

Course Detail

Master of Science Program in Smart Grid Technology

Course Title:	Master of Science Program in Smart Grid Technology
Master Degree:	M.S. Master of Science Program in Smart Grid Technology
Academic Institution:	Naresuan University, School of Renewable Energy and Smart Grid Technology
Duration:	Two (2) Years (Academic year 2021-2023). Master Course will start in June 2021 and end in May 2023

Background and Rational:

To be knowledgeable, skillful, competitive, innovative and dynamic infrastructure experience in smart grid technology worldwide to handle and deal with the great energy disruption

Objectives:

- Keen in knowledge, skills, and experiences in smart grid technology and able to integrate smart grid technology with other relevant technology focusing on the smart grid technology development for the benefits of the nation
- Competent in smart grid technology research in a systematic
- Equipped with an inquiry mind and professional ethics.

Course Synopsis and Methodology:

1. Structure of the Program

1.1 Credit Requirement*

Requirements	Plan A Type A2
Coursework	24
- Core Courses	12
- Electives	12
Required Non-Credit courses	5
Thesis	12
Independent Study	-
Total	36

* Minimum credits required.

1.2 Core Course

Requirements	Plan A Type A2	
	Course No.	Credits
Energy Source and Energy Management	853504	3
Smart Grid Infrastructure and Planning	853505	3
Smart Grid Technology	853506	3
Information and Communication Technology for Smart Grid	853507	3
Total	4	

1.3 Electives

Requirements	Plan A Type A2	
	Course No.	Credits
Digital and Computer Application	853511	-
Algorithm and Energy Management Software for Smart Grid	853512	-
Communication Infrastructure for Smart Grid	853513	-
Renewable Energy Power Generation	853521	-
Micro grid System	853522	-
Power Electronic Converters for Smart Grid	853523	-
Electric Vehicle Technology	853524	-
Power Electronics Converters for Renewable Energy Sources and Storages	853525	-
Energy Storage System for Smart Grid	853531	-
Hydrogen and Fuel Cell Technology for Smart Grid	853532	-
Business Management for Smart Grid	853541	-
Smart Grid Economic	853542	-
Smart Grid for Community Infrastructure	853543	-
Community Smart Micro Grid Technology	853544	-
Economic Policy Formulation of Smart Grid	853545	-
Selected Topics in Smart Grid Technology	853546	-
Total	16	≥ 12

1.4 Required Non-Credit Courses.

Requirements	Plan A Type A2	
	Course No.	Credits
Research Methodology in Science and Technology	853501	3
Seminar 1	853502	1
Seminar 2	853503	1
Total	3	5

1.5 Thesis Credit Requirements.

Requirements	Plan A Type A2	
	Course No.	Credits
Thesis 1, Type A2	853591	3
Thesis 2, Type A2	853592	3
Thesis 3, Type A2	853593	6
Total	3	12

Study plan**The first year****First Semester**

Requirements	Plan A Type A2	
	Course No.	Credits
Research Methodology in Science and Technology	853501	Non-Credit
Energy Source and Energy Management	853504	3
Smart Grid Infrastructure and Planning	853505	3
Smart Grid Technology	853506	3
Total	4	9

Second Semester

Requirements	Plan A Type A2	
	Course No.	Credits
Information and Communication Technology for Smart Grid	853507	3
Elective Course	853xxx	3
Thesis 1, Type A 2	853591	3
Seminar 1	853502	Non-credit
Total	4	9

The second year
First Semester

Requirements	Plan A Type A2	
	Course No.	Credits
Elective Course	853xxx	3
Elective Course	853xxx	3
Thesis 2, Type A 2	853592	3
Independent Study 1	-	-
Seminar 2	853503	Non-credit
Total	4	9

Second Semester

Requirements	Plan A Type A2	
	Course No.	Credits
Elective Course	853xxx	3
Thesis 3, Type A 2	853593	6
Independent Study 2	-	-
Total	2	9

2. Course Content

853501 Research Methodology in Science and Technology 3(3-0-6)

Characteristics and research goals, types and research processes, variables and hypothesis, collecting data, proposal and research writing, research evaluation and its application, ethics of researcher, proper techniques of research methodology in science and technology

853502 Seminar 1 1(0-3-1)

Emphasize on encouraging students to learn how to search, criticize the articles and published papers, and practice the oral presentation on selected topics of current research or thesis progress in smart grid technology

853503 Seminar 2 1(0-3-1)

Presentation and discussion of current research topics related to smart grid technology with precise topic and content

853504 Energy Source and Energy Management 3(2-3-5)

Energy infrastructure, energy sources, centralized generation during base load, intermediate load and peak load; load profile in city, community, industrial factory, office building and residence, electricity from renewable energy, energy demand and supply; demand response, decentralized generation from renewable energy, energy management system (HEMs, BEMs, FEMs, CEMs); low carbon interventions of micro-generation and electric vehicles (EVs), zero net energy, zero net emission, policy and regulatory framework for smart grids

853505 Smart Grid Infrastructure and Planning 3(2-3-5)

Smart grid infrastructure logistics and transportation for oil, gas, coal from sources to power plants around the world, modern forms of transmission lines for electrical energy instead of fuel transportation, electricity generation from renewable energy sources that is available in local area, the limited problems of traditional electricity transmission lines from renewable energy, decentralized generation connected with transmission lines, connection of the transmission lines in international, domestic and community levels, smart grid policies in different countries, incentives mechanism for smart grid deployment

853506 Smart Grid Technology 3(2-3-5)

Centralized and distribution generation, distributed generation connected with transmission lines, traditional transmission lines and smart grid system , information and communication technology (ICT), distribution management systems with smart metering, storage technology, EV, smart grid system for managing electricity use in smart building, electricity customer-side systems

853507 Information and Communication Technology for Smart Grid 3(2-3-5)

Information and communication technology, power system information, Smart Grid communication infrastructures, network coding (NC), compressive sensing (CS), communication architecture, communication application for smart grid, active network wireless communication information, array record and control electronic component, energy flow monitoring, power demand and supply status

853511 Digital and Computer Application 3(2-3-5)

Introduction to digital system, analysis of logic circuit and Boolean algebra, logic circuit design, number system and digital code, counter circuit and application, algorithms and logic circuits for processing, digital computer, microprocessors and microcomputer, application software for measurement, smart grid control system network, interface, data management and evaluation, monitoring and display

853512 Algorithm and Energy Management Software for Smart Grid 3(2-3-5)

Algorithm of electricity management from renewable energy, logic and priority of energy production; type of load profile, software development processes concepts, software system analysis and design; database system, network transport protocol, Socket programming, Real-time networking, Devices and gateways for smart grid

853513 Communication Infrastructure for Smart Grid 3(2-3-5)

Network architecture, data communication and network, power system information, smart grid communication applications for power monitoring system, wide-area communication network, wireless networks for smart grid applications, data security system in smart grid communications and networking

- 853521 Renewable Energy Power Generation 3(2-3-5)**
Renewable energy power generation technology in Smart Grid, constraint and algorithm of the power production from solar energy, wind energy, hydro energy and biomass, grid interconnection from renewable energy, intelligent demand response (DR) for energy management system (EMS), weather forecasting for energy usage and storage in battery by using smart grid management system, photovoltaic power generation in smart grid system, renewable energy power generation planning for community
- 853522 Microgrid System 3(2-3-5)**
Microgrid definition as in smart grid context, role and advantage of microgrid, architecture and components of microgrid, microgrid design and sizing, distribution generation and power quality control in microgrid, algorithm and demand response (DR) and energy management system (EMS) for smart microgrid
- 853523 Power Electronic Converters for Smart Grids 3(2-3-5)**
Power electronic devices, fundamental of power converters, pulse width modulation switching technique, AC-DC converters, DC-AC converters, DC-DC converters, wind energy inverters, photovoltaic inverters, electric vehicle battery chargers, battery inverters, control systems of power converters
- 853524 Electric Vehicle Technology 3(2-3-5)**
Electric vehicle evolution, criterion of internal combustion and electric vehicle, power train structures, traction motors, traction battery, power converters, battery chargers, charging infrastructure, vehicle to grid (V2G) and grid to vehicle (G2V) operations
- 853525 Power Electronics Converters for Renewable Energy Sources and Storages 3(2-3-5)**
Grid integrated converters for renewable energy and storage devices, modeling and control of power converters, grid connection standards, grid synchronization techniques, islanding detection, maximum power point tracking methods
- 853531 Energy Storage System for Smart Grid 3(2-3-5)**
World energy storage system and advantage, electro-physics and electro-chemical constraint of various battery, energy storage system algorithm for reducing the electrical fluctuation from renewable energy source, algorithm of battery storage for charging and quick discharging, immediately demand response, electrical reliability of energy storage system for smart grid, EV charging station planning, large-scale energy storage system in smart grid

- 853532 Hydrogen and Fuel Cell Technology for Smart Grid 3(2-3-5)**
Concepts of hydrogen production and hydrogen energy carrier, utilization of hydrogen, hydrogen transportation and storage, safety and environmental impacts of hydrogen, principles of fuel cell, delivering fuel cell power, applications and control algorithm of hydrogen and fuel cell systems connected to smart grid
- 853541 Business Management for Smart Grid 3(2-3-5)**
Electricity system markets and regulation, distribution system operators for smart grid, smart grid market, market efficiency, trading mechanisms, smart grid investment costs and operating savings, real time pricing, energy billing, supply and value chain in smart grid system, dynamic business model for prosumer, scenario schemes for smart grids
- 853542 Smart Grid Economic 3(2-3-5)**
Energy forecasting, power generation and consumer power demand, smart grid cost and benefit categorization, operation of the uncertain renewable energy resources, chargeable and dischargeable storage, network loss and security constraints, scoping and measuring impacts, impact attributable to investments, monetizing smart grid benefits and costs, value of demand response, the cost to maximize smart grid benefits
- 853543 Smart Grid for Community Infrastructure 3(2-3-5)**
Type of community, urban, suburb and rural community, Load profile analysis of communities, Smart grid for electricity management from renewable energy in community, Home and Building energy management, IT and Communication management for load balance and demand response (DR)
- 853544 Community Smart Micro Grid Technology 3(2-3-5)**
Level of transmission line, national grid, micro grid, electrical operation model for grid connection and island mode, island smart micro grid from renewable energy source, substation of smart micro grid, smart micro grid for campus power, independent smart micro grid for smart community and smart farming
- 853545 Economic Policy Formulation of Smart Grid 3(2-3-5)**
Smart grid market, energy industry and network operator and stakeholder, government roles in smart grid, policy formation and transition for smart grid issues, policies formulating analysis and trends in different countries, policy Impact assessment, regulatory incentives for smart grid deployment, energy budget and trade, risk analysis and management, future market and contract of electricity, optimization of smart grid technology deployment under domestic and international context

- 853546 Selected Topics in Smart Grid Technology 3(2-3-5)**
New knowledge in smart grid technology based on current interest such as Artificial Intelligence, Big data analysis, Block chain technology and Internet of things
- 853581 Independent Study 1 2 Credits**
Structural and formatting study of independent study including independent study proposal, literature review concerning interested topic of smart grid technology, set study problems or questions, identify independent study title for preparation of proposal
- 853582 Independent Study 2 2 Credits**
Writing independent study proposal, presenting a proposal in a seminar which will be arranged by the school, conducting the independent study
- 853583 Independent Study 3 2 Credits**
Writing a book of independent study following format of independent study guideline, presenting a defense independent study in a seminar
- 853591 Thesis 1, Type A 2 3 Credits**
Study the elements of thesis or thesis examples in the related field of study, determine thesis title, develop concept paper and prepare the summary of literature and related research synthesis
- 853592 Thesis 2, Type A 2 3 Credits**
Develop research instruments and research methodology and prepare thesis proposal in order to present it to the committee
- 853593 Thesis 3, Type A 2 6 Credits**
Collect data, analyze data, prepare progress report in order to present it to the thesis advisor, and prepare full-text thesis and research article in order to get published according to the graduation criteria

Graduation Conditions:

1. Having completed the duration of study as specified by the course
2. Having registered all courses as required by the course
3. Having passed the English proficiency test as announced by the University
 - 3.1 Paper based TOEFL: 417
 - 3.2 Internet based TOEFL: 35
 - 3.3 International English Language Testing System (IELTS): 5.0
 - 3.4 CU-TEP: 54
 - 3.5 Cambridge Placement Test (CEPT): B1(37)
 - 3.6 Naresuan University Standard English Test (NU-SET): 85
 - 3.7 Naresuan University Writing Proficiency Test (NU-Writing): 60

4. Having completed all courses and passed all conditions as specified in the course
5. Having a grade point average of not less than 3.00
6. Having proposed the thesis defense and passed the final oral thesis defense
7. The thesis or a part of it must be published or accepted as full paper publication by a national or international journal, which is in the database of ISI Web Science or the SCOPUS journal list and must publish at least one study for master level.

Applicant Qualifications:

This program is open to applicants who have a bachelor degree in Engineering, Science, Applied Science and bachelor degree in any relevant field, or are in the final semester of their study

Document Required:

1. The Application Form affixed with colored photographs.
2. A letter of recommendation or a reference
3. A copy of Educational certificate
4. A copy of an Academic transcript
5. A copy of Personal Identity Card or Official Staff Card.
6. A copy of English languages certificates e.g. TOEFL, IELTS, or CU-TEP or NULC (if any)
7. Document to certify change of name or surname and/or marital status (if any).
8. Other supporting document

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***The application procedure will complete when TICA has received the hard copy of the application form and other related documents through the Royal Thai Embassy/Permanent Mission of Thailand to the United Nations/Royal Thai Consulate – General accredited to eligible countries/territories.