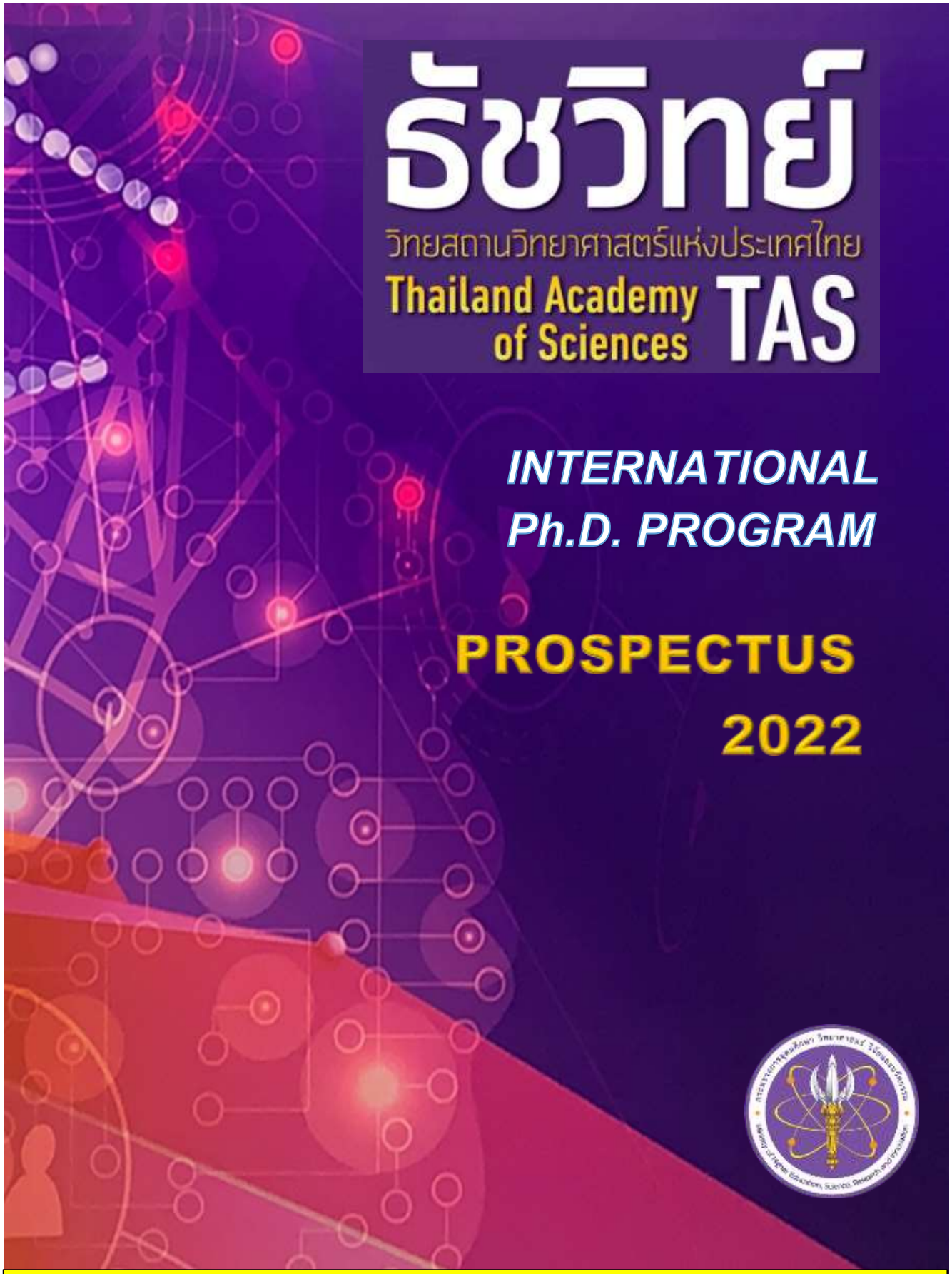

Ministry of Higher Education, Science, Research and Innovation

CONTENT

Section 1 About TAS and TAS Ph.D. General Information

1) About Thailand Academy of Science

Tremendous growth of research and development in science and technology is a key factor for a development of the country including economic, sociological, and economical aspects. Regarding to the rapid change of global competition, the enhancement of scientific and technological research is urgently required. Thailand Academy of Sciences (TAS) is established to be a central networking organization for bridging researchers and scientists from various national research institutes and universities to work together as a unit. In addition, an integrated utilization of existing national infrastructures will improve the basic knowledge of sciences and technology, and the fundamental development of human resources of the country. Consequently, it can leverage and enhance the global competitive ability of the whole country. TAS will be proceeded in 3 main perspectives as follow:

1) Knowledge network of sciences and technology for a development of the country
2) Frontier research for an improvement of global competitiveness
3) Creation and development of high-performance human resources for a development of the country

Herein, the recruitment of Ph.D. students under the TAS program is one of the main activities to fulfil the 3rd perspective. TAS Ph.D. program will provide the targeted creation of high-performance human resources by employing the integration of infrastructures at national research facilities with high-quality personnel from universities. TAS will be a key mechanism allowing national institutes to issue the educational degrees and develop the key human resources for such urgently important disciplines of the country. The graduates from TAS program should have high qualifications and are expected to achieve their successful career path in governmental institutions, business sectors, and self-employment. TAS is a central unit of the academic and research networking consisting of universities, national research institutes, excellent centers, policy agencies, research funding agencies, and their international collaborations. TAS will proceed under the concept of "**work with creativity, enthusiasm, and passion**" to provide a value creation to move Thailand to be one of the developed countries within 2027.

2) TAS Ph.D. General Information

Name of Institution Thailand Academy of Sciences (TAS),
Ministry of Higher Education Science Research and Innovation

Curriculum Name: Doctor of Philosophy Program (International Program)

Academic Year: 2022

Name of Degree and Major

Full Name: Doctor of Philosophy

Abbreviation: Ph.D.

Major Subject: None

Required Credits:

Plan 1: Research Only

Plan 1(1.1) For students with Master's Degree Not less than 48 credits

Plan 2: Coursework and Research

Plan 2(2.1) For students with Master's Degree Not less than 48 credits

Plan 2(2.2) For students with Bachelor's Degree Not less than 72 credits

Curriculum Characteristics

Curriculum type: Doctor of Philosophy

Language: English

Recruitment: Thai and International Students

Collaboration with Other Universities: TBD

Graduate Degrees Offered to the Graduates: One Degree

Career opportunities of the graduates

- Research scientists at research institutions and relevant research centers in local or abroad
- Research and development researcher in the Industrial sectors, private companies or government sectors

Faculty in Charge of the Program

1) National Astronomical Research Institute of Thailand (Public Organization)
   - Dr. Peerapong Torteeka — Ph.D. (Celestrial Mechanic and Applied Astrometry Engineering)
   - Dr. Supachai Awiphan — Ph.D. (Astronomy and Astrophysics)
   - Dr. Suparerk Aukkaravittayapun — Ph.D. (Physics)

2) Synchrotron Light Research Institute (Public Organization)
   - Dr. Somjai Chunjarean — Ph.D. (Physics)
   - Dr. Supagorn Rugmai — Ph.D. (Physics)
   - Dr. Yingyot Poo-arporn — Ph.D. (Chemistry)

3) Thailand Institute of Nuclear Technology (Public Organization)

- Assoc. Prof. Dr. Somsak Dangtip Ph.D. (Applied Neutron Physics)
- Dr. Kanokporn Boonsirichai Ph.D. (Genetics)
- Dr. Phiriyathorn Suwanmala Ph.D. (Macromolecular Science)

4) National Science and Technology Development Agency

- Dr. Adisorn Tuantranont Ph.D. (Electrical Engineering)
- Dr. Uracha Ruktanonchai Ph.D. (Advanced Drug Delivery)
- Dr. Wonnop Visessanguan Ph.D. (Food Science and Technology)

Venue for Research: Ministry of Higher Education Science Research and Innovation

- National Astronomical Research Institute of Thailand (NARIT)
- Synchrotron Light Research Institute, (SLRI)
- Thailand Institute of Nuclear Technology (Public Organization) (TINT)
- National Science and Technology Development Agency (NSTDA)

External Factors in Program Planning

Economic situation/Development

According to Thailand vision's 2037, promoting multidimensional human capital development for righteous, skillful and quality citizens, broadening opportunities and promoting equality in society are paramount importance for the prosperity of the country. Two of the six strategies under the national strategy of Thailand: National Strategy on Competitiveness Enhancement and National Strategy on Developing and Strengthening Human Capital, strongly demand the future Thailand to have a continuous development of human and intellectual capital. Strategy on competitiveness enhancement includes production of modern technological structures and smart entrepreneur. Smart entrepreneur broadly extends to academicians and researchers possessing innovative idea and entrepreneurial skills.

In addition, technologies and innovations are dynamically developing and hence, affecting employment, occupation, and highly skilled workforce of the country, especially in this era of globalization and newer technologies. Booming of disruptive technologies demands highly talented manpower with life-long learning and 21st century skills. In the helm of post-pandemic Covid-19 era, the economic development and the recovery depends on how the citizen innovate, develop, adopt, and utilize the technology.

All these challenging situations pose the need to prepare human resources who have a sound foundation in academic knowledge and innovative research skills together with a life-long learning mind-set, entrepreneurial mindset while equipping them with 21st century and future job relevant skills. The Doctoral program under TAS would fulfill all these requirements in the fields of nuclear technology, synchrotron light research and

astronomical research, bioscience and biotechnology, nanoscience and nanotechnology, information science and digital technology, and materials science.

Nuclear technology covers a wide range of area and beneficial uses in agriculture, food, medical space exploration and water desalination, in addition to the creating electricity. Because of the complex nature of the system and high safety requirements, nuclear technology requires specific skills and competence. It is important to train and to open opportunities in this sector for the potential talented students. To develop nuclear technology with full capacity, there is an urgent need to prepare human resources in Thailand. One important way for sustainable production of highly skilled personnels in this sector is to nurture Thailand's own expertise, in addition to sending trainees to nuclear-technology-matured countries. The product of the training can efficiently operate, maintain and develop both power and non-power applications in nuclear technology, and develop human resources in emergency preparedness, safety analysis, radioactive management, and regulatory body; all adding significant contributions to the learned society of future Thailand.

Similarly, synchrotron light research has a variety of benefits in medical science, advanced materials industry, agriculture, environment, archeology, and several other areas. To support Thailand’s development in several aspects synergistically, the country also needs to produce man-power in the area of light research. The proposed plan of a new light research center in Eastern Economic Corridor of Innovation (EECi) will also give the way for advancement of technology, research and human capital development while creating the job opportunities in the labor market in this research area. The degree program of TAS will fulfill this specific need as well.

Most of the developing countries in Asia, including Thailand, are aware of the importance of science and technology including astronomy and astronomical research. For the past several decades, south-east Asian nations have had a significantly slower rate than other Asian developing countries in growth and productivity in promoting astronomy. Data in 2 0 0 5 indicated Thailand had a comparably lower ratio of astronomers per population (0.04 astronomers per population) in comparison with other ASEAN countries such as Singapore (0.70), Malaysia (0.28) and Indonesia (0 .0 8). Investment in infrastructure, a great surge in an effort to foster the development of science and technology to target Thailand 4.0, international collaboration and opening of research centers in astronomy promote astronomy and related job opportunities.

The doctor of philosophy program in TAS will serve the production of highly specialized and talented man-power in nuclear technology, synchrotron light research, astronomical and space research. Furthermore, TAS program also helps fulfil the needs of high quality researchers and research engineers who specialise in the advanced science and technology that will shape the future of industries in four domains, i.e. bioscience and biotechnology, nanoscience and nanotechnology, information science and digital

technology, and materials science which partly help to build the nation's development of human capital, creating jobs, careers and developing skilled laborers.

Social and Cultural Situation/Development

The National Strategy on Developing and Strengthening Human Capital aims to develop Thai people of all ages in a multidimensional manner to become good, skillful, and quality citizens. Citizens are expected to acquire lifelong learning habits and equipped with logical thinking, 21st century skills, communication skills in English and other additional language. The National Strategy envisages that the developments following this Strategy will help promote modern innovators, thinkers, entrepreneurs, farmers, and so forth based on personal skills and abilities.

Thailand is one of the communities of ASEAN where it enjoys several cultural and economic ties with all ASEAN nations. With a population of 0.6 billions, ASEAN is a community with diversity in ethnicity, language, culture and differing economic development and prosperities. The ASEAN Economic Community has brought the increasing volumes of transboundary exchange, trade, contact and mobility. There is a mass migration and transboundary movement of both skilled and unskilled workers across ASEAN as it is favoured by familiarity of culture and geographical closeness. The migration of workforce is tremendously accelerated by Covid-19 pandemic and technological advancement.

The situation will demand the next generation graduates to efficiently work not only in their birthplace, but also in larger ASEAN communities. The workforce will experience unprecedented competitions among each other, crossing the national boundaries. This require a graduate with several capacities; among which essential 21st century skills such as flexibilities, adaptability, proficiency of third language and spirit of global citizenship.

These challenging socio-cultural conditions call for visionary and knowledgeable new graduates who can work for a better Thailand and for a broader ASEAN or global; that is locally, regionally and globally. With the program under TAS, academic outstanding in each specific fields, combining specific science disciplines with compulsory training for 21st century essential skills and global citizen skills will help the implementation of national strategy.

Curriculum Development

The economic and cultural perspective mentioned above indicate that nurturing a 21st century graduate is essential for the development of a nation. There needs to develop human resources of various disciplines and various levels of competency to fit in the workforce, with a knowledge and understanding of highly specialised knowledge and technical expertise and in the same time to be a lifelong learner with global citizen mindset

and readiness for 21st century workforce. The development of the curriculum focuses on the production of human resources with integrated knowledge of specialised hard skills, knowledge of ASEAN, global citizen mindset and proficiency in language and communication skills.

Relevance to the Missions of the Thailand Academy of Sciences

This program is one mechanism for realising TAS' mission. It is developed to match the changes taking place in the post-pandemic world affecting the ASEAN region as well. The program aims to build academic excellence in the field of astronomical and space research, nuclear technology, synchrotron light research, bioscience and biotechnology, nanoscience and nanotechnology, information science and digital technology, and materials science by producing students with knowledge in these specific fields, with excellent research skills, ethics, responsibility, lifelong learning, 21st century skills, global citizen mindset and additional language proficiency. It will promote academic development and high-quality researches in the relevant fields. The program strongly commits to excellence in outcome-based education for globally-competent graduates with international standards and to the needs of both local and international societies.

Section 2 Information of the Curriculum

Philosophy/Justification of the Curriculum

The Doctor of Philosophy program as a tool to develop human resourses equipped with knowledge and technological competency in astronomical, space, nuclear technology, synchrotron light research, bioscience and biotechnology, nanoscience and nanotechnology, information science and digital technology, and materials science integrated with global citizen mindset and 21st century skills. They also will have integrated skills in entrepreneurial, language proficiency and skills to conduct research, analyse data and evaluate systematically, leadership in advanced academic and technological advances with ethical standard.

Objectives of the Program

By the end of the study, the graduates will have qualifications according to Thailand Qualifications Framework for Higher Education as shown below:

- Have good attitudes in professional settings and enhanced sense of morality and ethics
- Demonstrate in-depth, integrative knowledge and skills in using appropriate research methodology and tools in the field of study in both broad and specific contexts as well as internal and external factors related to innovation.
- Create scientific research and/or innovation which serves the need of the Nation

based on in-depth, integrative knowledge, scientific analytical skills and critical thinking.

- Build up capacity to be an ASEAN and global citizen, be able to adapt to the future work efficiently and capable of being in a teamwork both as a leader and a follower in order to drive innovation forward with a high sense of social responsibility.
- Use information technology, numerical and statistical methods in analysing scientific data and comprehensively communicate relevant knowledge and academic findings in oral or in written form to diverse audiences

Program Learning Outcomes (PLOs)

Graduates should be able to:

(1) Perform work following scientific regulations, ethics and related law, and safety practices as appropriate

(2) Fully understand key principles, theories, research methodology and its application to conduct research in the field of study

(3) Illustrate in-depth knowledge and innovative concepts in the field of study

(4) Assess and analyze quantitative and qualitative data to investigate problems and propose solutions or recommendations

(5) Apply knowledge and techniques to conduct research independently with academic and profession merit and appropriate research ethics to solve problems or create innovation for industries (Intellectual Development)

(6) Show proficient scientific attitude, learning culture, and creativity in producing innovation and knowhow

(7) Conduct technical, financial, and legal feasibility studies of the developed innovation

(8) Demonstrate entrepreneurial mindset, with awareness in regards to intellectual property, legislation, the environment

(9) Demonstrate leadership skills for research, including information technology and communication skills, creative thinking, problem-solving, and work-related decision-making

(10) Be able to use information technology, numerical and statistical methods in analysing data appropriately

(11) Demonstrate effective communication skill both officially and unofficially to diverse audiences

Section 3 Educational Management System, Curriculum Implementation and Structure

Educational Management System

System: The educational system is of the Semester Credit type. One Academic Year consists of 2 Regular Semesters, each with not less than 15 weeks of study.

Summer Session: There is a 6-week Summer Semester in year 1 or as considered by the Curriculum Administration Committee.

Curriculum Implementation

Schedule: Full-Time during Weekdays

First Semester : August - December
Second Semester : January - April
Summer Semester : May -July

Qualifications of Prospective Students

Plan 1(1.1): Research Only (for Students with Master's Degree)

1. Graduated with a Master's degree in Science, Engineering or related fields from an accredited national or international academic institution recognized and attested by the Office of the Ministry of Higher Education, Science, Research and Innovation
2. Grade point average not less than 3.50
3. Have an English Proficiency Examination score meeting the requirements according to the announcement of TAS
4. Work or have experience as an instructor or researcher in the relevant fields of the proposed dissertation project for at least three years
5. Have at least 1 publication in peer-reviewed international journals within the last 5 years, as the first or corresponding author, or have prior patent
6. Exemptions from the above conditions 2. to 5. may be granted by the Program Committee and TAS.

Plan 2(2.1): Coursework and Research (for Students with Master's Degree)

1. Graduated with a Master's degree in Science, Engineering or related fields from an accredited national or international academic institution recognized and attested by the Office of the Ministry of Higher Education, Science, Research and Innovation
2. Grade point average not less than 3.50
3. Have an English Proficiency Examination score meeting the requirements according to the announcement of TAS
4. Exemptions from the above conditions 2. and 3. may be granted by the

Program Committee and TAS.

Plan 2(2.2) Coursework and Research (for students with Bachelor's Degree)

1. Graduated with Bachelor's degree in Science, Engineering or related fields from an accredited national or international academic institution recognized and attested by the Office of the Ministry of Higher Education, Science, Research and Innovation
2. Grade point average not less than 3.50
3. Have an English Proficiency Examination score meeting the requirements according to the announcement of TAS
4. Exemptions from the above conditions 2. and 3. may be granted by the Program Committee and TAS

Five-Year Plan for Enrollment and Graduation of Students

Plan 1(1.1) Research Only (for students with Master's Degree)

Year	2022	2023	2024	2025	2026
1st	2	2	2	2	2
2nd		2	2	2	2
3rd			2	2	2
4th				2	2
Cumulative numbers	2	4	6	8	8
Expected number of students graduated	-	-	-	2	2

Plan 2(2.1) Coursework and Research (for students with Master's Degree)

Year	2022	2023	2024	2025	2026
1st	30	30	30	30	30
2nd		30	30	30	30
3rd			30	30	30
4th				30	30
Cumulative numbers	30	60	90	120	120
Expected number of students graduated	-	-	-	30	30

Plan 2(2.2) Coursework and Research (for students with Bachelor's Degree)

Year	2022	2023	2024	2025	2026
1st	3	3	3	3	3
2nd		3	3	3	3
3rd			3	3	3
4th				3	3
5th					3
Cumulative numbers	3	6	9	12	15
Expected number of students graduated	-	-	-	-	3

Educational System: mixed, classroom and long distance mode.

Transfer of Credits, Courses and Cross-University Registration

Transferring of credits from other programs/universities should be in accordance with the rules and regulations of Higher Education Commission and TAS.

The number of credits required for the program

Plan 1(1.1) for graduates with a Master's Degree or equivalent enrolled to a doctoral degree, not fewer than 48 total credits are required.

Plan 2(2.1) for graduates with a Master's Degree enrolled to a doctoral degree, at least 48 credits are required.

Plan 2(2.2) for graduates with a Bachelor's Degree enrolled to a doctoral degree, at least 72 credits are required

Curriculum Structure

The curriculum structure is set in compliance with the Announcement of Ministry of Education on the subject of Criteria and Standards of Graduate Studies 2015, Doctoral Degree, Plan 1(1.1), 2(2.1) and Plan 2(2.2) as below:

	Plan 1(1.1) (Master's Degree)	Plan 2(2.1) (Master's Degree)	Plan 2(2.2) (Bachelor's Degree)
(1) Required Courses	- Credits	12 Credits	24 Credits
(2) Elective Courses Not Fewer Than	- Credits	- Credits	- Credits
(3) Dissertation	48 Credits	36 Credits	48 Credits
Total Number of Credits Not Fewer Than	**48 Credits***	**48 Credits**	**72 Credits**

*Extra credits for Plan 1(1.1) may be required based on determination by the program committee.

Courses in the curriculum

Plan 1(1.1): Research Only (for Students with Master Degree)

(1) Dissertation (48 Credits)

		Credits (Lecture-Practice-Self-Study)
TASPHD 991	Dissertation	48 (0-192-0)

Plan 2(2.1): Coursework and Research (for Students with Master Degree)

(1) Required Courses (12 Credits)

		Credits (Lecture-Practice-Self-Study)
TASPHD 590	Internship	3(0-35-0)

The other 9 credits of the required courses of each student must be chosen from all 4 clusters below. Each student is required to take any course from all four clusters at least one course from each cluster.

Cluster 1: Science and Technology Cluster

		Credits (Lecture-Practice-Self-Study)
TASPHD 601	Optical Instrumentation Design	1(1-0-2)
TASPHD 602	Techniques of Astronomical Observations	1(1-0-2)
TASPHD 603	Data Intensive Analytics and High-Performance Data Processing System	2(2-0-4)
TASPHD 604	Fundamental of Astrodynamics	1(1-0-2)
TASPHD 605	Advanced Engineering Mathematics	2(2-0-4)
TASPHD 606	Probability, Random Variables and Stochastic Process for Engineering	2(2-0-4)
TASPHD 607	Understanding of Space Environment	1(1-0-2)
TASPHD 608	Space System Engineering	2(2-0-4)
TASPHD 609	Frontier Biotechnology in the 21st Century	1(1-0-2)
TASPHD 610	Nanofabrication and Nanorobotics	1(1-0-2)
TASPHD 611	Nanobiotechnology and nanomedicine	1(1-0-2)
TASPHD 612	Advanced Nanomaterials for Energy & Environment	2(2-0-4)
TASPHD 613	Natural Language Processing and Knowledge Graph	2(2-0-4)
TASPHD 614	Advanced Topics in Applied Speech and Audio Processing	1(1-0-2)
TASPHD 615	Image and Video Understanding	1(1-0-2)
TASPHD 616	Applied Information Security for Critical Infrastructure	2(2-0-4)
TASPHD 617	Spectroscopic Sensing Technologies	1(1-0-2)
TASPHD 618	Advanced Sensing and Quantum Materials	2(2-0-4)
TASPHD 619	Advanced Materials for Future Industries	2(2-0-4)
TASPHD 620	Technologies in Modern Accelerator Systems	1(1-0-2)
TASPHD 621	Principles of Advanced Measurement Techniques Using Synchrotron Radiation	2(2-0-4)
TASPHD 622	Data Acquisition and Data Manipulation in Accelerators and Synchrotron Beamlines	2(2-0-4)
TASPHD 623	Advanced Nuclear Facilities and Infrastructures	1(1-0-2)
TASPHD 624	Source of Radiation in Advanced Nuclear Facilities and	1(1-0-2)

	Radiation Safety	
TASPHD 625	Radiation Processing and Its Useful and Diverse Applications in Material Science	2(2-0-4)
TASPHD 626	Seminar in Sciences and technology	1(1-0-2)
TASPHD 627	Research Methodology	1(1-0-2)

In addition to the courses mentioned above, a student may register other courses in international program offered by other universities according to the student's interest with the approval of the program committee and TAS.

Cluster 2: IT Cluster

		Credits (Lecture-Practice-Self-Study)
TASPHD 501	Business Intelligence and Data Visualization	2(2-0-4)
TASPHD 502	Artificial Intelligence (AI)	2(2-0-4)
TASPHD 503	Internet of Things	2(2-0-4)
TASPHD 504	Mobile Technology and Application	2(2-0-4)
TASPHD 505	Business Analytics and Big Data	2(2-0-4)
TASPHD 506	Management of Information Technology	2(2-0-4)
TASPHD 507	Computer Network and Security	2(2-0-4)
TASPHD 508	Worldwide Network Infrastructure	2(2-0-4)
TASPHD 509	Enterprise Computing	2(2-0-4)
TASPHD 510	Information Technology Security	2(2-0-4)

In addition to the courses mentioned above, a student may register other courses in international program offered by other universities according to the student's interest with the approval of the program committee and TAS.

Cluster 3: Entrepreneur Cluster

		Credits (Lecture-Practice-Self-Study)
TASPHD 511	Start Up Mindset	2(2-0-4)
TASPHD 512	Organization and Management	2(2-0-4)
TASPHD 513	Design Thinking and Business Model	2(2-0-4)
TASPHD 514	Marketing and Brand Building	2(2-0-4)
TASPHD 515	Essential Finances and Tax Management	2(2-0-4)
TASPHD 516	Start Up the Startup and Pitching Process	2(2-0-4)
TASPHD 517	Funding and Fund Raising	2(2-0-4)
TASPHD 518	Cost Management	2(2-0-4)
TASPHD 519	Digital Technology, Innovation and Intellectual Property	2(2-0-4)
TASPHD 520	Startup Ecosystem	2(2-0-4)

In addition to the courses mentioned above, a student may register other courses in international program offered by other universities according to the student's interest with the approval of the program committee and TAS.

Cluster 4: ASEAN Cluster

		Credits (Lecture-Practice-Self-Study)
TASPHD 521	ASEAN Regionalization and Regionalism Economic, Social, Security and Political Perspectives	2(2-0-4)
TASPHD 511	Start Up Mindset	2(2-0-4)
TASPHD 512	Organization and Management	2(2-0-4)
TASPHD 513	Design Thinking and Business Model	2(2-0-4)
TASPHD 514	Marketing and Brand Building	2(2-0-4)
TASPHD 515	Essential Finances and Tax Management	2(2-0-4)
TASPHD 516	Start Up the Startup and Pitching Process	2(2-0-4)
TASPHD 517	Funding and Fund Raising	2(2-0-4)
TASPHD 518	Cost Management	2(2-0-4)
TASPHD 519	Digital Technology, Innovation and Intellectual Property	2(2-0-4)
TASPHD 520	Startup Ecosystem	2(2-0-4)
TASPHD 522	Cultural Identities and Diversity in ASEAN	2(2-0-4)
TASPHD 523	Education for All: ASEAN Way Towards Education Sustainability	2(2-0-4)
TASPHD 524	Integrating Science and Technology for Regional Cooperation	2(2-0-4)
TASPHD 525	Creative Economy and The Future of ASEAN	2(2-0-4)
TASPHD 526	Entrepreneurship, Risks, Laws and Business Essentials for Cross Border Economic Relations in ASEAN	2(2-0-4)
TASPHD 527	Doing Business in ASEAN and AEC	2(2-0-4)
TASPHD 528	ASEAN External Relations: Harmony in Diversity	2(2-0-4)
TASPHD 529	Globalization and Local Identity in Southeast Asia	2(2-0-4)
TASPHD 530	ASEAN and Sustainable Energy	2(2-0-4)

In addition to the courses mentioned above, a student may register other courses in international program offered by other universities according to the student's interest with the approval of the program committee and TAS.

Cluster 5: Language Cluster

		Credits (Lecture-Practice-Self-Study)
TASPHD 531	Basic ASEAN Language of Choice	2(2-0-4)
TASPHD 532	Basic Listening and Speaking ASEAN Language of Choice	2(2-0-4)
TASPHD 533	ASEAN Language of Choice for Basic Communication	2(2-0-4)
TASPHD 534	Basic Chinese Language	2(2-0-4)
TASPHD 535	Basic Chinese Listening and Speaking	2(2-0-4)
TASPHD 536	Chinese Language for Basic Communication	2(2-0-4)
TASPHD 537	Creative Communication Skills	2(2-0-4)

In addition to the courses mentioned above, a student may register other courses in international program offered by other universities according to the student's interest with the approval of the program committee and TAS.

(2) Dissertation (36 Credits)

		Credits (Lecture-Practice-Self-Study)
TASPHD 992	Dissertation	36 (0-144-0)

Plan 2(2.2): Coursework and Research (for students with Bachelor's Degree)

(1) Required Courses (24 Credits)

		Credits (Lecture-Practice-Self-Study)
TASPHD 590	Internship	3(0-35-0)

Twelve credits of the required courses of each student must be chosen from cluster 1 Science and technology below. Each student is required to take any course from all five clusters at least one course from each cluster.

Cluster 1: Science and Technology Cluster

		Credits (Lecture-Practice-Self-Study)
TASPHD 601	Optical Instrumentation Design	1(1-0-2)
TASPHD 602	Techniques of Astronomical Observations	1(1-0-2)
TASPHD 603	Data Intensive Analytics and High-Performance Data Processing System	2(2-0-4)
TASPHD 604	Fundamental of Astrodynamics	1(1-0-2)
TASPHD 605	Advanced Engineering Mathematics	2(2-0-4)
TASPHD 606	Probability, Random Variables and Stochastic Process for Engineering	2(2-0-4)
TASPHD 607	Understanding of Space Environment	1(1-0-2)
TASPHD 608	Space System Engineering	2(2-0-4)
TASPHD 609	Frontier Biotechnology in the 21st Century	1(1-0-2)
TASPHD 610	Nanofabrication and Nanorobotics	1(1-0-2)

TASPHD 611	Nanobiotechnology and nanomedicine	1(1-0-2)
TASPHD 612	Advanced Nanomaterials for Energy & Environment	2(2-0-4)
TASPHD 613	Natural Language Processing and Knowledge Graph	2(2-0-4)
TASPHD 614	Advanced Topics in Applied Speech and Audio Processing	1(1-0-2)
TASPHD 615	Image and Video Understanding	1(1-0-2)
TASPHD 616	Applied Information Security for Critical Infrastructure	2(2-0-4)
TASPHD 617	Spectroscopic Sensing Technologies	1(1-0-2)
TASPHD 618	Advanced Sensing and Quantum Materials	2(2-0-4)
TASPHD 619	Advanced Materials for Future Industries	2(2-0-4)
TASPHD 620	Technologies in Modern Accelerator Systems	1(1-0-2)
TASPHD 621	Principles of Advanced Measurement Techniques Using Synchrotron Radiation	2(2-0-4)
TASPHD 622	Data Acquisition and Data Manipulation in Accelerators and Synchrotron Beamlines	2(2-0-4)
TASPHD 623	Advanced Nuclear Facilities and Infrastructures	1(1-0-2)
TASPHD 624	Source of Radiation in Advanced Nuclear Facilities and Radiation Safety	1(1-0-2)
TASPHD 625	Radiation Processing and Its Useful and Diverse Applications in Material Science	2(2-0-4)
TASPHD 626	Seminar in Sciences and technology	1(1-0-2)
TASPHD 627	Research Methodology	1(1-0-2)

In addition to the courses mentioned above, a student may register other courses in international program offered by other universities according to the student's interest with the approval of the program committee and TAS.

The other 9 credits of the required courses of each student must be chosen from all 4 clusters (Cluster 2-5) below. Each student is required to take any course from all four clusters at least one course from each cluster.

Cluster 2: IT Cluster

		Credits (Lecture-Practice-Self-Study)
TASPHD 501	Business Intelligence and Data Visualization	2(2-0-4)
TASPHD 502	Artificial Intelligence (AI)	1(1-0-2)
TASPHD 503	Internet of Things	1(1-0-2)
TASPHD 504	Mobile Technology and Application	1(1-0-2)
TASPHD 505	Business Analytics and Big Data	2(2-0-4)
TASPHD 506	Management of Information Technology	2(2-0-4)
TASPHD 507	Computer Network and Security	1(1-0-2)

TASPHD 508	Worldwide Network Infrastructure	1(1-0-2)
TASPHD 509	Enterprise Computing	1(1-0-2)
TASPHD 510	Information Technology Security	2(2-0-4)

In addition to the courses mentioned above, a student may register other courses in international program offered by other universities according to the student's interest with the approval of the program committee and TAS.

Cluster 3: Entrepreneur Cluster

		Credits (Lecture-Practice-Self-Study)
TASPHD 511	Start Up Mindset	1(1-0-2)
TASPHD 512	Organization and Management	1(1-0-2)
TASPHD 513	Design Thinking and Business Model	1(1-0-2)
TASPHD 514	Marketing and Brand Building	1(1-0-2)
TASPHD 515	Essential Finances and Tax Management	2(2-0-4)
TASPHD 516	Start Up the Startup and Pitching Process	1(1-0-2)
TASPHD 517	Funding and Fund Raising	1(1-0-2)
TASPHD 518	Cost Management	1(1-0-2)
TASPHD 519	Digital Technology, Innovation and Intellectual Property	2(2-0-4)
TASPHD 520	Startup Ecosystem	1(1-0-2)

In addition to the courses mentioned above, a student may register other courses in international program offered by other universities according to the student's interest with the approval of the program committee and TAS.

Cluster 4: ASEAN Cluster

		Credits (Lecture-Practice-Self-Study)
TASPHD 521	ASEAN Regionalization and Regionalism Economic, Social, Security and Political Perspectives	2(2-0-4)
TASPHD 522	Cultural Identities and Diversity in ASEAN	1(1-0-2)
TASPHD 523	Education for All: ASEAN Way Towards Education Sustainability	1(1-0-2)
TASPHD 524	Integrating Science and Technology for Regional Cooperation	2(2-0-4)
TASPHD 525	Creative Economy and The Future of ASEAN	1(1-0-2)
TASPHD 526	Entrepreneurship, Risks, Laws and Business Essentials for Cross Border Economic Relations in ASEAN	2(2-0-4)
TASPHD 527	Doing Business in ASEAN and AEC	1(1-0-2)
TASPHD 528	ASEAN External Relations: Harmony in Diversity	1(1-0-2)
TASPHD 529	Globalization and Local Identity in Southeast Asia	1(1-0-2)

TASPHD 530 ASEAN and Sustainable Energy 1(1-0-2)

In addition to the courses mentioned above, a student may register other courses in international program offered by other universities according to the student's interest with the approval of the program committee and TAS.

Cluster 5: Language Cluster

	Credits (Lecture-Practice-Self-Study)
TASPHD 531 Basic ASEAN Language of Choice	1(1-0-2)
TASPHD 532 Basic Listening and Speaking ASEAN Language of Choice	1(1-0-2)
TASPHD 533 ASEAN Language of Choice for Basic Communication	1(1-0-2)
TASPHD 534 Basic Chinese Language	1(1-0-2)
TASPHD 535 Basic Chinese Listening and Speaking	1(1-0-2)
TASPHD 536 Chinese Language for Basic Communication	1(1-0-2)
TASPHD 537 Creative Communication Skills	1(1-0-2)

In addition to the courses mentioned above, a student may register other courses in international program offered by other universities according to the student's interest with the approval of the program committee and TAS.

(2) Dissertation (48 Credits)

	Credits (Lecture-Practice-Self-Study)
TASPHD 993 Dissertation	48 (0-192-0)

Section 4 Research Projects of the Program (Dissertation) @National Institutes

National Astronomical Research Institute of Thailand (NARIT)

1) Very high-energy gamma-ray analysis with Water Cherenkov Detector Array of LHAASO
2) Jupiter's and Earth's auroral and ionospheric variabilities in response to the dynamics in the magnetospheres
3) Astronomical observatory site characterization
4) Study of complex molecules in interstellar conditions
5) Dynamics and atmospheric studies of transiting exoplanets
6) Characterization of exoplanet host stars using machine learning, photometry, spectroscopy
7) Simons Array (Data analysis for the first observational season from Simons Array
8) Electromagnetic and gravitational radiation from black holes and neutron stars
9) Optical transient search from gravitational wave event

10) Unveiling 3-dimensional velocity structures around high-mass protostars with very-long-baseline-interferometry technique
11) Interpretation of maser flares in star-forming regions, and association with 3D structures
12) Understanding pulse profile properties and geometry of moding pulsars
13) Investigating second-generation star formation around galactic infrared bubbles
14) Distance-resolved Raman LIDAR for Analyzing Air Pollution
15) Biosensing cisplatin in fixed/live cells
16) Near-Infrared (NIR) Hyperspectral Imaging for Industrial Applications
17) An Optimization of Design Layout and Assembly for Small Satellite Structure
18) Design of Deployable and Separation System for Small Satellite
19) Battery Management and Prognosis system in Small Satellite
20) Attitude determination and Control System design, Sensor, Actuator and Modelling
21) Orbit design and optimization, and Low-thrust Orbit control (Guidance, Navigation and Control)

*For the scope of dissertations above click https://www.narit.or.th/tas

Synchrotron Light Research Institute (Public Organization) (SLRI)

1) Advanced measurement techniques based on synchrotron radiation
2) Development of AI for atomic and molecular structural analyses with X-Ray Diffraction and X-ray Scattering
3) Development of X-ray lenses for nano-beam
4) Study on collective bunch instabilities in electron storage rings
5) Study on longitudinal dynamics of Landau cavity in electron storage ring
6) Study on low-emittance beam injection efficiency of 4th generation synchrotron light source
7) Development of advanced photon detectors
8) Development of pulse magnets for high energy electron synchrotron
9) Development of ultra-high stability power supply
10) Advanced control system with unified classical, modern, and AI- based approaches
11) Development of Radio Frequency amplifier system
12) Development of Low Level Radio Frequency system
13) Autonomous control for Radio Frequency control system
14) Design and fabrication of Radio Frequency harmonic cavity for electron storage ring
15) Development of RF-shield bellow for low impedance electron storage ring
16) Development of high field gradient accelerating structure for industrial applications

*For the scope of dissertations above click https://www.slri.or.th/TAS/

Thailand Institute of Nuclear Technology (Public Organization) (TINT)

1) Modification of carbon-based materials from biomass via radiation processing
2) Fabrication of cellulose fiber based functional material by radiation processing for food and environmental applications
3) Radiation-induced synthesis of advanced nanohybrids as smart nanocarriers for biomedicinal applications
4) Biopolymer-based nanoparticles for biomedical and cosmetic applications
5) Design and Optimization of Heating Scenarios for Thailand Tokamak-2
6) Design and Development Superconducting Magnets for Thailand Tokamak 2: Engineering Perspective and Value-Chain outlook
7) Mechanics and Mechanism for Acceleration and Diagnostics using microwave in Tokamak and Cyclotron
8) Radionuclide determination in food and environmental samples by inductively coupled plasma mass spectrometry

*For the scope of dissertations above click https://www.tint.or.th/TAS/

National Science and Technology Development Agency

1) Material engineering for adsorption-based atmospheric water harvesting
2) CO2 capture and Catalytic Thermal Conversion of CO2 to Fuels
3) Electrochemical properties of Ni(OH)2 and Ni(OH)2/Co(OH)2 composites in supercapacitor applications
4) Non-destructive assessment of nitrite in sausages using a nearinfrared hyperspectral imaging technique
5) Fabrication and design bio-based polymer capsule particle for various applications
6) Genetic adaptation to high-altitude and evergreen forest environmental selection in the hill-tribe group of Thailand
7) Elucidation of the host-virus interaction network using engineered dengue virus
8) Fabrication of biomimic superhydrophobic surface using micropattern technology for self cleaning applications
9) Utilization of technical lignin and lignin nanoparticles for plastic industry
10) Advanced healthcare nanomaterials for cancer detection and therapy using light-responsive molecules
11) Value-added conversion of molasses to porous carbon and carbon dots and their novel applications in supercapacitor, sensors, and as UV blocking agent and antioxidant
12) Enhanced thermal stability of all- inorganic perovskite solar cells with carbon electrode
13) Development of bio- inspired nanocomposites from agro- waste industry for packaging applications
14) Unsupervised Anomaly Event Detection in Video
15) Action recognition using few shot learning

16) Action localization using graph neural network
17) The Development of Partial Diesel Particulate Filter Assisted in Particulate matter (PM 2.5) emission Reduction for engine fuelled with biodiesel
18) Adding values and utilizing of oil palm empty fruit branches (OPEFB) for the application of agricultural wastewater treatment
19) Graphene enhanced plasmonics for high sensitivity optical based biochemical detection
20) Metamaterials for sensing applications.
21) Stretchable and wearable electrochemical sensors for health care monitoring
22) Development of Lipid Nanoparticles as Carriers for mRNA Vaccine
23) Encapsulation of Andrographis paniculata extract in nanoparticles for mucosal delivery
24) Development of anti- obesity nutraceutical products containing Kaempferia parviflora (KP) nanoparticles
25) Exploitation of viral accommodation mechanism to control viral diseases in shrimp
26) Improving speech recognition for call centers
27) Representation learning for Conversational AI
28) Deep Learning for Image Processing
29) Image synthesis using generative model
30) Thai Caption Generation
31) Knowledge Distillation for NLP
32) GAN for Thai Language Processing
33) Multimodal Pretrained model for NLP
34) Knowledge Graph for Text Summarization
35) Learning Analytics using e-book based representation
36) Knowledge Extraction in Culture Informatics
37) Blockchain-based Traceability Systems
38) A Study and Development of Usability Guidelines for Blockchain Systems for End Users
39) Spoofing detection for automatic speaker recognition
40) Speaker anonymization
41) Voice privacy protection
42) Emotion recognition in speech signal
43)Developing High-loading Metal Single-atom Catalysts for Efficient Photo/ Electrochemical Applications
44)Development of electrolyzer platform for electrochemical CO_2 reduction and high value chemical synthesis
45) Rational design and development of high performance catalysts for CO_2 conversion to valuable products: multiscale modeling
46) Optimization of extraction and purification process prototype for the production of policosanol from sugarcane filter press at pilot plant production level

47) Next generation lithium ion battery for safety and high energy density applications
48) Multivalent ion rechargeable battery for stationary energy storage systems
49) Carbon-based nanomaterials for energy storage and harvesting devices
50) Printed nano electrochemical sensors for food pathogen detection
51) High valued carbon-based nanomaterials synthesized from carbon dioxide gas
52) Novel synthesis of nanocarbon materials from bio and agricultural wastes

*For the scope of dissertations above click https://www.nstda.or.th/tas

Definition of Course Codes

The definition of the letters for the program course codes is based on the rules and regulations set up by the Thailand Academy of Science (TAS) as follows:

The first three letters represent the Thailand Academy of Science (TAS). The last three alphabets describe the program responsible for teaching. PHD means the Doctoral level. The three-digit number sequence following the letters, e.g., 5xx indicates that the courses are in the graduate level.

Study Plan

Plan 1(1.1): Research Only (for Students with Master's Degree)

Year	Semester 1	Semester 2
1	Coursework (If Required) TASPHD 991 Dissertation 8 (0-32-0) Qualifying Examination Defending Research Topic **Total 8 Credits**	TASPHD 991 Dissertation 8 (0-32-0) - Developing Proposal - Seminar **Total 8 Credits**
2	TASPHD 991 Dissertation 8 (0-32-0) - Defending Dissertation Proposal - Apply for Ethics Committee Approval **Total 8 Credits**	TASPHD 991 Dissertation 8 (0-32-0) - Pilot Study (If Required) **Total 8 Credits**
3	TASPHD 991 Dissertation 8 (0-32-0) - Data Collection and Management - Writing Manuscript #1 **Total 8 Credits**	TASPHD 991 Dissertation 8 (0-32-0) - Data Analysis - Dissertation Writing **Total 8 Credits**
4	- Data Analysis - Dissertation Writing - Writing Manuscript #2	- Internship - Dissertation Defense - Submission of Dissertation

Plan 2(2.1): Coursework and Research (for Students with Master's Degree)

Year	Semester 1	Semester 2
1	Coursework 5 Credits Qualifying Examination Defending Research Topic Developing Proposal **Total 5 Credits**	Coursework 4 Credits TASPHD 992 Dissertation 6(0-24-0) -Developing Proposal -Seminar **Total 10 Credits**
2	TASPHD 992 Dissertation 6(0-24-0) -Defending Dissertation Proposal -Apply for Ethics Committee Approval **Total 6 Credits**	TASPHD 992 Dissertation 6(0-24-0) -Applying for Grant -Pilot Study (If Required) **Total 6 Credits**
3	TASPHD 992 Dissertation 6(0-24-0) -Data Collection and Management -Writing Manuscript #1 **Total 6 Credits**	TASPHD 992 Dissertation 6(0-24-0) -Data Analysis -Dissertation Writing **Total 6 Credits**
4	TASPHD 992 Dissertation 6(0-24-0) -Data Analysis -Dissertation Writing -Writing Manuscript **Total 6 Credits**	TASPHD 590 Internship 3(0-45-0) -Dissertation Defense -Submission of Dissertation **Total 3 Credits**

Plan 2(2.2): Coursework and Research (for Students with Bachelor's Degree)

Year	Semester 1	Semester 2
1	Coursework 12 Credits Qualifying Examination Defending Research Topic Developing Proposal **Total 12 Credits**	Coursework 9 Credits -Developing Proposal -Seminar **Total 9 Credits**
2	TASPHD 992 Dissertation 8(0-32-0) -Defending Dissertation Proposal -Apply for Ethics Committee Approval **Total 8 Credits**	TASPHD 992 Dissertation 8(0-32-0) -Applying for Grant -Pilot Study (If Required) **Total 8 Credits**
3	TASPHD 992 Dissertation 8(0-32-0) -Data Collection and Management -Writing Manuscript #1 **Total 8 Credits**	TASPHD 992 Dissertation 8(0-32-0) -Data Analysis -Dissertation Writing **Total 8 Credits**
4	TASPHD 992 Dissertation 8(0-32-0) -Data Analysis -Dissertation Writing **Total 8 Credits**	TASPHD 992 Dissertation 8(0-32-0) - Dissertation Writing - Writing Manuscript **Total 8 Credits**
5	TASPHD 590 Internship 3(0-45-0) -Dissertation Defense -Submission of Dissertation **Total 3 Credits**	

Dissertation Requirements

The dissertation involves research on topics related to the development of knowledge as listed in section 4. It must be submitted in the format and timeframe required by TAS committee.

Short Description

Defining research questions, study planning, study design, research proposal, ethics approval, data collection and retrieval, data/model analysis, discussion, and compile research results into the dissertation.

Dissertation presentation: The dissertation has ethics approval and research findings are disseminated through manuscripts published in journals or academic publications, or significantly make impact to the National competitiveness through government, private or industrial sectors.

Standard Learning Outcomes

Students are able to integrate deep knowledge as well as their soft skills in order to work in the research team, which includes a variety of professionals. The dissertation may be used in the improvement of several organizations in order to get better living of individuals and the population, and raise Thailand global competitiveness.

Time Frame

Study Plan 1(1.1): Research Only

- From Semester 2 Year 1 forward

Study Plan 2(2.1): Coursework and Research

- From Semester 2 Year 1 forward

Study Plan 2(2.2): Coursework and Research

- From Semester 1 Year 2 forward

Number of Credits

36 Credits and 48 Credits

Preparation

Regular meetings are offered for mentoring during research conduct. Dissertation timeline and specification must be clear. Progress is tracked on a regular schedule.

Evaluation Process

Evaluation is based on research progress as advised by an advisory team each semester. The advisory committee follows the evaluation process until the dissertation is completed and presented to TAS committee.

Section 5 Scholarship and conditions

At the beginning of program, student will obtain scholarship from Ministry of Higher Education Science Research and Innovation and/or from private sector. Student's performance then will be evaluated at the end of academic year in order to continue receiving the scholarship.

Section 6 Criteria for Student Evaluation

Grading System

Evaluation and grading conform to the announcement of TAS.

Evaluation Process for the Learning Outcome of Students

For coursework, students will be evaluated according to the learning outcome of each course either by written examination, quality of the assigned work, class participation, group activities, presentation or behavior observation, etc. The Program Committee ensures that the quality of the evaluation methods used is suitable and proper.

Students will be evaluated by other students. Assessments and learning outcomes will be settled through consensus prior the evaluation.

Responsible faculty members will clearly define indicators and evaluation criteria and made them available to students in advance when evaluating student assignments.

Graduation Requirements

Study Plan 1(1.1): Research Only (for student with Master's degree)

1. Full-time study should be according to the study plan.
2. The total number of credits required must not fewer than 48 credits.
3. Students must meet the English proficiency standard according to TAS announcement.
4. Students must pass the qualifying examination prior to the dissertation proposal examination.
5. Students must submit the dissertation for examination following the regulations of TAS and the examination system is open to those interested in listening.

6. Parts or all of the dissertation must be published or accepted for publication in an international peer-reviewed journal for at least two manuscripts following the TAS announcement or
7. Student must create an innovation in a form of product, process, knowledge, service, or other applicable forms. The evidence of innovation creation must be presented in the dissertation

Study Plan 2(2.1): Coursework and Research (for student with Master's degree)

1. Full-time study should be according to the study plan.
2. Students must complete at least 12 credits of courses and 36 credits of dissertation as stated in the curriculum. The total number of credits throughout the program is not less than 48 credits with a minimum cumulative grade point average of 3.00
3. Students must meet the English proficiency standard according to TAS announcement.
4. Students must pass the qualifying examination prior to the dissertation proposal examination.
5. Students must submit the dissertation for examination following the regulations of the TAS and the examination system is open to those interested in listening.
6. Parts or all of the dissertation must be published or accepted for publication in an international peer-reviewed journal for at least two manuscripts following the TAS announcement or
7. Student must create an innovation in a form of product, process, knowledge, service, or other applicable forms. The evidence of innovation creation must be presented in the dissertation.

Study Plan 2(2.2): Coursework and Research (for students with Bachelor's Degree)

1. Full-time study should be according to the study plan.
2. Students must complete at least 24 credits of courses and 48 credits of dissertation as stated in the curriculum. The total number of credits throughout the program is not less than 72 credits with a minimum cumulative grade point average of 3.00
3. Students must meet the English proficiency standard according to TAS announcement.
4. Students must pass the qualifying examination prior to the dissertation proposal examination.

5. Students must submit the dissertation for examination following the regulations of the TAS and the examination system is open to those interested in listening.
6. Parts or all of the dissertation must be published or accepted for publication in an international peer-reviewed journal for at least two manuscripts following the TAS announcement or
7. Student must create an innovation in a form of product, process, knowledge, service, or other applicable forms. The evidence of innovation creation must be presented in the dissertation

Section 7 Process for entry/completion

1) Student acceptance Process

The program is designed to accept students for every academic year to provide educational opportunities to those interested in the study program. The program will actively recruit the talented students from local, ASEAN and internationally. The student selection committee will be responsible for setting up the selection criteria strictly.

2) Academic Advising/Counseling and Other Support for Students

- The program provides student orientation for technical advices about learning in the courses and how to study in the program.
- A program adviser is provided to advise and assist students in learning and to provide necessary support when a student is having a problem.
- Students are provided an opportunity to work and present their work abroad, so that students can have an experience for public presentation and an opportunity to acquire more knowledge.

3) Students' Rights to File Complaints

If students question grading of a course, they have a right to review their exam papers and grades. In addition, if students are charged and/or punished for cheating, they can appeal within 7 days after the time that they received such notice. Students can also appeal any other concerns by writing or meeting in persons with program director of The TAS will consider such appeals.

4) Successful completion of the study.

For the achievement criteria, the duration of the course is at least 3 academic year, and must be studied in accordance with the structure of the curriculum, that is to complete the specified numbers of credits for each study plan. Student must pass the English proficiency test according to the criteria of TAS. Students must submit dissertation

which in conformity with the regulations of TAS. Dissertation examination is open to the public. A work or part of a dissertation must be published or at least accepted for publication in a peer-review journal in relevant fields. Student's name appears as a first author in such publication and it will be counted as a graduation criteria. Graduation requirements are to be met according to the regulations set up by TAS.

Section 8 Course Description

Internship

Credits (Lecture-Practice-Self-Study)

TASPHD 590 Internship 3(0-45-0)

A practice of real work suitable to a vocational field for a period not less than 320 hours or 8 weeks in either a governmental or public organization in foreign countries, including doing a report or seminar after finishing an internship.

Cluster 1: Science and Technology Cluster

Credits (Lecture-Practice-Self-Study)

TASPHD 601 Optical instrumentation design 2(2-0-4)

Optical system, optical aberrations, image quality criteria, optical design methods and related experiments e.g. specgtrograph

Credits (Lecture-Practice-Self-Study)

TASPHD 602 Techniques of astronomical observations 2(2-0-4)

Techniques of astronomical observations in optical and radio wavelengths, electromagnetic radiation, telescopes, scientific instruments and detectors, observation plans and observations, techniques of interferometry, data processing for astronomical data, data analyses for astronomical research and related fields.

Credits (Lecture-Practice-Self-Study)

TASPHD 603 Data Intensive Analytics and High-Performance Data Processing System 2(2-0-4)

Science and humanity are undergoing a data explosion, and astronomy is leading the way. Modern telescopes produce terabytes of data per observation, and the simulations required to model our observable Universe push supercomputers to their limits. In this course, students will learn how to develop, test and apply new methods for discovery and insight. This includes creating innovative and optimised algorithms, applications of machine learning and artificial intelligence, and the adoption of advanced visualisation solutions for individual and collaborative data exploration. Underpinning our course is the use of high-performance computing and graphics processing units to effectively deploy a derivation, validation and deployment of predictive models based on

collected data and provides training in the use of industry- and research-standard technologies and techniques.

Credits (Lecture-Practice-Self-Study)

TASPHD 604 Fundamental of Astrodynamics 2(2-0-4)

This course covers the fundamentals of astrodynamics, vector kinematics in three dimension and of Newton's law of motion and gravitation. The two-body orbital initial-value and boundary-value problems with applications to spacecraft navigation, guidance, and control. Other related topics include celestial mechanics, Kepler's problem, Lambert's problem, angle-only orbit determination, and recursive algorithms for deep space navigation. Selected applications from the related projects based on basic scientific equipment for ground and space domain.

Credits (Lecture-Practice-Self-Study)

TASPHD 605 Advanced engineering mathematics 2(2-0-4)

This course covers the theories of linear equations, vector, introduction to ordinary differential equations, homogeneous linear equations of second order, non-homogeneous linear equations of second order, Fourier series, transform, Laplace equation, Laplace transform, introduction to differencing methods; basic concepts of partial differential equation, classification of second order equations, heat and wave propagation in one-dimension, Series solutions, elements of complex variables.

Credits (Lecture-Practice-Self-Study)

TASPHD 606 Probability, Random Variables and Stochastic Process for engineering 2(2-0-4)

This course provides the fundamentals and advanced concepts of probability theory and random process to support research in electrical, electronic, computer and aerospace engineering which consists of overview of elementary probability, discrete and continuous random variables and their statistical properties, functions of random variables, properties of random processes: Stationarity, correlation function, power spectral density, spectral analysis, overview of Markov process and applications, examples of applications from signal processing and digital communications.

Credits (Lecture-Practice-Self-Study)

TASPHD 607 Understanding of space environment 2(2-0-4)

The course introduces the space environment and its effects on space systems and methods to mitigate these effects which consists of solar properties and Earth, neutral atmosphere, magnetosphere and ionosphere, neutral environment, ionosphere and plasma environment, radiation environment, micrometeoroid and orbital debris

environment, spacecraft thermal design, spacecraft environment interaction case studies and project reports.

Credits (Lecture-Practice-Self-Study)

TASPHD 608 Space system engineering 2(2-0-4)

This course covers the introduction to design, development, construction, testing, and operation (end-to-end engineering) of spacecraft: launchers, satellites, etc. operating around Earth and other planetary bodies as well as in outer space. It addresses the engineering of the spacecraft subsystems in relation to the overall spacecraft and its life cycle. The emphasis is on miniaturization and spin-in of commercial technology into space systems for increased performance or cost reduction and introduction to space law.

Credits (Lecture-Practice-Self-Study)

TASPHD 609 Frontier Biotechnology in the 21st Century 2(2-0-4)

Key concepts in modern biotechnology will be introduced to understand selected innovations and future trends in bioscience and biotechnology in the 21st century. The covered technical knowledge will be emphasized through various selected applications including agriculture and food, innovative biochemicals, health & medicine. This course will also teach basic skills and tools in tackling biotechnology literature to gain new technical knowledge for understanding the future trends in bio-industry.

Credits (Lecture-Practice-Self-Study)

TASPHD 610 Nanofabrication and Nanorobotics 2(2-0-4)

Introduction to micro- and nanofabrication techniques and applications, basic photolithography technique, thin film deposition techniques in microfabrication, etching techniques in micro- and nanofabrication, overview of maskless micro- and nanolithography, self-assembly and template based patterning, organic electronics, light-emitting diode, field-effect transistors, thermoelectrics, next generation solar cells, chemical sensors, nanopores fabrication, concept and design of nanorobotics and its application, micro & nano-needles, Nanostructural and nanomechanical analysis, nano stability analysis, nanoscale and chemical identification and analysis, computer simulation for nanostructured materials design and analysis

Credits (Lecture-Practice-Self-Study)

TASPHD 611 Nanobiotechnology and nanomedicine 2(2-0-4)

Introduction to nanobiotechnology, classification of nanomaterials, design-synthesis of nanomaterials and their applications, Inorganic nanoparticles for diagnostics, nanoparticle-based lateral flow biosensors for biomedical and diagnostic applications, surface enhanced Raman scattering (SERS) biosensing, Inorganic nanoparticles/nanowires and their sensing applications, responsive nanomaterials for biosensors, nano-

encapsulation for cosmeceutical and drug delivery, polymeric nanoparticles and lipid nanoparticles for drug delivery systems for targeting and therapy, nanotoxicology, 3D & ex vivo tissue models for safety and efficacy evaluation of nanomaterials.

Credits (Lecture-Practice-Self-Study)

TASPHD 612 Advanced nanomaterials for Energy & Environment2(2-0-4)

Introduction of advanced nanomaterials and nanostructured materials, concept and types of nanostructured materials, Design and synthesis of thin film & nanocomposites, nano-coating, nano-filtration and nano-bubble for water remediation, nanofiber-electro spinning, design and synthesis of nanocatalysts for energy and biorefinery applications, artificial photosynthesis for CO2 reduction, photocatalysis for treating organic substances, photocatalyst synthesis for environmental and agricultural applications, chelate compounds synthesis for agricultural applications, metal organic frameworks (MOF) for environmental applications, carbon nanomaterials (carbon nanotube, carbon nanohorn, graphene, graphdiyne).

Credits (Lecture-Practice-Self-Study)

TASPHD 613 Natural Language Processing and Knowledge Graph 2(2-0-4)

Introduction to Natural Language Processing (NLP) and Linguistics, Formal Grammars and Chomsky Hierarchy, Knowledge Graph (KG) and Meaning Representations, Rule-based Algorithms for Text Processing, Statistical Methods in NLP, Statistical Machine Translation, Spectral Learning in NLP, Artificial Neural Networks and Sequence Prediction, Sequence-to-Sequence Prediction and Neural Machine Translation, Transformer Models and BERT, Graph-based Algorithms in NLP and KG, Neural Networks on Knowledge Graph.

Credits (Lecture-Practice-Self-Study)

TASPHD 614 Advanced Topics in Applied Speech and Audio Processing 2(2-0-4)

This Course Will Cover Corpus Development, Acoustic Speech Recognition, Text to Speech, Psychoacoustic Models with Applications in Information Hiding and Audio Coding, Spoofing / Tampering Detection, Room Acoustic Parameters

Credits (Lecture-Practice-Self-Study)

TASPHD 615 Image and Video Understanding 2(2-0-4)

This Course Will Cover the Fundamentals and Recent Advances in Image and Video Understanding. Topics Include Image Classification, Object Detection, Image Segmentation, Motion Analysis, Object Tracking, Human Pose Estimation, Temporal Representation, Action Recognition, and Action Localization.

Credits (Lecture-Practice-Self-Study)

TASPHD 616 Applied Information Security for Critical Infrastructure 2(2-0-4)

Introduction to Fundamental Information Security with Emphasis on Critical Domains, Including but Not Limited to Security and Risk Management, Asset Security, and Security Operations. Deep Understanding and Acquiring Skills Through Hands-On Experience of Working with Practical Systems. Case Studies by Leading Experts from Different Sectors such as Healthcare, Manufacturing, Energy, Telecommunication, and Security Agencies.

Credits (Lecture-Practice-Self-Study)

TASPHD 617 Spectroscopic Sensing Technologies 2(2-0-4)

Fundamental Knowledges for Developments of Spectroscopic Sensors and Systems Utilizing the UV, Visible, IR, THz Wavelength Regions Sensing via Direct Absorption, Raman, Fluorescence, or Other Spectroscopic Processes. Advanced Spectroscopic Nano Sensors Including Surface-Enhanced Raman Spectroscopy (SERS), Surface-Enhanced Fluorescence (SEF) and Quantum Plasmonic Sensors. Utilizing Artificial Intelligence (AI) To Analyze Spectroscopic Sensing Data. Implementation of Spectroscopic Sensors in Different Areas of Applications, such as Agricultural/Food Production, Environmental Monitoring, Analysis of Biological/Medical Specimens, Forensic and Homeland Securities.

Credits (Lecture-Practice-Self-Study)

TASPHD 618 Advanced Sensing and Quantum Materials 2(2-0-4)

Introduction to Nano Sensing and Quantum Materials Including Their Related Applications. Definitions and Properties of Nano Sensing and Quantum Materials, Fundamentals of Material Modeling, Nanofabrication, Nano/Quantum Material Characterization Techniques, Nano-Scale Devices, Fabrication of Sensors and Applications such as Biosensors, Chemical Sensor, and Other Related Applications, Basics of Signal Processing and Analysis Techniques, Advanced Intelligent Sensing System.

Credits (Lecture-Practice-Self-Study)

TASPHD 619 Advanced Materials for Future Industries 2(2-0-4)

Key concepts in material science and engineering of advanced materials will be introduced selected for various future industries such as automotives, medical devices, robotics, renewable energy and energy storage etc. This course will teach basic in material structures, characterization and applications of novel materials; biomaterials; nanomaterials; composite materials; smart materials including novel carbon materials; diamond-like carbon; carbon nanotubes; graphene; synthesis, properties, functionalization, modification and applications of graphene and carbon nanotubes for energy storages and chemical sensors. Advanced materials for innovation and sustainability; management of science and technological innovations in materials science;

basic concepts of entrepreneurship and strategic marketing planning of advanced materials for future industries

Credits (Lecture-Practice-Self-Study)

TASPHD 620 Technologies in Modern Accelerator Systems 1(1-0-2)

Principles of sophisticated scientific and engineering systems used in modern accelerators; high power microwave; radio frequency; vacuum; magnet; particle beam monitoring and high precision timing and control systems; technology's importance and application in industrial applications

Credits (Lecture-Practice-Self-Study)

TASPHD 621 Principles of Advanced Measurement Techniques Using Synchrotron Radiation 2(2-0-4)

Principles of advanced measurement techniques utilizing high intensity synchrotron x-rays; ultra violet and infrared; characterization of micro- nano- and atomic-scale structures; principles of advanced photon detectors; basic data visualization and interpretation

Credits (Lecture-Practice-Self-Study)

TASPHD 622 Data Acquisition and Data Manipulation in Accelerators and Synchrotron Beamlines 2(2-0-4)

Methods, instrument and principles of modern data acquisition systems used in modern accelerator and synchrotron beamlines; data formats; basic modern programing for acquisition, manipulation and visualization of complex scientific data

Credits (Lecture-Practice-Self-Study)

TASPHD 623 Advanced Nuclear Facilities and Infrastructures 1(1-0-2)

Advancement in Nuclear technologies and instrumentation, nuclear reactor, industrial gamma irradiator, linear accelerator, linear device, X-ray free electron laser, Synchrotron, tandem accelerator, Cyclotron, Tokamak, Plasma Focus, Other accelerators and reactors, licensing process, socioeconomic impact, budget and human resource planning

Credits (Lecture-Practice-Self-Study)

TASPHD 624 Source of Radiation in Advanced Nuclear Facilities and Radiation Safety 1(1-0-2)

Nuclear mass and stability, half-life, nuclear reactions, cross section, radioactive decays, radioactivity and series radioactive decays, photon interactions with matter, gamma spectral identification, shielding calculations, ion-nuclear interactions, scattering and stopping power derivation, ion range, bremsstrahlung, X-ray spectra, reactor physics,

basic reactor engineer, experimental nuclear engineer, nuclear electronics, radiation productions in some selected facilities, nuclear reactors, cyclotrons, and electron Accelerator, radiation detection and detector, nuclear instrumentation and measurement, ionizing radiation calibration and dosimetry, environmental radiation measurement, health physics and radiation protection, occupational dose control and measures

Credits (Lecture-Practice-Self-Study)

TASPHD 625 Radiation Processing and Its Useful and Diverse Applications in Material Science 2(2-0-4)

Basics of radiation physics, general aspects of particle accelerator technology, electron beam, gamma- and X-ray irradiators, different characters, effects on materials, effects of radiation on materials in solid state and liquid systems, crosslinking, degradation and polymerization reactions induced by radiation, preparation of nanopolymers, effects of radiation on properties of natural and synthetic polymers, preparation of nanopolymers, preparation of hydrogels and characterization

Credits (Lecture-Practice-Self-Study)

TASPHD 626 Seminar in Science and Technology 1(1-0-2)

Knowledge, information and exchanges of views for understanding on the contemporary issues related to science and technology; science and technology behind innovation in theory, fundamentals, practices, and applications; knowledge synthesis; presenting analyzed and synthesized topic in innovation in science and technology education; discussing and sharing experiences and knowledge in science and technology

Credits (Lecture-Practice-Self-Study)

TASPHD 627 Research Methodology 1(1-0-2)

Research methodology and types of research; observational, experimental, qualitative researches, applications of scientific process in research design, formulation of research questions and hypotheses, research proposal development, technique of data collection, data management and analysis, critical reading of scientific research articles using literature search through electronic equipment and information sources in medical sciences

Cluster 2: IT Cluster

Credits (Lecture-Practice-Self-Study)

TASPHD 501 Business Intelligence and Data Visualization 2(2-0-4)

Basic principles of business intelligence (BI) ; components of BI; BI infrastructure, data warehousing and data mining, business performance management, dashboard, tools for implementing BI in organization; BI applications in information system platforms; BI

applications used in current businesses; principles of data visualization; data visualization design and tools.

Credits (Lecture-Practice-Self-Study)

TASPHD 502 Artificial Intelligence (AI) 2(2-0-4)

Introduction to artificial intelligence, types of intelligent agents, blind searches, informed/ heuristic searches, AND/ OR graph, game playing, alpha-beta cutoff, propositional logic and its application, first order logic and its application reasoning with uncertainty and Bayesian Network, truth maintenance system, certainty factor method, dempster and Shafter method, fuzzy logic, inductive learning, genetic algorithms, neural network, expert system, future and impact of artificial intelligence

Credits (Lecture-Practice-Self-Study)

TASPHD 503 Internet of Things 2(2-0-4)

Introduction to IoT, IoT Architecture, Sensor, IoT Endpoint, and Power System, IoT Process, IoT Edge, Communication and Information Theory, Non-IP Based WPAN, IP-Based WPAN and WLAN, Long-Range Communication System and Protocol (WAN), Routers and Gateway, IoT Security

Credits (Lecture-Practice-Self-Study)

TASPHD 504 Mobile Technology and Application 2(2-0-4)

Introduction to mobile technologies and operating systems, sensors on mobile devices, differences between mobile technology and personal computers, designing and implementing a mobile application on iOS or Android, the life cycle of a mobile application, input/output on a mobile device, persistence in a mobile application, user interface components on a mobile application, deploying an application to a mobile device

Credits (Lecture-Practice-Self-Study)

TASPHD 505 Business Analytics and Big Data 2(2-0-4)

Overview of business analytics, evolution of business analytics, importance of data, data quality, data collection, structuring data, data cleaning, benefits of data mining, introduction to big data, data growth, introduction to big data and business intelligent, significance of big data analytics, social media analytics, social media analytics process.

Credits (Lecture-Practice-Self-Study)

TASPHD 506 Management of Information Technology 2(2-0-4)

Information Technology (IT) organization; IT stakeholders analysis; IT services; IT governance and IT management; IT governance and management standards and frameworks: business strategy and IT strategy, management of service agreements, supplier management, risk management, security management, availability and capacity

management, change management, incident management, problem management, continuity management

Credits (Lecture-Practice-Self-Study)

TASPHD 507 Computer Network and Security 2(2-0-4)

Elements of computer networking, computer networking process, Open System Interconnection (OSI), switch process on the Ethernet in layer 2, routing process in layer 3, wireless technologies, design and management of computer networks in an organization, meaning and elements of network security, network security techniques and the standards of network security in organizations

Credits (Lecture-Practice-Self-Study)

TASPHD 508 Worldwide Network Infrastructure 2(2-0-4)

Background and history of networks and the Internet; principles of network applications, protocols, services, socket programming; client/ server and peer-to-peer network; reliable data transfer; congestion control; the Internet Protocol (IP) ; routing in the Internet; multimedia networking; wireless and mobile networks; large-scale and global networks; next generation networks.

Credits (Lecture-Practice-Self-Study)

TASPHD 509 Enterprise Computing 2(2-0-4)

IT infrastructure; management; stability, efficiency and responsiveness; theoretical and practical aspects of systems management; discipline in data centres; development, integration, and management of IT process; business-support functions; enterprise services; information systems services.

Credits (Lecture-Practice-Self-Study)

TASPHD 510 Information Technology Security 2(2-0-4)

Business opportunities and risks, understanding the threats to security, building an internet security program, implementing an internet security program, securing the internet connection, intrusion detection systems, securing user services, securing business services, virus management, introduction to cryptography and information technology security project presentation

Cluster 3: Entrepreneur Cluster

Credits (Lecture-Practice-Self-Study)

TASPHD 511 Start Up Mindset 2(2-0-4)

Entrepreneurial motivation, entrepreneurial characteristics, contexts of entrepreneurial activity, opportunity recognition, opportunity assessment, acquiring

resources, validation of idea with end users, business models, entrepreneurial activities, leadership and social entrepreneurship, exits and outcomes

Credits (Lecture-Practice-Self-Study)

TASPHD 512 Organization and Management 2(2-0-4)

Concepts of organization and management. Organizational environment. Manager's roles and managerial functions. Planning, organizing to establish an appropriate organizational structure, leadership and controlling. Ethics and corporate social responsibility. Trends of organization and management in the future.

Credits (Lecture-Practice-Self-Study)

TASPHD 513 Design Thinking and Business Model 2(2-0-4)

Concept, principle, process and tools used in design thinking for innovation; product, service, and business design, different business models; 3 components of the business model; value proposition; value architecture; profit equation to define suitable business model for innovation

Credits (Lecture-Practice-Self-Study)

TASPHD 514 Marketing and Brand Building 2(2-0-4)

Concepts of Marketing and brand-building, decision market; development of the marketing mix, planning, strategy formulation, control, and market evaluation; brand equity, the branding process, brand design, building brand identity, brand communications, development of integrated marketing strategies in brand-building, measurement and evaluation of branding, the creation and development of sustainable brand growth

Credits (Lecture-Practice-Self-Study)

TASPHD 515 Essential Finances and Tax Management 2(2-0-4)

Understanding and calculation of financial management indicators, assessment of financial health; application of finance and accounting tools, cost benefit analysis, break even analysis, in decision-making in organization, principles of business tax planning; differences between tax planning and tax avoidance; methods of reducing taxes by law and ethics; tax planning for small, medium, large, and international corporations, tax management methods, tax planning,

Credits (Lecture-Practice-Self-Study)

TASPHD 516 Start Up the Startup and Pitching Process 2(2-0-4)

Introduction to start-up and entrepreneurship, start-up terminology and core-concepts, successful factors for start-ups, ideation, understanding market and competition, idea to business proposition, validation of business idea, launching of start-

up, pitching and selling, price setting strategies, marketing and sales essentials, points to consider in pitching

Credits (Lecture-Practice-Self-Study)

TASPHD 517 Funding and Fund Raising 2(2-0-4)

Types of funding sources, general view of fundraising, importance of fundraising, principles and strategy of fundraising in nonprofit organizations, motivations for donors, grant proposal writing, fund raising in social media and technologies, ethical aspects of fund raising

Credits (Lecture-Practice-Self-Study)

TASPHD 518 Cost Management 2(2-0-4)

Framework of managerial accounting and control, cost management, various strategies of cost management, variance analysis, contemporary cost management systems, decentralization management and evaluation of business units, transfer pricing, performance evaluation, compensation systems, and cost analysis under uncertain circumstances.

Credits (Lecture-Practice-Self-Study)

TASPHD 519 Digital Technology, Innovation and Intellectual Property 2(2-0-4)

Advancement of technology in the digital age; technological diversity; the impact of the digital era on people's lifestyles; operations management, economics and the environment, morals and ethics; adapting in the Digital Age to Deal with Changes and Impacts; differences of property and assets, definition, importance of intellectual property (IP) in a knowledge based economy, characteristics of IP, types of IP e.g. patent, patty patent, copyrights and related rights, trademarks, industrial design, geographical indications, principles of intellectual property management, international cooperation treaties and agreements e. g. TRIPS, PCT, cycles of intellectual property management, IP creation, IP protection and IP exploitation to maximize the IP value

Credits (Lecture-Practice-Self-Study)

TASPHD 520 Startup Ecosystem 2(2-0-4)

Components of start-up ecosystem, the process of building and nurturing innovation ecosystems, assessment for productivity, factors important for development of start-up ecosystem, case-studies of start-up ecosystem in different geographic and economic backgrounds

Cluster 3: ASEAN Cluster

Credits (Lecture-Practice-Self-Study)

TASPHD 521 ASEAN Regionalization and Regionalism Economic, Social, Security and Political Perspectives 2(2-0-4)

Theories and approaches to the regionalism and regional integration in ASEAN, economics, society and politics, institutional structure and policy decision making in ASEAN, political economy of ASEAN, conflicts, crises, and change, ASEAN and the management of regional security, society and politics in ASEAN, ASEAN regional groupings and regionalization.

Credits (Lecture-Practice-Self-Study)

TASPHD 522 Cultural Identities and Diversity in ASEAN 2(2-0-4)

ASEAN cultural landscapes, multiculturalism, borders and transnational cultural practices in ASEAN, ASEAN governance of cultural diversity and multiculturalism, indigenous identities in ASEAN and a new concept for the region, cultural similarities, differences, and cultural modernisation in ASEAN, ethnic and religious diversity in ASEAN, cross cultural communication in ASEAN.

Credits (Lecture-Practice-Self-Study)

TASPHD 523 Education for All: ASEAN Way Towards Education Sustainability 2(2-0-4)

Strategic approaches to sustainability in new international contexts, great diversity of sustainable Asia, education policy and management frameworks for ASEAN, internalisation and internationalisation of ASEAN education, micro and macro trends and the shaping of education development in ASEAN, demand for education, access, equality and equity in ASEAN

Credits (Lecture-Practice-Self-Study)

TASPHD 524 Integrating Science and Technology for Regional Cooperation 2(2-0-4)

Strategies and policies of the ASEAN member states (AMS) in the area of science and technology, regional competitiveness and challenges in advanced technologies and services in ASEAN, regional sustainability and the future of science and technology policy in ASEAN, evolution and contemporary problems in science and technology policy in ASEAN, democratising process for regional science and technology policy, the management of risk and uncertainty in science and technology cooperation in ASEAN

Credits (Lecture-Practice-Self-Study)

TASPHD 525 Creative Economy and The Future of ASEAN 2(2-0-4)

Creative economy, history, concepts definition, and its policy implication for ASEAN, regulating the regional creative economy and the dynamics of economics, politics, economics, cultures and technology for ASEAN creative economy, creative economy policy and a complex marriage of business, politics and cultures, nature and importance of the creative industries in ASEAN, role of the state and market in creative industrial development.

Credits (Lecture-Practice-Self-Study)

TASPHD 526 Entrepreneurship, Risks, Laws and Business Essentials for Cross Border Economic Relations in ASEAN 2(2-0-4)

Business cultures in ASEAN countries, economic integration, trade and monetary policy in ASEAN, doing business in ASEAN and AEC, business ethics and social responsibility for ASEAN, the political economy of ASEAN, conflicts, crises, and change, international business law for ASEAN.

Credits (Lecture-Practice-Self-Study)

TASPHD 527 Doing Business in ASEAN and AEC 2(2-0-4)

Importance of ASEAN; economical conditions; opportunities and barriers analysis of ASEAN; competitiveness of ASEAN; countries; operating business in ASEAN countries; Cooperation with external countries and opportunities.

Credits (Lecture-Practice-Self-Study)

TASPHD 528 ASEAN External Relations: Harmony in Diversity 2(2-0-4)

ASEAN in the global economy, characteristics of ASEAN foreign policies, ASEAN's external relations with other regional cooperation, ASEAN and big powers and assessment of ASEAN engagement of big powers in global and regional situation, China, Japan, the United States, and ASEAN integration, ASEAN and external relations with the south

Credits (Lecture-Practice-Self-Study)

TASPHD 529 Globalization and Local Identity in Southeast Asia 2(2-0-4)

The theory of globalization and modernity, colonialism and orientalism; post-colonialism and the rise of the "third world" as international political forces; developmentalism; nationalism; the nation state and bureaucracy, communist movements and other counter state movements; religious movements as counter monopolized modernity; gender and class in Southeast Asia; popular culture in Southeast Asia.

Credits (Lecture-Practice-Self-Study)

TASPHD 530 ASEAN and Sustainable Energy 2(2-0-4)

ASEAN' s policies and practices on energy production technologies, wind energy, solar cell, biogas process, a bioethanol production process technology, biodiesel production process technology, biohydrogen principles and future perspectives, and other alternative energy sources. Common regional outlook and its international cooperation for promoting sustainable energy

Cluster 4: Language Cluster

Credits (Lecture-Practice-Self-Study)

TASPHD 531 Basic ASEAN Language of Choice 2(2-0-4)

Reading aloud and writing the ASEAN languages' characters (language of choice); comprehension of basic grammar and sentence structures; practice single-sentence listening, speaking, reading, and writing.

Credits (Lecture-Practice-Self-Study)

TASPHD 532 Basic Listening and Speaking ASEAN Language of Choice 2(2-0-4)

Practice listening and speaking in ASEAN languages (language of choice) , with a focus on vocabulary and sentence patterns. Conversations in general

Credits (Lecture-Practice-Self-Study)

TASPHD 533 ASEAN Language of Choice for Basic Communication 2(2-0-4)

The alphabet of the ASEAN languages (chosen), fundamental vocabulary, idioms, and sentence patterns, as well as speaking, listening, reading, and writing skills in telling or chatting about everyday life issues

Credits (Lecture-Practice-Self-Study)

TASPHD 534 Basic Chinese Language 2(2-0-4)

Vowels, consonants, tones, and the Chinese Pinyin phonetic system are all included in the Mandarin Chinese phonemes; The fundamental principles of writing Chinese characters; At least 100 Chinese characters should be studied.

Credits (Lecture-Practice-Self-Study)

TASPHD 535 Basic Chinese Listening and Speaking 2(2-0-4)

Practice listening and speaking with a focus on vocabulary and sentence structures; general dialogues

Credits (Lecture-Practice-Self-Study)

TASPHD 536 Chinese Language for Basic Communication 2(2-0-4)

Chinese Standard Transcription System (Pinyin System) ; Characters, vocabulary, phrases, and fundamental sentence structures in Chinese in telling or discussing ordinary things, speaking, listening, reading, and writing skills about everyday life issues

Credits (Lecture-Practice-Self-Study)

TASPHD 537 Creative Communication Skills 2(2-0-4)

Fundamentals of communication; Communication, both verbal and nonverbal; communication talents that are both creative and effective in a range of sectors; communication between cultures; Communication via social media; digital literacy

Dissertation

Plan 1(1.1): Research Only (for students with Master's Degree)

Credits (Lecture-Practice-Self-Study)

TASPHD 991 Dissertation 48 (0-192-0)

Research training and practice dissertation; identification of research interest and research questions, literature review, schema development, knowledge gap exploration, critical rationale development, problem-solving skills exercise, technological development or innovation by research process complying to the international standard; research conduct with concern of research ethics; data collections, data analyses, interpretations and discussions of the results, dissertation writing, dissertation examination, and publications of research in peer-review national or international journals or patent registration or an innovation in a form of product, process, knowledge, service, or other applicable forms

Plan 2(2.1): Coursework and Research (for students with Master's degree)

Credits (Lecture-Practice-Self-Study)

TASPHD 992 Dissertation 36 (0-144-0)

Research training and practice dissertation; identification of research interest and research questions, literature review, schema development, knowledge gap exploration, critical rationale development, problem-solving skills exercise, technological development or innovation by research process complying to the international standard; research conduct with concern of research ethics; data collections, data analyses, interpretations and discussions of the results, dissertation writing, dissertation examination, and publications of research in peer-review national or international journals or patent registration or an innovation in a form of product, process, knowledge, service, or other applicable forms.

Plan 2(2.2): Research Only (for students with Bachelor's Degree)

Credits (Lecture-Practice-Self-Study)

TASPHD 993 Dissertation 48 (0-192-0)

Research training and practice dissertation; identification of research interest and research questions, literature review, schema development, knowledge gap exploration, critical rationale development, problem-solving skills exercise, technological development or innovation by research process complying to the international standard; research conduct with concern of research ethics; data collections, data analyses, interpretations and discussions of the results, dissertation writing, dissertation examination , and publications of research in peer-review national or international journals or patent registration or an innovation in a form of product, process, knowledge, service, or other applicable forms

Section 9 Introduction to Associated National Institutes

- National Astronomical Research Institute of Thailand (NARIT)

NARIT is one of leading national research institute under the supervision of the Ministry of higher Education, Science, Research, and Innovation based in Chiang Mai. NARIT carries out astronomical, atmospheric and space research and development with competitive facilities such as Thai National Observatory (TNO) at a 2,457m site on Doi Inthanon, with 2.4-meter telescope and Thai National Radio Observatory (TNRO) with 40-meter telescope at Huai Hong Krai, Chiangmai which are currently the largest of its kind in South East Asia. NARIT also has other facilities throughout the country and abroad such as Regional Observatories for the Public (ROP) located in Songkhla, Chachoengsao, and nakornratchasima, Thai Southern Hemisphere Telescope (TST) located in Chile and Thai Robotic Telescope Network (TRT) located in USA, China and Australia.

Apart from above facilities, NARIT has developed key laboratories for supporting research and innovation (for both internal and external demands from universities, public and private sectors), and also for enhancing those facilities mentioned above. The laboratories at NARIT are listed as follows,

- Optics and Photonics
- Radio Frequency Technology
- Mechatronics
- High Precision Machining
- High Performance Computing and Data Science

NARIT welcome and offers opportunities to graduate students, research assistants and engineers to conduct research and development on the dissertation topics mentioned in section 4.

For further information about NARIT, please visit
https://www.narit.or.th/index.php/en-home

• Synchrotron Light Research Institute, (SLRI)

Synchrotron Light Research Institute (SLRI) is a Public Organization under the supervision of the Ministry of Higher Education, Science, Research, and Innovation. The institute operates the Siam Photon Source (SPS), a 1.2 GeV synchrotron light source and the first synchrotron facility of Thailand. As a brief history, the Siam Photon Project was approved by the government of Thailand in 1996 to develop the SPS. Major parts of the source were transferred from the shutdown SORTEC laboratory, Japan. The storage ring was redesigned for 1.2 GeV operation. The Siam Photon Project was managed by then the National Synchrotron Research Center (NSRC) which was established under the resolution of the Cabinet of the Thai Government met on 5th March 1996. At that time, the Cabinet agreed on the establishment of the NSRC Project under supervision of the Ministry of Science, Technology and Environment. The project aimed at promoting basic and applied scientific research in Thailand. The NSRC was located at the Technopolis of Suranaree University of Technology in Nakhon Ratchasima. Later, the Synchrotron Light Research Institute (SLRI) was established to replace the NSRC.

SLRI provides synchrotron characterization techniques and complimentary facilities at the Siam Photon Laboratory (SPL) for both national and international users from academic and industrial sectors. Our missions are conducting research, providing service, and promoting knowledge transfer and learning in synchrotron radiation, applications, and related technology. A vision of SLRI is to be an ASEAN's leader in synchrotron science, supporting food, agricultural, and industrial development. The wide spectral range of synchrotron light, with photon energy spanning from infrared to X-ray make it an indispensable investigating tool for a variety of applications including materials science, chemistry, physics, engineering, life science, archeological science, earth science, and environmental science.

SLRI offers opportunities to researchers, undergraduate, and graduate students for synchrotron research experiments and accelerators with scientific supports from SLRI accelerator physicists and beamline scientists.

For further information about SLRI, please visit https://www.slri.or.th/en/

• Thailand Institute of Nuclear Technology (Public Organization) (TINT)

Thailand Institute of Nuclear Technology (TINT) is a public organization under the supervision of the Ministry of Higher Education, Science, Research, and Innovation. TINT was established in April 2006, as a separate entity from its sibling nuclear regulatory body, the Office of Atoms for Peace. TINT focuses on peaceful nuclear research and offer services to the public by utilizing various nuclear and radiation technologies. TINT has three branches with the main office in Nakorn Nayok. Currently, TINT has about 340 employees.

TINT has rather unique facilities and infrastructures, including nuclear research reactor, electron accelerators, 30-MeV Cyclotron, tokamak, nuclear waste management and industrial gamma radiators; many of them are the only facilities in the country and some even in ASEAN. In addition to the possibilities to access these unique facilities, TINT also equips with irradiation units, radiation hardness tests and calibration labs, engineering workshops, and high-performance computing center.

Broad range of research and service area are open and well connected at TINT. Irradiation units to remove insecticide and pesticide from fruits and food before exporting, to sterilize fruit insects for supporting food security. Various radiation types for materials and gem modification are also available with well-equipped analytical tools. Radio-isotope productions for pharmaceuticals and medical imaging are carried out on routine basis by using research reactor. Expansion of these services has been requested to help more patients better access at reasonable cost; this includes our new cyclotron center. Non-destructive evaluation by nuclear technology is available at hands for inspecting oil or gas column without ever stopping their operation; both on- and off-shore are available upon requested. Fighting climate changes and prolonging global warming are projected with alternative and non-carbon energy source. TINT can also offer fusion technology and engineering as a platform for training and up-skill fusionists.

TINT is working closely with domestic advanced engineering partners like SLRI, NARIT, etc. and with international organizations such as IAEA for scientific visits, training, internships, workshops, and conferences. TINT has very strong international network, e.g., ITER and CEA in Frances, ASIPP in China, NIFS in Japan where exchanging experts and personnel, research visits and internships are supported regularly.

TINT welcomes young mind, enthusiasts and alike to explore and start up new advanced nuclear sciences, technology innovation and utilization.

For further information about TINT, please visit https://www.tint.or.th/

- National Science and Technology Development Agency (NSTDA)

The National Science and Technology Development Agency (NSTDA) was established in 1991 under the National Science and Technology Development Act 1991. The agency is affiliated to the Ministry of Higher Education, Science, Research and Innovation and reports to the NSTDA Governing Board, chaired by Minister of Higher Education, Science, Research and Innovation.

NSTDA is entrusted with an important task to accelerate science, technology and innovation development in Thailand in order to respond to the need of the industry and enhance the country's competitiveness in the global economy, and as a result, making contribution to national economic and social development. The Institute's mission is to perform and support Research and Development, Design and Engineering, Technology Transfer, Science and Technology Human Resource Development, and Infrastructure Development. The institute's mission is implemented through working with partners from academic, government, private, and non-government sectors, both domestically and internationally.

NTSDA offers opportunities to undergraduate and graduate students to carry out thesis/dissertation research in their respective laboratories with NSTDA's researchers.

NSTDA research laboratories are located in 5 national research centers, 5 national science and technology infrastructures, and 3 focus centers as the followings:

National research centers:

- National Electronics and Computer Technology Center (NECTEC)
- National Center for Genetic Engineering and Biotechnology (BIOTEC)
- National Metal and Materials Technology Center (MTEC)
- National Nanotechnology Center (NANOTEC)
- National Energy Technology Center (ENTEC)

National Science and Technology Infrastructure:

- National Biobank of Thailand (NBT)
- National Omics Center (NOC)
- NSTDA Supercomputer Center (Thai SC)
- Technology and Informatics Institute for Sustainability (TIIS)
- Thai Microelectronics Center (TMEC)

Focus centers:

- Assistive Technology and Medical Services Research Center (A-MED)
- National Security and Dual-Use Technology Center (NSD)
- Rail and Modern Transports Research Center (RMT)

See More Info https://www.nstda.or.th/en/