Course Detail

1. Course Title: Doctor of Philosophy Program in Smart Grid Technology

2. Master Degree: Doctor of Philosophy (Smart Grid Technology) /
Ph.D. (Smart Grid Technology)

3. Academic Institution: Naresuan University,
School of Renewable Energy and Smart Grid Technology (SGtech)

4. Duration: Three (3) Years

5. Language: ☐ English ☑ Bilingual (Thai-English)

6. Background and Rational:

The program aims to encourage and develop students to integrate between systematically knowledge of smart grid technology and other related sciences for their research. Our students can create new knowledge and innovations that can find the solutions of the exponential technology and emerge the smart grid technology application responded to the potential of energy consumption also related all level networking to the national energy problems, regional and global scenarios.

7. Objectives:

The purpose of the Ph.D. program in Smart Grid Technology is to empower and enable students to develop advanced knowledge and skills in order to become leaders and managers in the smart grid technology sector. Desirable characteristics are as follows:

- Keen in knowledge, skills, and experiences in advanced smart grid technology and able to integrate all personal assets for the benefits of the nation
- Competent in smart grid technology research in a systematic way to create innovations and new knowledge in the field
- Equipped with an inquiry mind and professional ethics.

8. Course Synopsis and Methodology:

The course will be taught in English. The students must write a thesis emphasizing high quality research.

Structure of the Program

1. Credit Requirement.*

Requirements	Option 1.1	Option 2.1	Option 2.2
Coursework	-	12	24
- Core Courses	-	6	15
- Electives	-	6	9
Required Non-Credit courses	3	3	6
Dissertation	48	36	48
Total	**48**	**48**	**72**

***** Minimum credits required.

2. Core Course

Requirements	Option 1.1		Option 2.1		Option 2.2	
	Course No.	Credits	Course No.	Credits	Course No.	Credits
Distributed Generation and Energy Management for Smart Grid	-	-	853601	3	853601	3
Smart Grid Technology Infrastructures	-	-	853602	3	853602	3
Distributed Energy Resources and Management	-	-	-	-	853504	3
Smart Grid Technology	-	-	-	-	853505	3
Information and Communication Technology for Smart Grid	-	-	-	-	853506	3
Total	**-**	**-**	**2**	**6**	**5**	**15**

3. Electives

Requirements	Option 1.1		Option 2.1		Option 2.2	
	Course No.	Credits	Course No.	Credits	Course No.	Credits
Algorithm and Software for Smart Grid Management	-	-	853611	3	853611	3
Digital System and Information Technology for Smart Grid	-	-	853612	3	853612	3
Networking and Communication for Smart Grid	-	-	853613	3	853613	3
Monitoring and Advance Metering Infrastructure (AMI)	-	-	853614	3	853614	3
Advance Information and Communication Technology for Smart Grid	-	-	-	-	853615	3
Advanced Power Electronic for Smart Grid	-	-	853621	3	853621	3
Advanced Soft Computing and Optimization Technique for Smart Grid	-	-	853622	3	853622	3
Multiple Distributed Smart Microgrids	-	-	853623	3	853623	3
Power System Stability and Electrical Power System Protection	-	-	-	-	853624	3
Photovoltaic System in Smart Grid Network	-	-	-	-	853625	3
Advanced Energy Storage System for Smart Grid	-	-	853631	3	853631	3
Electric Vehicle for Smart Grid	-	-	853632	3	853632	3
Fuel Cell Technology and Applications for Smart Grid	-	-	853633	3	853633	3

Requirements	Option 1.1		Option 2.1		Option 2.2	
	Course No.	Credits	Course No.	Credits	Course No.	Credits
Smart Grid Investment Strategies and Business Solutions	-	-	853641	3	853641	3
Smart Grid for Community Energy Management System	-	-	853642	3	853642	3
Total	**-**	**-**	**2**	**6**	**2**	**6**

4. Required Non-Credit Courses.

Requirements	Option 1.1		Option 2.1		Option 2.2	
	Course No.	Credits	Course No.	Credits	Course No.	Credits
Seminar 1	853603	1	853603	1	853603	1
Seminar 2	853604	1	853604	1	853604	1
Seminar 3	853605	1	853605	1	853605	1
Research Methodology in Science and Technology	-	-	-	-	853606	3
Total	**3**	**3**	**3**	**3**	**4**	**6**

5. Dissertation Credit Requirements.

Requirements	Option 1.1		Option 2.1		Option 2.2	
	Course No.	Credits	Course No.	Credits	Course No.	Credits
Dissertation 1	853681	6	853691	3	853681	6
Dissertation 2	853682	6	853692	6	853682	6
Dissertation 3	853683	9	853693	9	853683	9
Dissertation 4	853684	9	853694	9	853684	9
Dissertation 5	853685	9	853695	9	853685	9
Dissertation 6	853686	9	-	-	853686	9
Total	**6**	**48**	**5**	**36**	**6**	**48**

8.1 Study Plan

The first year

- First Semester

Requirements	Option 1.1		Option 2.1		Option 2.2	
	Course No.	Credits	Course No.	Credits	Course No.	Credits
Seminar 1	853603	Non-Credit	853603	Non-Credit	-	-
Dissertation 1, Type 1.1	853681	6	-	-	-	-
Distributed Generation and Energy Management for Smart Grid	-	-	853601	3	-	-
Smart Grid Technology Infrastructures	-	-	853602	3	-	-
Distributed Energy Resources and Management	-	-	-	-	853504	3
Smart Grid Technology	-	-	-	-	853505	3
Information and Communication Technology for Smart Grid	-	-	-	-	853506	3
Research Methodology in Science and Technology	-	-	-	-	853606	Non-Credit
Total	**2**	**6**	**3**	**6**	**4**	**9**

- Second Semester

Requirements	Option 1.1		Option 2.1		Option 2.2	
	Course No.	Credits	Course No.	Credits	Course No.	Credits
Dissertation 1, Type 2.1	-	-	853691	3	-	-
Dissertation 2, Type 1.1	853682	6	-	-	-	-

Requirements	Option 1.1		Option 2.1		Option 2.2	
	Course No.	Credits	Course No.	Credits	Course No.	Credits
Elective Course	-	-	853xxx	3	853xxx	3
Elective Course	-	-	853xxx	3	853xxx	3
Distributed Energy Resources Generation and Energy Management for Smart Grid	-	-	-	-	853601	3
Smart Grid Technology Infrastructures	-	-	-	-	853602	3
Total	**1**	**6**	**3**	**9**	**4**	**12**

The second year

- **First Semester**

Requirements	Option 1.1		Option 2.1		Option 2.2	
	Course No.	Credits	Course No.	Credits	Course No.	Credits
Seminar 1	-	-	-	-	853603	Non-Credit
Seminar 2	853604	Non-Credit	853604	Non-Credit	-	-
Dissertation 1, Type 2.2	-	-	-	-	853691	6
Dissertation 2, Type 2.1	-	-	853692	6	-	-
Dissertation 3, Type 1.1	853683	9	-	-	-	-
Elective Course	-	-	-	-	853xxx	3
Total	**2**	**9**	**2**	**6**	**3**	**9**

- Second Semester

Requirements	Option 1.1		Option 2.1		Option 2.2	
	Course No.	Credits	Course No.	Credits	Course No.	Credits
Dissertation 2, Type 2.2	-	-	-	-	853692	6
Dissertation 3, Type 2.1	-	-	853693	9	-	-
Dissertation 4, Type 1.1	853684	9	-	-	-	-
Total	**1**	**9**	**1**	**9**	**1**	**6**

The third year

- First Semester

Requirements	Option 1.1		Option 2.1		Option 2.2	
	Course No.	Credits	Course No.	Credits	Course No.	Credits
Seminar 2	-	-	-	-	853604	Non-Credit
Seminar 3	853605	Non-Credit	853605	Non-Credit	-	-
Dissertation 3, Type 2.2	-	-	-	-	853693	9
Dissertation 4, Type 2.1	-	-	853694	9	-	-
Dissertation 5, Type 1.1	853685	9	-	-	-	-
Total	**2**	**9**	**2**	**9**	**2**	**9**

- Second Semester

Requirements	Option 1.1		Option 2.1		Option 2.2	
	Course No.	Credits	Course No.	Credits	Course No.	Credits
Dissertation 4, Type 2.2	-	-	-	-	853694	9
Dissertation 5, Type 2.1	-	-	853695	9	-	-
Dissertation 6, Type 1.1	853686	9	-	-	-	-
Total	**1**	**9**	**1**	**9**	**1**	**9**

The fourth year

- First Semester

Requirements	Option 1.1		Option 2.1		Option 2.2	
	Course No.	Credits	Course No.	Credits	Course No.	Credits
Seminar 3	-	-	-	-	853605	Non-Credit
Dissertation 5, Type 2.2	-	-	-	-	853695	9
Total	**-**	**-**	**-**	**-**	**1**	**9**

- Second Semester

Requirements	Option 1.1		Option 2.1		Option 2.2	
	Course No.	Credits	Course No.	Credits	Course No.	Credits
Dissertation 6, Type 2.2	-	-	-	-	853696	9
Total	**1**	**9**	**1**	**9**	**1**	**9**

8.2 Course Content/Study Topic:

853601 **Distributed Generation and Energy Management for Smart Grid 3(2-3-5)**

Centralized and distributed generation from renewable energy; smart grid for decentralized generation system and demand management; power trading through smart meter, energy capability (demand, generation, and storage), design aspects for smart grid energy management system, intelligent demand response(DR) energy management system(EMS), customer-side management systems, grid energy service, customer energy service, energy service provider

853602 **Smart Grid Technology Infrastructures 3(2-3-5)**

Smart grid technology infrastructures, transmission lines management for smart grid technology; power system stability for smart grid, smart grid transmission lines management by using information technology and communication network, smart home, modern storage technology, smart meter, Electric Vehicle; building automation systems

853603 **Seminar 1 1(0-2-1)**

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 in smart grid in order to develop it into a dissertation title.

853604 **Seminar 2 1(0-2-1)**

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

853605 **Seminar 3 1(0-2-1)**

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

853611 **Algorithm and Software for Smart Grid Management 3(2-3-5)**

Smart grid system architecture, standard and quality control of power in smart grid system, algorithm of power integration between conventional energy and renewable energy, logic and priority of load demand and load characteristics,

pseudo code for computer programming to control power electronics devices, power conversion, centralized and decentralized command systems, real-time tracking and monitoring of power systems, power connection and cut off in smart grid system

853612 Digital System and Information Technology for Smart Grid 3(2-3-5)

Digital systems and techniques design, programmable logic device, algorithms and logic circuits for processing, evaluation and simulation software, computer-aided logic design, information technology for smart grid, information technology layer for smart grid, information and database management, application software for smart grid

853613 Networking and Communication for Smart Grid 3(2-3-5)

Networking and Communication technology, smart grid communication infrastructure, power system information, machine-to-machine communication, wide-area measurement applications, wireless networks for smart grid applications, network coding (NC), compressive sensing (CS), security system in smart grid communications and networking

853614 Monitoring and Advance Metering Infrastructure (AMI) 3(2-3-5)

Monitoring and advance metering infrastructure technology, smart meter standards, AMI Metering Equipment and Communications components, smart meter measurements, networking for AMI, AMI Operations, Data security for AMI, automatic meter reading (AMR) and billing, Cost benefit analysis, AMI Implementation Benefits

853621 Advanced Power Electronic for Smart Grid 3(2-3-5)

Voltage Source and Current Source Converters, multi-level converters, grid integrated converters for renewable energy and storage devices, power converters for FACT devices and HVDC systems, grid synchronization techniques, islanding detection, low voltage ride through (LVRT) operation, modeling and control of power converters

853622 Advanced Soft Computing and Optimization Technique for Smart Grid 3(2-3-5)

Applications of artificial intelligence in smart grids, load forecasting, generation prediction, optimized operations among sources, consumers and storages, AI for grid stability monitoring and diagnosis, decision making of power flow, EV charging scheduling and prioritizing, real time pricing calculation

853623 Multiple Distributed Smart Microgrids 3(2-3-5)

Overview of multiple distributed smart microgrid, architecture of multiple distributed smart microgrid, self-autonomous control, control strategies for multiple distributed smart microgrid, energy forecast, harvesting and planning for multiple distributed smart microgrid, economics of multiple distributed smart microgrid, business innovation from multiple distributed smart microgrid

853631 Advanced Energy Storage System for Smart Grid 3(2-3-5)

Electrical energy storage system, electrical energy storage technology and applications, Reliability impact of power system for energy storage integrated with intelligent operating strategy, decentralized energy storage in residential feeders with independent photovoltaic operation, large-scale battery storage system in energy and reserve market

853632 Electric Vehicle for Smart Grid 3(2-3-5)

Worldwide electric vehicle in the future, Electric vehicle components, Autonomous Vehicle, Self-driving car technology for autonomous vehicle, Algorithm for Advanced vehicle to grid (V2G) and grid to vehicle (G2V) operations, Algorithm for charging and discharging management of battery for electric vehicle

853633 Fuel Cell Technology and Applications for Smart Grid 3(2-3-5)

Technology and applications of fuel cell for power generation, Fuel cell grid connected, algorithm for fuel cell management in smart grid system, new approach for fuel cell system development and its appropriate applications with smart grid system connection

853641 **Smart Grid Investment Strategies and Business Solutions** **3(2-3-5)**

Integration of technical and financial data, Forecasting, real-time time series forecasting, real-time flexibilities in energy supply and demand, regulations and policy reforming, simulation for decision, multidimensional model, network optimization, dynamics modeling, analytics for marketing and planning, smart grid data analytics for business intelligence

853642 **Smart Grid for Community Energy Management System** **3(2-3-5)**

Community load profile, Electrical production on grid connected system and stand-alone system, community micro grid infrastructure, Electricity production management by ITC for community, Distribution system, Development of community smart grid infrastructure technology based on with national policy, Developing potential and trends of community smart grid in the present, future and domestic, foreign countries

853681 **Dissertation 1, Type 1.1** **6 Credits**

Study the Elements of thesis, review literature and related research, and determine thesis title

853682 **Dissertation 2, Type 1.1** **6 Credits**

Develop concept paper and prepare the summary of literature and related research synthesis

853683 **Dissertation 3, Type 1.1** **9 Credits**

Develop research instruments and research methodology, and prepare thesis proposal in order to present it to the committee

853684 **Dissertation 4, Type 1.1** **9 Credits**

Collect data and report the progress of the thesis to the thesis advisor

853685 **Dissertation 5, Type 1.1** **9 Credits**

Analyze data and prepare a draft of the thesis

853686 **Dissertation 6, Type 1.1** **9 Credits**

Prepare full-text thesis and research article in order to get published according to the graduation criteria

853691 **Dissertation 1, Type 2.1** **3 Credits**

Study the elements of thesis, review literature and related research, and determine thesis title

853692 **Dissertation 2, Type 2.1** **6 Credits**

Develop concept paper and prepare the summary of literature and related research synthesis

853693 **Dissertation 3, Type 2.1** **9 Credits**

Develop research instruments and research methodology and prepare thesis proposal in order to present it to the committee

853694 **Dissertation 4, Type 2.1** **9 Credits**

Collect data, analyze data, and prepare a draft of the thesis

853695 **Dissertation 5, Type 2.1** **9 Credits**

Prepare full-text thesis and research article in order to get published according to the graduation criteria

9. Graduation Condition: In accordance with the Graduate School Rules and Regulations.

10. Applicant Qualification:

This program is open to applicants who have a degree in any field with experience in the field of smart grid technology or occasionally grant at the discretion of the Program Committee.

11. Document Required:

Applicant can fill required information in the application form and send it with these enclosed document:

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 iBT, IELTS, TOEIC, TEC-W Score, 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

12. Contact:

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