Doctor of Philosophy Program in Materials Science and Innovation (International Program)

1. **Course Title:** Doctor of Philosophy Program in Materials Science and Innovation (International Program)
2. **Ph.D. Degree:** Doctor of Philosophy (Materials Science and Innovation)
3. **Academic Institution:** College of Graduate Studies/Walailak University
4. **Duration:** 3 Years for Program Type 1.1 (for Master holder) and 4 Years for Program Type 1.2 (for Bachelor holder)
5. **Background and Rational**

Industrial development is seen by the United Nations as the primary means of income generation and the means through which everyone can enjoy a better standard of living. Infrastructure provides facilities for industry and society, while innovation expands technological capacity and leads to the development of new skills. The industrialization envisioned by SDG 9 is "inclusive and sustainable" (SDG 9.2), different from the polluting industrial manufacturing and production we are familiar with.

The current industrial trend toward automation and new technology is known as the Fourth Industrial Revolution (Industry 4.0). Societies are experiencing fast and transformative change as a result of technological advances, from artificial intelligence to robotics, new energy sources and storage. Change is expected to happen quickly and disrupt the way manufacturing and services have traditionally been carried out, bringing with it difficulties as well as benefits. Technological innovation is at the root of current industrialization trends, and among other things, can provide a basis for climate-adapted infrastructure and climate-resilient development. Implementation of SDG 9 in the least-developed countries dependent on manufacturing for their economies such as Cambodia, Lao PDR and Myanmar, needs to be aware of Industry 4.0 in order to remain relevant in the coming years. In the case of Thailand, SDGs have already been implemented into the Thai government's 20 year plan.

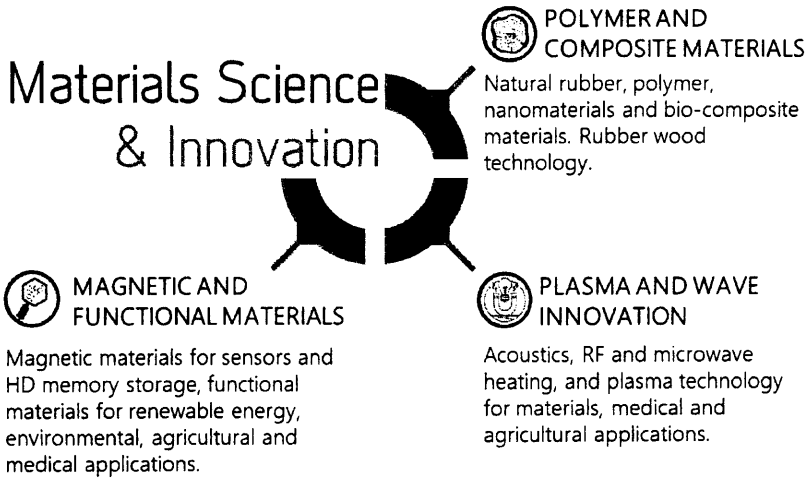
SDG 9 forms one part of a three-part nexus known as the infrastructure – inequality – resilience nexus. The other two most relevant SDGs are SDG 10 (Reduced inequalities) and SDG 11 (Sustainable cities and communities). This means that any changes that happen in one of the aspects will impact the other two. SDG 9 is also interlinked with many of the other SDGs. Inclusive and sustainable industrial development is connected to job creation (SDG 8), better health (SDG 3), food security (SDG 2), environmental protection (SDGs 14 and 15), and climate change action (SDG 13). Technology is the other key resource required to implement SDG 9. The ASEAN Plan of Action

on Science, Technology and Innovation (APASTI) 2016–2025 Implementation Plan addresses supporting research and development (SDG 9.B).

The facts and figures given by UN show that

- Small and medium-sized enterprises that engage in industrial processing and manufacturing are the most critical for the early stages of industrialization and are typically the largest job creators. They make up over 90 per cent of business worldwide and account for between 50-60 per cent of employment.
- Least developed countries have immense potential for industrialization in food and beverages (agro-industry), and textiles and garments, with good prospects for sustained employment generation and higher productivity.
- Middle-income countries can benefit from entering the basic and fabricated metals industries, which offer a range of products facing rapidly growing international demand.

In 2019, Walailak University in moving forward to a more sustainable and employable future for our postgraduate students has aligned with Thailand's 20 year Sustainable Development Goals in our postgraduate programs. To this end, we have combined three outstanding and long serving PhD programs; Chemistry, Physics and Materials Science and Engineering into one PhD program namely, Materials Science and Innovation (International program). The advantage of merging science and engineering together is to create a platform that facilitates researchers in conducting transdisciplinary research. Transdisciplinary research differs from traditional research in that students are exposed to and expected to master a range of disciplines throughout their study. The program also has a multicultural environment with students able to access knowledge and equipment from three of the best Centers of Excellence at Walailak University; Functional Materials and Nanotechnology (FuNTech), Plasma and Electromagnetic Wave Science (PE Wave Center) and Wood Science and Engineering.



Each center of excellence has its own outstanding expertise:

- **Functional Materials and Nanotechnology (FuNTech):** with members who are chemists and physicists with frontier research in magnetic materials for sensors, memory storage and nanoelectrodes with detailed computational calculations. Furthermore, functional porous materials give rise to many applications in the fields of medical, agricultural and alternative energy. Recently, FuNTech has become one of world's leading centres in Iron(III) Spin Crossover magnetic materials.
- **Plasma and Electromagnetic Wave Science (PE Wave Center):** RF and Microwave heating, atmospheric cold plasma sources and applications in agricultures and medicines, high-density plasmas and ion sources, plasma diagnostics, plasma modelling and simulations. Value added agriculture products is the key research for PE Wave Center by working closely to local Small and Medium Enterprises (SMEs). So far PE Wave has one spin off company and has won innovation awards through many custom designed drying systems for SMEs.
- **Wood Science and Engineering:** Research is focused on natural rubber, polymers, nanomaterials and bio-composite materials. Innovation in rubber wood technologies with companies such as Asia Pacific Parawood Co. Ltd., Mega Wood Company Ltd. provide opportunities for researchers and students to gain industry experience. On the other hand, the companies can reduce the cost of importing technology.

The program will provide students with learning opportunities for acquiring a broad foundation in materials science and innovation knowledge, and in-depth research experience at the frontiers of materials science and innovation skills fully compatible with SDG9, indicator 9.5.2 relating to the number of researchers (full-time equivalent) per million inhabitants. Furthermore, research in materials science and innovation from the program will answer the indicator 9.B.1, i.e. the proportion of medium and high-tech industry value added in total value added. The improvement in relevant skills both technical and transferable for employment and sustainable jobs in materials science and innovations will enhance scientific research, upgrade the technological capabilities of the industrial sectors in all countries, in particular developing countries (indicator 9.5.1).

To ensure an international standard and provide a multicultural environment all principle investigators in this program provide connectivity with world class research laboratories. Students can access research instruments and advice from our collaborators.

International Collaboration

International Co-advisor	University
1) Prof. Tony James	University of Bath, UK
2) Prof. Steven Bull	University of Bath, UK
3) Prof. Stephen M. Goldup	University of Southampton, UK
4) Prof. Shane Telfer	University of Massey, New Zealand
5) Prof. Sally Brooker	University of Otago, New Zealand
6) Mr. Steve Riley	Wood drying Group, SCION, New Zealand
7) Assoc. Prof. Dr. Jack Clegg	The University of Queensland, Australia
8) Dr. David Turner	Monash University, Australia
9) Prof. John McMurtrie	Queensland University of Technology, Australia
10) Asst. Prof. Susana Campuzano Ruiz	Universidad Complutense de Madrid, Spain
11) Prof. Dr. Frank Lam	University of British Columbia, Canada
12) Prof. Mohamed Siaj	Université du Québec à Montréal, Canada
13) Dr. Guillaume Chastanet	Institut de Chimie de la Matière Condensée de Bordeaux CNRS – University of Bordeaux, France
14) Prof. Dr.-Ing. Dr. Marius C. Barbu	Salzburg University of Applied Sciences, Campus Kuchl, Austria
15) Prof. Dr. Gianluca Tondi	Salzburg University of Applied Sciences, Campus Kuchl, Austria
16) Prof. Dr. Jörg B. Ressel	Institute of Wood Science, University of Hamburg, Germany
17) Dr. Zoltan Pasztory	University of Sopron, Hungary
18) Prof. Jaejun Yu	Seoul National University, South Korea
19) Prof. Eun Ha Choi	Kwangwoon University, South Korea
20) Assoc. Prof. Dr. Rajdeep Singh Rawat	Nanyang Technological University, Singapore

Facilities

- FE-SEM (EDX & EBSD).
- NMR 500 MHz with CryoProbe, Assure NMR and variable temperature unit for low and high temperature studies.
- SuperNova single crystal X-ray diffractometer. The system includes an Oxford Cryosystems Cryostream (Cobra plus) allowing data collection between 80 K to 500 K.
- Mechanical testing (Universal testing machine, furniture testing).
- Thermal analysis (DSC, TGA, DMTA).

- Chemical analysis (GC-MS, FT-IR).
- Surface properties (wetting angle, abrasive test).
- Durability test (weathering test).
- Emission test (formaldehyde emission test).
- Atmospheric cold plasma sources.
- Microwave heating.
- Low pressure plasma and ion sources.
- Synthetic laboratories at FuNTech composed of two modules, the Molecular Design and Multifunctional Materials Laboratory and the Functional Porous Materials Laboratory, with high standard lab benches and infrastructure. Both modules have faculties for Argon atmosphere reactions.

6. Objectives:

The objectives of the Doctor of Philosophy in Materials Science and Innovation (International Program) at Walailak University are:

- To provide graduate students with learning opportunities for acquiring a broad foundation in materials science and innovation knowledge, and an in-depth research experience at the frontiers of materials science or ability to develop new innovation using materials as a foundation.
- To improve graduate students relevant skills both technical and transferable for employment and sustainable jobs in materials science and innovations.
- To build up skills for life-long learning and professional development for graduate students.
- Strengthen global partnerships for sustainable development of research and tertiary education through alumni.

Reduce inequality in accessibility of the basic and state of art equipment for materials science research in developing countries.

7. Course Synopsis and Methodology

7.1 Study plan

Type 1.1 for candidates with an MSc

Total credits to the value of 60 credits for trimester system normally consisting of only a thesis. Candidates may complete a subject by passing at least 60 credits in a subject including:

- A thesis of 60 credits
- At least 9 credits (not counting the credits), 6 credits of one course of Innovation of Materials Technology and two Scientific Writing courses and 3 credits of Seminars.

Study plan for Type 1.1 Total credits 60 credits (for students with an MSc)

Year	1st Term			2nd Term			3rd Term		
1	MSI62-930	Thesis	6 credits	MSI62-930	Thesis	10 credits	MSI62-930	Thesis	8 credits
	MSI62-681	Seminar I*	1 credit	MSI62-682	Seminar II*	1 credit			
	MSI62-602	Innovation of Materials Technology *	2 credits	MSI62-600	Scientific Writing I*	2 credits			
	Total 6 credits			**Total 10 credits**			**Total 8 credits**		
2	MSI62-930	Thesis	8 credits	MSI62-930	Thesis	8 credits	MSI62-930	Thesis	8 credits
	MSI62-781	Seminar III*	1 credit				MSI62-601	Scientific Writing II*	2 credits
	Total 8 credits			**Total 8 credits**			**Total 8 credits**		
3	MSI62-930	Thesis	4 credits	MSI62-930	Thesis	4 credits	MSI62-930	Thesis	4 credits
	Total 4 credits			**Total 4 credits**			**Total 4 credits**		

* Not counting credits but the study result must be S.

Type 1.2 for candidates with a BSc

Total credits to the value of 90 credits for trimester system normally consisting of only a thesis. Candidates may complete a subject by passing at least 90 credits in a subject including:

- A thesis of 90 credits
- At least 9 credits (not counting the credits), 6 credits of one course of Innovation of Materials Technology and two Scientific Writing courses and 4 credits of Seminars.

Study plan for Type 1.2 Total credits 90 credits (for students with a BSc)

Year	1st Term			2nd Term			3rd Term		
1	MSI62-931 MSI62-681 MSI62-602	Thesis Seminar I* Innovation of Materials Technology *	6 credits 1 credit 2 credits	MSI62-931 MSI62-682 MSI62-600	Thesis Seminar II* Scientific Writing I*	8 credits 1 credit 2 credits	MSI62-931	Thesis	10 credits
	Total 6 credits			**Total 8 credits**			**Total 10 credits**		
2	MSI62-931 MSI62-781	Thesis Seminar III*	10 credits 1 credit	MSI62-931 MSI62-782	Thesis Seminar IV*	10 credits 1 credit	MSI62-931 MSI62-601	Thesis Scientific Writing II*	10 credits 2 credits
	Total 10 credits			**Total 10 credits**			**Total 10 credits**		
3	MSI62-931	Thesis	8 credits	MSI62-931	Thesis	8 credits	MSI62-931	Thesis	8 credits
	Total 8 credits			**Total 8 credits**			**Total 8 credits**		
4	MSI62-931	Thesis	4 credits	MSI62-931	Thesis	4 credits	MSI62-931	Thesis	4 credits
	Total 4 credits			**Total 4 credits**			**Total 4 credits**		

* Not counting credits but the study result must be S.

7.2 Course content/Study Topic

MSI62-600 Scientific Writing I **2(1-3-3)**

Introduction to writing research proposals; finding and selecting suitable references, key points and note-making, developing an outline, paraphrasing and summarizing, writing a justification, describing methodology, re-writing and proof-reading.

MSI62-601 Scientific Writing II **2(1-3-3)**

Introduction to writing scientific papers/reports; outline writing, title, abstract, introduction, methodology, results and discussion and conclusion sections, discussion and argument, cause and effect, cohesion, comparison elements of writing.

MSI62-602 Innovation of Materials Technology **2(1-2-3)**

Introduces the fundamental process of innovating and its role in promoting growth and prosperity. Students will learn how to manipulate existing materials and how to develop new and improved ones, with access to equipment and tools for advanced materials characterization. Students will have the opportunity to meet with relevant academic contacts in materials innovation and entrepreneurship as well as non-academic partners (industries, RTOs, entrepreneurs) who will

support them through research methods in the context of materials technology development, market applications, industry structure, and intellectual property.

MSI62-681 Seminar I **1(0-4-2)**

Participation and presentation of seminar related to creating innovation and entrepreneurship.

MSI62-682 Seminar II **1(0-4-2)**

Participation and presentation of seminar related to materials science and innovation research.

MSI62-781 Seminar III **1(0-4-2)**

The same description as MSI62-682 Seminar II but the topics of the seminar must be different from those presented in other seminar courses.

MSI62-782 Seminar IV **1(0-4-2)**

The same description as MSI62-682 Seminar II but the topics of the seminar must be different from those presented in other seminar courses.

MSI62-930 Thesis **60 credits**

This course provides students the opportunity to conduct research in the field of materials science and innovation under the direct supervision of the thesis advisory committees. Innovation is defined in its broadest sense to include innovative solutions to scientific problems, development of innovative technologies and products to develop creative thinking and entrepreneurship. The thesis should be a significant contribution to knowledge in the discipline concerned and demonstrate the student's capacity to carry out independent research. Students have to present research reports in English at an international standard under the curriculum type 1.1 format.

MSI62-931 Thesis **90 credits**

This course provides students the opportunity to conduct research in the field of materials science and innovation under the direct supervision of the thesis advisory committees.

Innovation is defined in its broadest sense to include innovative solutions to scientific problems, development of innovative technologies and products to develop creative thinking and entrepreneurship. The thesis should be a significant contribution to knowledge in the discipline concerned and demonstrate the student's capacity to carry out independent research. Students have to present research reports in English at an international standard under the curriculum type 1.2 format.

8. Applicants Qualifications

Admission to the Doctor of Philosophy in Materials Science and Innovation (International Program)

- Type 1.1 is open to applicants who have completed a Master degree in Science, Engineer, Chemistry, Physics, Material Science or close equivalent one with knowledge and skills sufficient to conduct thesis research. The cumulative GPA of at least 3.50 for taught course program or with 1 ISI publication for research only program.
- Type 1.2 is open to applicants who have completed a Bachelor degree in Science, Engineer, Chemistry, Physics, Material Science or close equivalent one with knowledge and skills sufficient to conduct thesis research. The cumulative GPA of at least 3.25 or equivalent or in top 10% in the class.

English requirement: Capable of English communication, i.e. reading, speaking and writing; a minimum score should be as follows: TOEFL (Paper Based) 500 or TOEFL (Computer Based) 173 or TOEFL (Internet Based) 61 or IELTS (Academic Module) 6.0.

9. Document Required

- Application Form
- Personal Statement
- Research Proposal: Please specify clearly and as accurately as possible. Please describe in a coherent and comprehensive manner your research idea which will be the basis of your doctoral research. Your research idea should not exceed 1500 words including aims and objectives, a clear literature review of the theoretical background of your idea, proposed methodology and expected outcomes.
- Resume or CV
- A certified copy of Bachelor's Degree Transcript
- A certified copy of Master's Degree Transcript
- A certified copy of Bachelor's Degree Graduation Certificate
- A certified copy of Master's Degree Graduation Certificate
- A copy of the first page of your research publications (if applicable)
- A copy of TOEFL/IELTS Score Report

- A copy of Passport's Master Page or National ID
- A copy of the approval from your affiliation for a full time study (For Walailak University Ph.D. Excellence Scholarship)
- Other supportive documents such as awards, distinctions, etc. please specify below:

10. Contacts:

Faculty	Research expertise	Contact information
Assoc. Prof. Dr. D. J. Harding	➢ Spin crossover ➢ Crystal engineering ➢ Single molecule magnetism ➢ Molecular electronics	hdavid@mail.wu.ac.th
Assoc. Prof. Dr. N. Matan	➢ Detection and control of internal stress within wood ➢ Collapse in oil palm lumber during drying ➢ Color change in rubber wood during processing ➢ Efficiency improvement in lumber processing Sustainable utilization of wood	mnirondo@yahoo.com
Assoc. Prof. Dr. C. Sirisathitkul	➢ Novel permanent magnets ➢ Magnetic composites and nanoparticles ➢ Magnetoimpedance (MI) and magnetoresistance (MR) ➢ Ancient pottery	schitnar@mail.wu.ac.th
Assoc. Prof. Dr. P. Chaowana	➢ Wood composites ➢ Adhesive technology	mpannipa@wu.ac.th
Assoc. Prof. Dr. P. Harding	➢ Spin crossover nanomaterials ➢ Crystal engineering ➢ Redox coupled-spin crossover complexes	kphimpha@mail.wu.ac.th
Assoc. Prof. Dr. S. Danworaphong	➢ Acoustics and optics for non-destructive testing	dsorasak@gmail.com
Asst. Prof. Dr. M. Nisoa	➢ RF and Microwave heating ➢ Atmospheric cold plasma sources and applications in agriculture and medicine ➢ High-density plasmas and ion sources, Plasma diagnostics, Plasma modelling and simulations	mnisoa@yahoo.com
Asst. Prof. Dr. P. Rattanakit	➢ Green Chemistry ➢ Flow-based system ➢ Nanomaterial ➢ Environmental Analysis	parawee.ra@mail.wu.ac.th
Asst. Prof. Dr. U. Boonyang	➢ Absorbent materials for water treatment ➢ Bioactive glass with hierarchical pore structures	upsorn.bo@mail.wu.ac.th

Faculty	Research expertise	Contact information
Asst. Prof. Dr. S. Srivaro	➢ Wood Science and Engineering	ssuthon@wu.ac.th
Asst. Prof. Dr. S. NaPhattalung	➢ TiO_2 photocatalysts ➢ Defects in gemstones ➢ Nanoparticles for cancer treatment ➢ Spin crossover materials calculations	sutassana@gmail.com
Asst. Prof. Dr. U. Thubsuang	➢ Porous materials and their applications ➢ Energy storage materials	uthen.th@wu.ac.th
Asst. Prof. Dr. S. Khongtong	➢ Wood-Polymer composites ➢ Rubber Property improvement	ksureurg@wu.ac.th
Asst. Prof. Dr. W. Preechatiwong	➢ Polymer Electrolyte Polymer Characterization Adhesive	pwanchar@wu.ac.th
Asst. Prof. Dr. P. Saramolee	➢ Rubber Technology	sprachid@wu.ac.th
Dr. S. Poorahong	➢ Electrochemistry based on Nanomaterials	sujittra.po@mail.wu.ac.th
Dr. C. Tantapakul	➢ Natural Products Chemistry ➢ Biological Activity (Antioxidant, Antibacterial, Alpha-Glucosidase Inhibition)	cholpisut.ta@mail.wu.ac.th

11. Key Contact

Assoc. Prof. Dr. Phimphaka Harding (Program coordinator)
Functional Materials and Nanotechnology Center of Excellence (FuNTech)
Walailak University, Thasala, Nakhon Si Thammarat, Thailand 80160
Tel: +66-75-672100, +66-815958338
E-mail: kphimpha@mail.wu.ac.th

กำหนดการสมัครเข้าศึกษาระดับบัณฑิตศึกษา
และกำหนดการรับสมัครทุน Ph.D. Excellence (PE) Scholarship

ภาคการศึกษาที่ 1/2562 (1 กรกฎาคม 2562 – 30 กันยายน 2562)

กำหนดการ	สมัครเข้าศึกษา	สมัครขอรับทุน PE Scholarship	
		นักศึกษาต่างชาติ	นักศึกษาไทย
ส่งใบสมัครออนไลน์ - เปิดรับสมัคร - ปิดรับสมัคร	ตั้งแต่วันนี้ 31 พ.ค. 2562	ตั้งแต่วันนี้ 30 เม.ย. 2562	ตั้งแต่วันนี้ 31 พ.ค. 2562
การพิจารณา	มี.ค. – มิ.ย. 2562	มี.ค. – พ.ค. 2562	มี.ค. – มิ.ย. 2562
ประกาศผล	ตามที่หลักสูตรกำหนด (มี.ค. – มิ.ย. 2562)		
ขึ้นทะเบียนนักศึกษาใหม่	มี.ค. – มิ.ย. 2562		
เริ่มภาคการศึกษา	1 ก.ค. 2562		

ภาคการศึกษาที่ 2/2562 (21 ตุลาคม 2562 – 20 มกราคม 2563)

กำหนดการ	สมัครเข้าศึกษา	สมัครขอรับทุน PE Scholarship	
		นักศึกษาต่างชาติ	นักศึกษาไทย
ส่งใบสมัครออนไลน์ - เปิดรับสมัคร - ปิดรับสมัคร	ตั้งแต่วันนี้ 23 ก.ย. 2562	ตั้งแต่วันนี้ 20 ส.ค. 2562	ตั้งแต่วันนี้ 23 ก.ย. 2562
การพิจารณา	ส.ค. – ต.ค. 2562	ส.ค. – ก.ย. 2562	ส.ค. – ต.ค. 2562
ประกาศผล	ตามที่หลักสูตรกำหนด (ส.ค. – ต.ค. 2562)		
ขึ้นทะเบียนนักศึกษาใหม่	ส.ค. – ต.ค. 2562		
เริ่มภาคการศึกษา	21 ต.ค. 2562		

ภาคการศึกษาที่ 3/2562 (10 กุมภาพันธ์ 2563 – 18 พฤษภาคม 2563)

กำหนดการ	สมัครเข้าศึกษา	สมัครขอรับทุน PE Scholarship	
		นักศึกษาต่างชาติ	นักศึกษาไทย
ส่งใบสมัครออนไลน์ - เปิดรับสมัคร - ปิดรับสมัคร	ตั้งแต่วันนี้ 13 ม.ค. 2563	ตั้งแต่วันนี้ 11 ธ.ค. 2562	ตั้งแต่วันนี้ 13 ม.ค. 2563
การพิจารณา	พ.ย. 2562 – ม.ค. 2563	ธ.ค. 2562 – ม.ค. 2563	พ.ย. 2562 – ม.ค. 2563
ประกาศผล	ตามที่หลักสูตรกำหนด (ธ.ค. 2562 – ม.ค. 2563)		
ขึ้นทะเบียนนักศึกษาใหม่	ธ.ค. 2562 – ม.ค. 2563		
เริ่มภาคการศึกษา	10 กุมภาพันธ์ 2563		

บัณฑิตวิทยาลัย มหาวิทยาลัยวลัยลักษณ
โทร. 075 673000 ต่อ 4281, 4282

แบบตอบรับ
ทุนการศึกษาระดับปริญญาเอกสำหรับบุคลากร
ปีการศึกษา 2562

หน่วยงาน.....**ที่อยู่**.....**โทร**.....

มีบุคลากรประสงค์เข้าศึกษาต่อ ณ มหาวิทยาลัยวลัยลักษณ์ จำนวน ..... **คน** รายละเอียด ดังนี้

ลำดับ	ชื่อ-สกุล	หลักสูตรที่ประสงค์ศึกษาต่อ	ภาคการศึกษา			ระดับปริญญาปัจจุบัน/ผลการศึกษา	คะแนนภาษาต่างประเทศ		เบอร์โทรศัพท์/E-Mail สำหรับติดต่อ
			1/2562	2/2562	3/2562		มี (โปรดระบุ)	ไม่มี	
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ลงชื่อ ..... หัวหน้าหน่วยงาน
(.....)
ตำแหน่ง .....
วันที่ .....

หมายเหตุ ส่งแบบตอบรับมาได้ทาง E-Mail: grad.walailak@gmail.com โดยใช้หัวข้อเรื่อง "แบบตอบรับทุนการศึกษาระดับปริญญาเอกสำหรับบุคลากร" หรือ ส่งไปรษณีย์มาที่
ที่อยู่ บัณฑิตวิทยาลัย อาคารปฏิบัติการสถาปัตยกรรมศาสตร์และการออกแบบ
มหาวิทยาลัยวลัยลักษณ์ 222 ต.ไทยบุรี อ.ท่าศาลา จ.นครศรีธรรมราช 80160
(แบบตอบรับ-ทุนการศึกษาระดับปริญญาเอกสำหรับบุคลากร)