn_{1-x}N$ thin firm grown on SiC Substrate	The World Academy of Sciences	36,558.00	10/09/2012 to 09/03/2014
2.	Assoc. Prof. Dr. Ng Sha Shiong	Mg-doped GaN thin Films Grown on AlN/Sapphire Substrate Prepared by Sol-Gel Spin Coating Method	Yayasan Nippon Sheet Glass Foundation, Japan	20,251.70	01/01/2016 to 31/12/2017
3.	Assoc. Prof. Dr. Norzaini Zainal	Producing cubic GaN using Porous Si Substrate	The World Academy of Sciences	36,558.00	10/09/2012 to 09/03/2014
4.	Prof. Dr. Zainuriah Hassan	A strategy for the production of thermochromic energy saving materials for use in roofing and other applications	Cygnet, USA	100,000.00	01/11/2013 to 29/02/2016

List of industry funded research projects. Data retrieved from 2014-2018.

No.	Project Leader	Research Title	Sponsor	Approved Amount (RM)	Period
1.	Assoc. Prof. Dr. Ng Sha Shiong	The fabrication and investigation of nitrogen doped copper oxide thin films on polyethylene terephthalate by radio frequency sputtering for photovoltaic application	Malaysia Toray Science Foundation	20,000.00	05/10/2012 to 31/12/2014
2.	Dr. Lim Way Foong	Managing R&D-based academia-industry collaboration projects related to light-emitting diode (LED) lighting	ITRAMAS Corporation Sdn. Bhd., Malaysia	86,400.00	13/06/2018 to 12/06/2019

List of national funded research projects. Data retrieved from 2014-2018.

No.	Project Leader	Research Title	Sponsor (Category)	Approved Amount (RM)	Period
1.	Assoc. Prof. Dr. Ng Sha Shiong	Surface phonon polariton resonance modulation in wurtzite III-nitride semiconductor system via modification of surface structure and formation of alloy structure	MOHE (FRGS)	159,000.00	16/04/2013 to 15/04/2015
2.	Assoc. Prof. Dr. Ng Sha Shiong	Investigation of InN-based semiconductors prepared using sol-gel spin coating method	MOHE (FRGS)	67,200.00	01/12/2014 to 28/02/2017
3.	Assoc. Prof. Dr. Ng Sha Shiong	Low-cost sol-gel spin coating growth of GaN-based semiconductors for optoelectronic applications	MOSTI (Science Fund)	395,115.00	01/05/2015 to 31/12/2017
4.	Assoc. Prof. Dr. Norzaini Zainal	Investigation on hexagonal inclusions in cubic gallium nitride materials	MOHE (FRGS)	92,000.00	01/06/2012 to 31/05/2014
5.	Assoc. Prof. Dr. Norzaini Zainal	Producing high quality cubic GaN using porous gas substrate for high efficient devices	MOHE (ERGS)	104,000.00	01/06/2013 to 31/05/2015
6.	Assoc. Prof. Dr. Norzaini Zainal	Producing high quality free-standing Gan substrate through cost-effective technique for excellent performance nitrides based devices	MOSTI (Science Fund)	348,630.00	01/01/2015 to 30/06/2017
7.	Assoc. Prof. Dr. Norzaini Zainal	Novel concept of role of pitch and shape of patterned sapphire substrate (PSS) in initial epi-growth of nitrides based LEDs for high-efficient lighting	MOHE (FRGS)	164,000.00	01/08/2016 to 31/07/2019
8.	Prof. Dr. Kamarulazizi Ibrahim	Cost effective and high efficient flexible nano solar cell technology	MOHE (LRGS)	6,000,000.00	01/08/2011 to 31/08/2014

9.	Prof. Dr. Kamarulazizi Ibrahim	Low cost inorganic nano alloys semiconductor solar cell study	MOHE (LRGS)	2,205,463.00	01/Aug/2011 to 21/Mar/2015
10.	Prof. Dr. Zainuriah Hassan	Fabrication and characterization of nanostructured compound semiconductors for application as gas sensors	MOHE (ERGS)	92,000.00	1/8/2012 to 31/7/2014
11.	Prof. Dr. Zainuriah Hassan	Study of structural and optical properties of nanostructured wide band gap ternary alloy semiconductors	MOHE (FRGS)	137,000.00	01/12/2013 to 30/11/2015
12.	Prof. Dr. Zainuriah Hassan	Preparation and characterization of nanostructured porous ternary and quaternary III-nitrides alloys	MOHE (FRGS)	200,000.00	01/01/2014 to 31/12/2016
***13.**	Prof. Dr. Zainuriah Hassan	GaN on GaN project	EPU	-	02/12/2015 to 01/12/2020
14.	Prof. Dr. Zainuriah Hassan	Wide bandgap semiconductor - energy efficient lighting	MOHE (LRGS)	2,000,000.00	15/Oct/2017 to 15/Oct/2020

Notes:

*Total funding of the project is RM 75 million. The funding was managed by the secretariat of the project, ie., Collaborative Research in Engineering, Science and Technology Center (CREST), Malaysia.

EPU – Economic Planning Unit, Malaysia

MOHE – Ministry of Higher Education, Malaysia

MOSTI – Ministry of Science Technology and Innovation, Malaysia

ERGS – Exploratory Research Grant Scheme

FRGS – Fundamental Research Grant Scheme

LRGS – Long-term Research Grant Scheme

List of university funded research projects. Data retrieved from 2014-2018.

No.	Project Leader	Research Title	Category	Approved Amount (RM)	Period
1.	Assoc. Prof. Dr. Ng Sha Shiong	Effects of crystal orientation on the surface and optical phonon characteristics of wurtzite crystals	RU	153,335.40	15/07/2012 to 14/07/2015
2.	Assoc. Prof. Dr. Ng Sha Shiong	Microwave assisted growth of gallium nitride thin films on patterned sapphire substrate prepared by sol-gel spin coating technique.	Bridging	25,000.00	01/12/2018 to 30/11/2019
3.	Assoc. Prof. Dr. Norzaini Zainal	Development of $Al_xGa_{1-x}N$/GaN strained-layer superlattice stack structure for high energy-efficient & cost -effective InGaN based LEDs	APEX	229,600.00	01/11/2012 to 31/10/2014
4.	Assoc. Prof. Dr. Norzaini Zainal	Study of cubic GaN on porous GaAs substrate for high efficient energy devices	RU	178,800.00	15/12/2012 to 14/12/2014
5.	Assoc. Prof. Dr. Norzaini Zainal	Improvement of GaN template and staggered lnGaN quantum-wells for high brightness III-V nitrides green light emitting diode (LED)	Bridging	10,000.00	25/01/2018 to 24/1/2019
6.	Assoc. Prof. Dr. Norzaini Zainal	Epitaxial growth of high efficient lnGaN based LEOs for wide spectral tunnability in visible lighting	RUI	94,000.00	01/06/2018 to 31/05/2021
7.	Prof. Dr. Kamarulazizi Ibrahim	Development of bulk growth of gallium nitride by the ammonothermal method	RU	101,800.00	14/04/2015 to 14/04/2017
8.	Prof. Dr. Md Roslan Hashim	Study of growth mechanisms of GaN nano-structures using electrochemical deposition technique	RU	133,100.00	01/01/2011 to 30/06/2014

9.	Prof. Dr. Md Roslan Hashim	Study of the growth mechanisms of GaN layers on porous SiC using electrochemical etching/deposition and RF sputtering for photonic applications	RU	147,100.00	01/11/2014 to 30/10/2017
10.	Prof. Dr. Zainuriah Hassan	Fabrication and characterization of GaN-based heterostructures for energy efficient LED-based solid state lighting	RU	189,500.00	15/12/2012 to 14/12/2015
11.	Prof. Dr. Zainuriah Hassan	Growth and characterization of hybrid heterostructures for ultraviolet emission	RUI	87,100.00	07/01/2018 to 30/06/2020
12.	Prof. Dr. Zainuriah Hassan	LED technology research cluster (LEDTREC) for development of next generation solid state lighting based on GaN-on-GaN and OLED	RU-TOP DOWN	1,000,000.00	01/07/2014 to 30/06/2017

Notes:

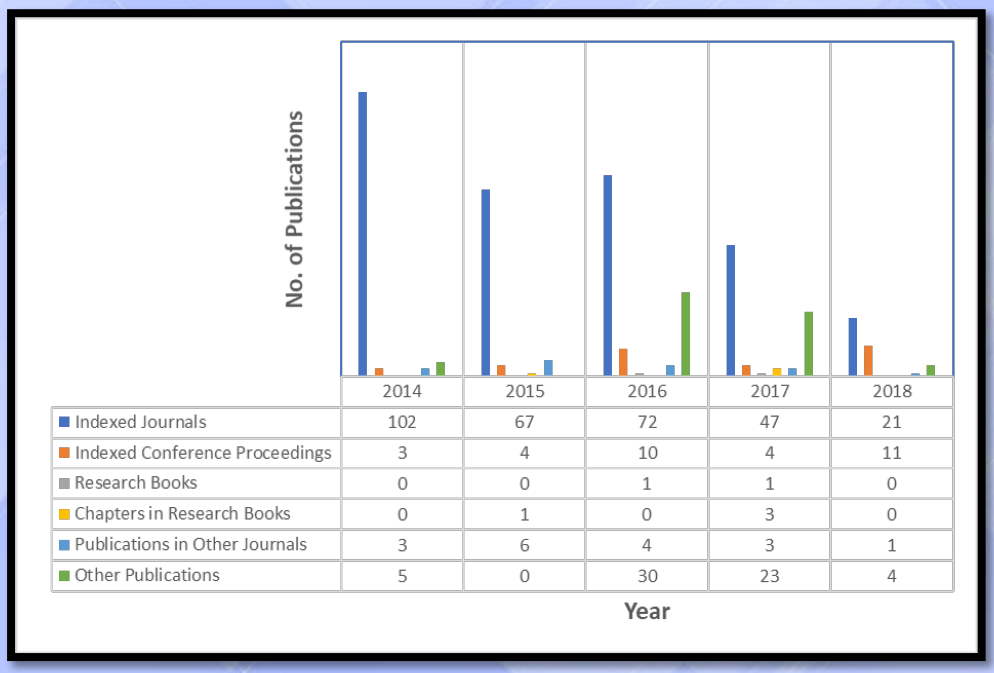
RU – Research University Grants

RUI – Research University Grant for Individual

APEX – Delivering Excellence (DE) Grants

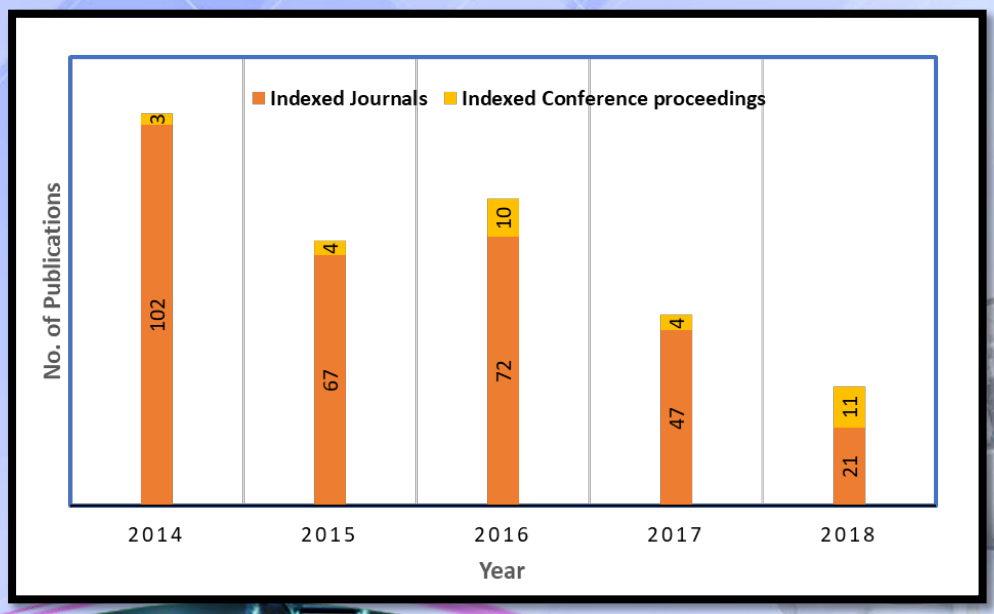
C. Publications

Total number of publications over 5 years (2014-2018).

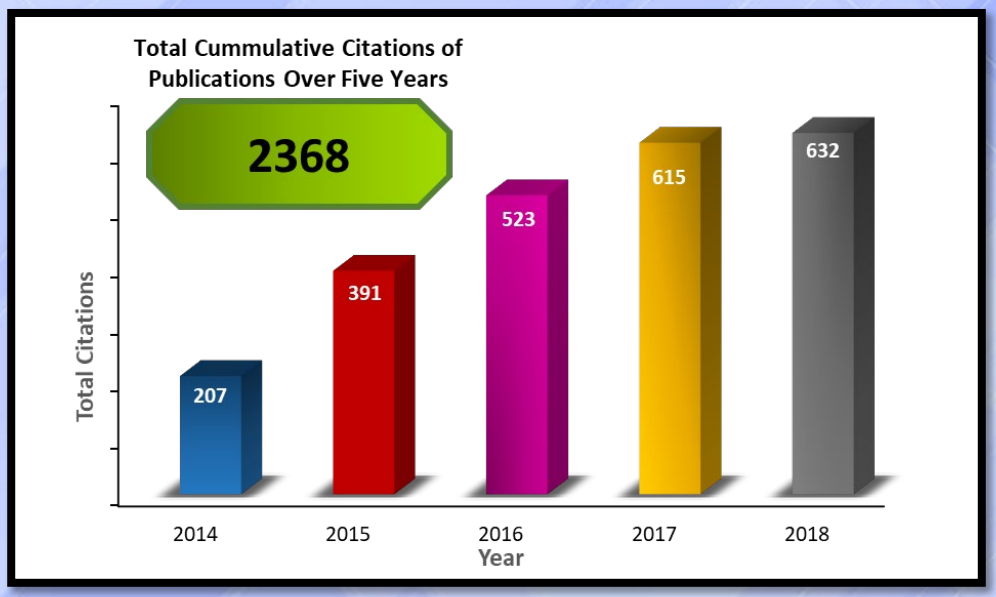


	2014	2015	2016	2017	2018
Indexed Journals	102	67	72	47	21
Indexed Conference Proceedings	3	4	10	4	11
Research Books	0	0	1	1	0
Chapters in Research Books	0	1	0	3	0
Publications in Other Journals	3	6	4	3	1
Other Publications	5	0	30	23	4

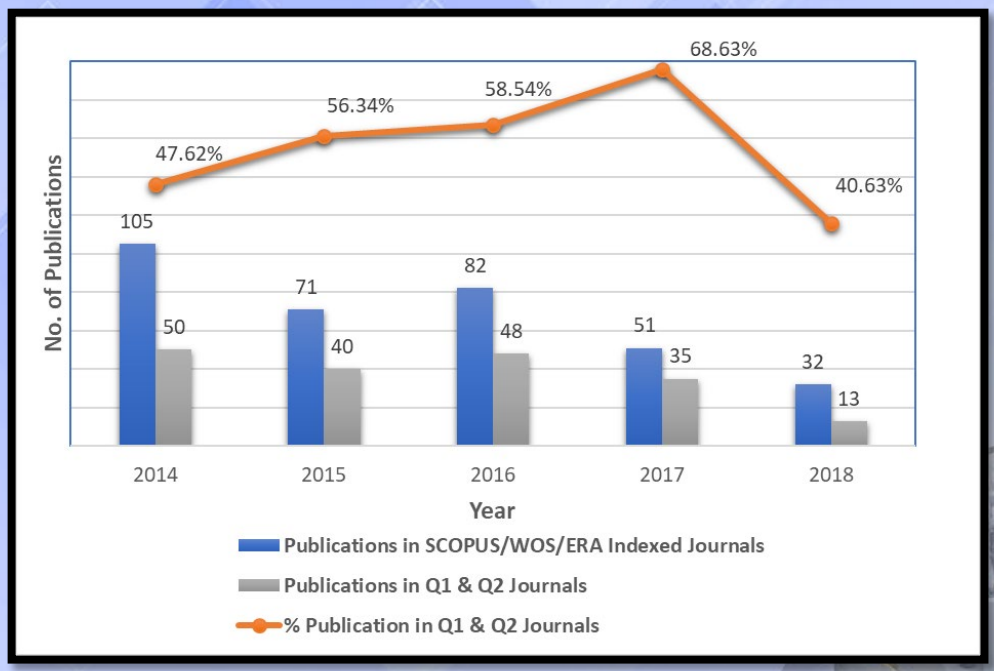
Total number of publications in SCOPUS/WOS indexed journals and conference proceedings over 5 years (2014-2018).



Total citations of publications for year 2014-2018.

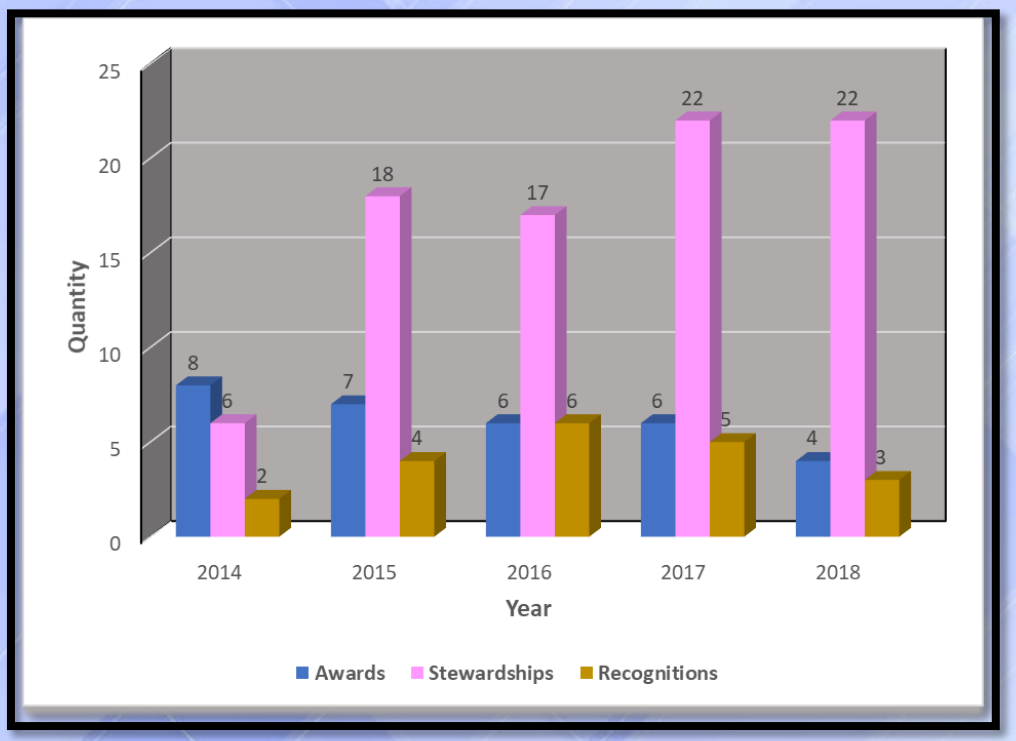


Percentage of articles published in Q1 and Q2 journals for year 2014-2018.

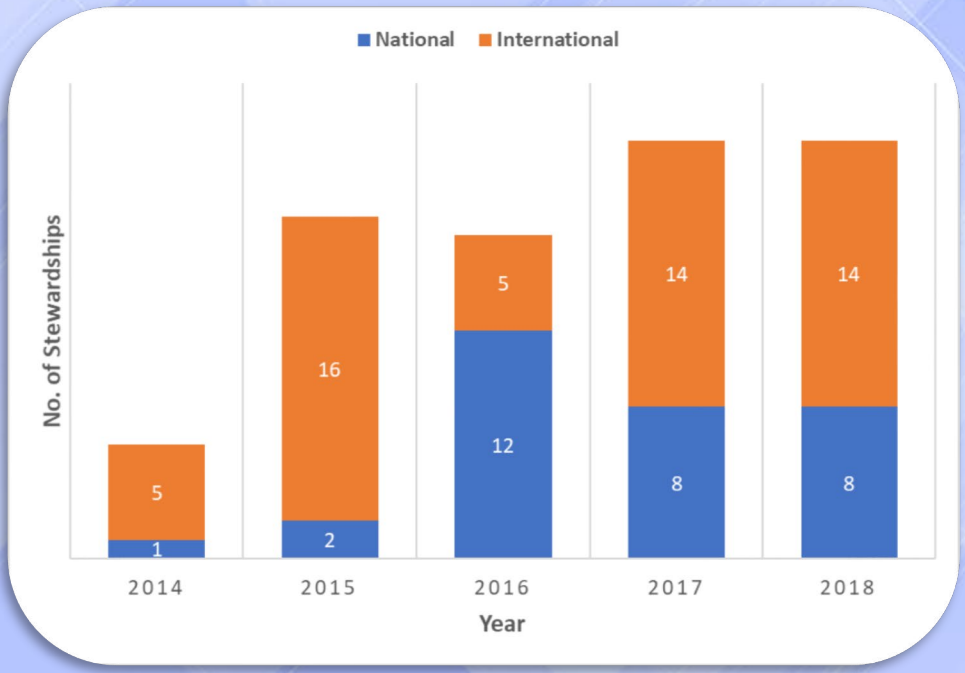


D. Awards, Stewardships, and Recognitions

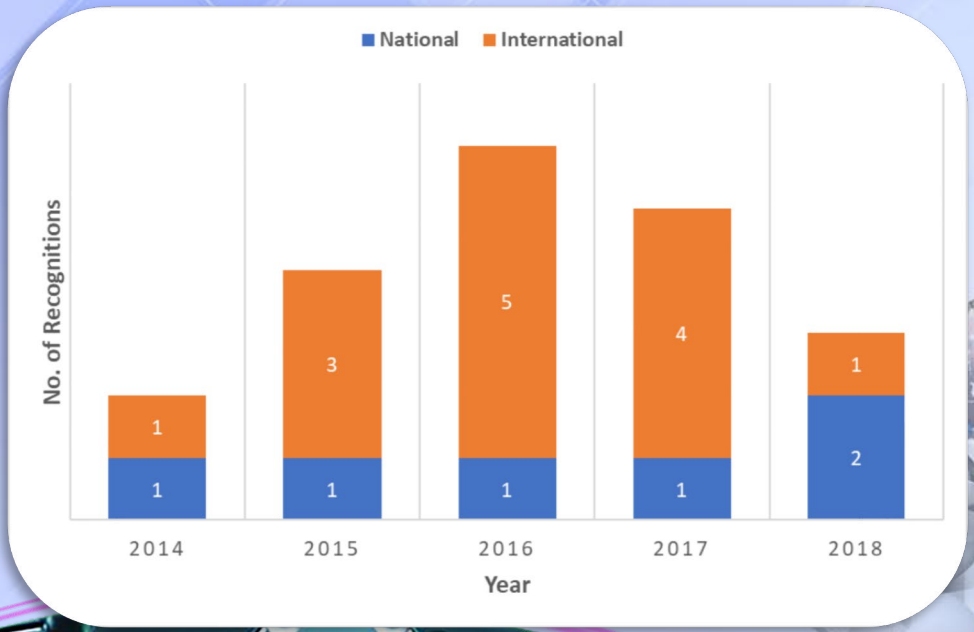
Awards/stewardships/recognitions conferred by academic and professional bodies for research excellence. Data retrieved from 2014-2018.



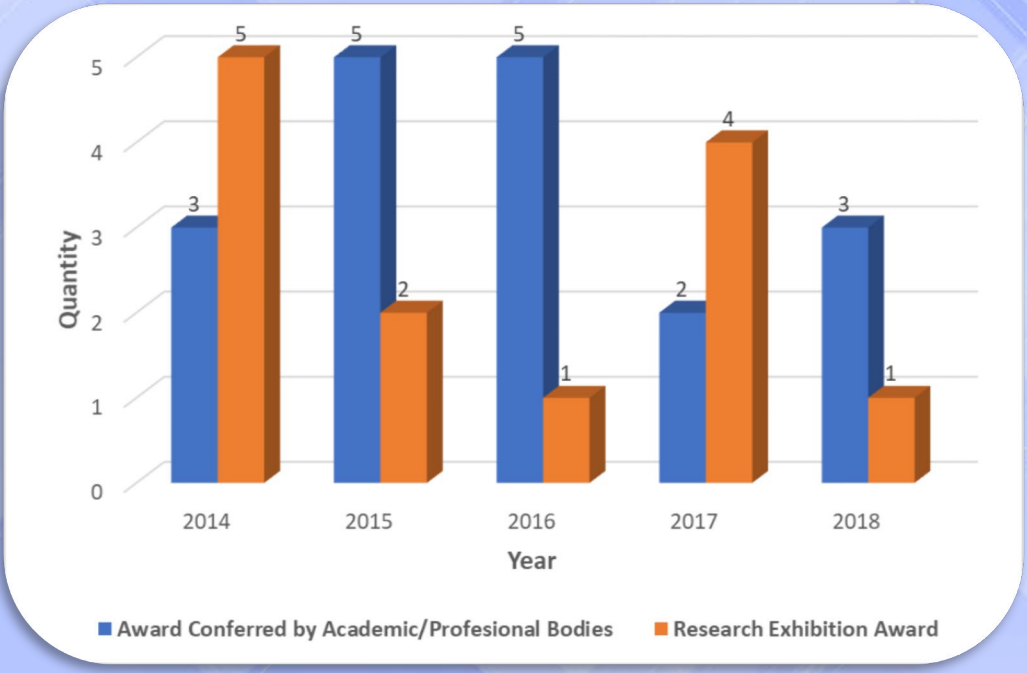
Stewardships conferred by academic and professional bodies for research excellence. Data retrieved from 2014-2018.



Recognitions conferred by national and international academic and professional bodies for research excellence. Data retrieved from 2014-2018.



Awards conferred by academic and professional bodies and research exhibitions awards received by INOR. Data retrieved from 2014-2018.



Awards conferred by international academic and professional bodies for research excellence. Data retrieved from 2014-2018.

No.	Name	Award	Conferring Body	Year
1.	Prof. Dr. Zainuriah Hassan	A biographee in the edition of MALAYSIA: Who's Who in the Civil Service: The Steel Backbone Of The Government – Crème De La Crème	Marquis Who's Who, USA	2015
2.	Prof. Dr. Zainuriah Hassan	Who's Who in the World 2016	Marquis Who's Who, USA	2016
3.	Prof. Dr. Zainuriah Hassan	2017 Albert Nelson Marquis Lifetime Achievement Award	Marquis Who's Who, USA	2017
4.	Prof. Dr. Zainuriah Hassan	2018 Albert Nelson Marquis Lifetime Achievement Award	Marquis Who's Who, USA	2018
5.	Prof. Dr. Zainuriah Hassan	A biographee in the edition of Marquis Who's Who in the World	Marquis Who's Who, USA	2018

Achievements (Years: 2014 – 2018)

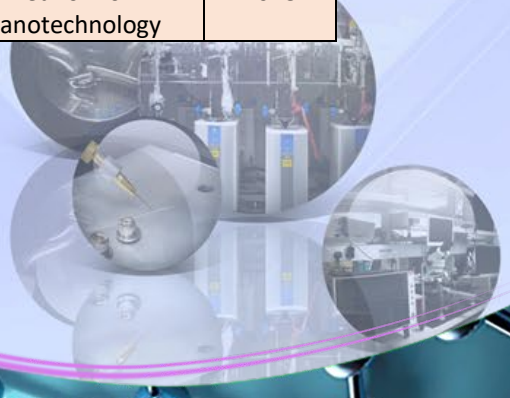
Awards conferred by national academic and professional bodies for research excellence.

Data retrieved from 2014-2018.

No.	Name	Award	Conferring Body	Year
1.	Assoc. Prof. Dr. Ng Sha Shiong	Anugerah Sanggar Sanjung (Hall of Fame) Journal Publication Category	Universiti Sains Malaysia	2014
2.	Prof. Dr. Zainuriah Hassan	Anugerah Sanggar Sanjung (Hall of Fame) Journal Publication Category	Universiti Sains Malaysia	2014
3.	Prof. Dr. Zainuriah Hassan	Anugerah Sanggar Sanjung (Hall of Fame) Patent Category	Universiti Sains Malaysia	2014
4.	Assoc. Prof. Dr. Ng Sha Shiong	Anugerah Sanggar Sanjung (Hall of Fame) Journal Publication Category	Universiti Sains Malaysia	2015
5.	Assoc. Prof. Dr. Norzaini Zainal	Anugerah Sanggar Sanjung (Hall of Fame) Journal Publication Category	Universiti Sains Malaysia	2015
6.	Prof Dr. Md Roslan Hashim	Anugerah Sanggar Sanjung (Hall of Fame) Journal Publication Category	Universiti Sains Malaysia	2015
7.	Prof. Dr. Kamarulazizi Ibrahim	Anugerah Sanggar Sanjung (Hall of Fame) Journal Publication Category	Universiti Sains Malaysia	2015
8.	Prof. Dr. Zainuriah Hassan	Anugerah Sanggar Sanjung (Hall of Fame) Journal Publication Category	Universiti Sains Malaysia	2015
9.	Prof. Dr. Zainuriah Hassan	Fellow of Academy of Sciences Malaysia	Academy of Sciences Malaysia	2016
10.	Prof. Dr. Zainuriah Hassan	Anugerah Sanggar Sanjung (Hall of Fame) Journal Publication Category	Universiti Sains Malaysia	2016
11.	Prof. Dr. Zainuriah Hassan	Sanggar Sanjung (Hall of Fame) Award (USM) 2016 - Prominent Figure (Ketokohan) Category	Universiti Sains Malaysia	2016
12.	Prof Dr. Md Roslan Hashim	Fellow of MASS	Malaysian Solid State Science and Technology Society (MASS)	2017
13.	Prof. Dr. Zainuriah Hassan	10 Top Malaysian Scientists on Nano	Inter-Islamic Network on Nanotechnology	2017

Achievements (Years: 2014 – 2018)

14.	Prof. Dr. Zainuriah Hassan	Merit Reward Journal Publication Category	Universiti Sains Malaysia	2017
15.	Prof. Dr. Zainuriah Hassan	Anugerah Sanggar Sanjung (Hall of Fame) Journal Publication Category	Universiti Sains Malaysia	2017
16.	Dr. Faezah Bt Jasman	IEEE Certificate of Achievement for Supervising FYP (2018 IEEE Malaysia Section Best Final Year Project Competition (Telecommunication)	IEEE Malaysia	2018
17.	Dr. Lim Way Foong	Anugerah Sanggar Sanjung (Hall of Fame) Journal Publication Category	Universiti Sains Malaysia	2018
18.	Dr. Lim Way Foong	Merit Reward Journal Publication Category	Universiti Sains Malaysia	2018
19.	Assoc. Prof. Dr. Ng Sha Shiong	Merit Reward Journal Publication Category	Universiti Sains Malaysia	2018
20.	Assoc. Prof. Dr. Ng Sha Shiong	30 Top Malaysian Scientists on Nano	Inter-Islamic Network on Nanotechnology	2018
21.	Assoc. Prof. Dr. Norzaini Zainal	Anugerah Sanggar Sanjung (Hall of Fame) Journal Publication Category	Universiti Sains Malaysia	2018
22.	Assoc. Prof. Dr. Norzaini Zainal	Merit Reward Journal Publication Category	Universiti Sains Malaysia	2018
23.	Dr. Quah Hock Jin	Merit Reward Journal Publication Category	Universiti Sains Malaysia	2018
24.	Prof. Dr. Zainuriah Hassan	Anugerah Sanggar Sanjung (Hall of Fame) Journal Publication Category	Universiti Sains Malaysia	2018
25.	Prof. Dr. Zainuriah Hassan	Merit Reward Journal Publication Category	Universiti Sains Malaysia	2018
26.	Prof. Dr. Zainuriah Hassan	10 Top Distinguished Malaysian Scientists on Nano	Inter-Islamic Network on Nanotechnology	2018



Achievements (Years: 2014 – 2018)

Research exhibition awards conferred by academic and professional bodies for research excellence. Data retrieved from 2014-2018.

No.	Name	Award	Event	Conferring Body	Year
1.	Prof. Dr. Kamarulazizi Ibrahim	**Gold medal** For the invention/ innovation of *New zinc boiling pilot plant*	Malaysia Technology Expo 2014	Malaysian Association Research Scientist	2014
2.	Prof. Dr. Kamarulazizi Ibrahim	**Bronze medal** For the invention/ innovation of *USM-SAM (Sustainability Assessment Methodology)*	Malaysia Technology Expo 2014	Malaysian Association Research Scientist	2014
3.	Prof. Dr. Zainuriah Hassan	**Bronze Medal** For the invention/ innovation of *Novelty technique cheap and fast ITO thin film annealing using CW CO_2 laser for light emitting diode application*	5th Exposition on Islamic Innovation 2014 (i-Inova14)	Ministry of Science, Technology & Innovation (MOSTI) and Universiti Sains Islam Malaysia (USIM)	2014
4.	Prof. Dr. Zainuriah Hassan	**Gold Medal** For the project of *High sensitivity of porous InGaN hydrogen gas sensor*	Penang Invention, Innovation and Research Design Platform (PIID) 2014	Universiti Teknologi Mara, Malaysia (UiTM)	2014
5.	Prof. Dr. Zainuriah Hassan	**Gold Medal** For the project of *High quality porous Si-doped GaN using a novel AC Technique for high efficient devices*	Penang Invention, Innovation and Research Design Platform (PIID) 2014	Universiti Teknologi Mara, Malaysia (UiTM)	2014
6.	Prof. Dr. Zainuriah Hassan	**Diamond Medal** For the invention/ innovation of For the project of *Enhancing the sensitivity of porous InAlGaN based hydrogen gas sensor using simple and cost effective photoelectrochemical etching*	Penang Invention, Innovation and Research Design Platform (PIID) 2015	Universiti Teknologi Mara, Malaysia (UiTM)	2015
7.	Prof. Dr. Zainuriah Hassan	**Silver Medal** For the project of *Undoped porous GaN using a novel front and backside contact for high efficient MSM photodetector*	Penang Invention, Innovation and Research Design Platform (PIID) 2015	Universiti Teknologi Mara, Malaysia (UiTM)	2015

8.	Prof. Dr. Zainuriah Hassan	**Gold** For the invention/ innovation of *Fabrication and characterization of Aluminum nitride for photodetector applications*	Eureka Innovation Exhibition (EIE) 2016	Universiti Kuala Lumpur Malaysian Spanish Institute, (UniKL MSI)	2016
9.	Assoc. Prof. Dr. Ng Sha Shiong	**Silver medal** For the invention/ innovation of *Sol-gel spin coating growth of III-nitride thin films*	Sirim Invention, Innovation and Technology Expo (SI2TE) 2017	SIRIM Berhad, Malaysia	2017
10.	Prof. Dr. Zainuriah Hassan	**Gold Medal** For the invention/ innovation/design of *High quality porous GaN using Pt-aasisted electroless etching for high efficient MSM photodetectors*	Penang International Invention, Innovation and Research Design Platform (PIID) 2017	Universiti Teknologi Mara, Malaysia (UiTM)	2017
11.	Prof. Dr. Zainuriah Hassan	**Silver Medal** For the invention/ innovation/design of *High sensitivity of undoped porous GaN MSM photodetector using Pt-assisted electroless etching*	Invention, Innovation and Design Exposition 2017 (iideX2017)	Universiti Teknologi Mara, Malaysia (UiTM)	2017
12.	Prof. Dr. Zainuriah Hassan	**Bronze Medal** For the project of *MBE growth of aluminum nitride heterostructure on silicon substrate*	The 1st International Malaysia-Indonesia-Thailand Symposium on Innovation and Creativity (iMITSiC2017)	Universiti Teknologi Mara, Malaysia (UiTM)	2017
13.	Prof. Dr. Zainuriah Hassan	**Gold Medal** For the invention of *Enhancing characteristic of porous GaN using cost effective photoelectrochemical etching for high performance sensing device*	Asia Innovation Show 2018	Bahagian Penyelarasan Bumiputra, Pulau Pinang, Unit Keselarasan Pelarasaan (icu), Jabatan Perdana Meteri, Malaysia, and Universiti Teknologi Mara, Malaysia (UiTM)	2018

E. Membership in International/National Organizations

Membership in international organizations / professional associations.

No.	Academic Staff	Name of Bodies/Associations	Status of Membership
1.	**Prof. Dr. Zainuriah Hassan**	Materials Research Society (MRS)	Member
		Optical Society of America (OSA)	Member
		Institute of Electrical & Electronics Engineers (IEEE)	Member
		Fulbright Association	Life Membership
		Steinbeis Transfer Center Network	Life Membership
		Journal of Materials	Editorial Board
		Journal of Kufa Physics	Editorial Board
		Ohio University Alumni	Member
		Women for Women International	Member
		Journal of Science and Technology	Advisory Board
2.	**Assoc. Prof. Dr. Ng Sha Shiong**	Materials Research Society (MRS)	Member
		Optical Society of America (OSA)	Member
		The Society of Applied Spectroscopy	Member
		The International Society for Optics and Photonics (SPIE)	Member

3.	**Assoc. Prof. Dr. Norzaini Zainal**	Optical Society of America (OSA)	Member
4.	**Dr. Lim Way Foong**	The International Society for Optics and Photonics (SPIE)	Member
		Frontiers in Materials	Review Editor
		Golden Key International Honour Society	Life Membership
5.	**Dr. Mohd Syamsul Nasyriq Samsol Baharin**	European Materials Research Society	Member
6.	**Dr. Quah Hock Jin**	Golden Key International Honour Society	Life Membership
		Colloidal Materials and Interfaces (Frontier in Materials)	Review Editor
		The Open Electrical &electronic Engineering Journal (Bentham Open)	Editorial Board Member

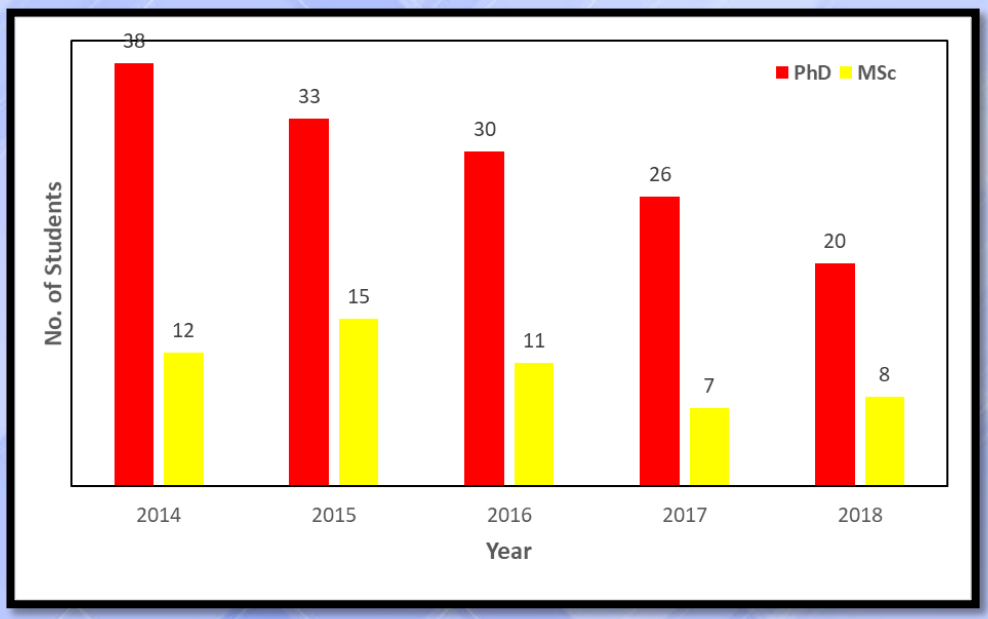
Membership in national organizations / professional associations.

No.	Academic Staff	Name of Bodies/Associations	Status of Membership
1.	**Prof. Dr. Kamarulazizi Ibrahim**	Malaysian Solid State Science and Technology Society (MASS)	Life Membership
		National Professors Council	Member
2.	**Prof. Dr. Md. Roslan Hashim**	Malaysian Solid State Science and Technology Society (MASS)	Life Membership
		National Professors Council	Member
3.	**Prof. Dr. Zainuriah Hassan**	Malaysian Solid State Science and Technology Society (MASS)	Life Membership
		Malaysian Institute of Physics (IFM)	Life Membership
		National Professors Council	Member
		Fellow of Academy of Sciences Malaysia (ASM)	Member
4.	**Assoc. Prof. Dr. Ng Sha Shiong**	Malaysian Solid State Science and Technology Society (MASS)	Life Membership
		Malaysian Institute of Physics (IFM)	Life Membership
5.	**Assoc. Prof. Dr. Norzaini Zainal**	Malaysian Solid State Science and Technology Society (MASS)	Life Membership
6.	**Dr. Lim Way Foong**	Board of Engineers Malaysia (BEM)	Life Membership
7.	**Dr. Sabah M. Mohammad**	Malaysian Solid State Science and Technology Society (MASS)	Life Membership
8.	**Dr. Quah Hock Jin**	Board of Engineers Malaysia (BEM)	Life Membership
9.	**Dr. Faezah Jasman**	Optical Society of Malaysia	Member

F. Quantity & Quality of Postgraduates

Total number of postgraduate students (by research mode) at INOR.

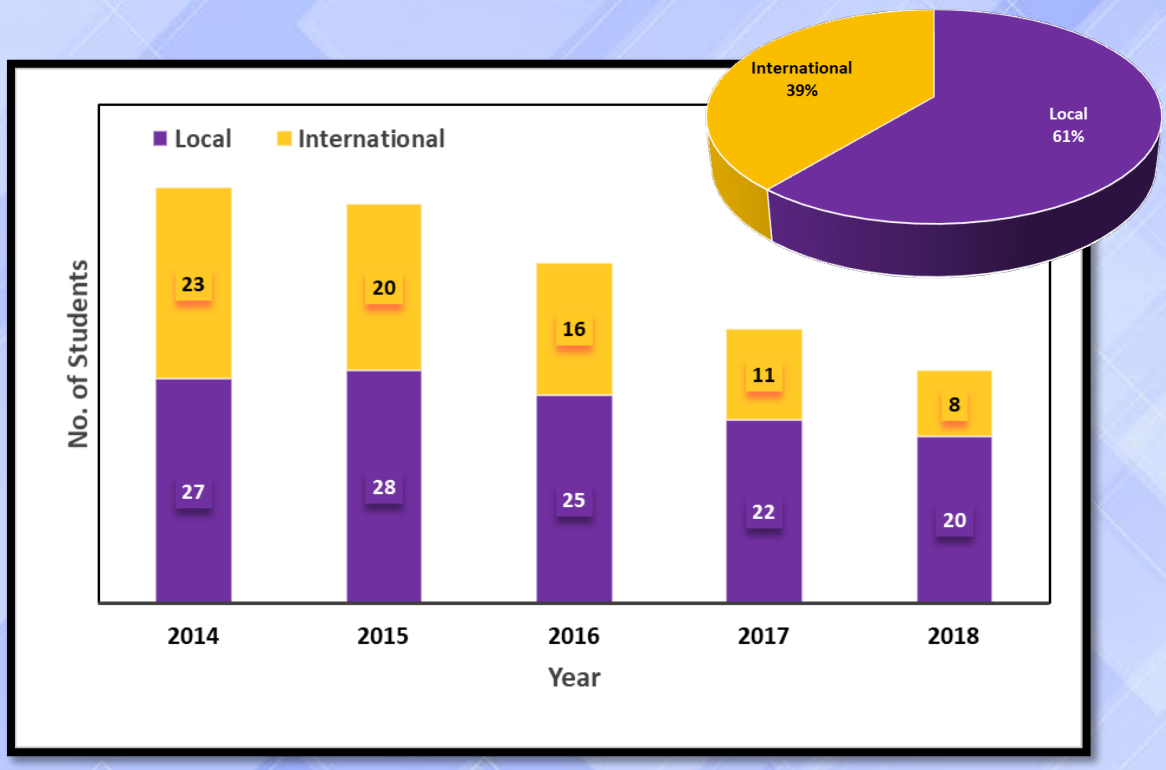
Data retrieved from 2014-2018.



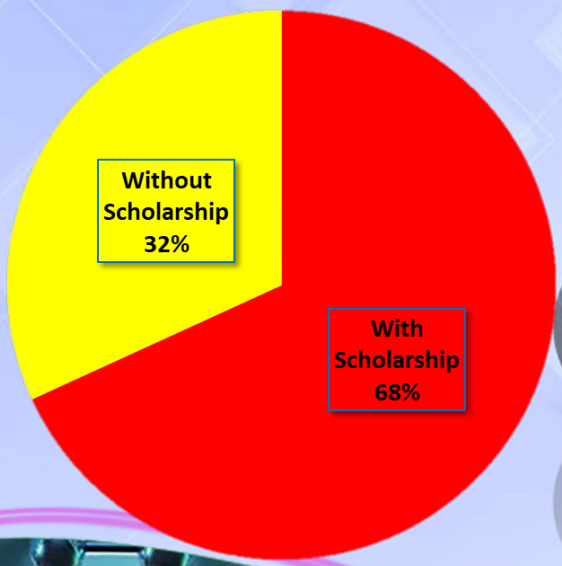
Number of postgraduate students (by research mode) enrolled under full time and part time mode. Data retrieved from 2014-2018.

	2014	2015	2016	2017	2018
PhD Full Time	38	33	29	26	20
PhD Part Time	0	0	1	0	0
MSc Full Time	12	14	10	7	8
MSc Part Time	0	1	1	0	0

Number and percentage of local and international postgraduate students (by research mode) enrolled at INOR from 2014-2018.

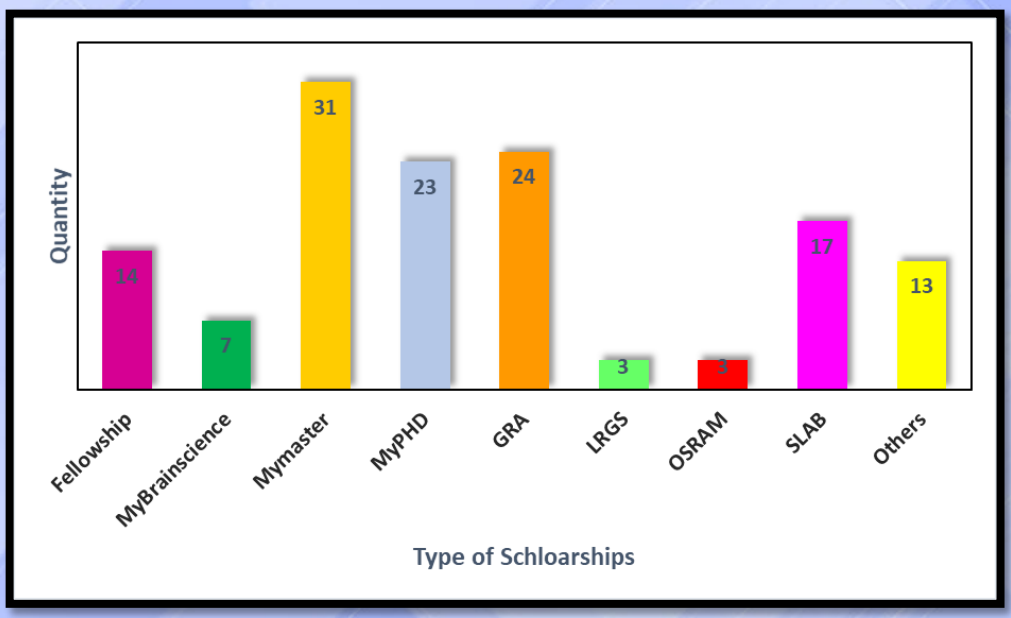


Postgraduate students (by research mode) with and without scholarship. Data retrieved from 2014-2018.



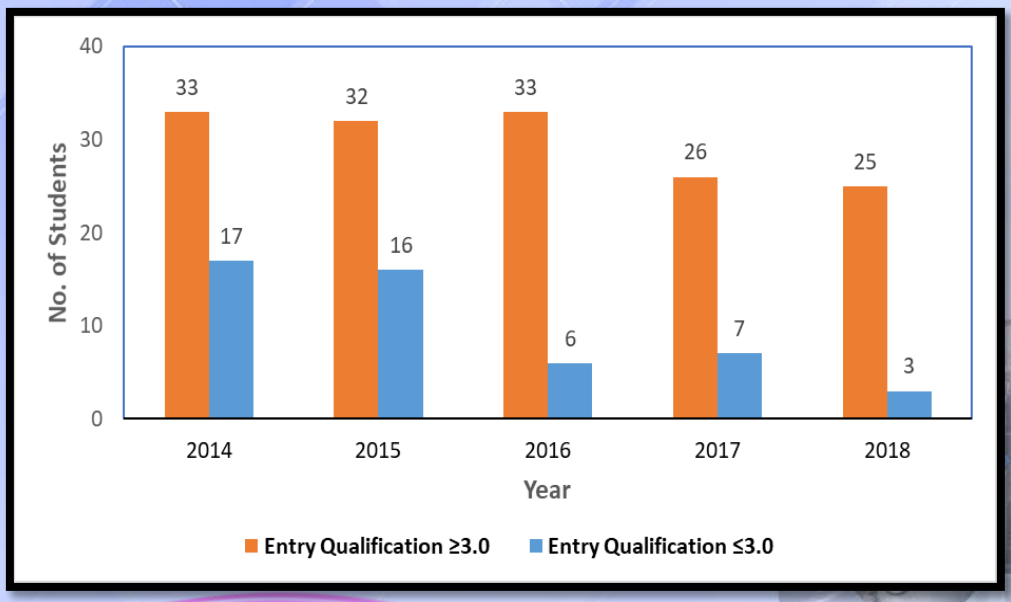
Type of scholarships received by the postgraduate students (by research mode).

Data retrieved from 2014-2018.



Entry qualification level of the postgraduate students (by research mode).

Data retrieved from 2014-2018.

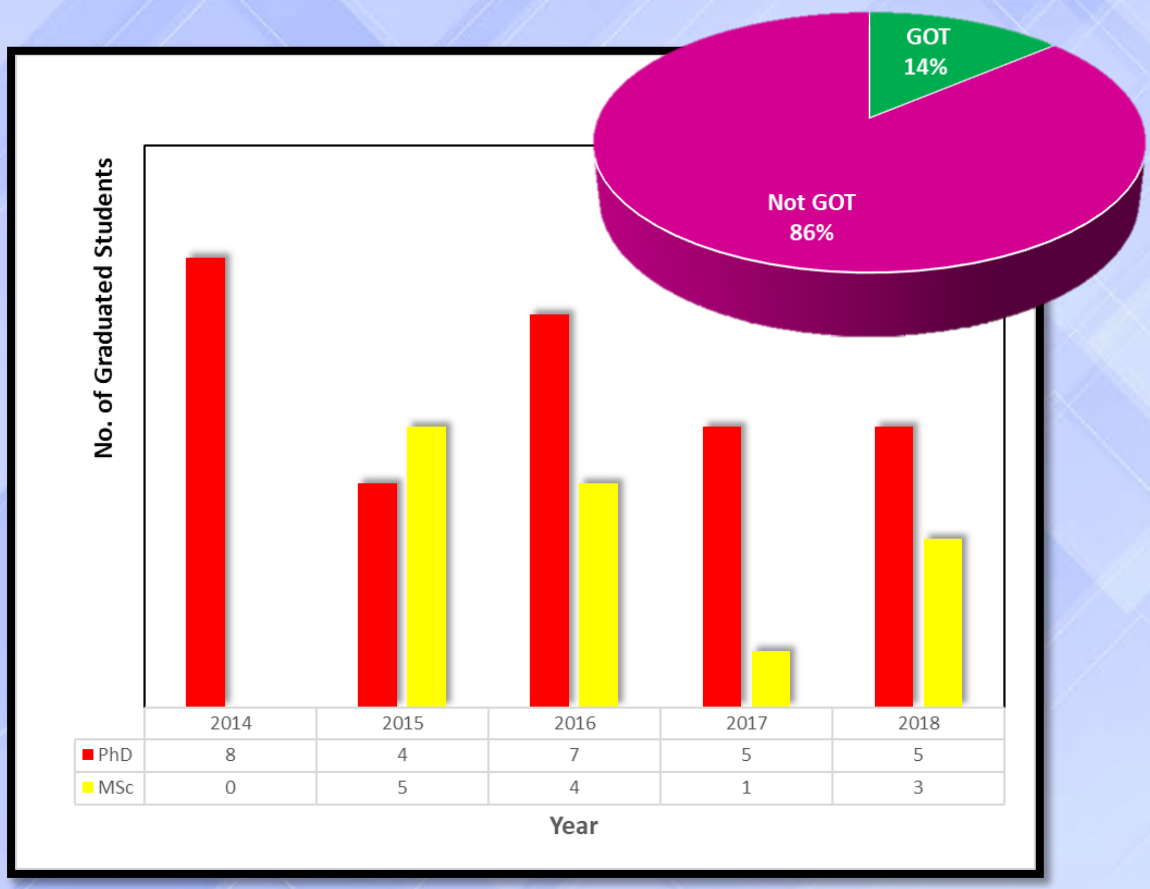


Achievements (Years: 2014 – 2018)

Number of postgraduate students (by research mode) graduated from 2014-2018.

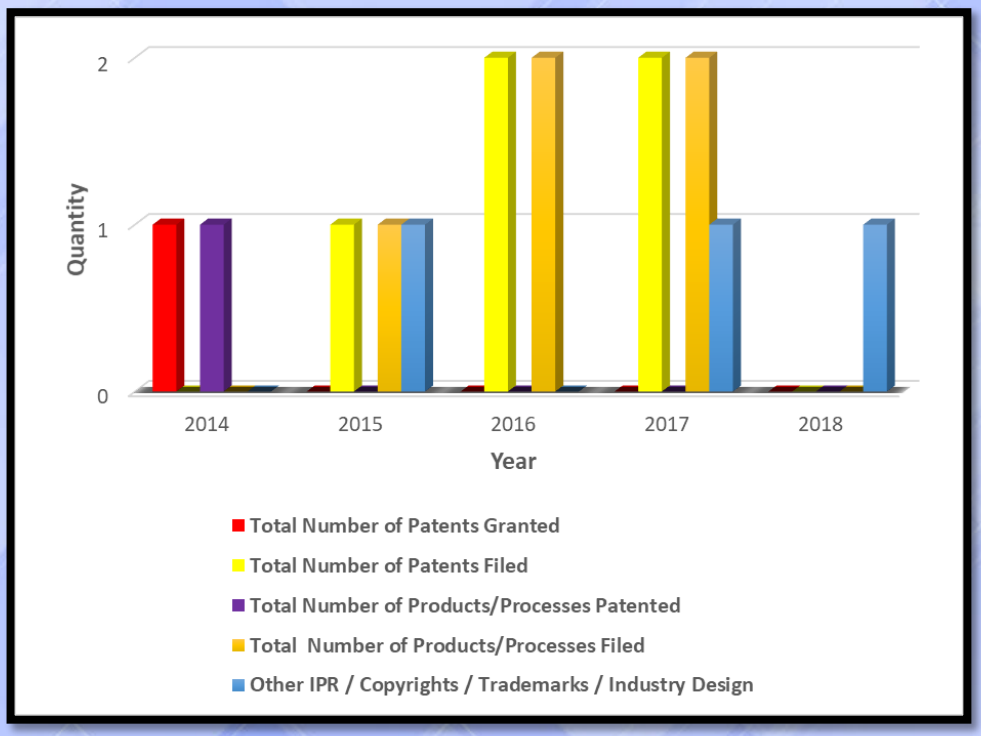
Inset shows the Percentage of PhDs graduated on time (GOT)

namely graduated within 7 Semesters or 42 Months.

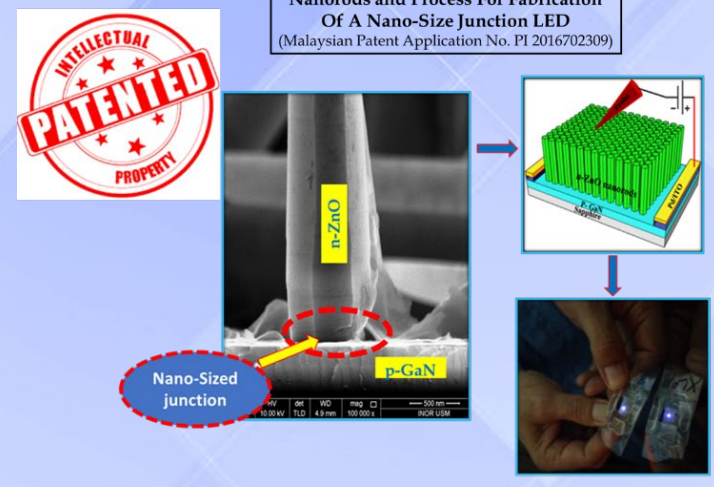


G. Innovation

Total number of innovations. Data retrieved from 2014-2018.



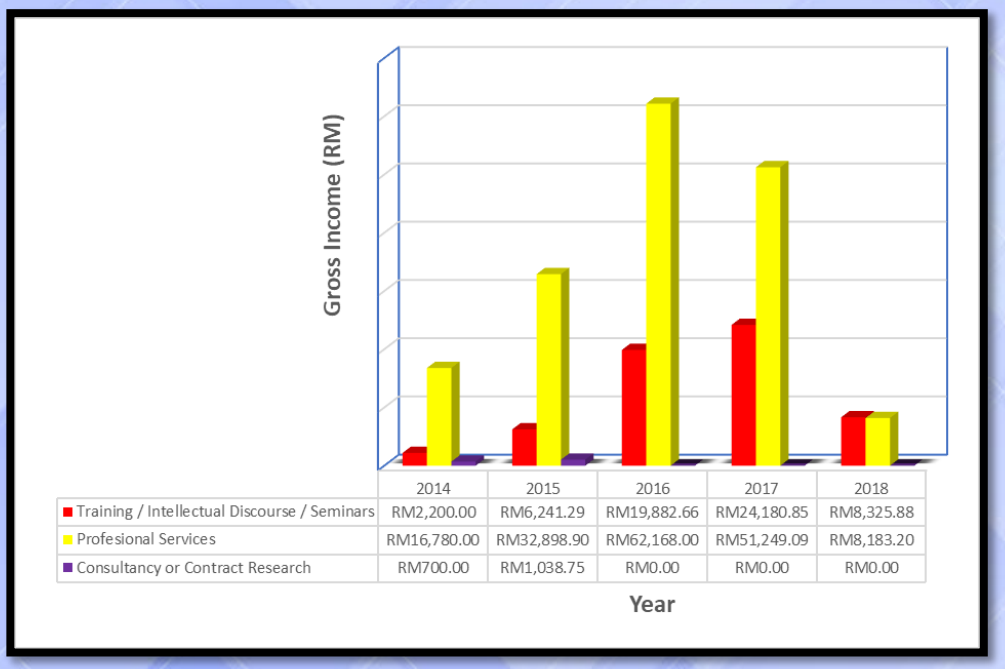
Direct Heat Substrate-Modified Chemical Bath Deposition System For Growth of Ultra Long Zinc Oxide (ZnO) Nanorods and Process For Fabrication Of A Nano-Size Junction LED
(Malaysian Patent Application No. PI 2016702309)



Alternating Current Assisted Photo-Electrochemical Etching System And Method
(Malaysian Patent Application No. PI 2015704640)

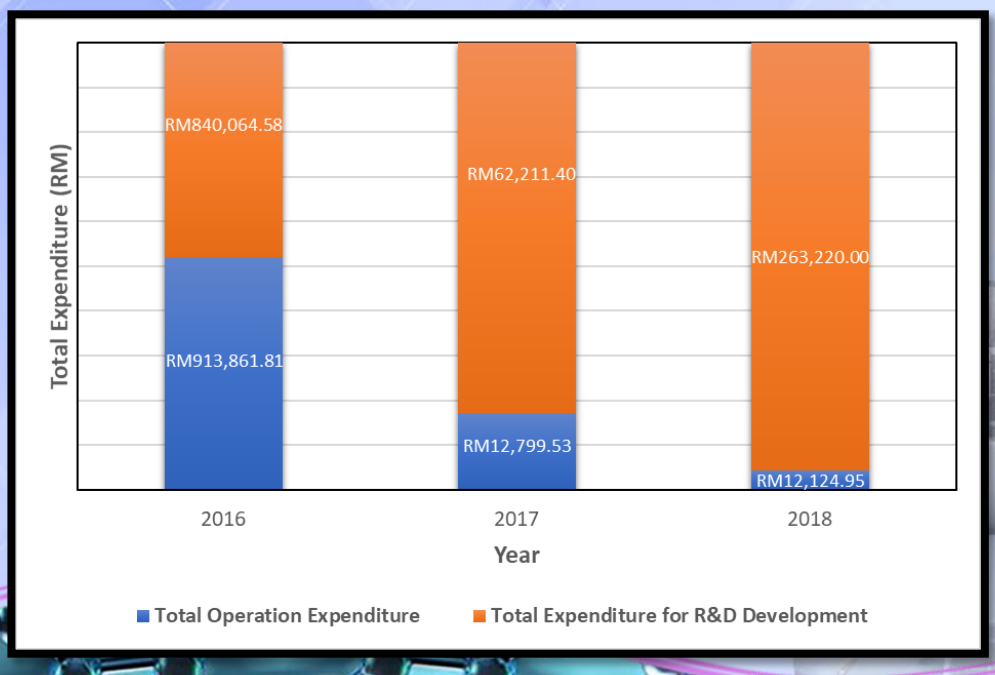
H. Professional Services and Gifts

Gross income generated from 2014-2018.



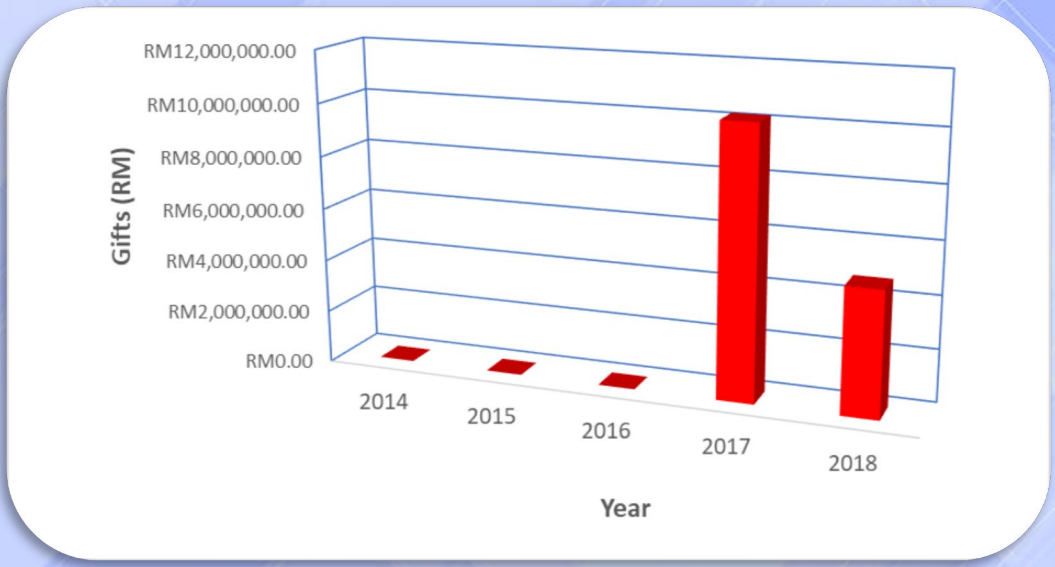
	2014	2015	2016	2017	2018
Training / Intellectual Discourse / Seminars	RM2,200.00	RM6,241.29	RM19,882.66	RM24,180.85	RM8,325.88
Profesional Services	RM16,780.00	RM32,898.90	RM62,168.00	RM51,249.09	RM8,183.20
Consultancy or Contract Research	RM700.00	RM1,038.75	RM0.00	RM0.00	RM0.00

Total expenditures over the last three years.



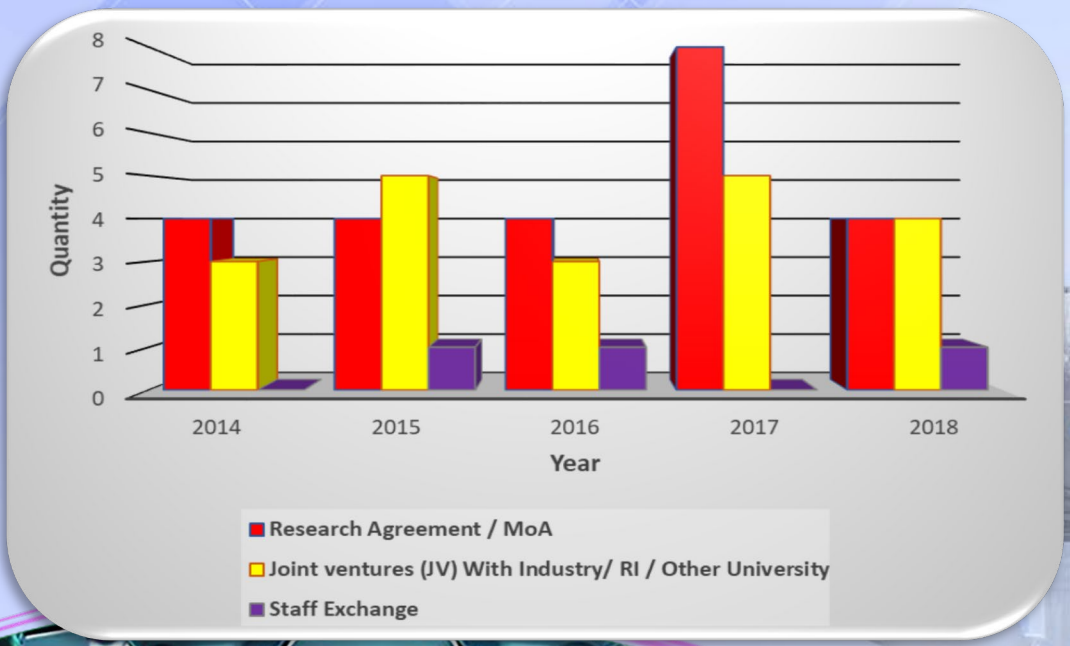
Gifts/donations (money, equipment, research materials, etc. worth ≥ RM 3,000.00 each).

Data retrieved from 2014-2018.



I. Networking and Linkages

Networking and linkages data for 2014-2018.



List of Activities (Years: 2014 – 2018)

No.	Activities/Seminars/Workshops/Conferences	Date	Venue
1.	1st Meeting of Malaysia Nitrides Research Group (MNRG)	7 April 2014	INFORMM Auditorium Room, USM.
2.	2nd Meeting of Malaysia Nitrides Research Group (MNRG)	8 – 9 June 2015	INFORMM Auditorium Room, USM.
3.	Rural Community Visit to Kg Bujang, Bedong, Kedah.	12 December 2015	Kg Bujang, Bedong, Kedah.
4.	International Symposium on LED and OLED Technology in Conjunction with the International Year of Light 2015 (ISOLED 2015)	14 December 2015	Auditorium Murad Mohd Noor, sains@usm, Bukit Jambul.
5.	Nobel Laureate Lecture Series: Prof. Dr. Shuji Nakamura	29 July 2016	Kompleks Cahaya Siswa, Lorong Cahaya, USM.
6.	Raman Workshop Raman Spectroscopy: Basic Principle, Instrumentation and Selected Applications	01 August 2016	Auditorium B, sains@usm, USM.
7.	Workshop on Scientific Research and Writing	05 December 2016	Auditorium B, sains@usm, USM.
8.	3rd Meeting of Malaysia Nitrides Research Group (MNRG)	06 - 07 December 2016	Auditorium Murad Mohd Noor, sains@usm, USM.
9.	Academy of Sciences Malaysia Fellow's Lecture by Professor Dr. Zainuriah Hassan FASc	07 December 2016	Auditorium Murad Mohd Noor, sains@usm, USM.
10.	Confocal Raman Spectroscopy: Advanced Surface Characterization Technique for Materials Science	02 – 03 October 2017	Seminar Room 3, sains@usm, USM.
11.	Workshop on Advanced Materials Technology: Growth and Characterization 2017 (AMT-GC 2017)	16 November 2017	Auditorium B, sains@usm, USM.
12.	4th Meeting of Malaysia Nitrides Research Group (MNRG)	21 December 2017	Conference Room, School of Physics, USM
13.	Symposium Journey to Astana 2018: Sustainable Development Initiatives at the Universities	08 March 2018	Dewan Tuanku Syed Putra (DTSP), USM
14.	Strategies & Ethics in Research Paper Writing and Publishing	4 October 2018	Auditorium 2, Eureka, USM.
15.	Program Cahaya Kasih 2018	19 September 2018	Tadika Minden USM.

List of Visitors (Years: 2014 – 2018)

No.	Visitor	Organization	Date
1.	Dr. Martin Stressburg and team	OSRAM Germany & OSRAM Opto Semiconductors (Malaysia) Sdn. Bhd.	07 July 2015
2.	Team from Universiti Putra Malaysia (UPM)	Universiti Putra Malaysia (UPM)	14 August 2015
3.	Minister of Higher Education of Malaysia, Dato Seri Idris Jusoh & team	Ministry of Higher Education of Malaysia, Malaysia	06 November 2017
4.	Prof. Dr. Gulnar Sugurbekova and team	Nazarbayev University, Kazakhstan	05 -06 December 2017
5.	Team from Universitas Pembangunan Pancabudi (UNPAB)	Universitas Pembangunan Pancabudi (UNPAB), Indonesia	23 January 2018
6.	President and Management team from Universite de Lorraine	Universite de Lorraine, French	20 February 2018
7.	President and Management team from National University of Singapore	National University of Singapore	02 March 2018
8.	Delegation of UNESCO Study Tour	UNESCO	26 April 2018
9.	Delegation of Politeknik Tuanku Sultanah Bahiyah	Politeknik Tuanku Sultanah Bahiyah, Kulim, Kedah, Malaysia	04 September 2018
10.	Deputy Vice-Chancellor (Research and Innovation) from Public Universities of Malaysia	Public Universities of Malaysia	19 September 2018
11.	Team from Nano Verify Sdn. Bhd., Malaysia	Nano Verify Sdn. Bhd., Malaysia	30 October 2018
12.	Delegation from Sabah State Government headed by Deputy Chief Minister YB Datuk Seri Panglima Wilfred Madius Tangau	Sabah State Government	27 September 2018

Galleries

1st MNRG

2nd MNRG

ISOLED2015

Nobel Laureate Lecture Series: Prof. Dr. Shuji Nakamura

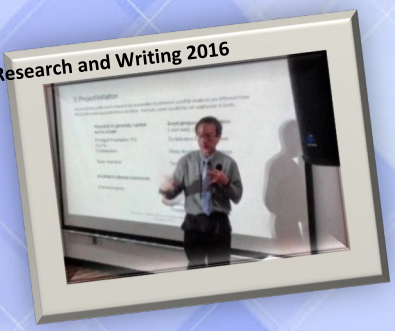
3rd MNRG

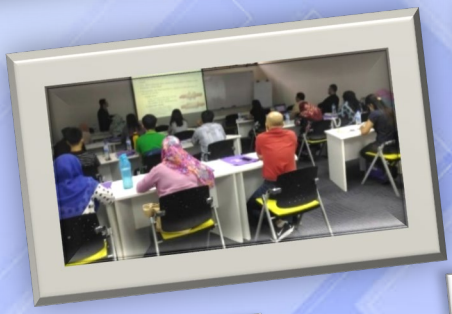
Academy of Sciences Malaysia Fellow's Lecture 2016

Activities

Raman Workshop 2016

Workshop on Scientific Research and Writing 2016





Confocal Raman Spectroscopy Workshop 2017

Symposium Journey to Astana 2018

AMT-GC 2017

4th MNRG

Strategies & Ethics in Research Paper Writing and Publishing

Program Cahaya Kasih 2018

Visitors


Dr. Martin Stressburg and team


Universiti Putra Malaysia (UPM)


Team from UNPAB


Prof. Dr. Gulnar Sugurbekova and team


President and Management team from Universite de Lorraine


Delegation of UNESCO Study Tour


President and Management team from National University of Singapore


Delegation of Politeknik Tuanku Sultanah Bahiyah


Deputy Vice-Chancellor (Research and Innovation) from Public Universities of Malaysia


Delegation from Sabah State Government headed by Deputy Chief Minister YB Datuk Seri Panglima Wilfred Madius Tangau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