

**Master of Engineering Program
in Water Resources Engineering
International Program
(New Program B.E.2552)**

1. Program Title:

- Title in Thai:** หลักสูตรวิศวกรรมศาสตรมหาบัณฑิต
สาขาวิศวกรรมทรัพยากรน้ำ (หลักสูตรนานาชาติ)
- Title in English:** Master of Engineering Program
in Water Resources Engineering
(International Program)

2. Degree Title:

- a. **Full Title in Thai:** วิศวกรรมศาสตรมหาบัณฑิต
(วิศวกรรมทรัพยากรน้ำ)
- b. **Full Title in English:** Master of Engineering
(Water Resources Engineering)
- c. **Abbreviated Title in Thai:** วศ.ม.(วิศวกรรมทรัพยากรน้ำ)
- d. **Abbreviated Title in English:** M.Eng.
(Water Resources Engineering)

3. Authorized Organizations:

- a. Faculty of Science and Technology, Nakhon Pathom Rajabhat University, Thailand and
- b. Department of Geohydraulics and Engineering Hydrology, Faculty of Civil Engineering, University of Kassel, Republic of Germany

4. Philosophy and Objective of the Curriculum

4.1 General Statement and Synopsis

This program of learning has been established as a joint collaborative venture between Nakhon Pathom Rajabhat University (NPRU), Thailand and the University of Kassel in the Republic of Germany (UNIK). The aim is to provide education for graduate engineers in the various sciences related to water resources and environmental management and to help them develop and apply this knowledge for the sustainable management of water and environmental resources with a view of serving both the public and private sectors of Thailand and other Asian countries.

4.2 Objectives

The primary objectives of this program are to produce graduate students who:

- 4.2.1 have strong academic and research capabilities for the management of water resources in a sustainable manner.
- 4.2.2 have the skills and are able to understand modern technology, the knowhow, and the innovative research skills in which they can apply those mentioned to deal with issues of sustainable water resources management.
- 4.2.3 are professionally moral and ethical.

5. Program Commencement

The program will initially enroll students onto this program in the first semester of the academic year 2009.

6. Applicant Qualifications

There are two recognized methods of entry onto this program for graduates with either:

6.1 Type A:

6.1.1 A Bachelor of Engineering (B.Eng) in Civil Engineering, Irrigation Engineering, Water Resources Engineering, Agricultural Engineering or equivalent.

6.1.2 Applicants who meet the regulation of Nakhon Pathom Rajabhat University of graduate study B.C. 2005.

6.1.3 Applicants must satisfy one of the following English proficiency requirements:

- A TOEFL® score of at least 450 (PBT), or 133 (CBT), or 45 (iBT), or
- IELTS score of at least 4.
- CU-TEP score of at least 45.

6.2 Type B:

6.2.1 A Bachelor of Science (B.Sc.) in Geology, Geotechnology, Environment Science or other related fields.

6.2.2 Applicants who meet the regulation of Nakhon Pathom Rajabhat University of graduate study B.C. 2005.

6.2.3 Applicants must meet the English proficiency requirements as title 6.1.3.

7. Admission

Admission to the course will be in accordance with the dates announced by the office of Graduate Studies School of Nakhon Pathom Rajabhat University.

8. Educational System

8.1 Educational Management System

Studies will be held at the two collaborating universities. During the first and second semester of the first academic year study will take place at Nakhon Pathom Rajabhat University and in the second year, the first and/or second semester, will take place at the University of Kassel in Germany.

At Nakhon Pathom Rajabhat University:

There are study routes available for completion of this master's degree. The first is the Thesis program (แผน ก แบบ ก (2)) and the second an Independent Study program (แผน ข). All course material, lectures and tuition is delivered solely in the English language.

8.1.1 Thesis Program (แผน ก แบบ ก (2))

The university uses a two-semester academic year comprising two regular 15-week semesters that usually run from June to October and November to March. Alternatively the course can run for one regular semester and a summer period, which is equivalent to a regular 15-week semester. The beginning of each semester will be in line with the announcement made by Nakhon Pathom Rajabhat University. This program must meet the requirements as follows:

8.1.1.1 To fulfill the requirements of the degree students must pass at least 36 credit courses from the curriculum. This will be made up from 12 credits from core courses, 12 credits from elective courses and 12 credits from the thesis. A student must have an advisory committee comprised of at least two people: the main advisor who is a permanent faculty member of the university, a Ph.D. holder or has an academic position of at least Associate Professor in the field of Water Resources Engineering or related areas and must have research experience which is not any part of their education; at least one co-advisor who is similarly qualified to the main advisor and is approved by the curriculum committee. During study, a student must propose their study plan to the advisory committee for approval.

8.1.1.2 Students must propose their thesis study plan to their advisory committee for approval. Students are entitled to register for their thesis after having successfully completed their first semester of study and at least nine credits of the core/prerequisite courses, acquired a G.P.A. of at least 3.00 and passed the thesis proposal with at least a "P" grade.

8.1.1.3 The thesis proposal examination is by oral presentation.

8.1.1.4 Thesis examination takes place after a student has successfully passed the thesis proposal examination and completely registered the thesis credits as specified in the curriculum. The thesis examination can be made by oral presentation to the thesis examination committee, which will be composed of the main advisor, co-advisor and at least one external specialist in the relevant field who is appointed by the committee of the office of Graduate Studies School and who has similar qualifications to the advisor at 8.1.1.1.

8.1.1.5 Thesis examination must be synchronized with the general regulations of graduate education management of Nakhon Pathom Rajabhat University B.E. 2005.

8.1.1.6 The presented Thesis must be written in the English Language either British or American style.

8.1.1.7 Students must prepare an academic article from their thesis for publishing in a journal or make an oral presentation at a conference which has a published proceedings book and is also accepted by the relevant academic professional bodies.

8.1.2 Independent Study (แบบ ๗)

The university uses a two-semester academic year comprising two regular 15-week semesters that usually run from June to October and November to March. Alternatively the course can run for one regular semester and a summer period, which is equivalent to a regular 15-week semester. The beginning of each semester will be in line with the announcement made by Nakhon Pathom Rajabhat University. This program must meet the requirements as follows:

8.1.2.1 To fulfill the requirements of the degree students must pass at least 36 credit courses from the curriculum. This will be made up from 12 credits from prerequisite/core courses, 18 credits from elective courses and 6 credits from an independent study. A student must have an advisory committee comprised of at least two people: the main advisor who is a permanent faculty member of the university, a Ph.D. holder or has an academic position of at least Associate Professor in the field of Water Resources Engineering or related areas and must have research experience which is not any part of their education; at

least one co-advisor who is similarly qualified to the main advisor and is approved by the curriculum committee. During study, a student must propose their study plan to the advisory committee for approval.

8.1.2.2 A student must propose their thesis study plan to their advisory committee for approval. Students are entitled to register for their thesis after having successfully completed their first semester of study and at least nine credits of the core/prerequisite courses, acquired a G.P.A. of at least 3.00 and passed the thesis proposal with at least a “P” grade.

8.1.2.3 Independent proposal examination is by oral presentation.

8.1.2.4 The independent study will be examined by the administrative curriculum committee through an oral interview to test the candidate’s knowledge and understanding on the relevant field.

8.1.2.5 The independent study must be written in the English Language either British or American style.

At University of Kassel:

The school year has two semesters. The Winter Semester (WS) classes usually run from the end of October until mid-February. There is a two-week break for Christmas. The Summer Semester (SS) classes begin mid-April and end in July.

8.2 Credits

8.2.1 Theory courses of at least 15 hours per semester for teaching or discussion are equal to one credit.

8.2.2 Practical courses of at least 30 hours per semester for training and experimental work are equal to one credit.

8.2.3 Thesis and independent study using at least 45 hours for research or searching per semester are equal to one credit.

9. Duration of the Program

A student may not take longer than four academic years from the time of registration to completion of the entire master’s program.

10. Registration

Registration for this course must conform to the specified the office of Graduate Studies regulations of Nakhon Pathom Rajabhat University.

11. Academic Evaluation and Graduation

11.1 Academic Evaluation

Evaluation will comply with the regulation of Nakhon Pathom Rajabhat University of graduate study B.C. 2005.

Nakhon Pathom Rajabhat University has two systems for academic evaluation purposes as follows:

11.1.1 Grade System

A Grade System, which is divided in to eight separate levels as seen below and is used evaluate core/prerequisite courses. The grade of at least “C” is considered a pass. For elective courses, a “B” grade is considered a pass.

Grade Symbol	Meaning	Numeric Grade
A	Excellent	4.0
B ⁺	Very Good	3.5
B	Good	3.0
C ⁺	Fairly Good	2.5
C	Fair	2.0
D ⁺	Poor	1.5
D	Very Poor	1.0
E	Fail	0.0

11.1.2 Non-Grade System

A Non-Grade System, which is divided into three levels is applied to elective courses of study based on specific requirements and additional courses of the University. The thesis proposal examination is also evaluated by this

system. A student is allowed to take an exam no more than three times if they attain an “F”.

Evaluation Level	Meaning
PD	Pass with Distinction
P	Pass
F	Fail

Thesis and independent study evaluation is divided into four levels: Excellent, Good, Pass and Fail. A student is allowed to take the exam no more than twice.

Other symbols used are:

Evaluation Level	Meaning
Au (Audit)	A course not requiring a credit.
W (Withdraw)	A course for which approval has been given to withdraw from or for temporarily leave from the study.
T (Transfer)	A student wants to transfer a credit from another university to NPRU.
I (Incomplete)	A student either cannot take an exam or has not fully completed the required work as specified. Evaluation of the course is required by the end of the next semester or an “E” grade will be awarded.
S (Satisfactory)	The result of a non-credit course, thesis or independent study is satisfied but the thesis or independent study has not been evaluated for the final examination.

Evaluation Level	Meaning
U (Unsatisfactory)	The result of a non-credit course, thesis or independent study which is not satisfied but the thesis or independent study has not been evaluated for the final examination.
N (No report)	A thesis, independent study or a course which takes longer than one semester to study with only one time of registration. The “N” must be changed to either a score level, “P” or “F” on final evaluation.

11.2 Graduation

11.2.1 Thesis or Independent Study Program:

Successful Thesis or Independent study is dependent on compliance with the following regulations:

11.2.1.1 The student’s behavior is good.

11.2.1.2 Study all specified courses in the curriculum in its entirety and meet the other requirements.

11.2.1.3 The student’s grade point average must be at least 3.00 based on the grade systems.

11.2.1.4 Obtain a pass grade on the Computer Course (1005907) in accordance with the general regulations of the Graduate Studies School of Nakhon Pathom Rajabhat University B.E. 2005.

11.2.1.5 Obtain an “S” grade in the Thesis proposal or Independent Study exam.

11.2.1.6 Obtain at least a “P” from the Thesis or Independent Study examination.

11.2.1.7 In the case of a Thesis then an academic article must be published in a journal or orally presented at a conference which has a published

proceedings book and is also accepted by the relevant academic professional bodies.

12. Academic Staffs

12.1 The Curriculum Faculty Members (อาจารย์ประจำหลักสูตร)

No.	ID Code	Academic Position	Full Name	Educational Degree	Educational Fields	University	Graduated Year	Text/ Research
1		Full Univ.Prof. (C4-Highest Level)	Dr.rer.nat Manfred Koch	Dr.rer.nat. Diploma Maitrise (Master) Vordiploma	Geophysics Geophysics Physics Physics and Mathematics	University of Karlsruhe University of Karlsruhe University of Paris XI The University of Göttingen	1983 1977 1974 1973	<p>Publications</p> <p>80 International Publications:</p> <p>1. Bejranonda, W., M. Koch and S. Koontanakulvong, Improving traditional conjunctive Use Management with Surface Water and Groundwater dynamic Interactions Modeling, International Symposium on Efficient Groundwater Resources Management (IGS-TH 2009), Bangkok, Thailand, February 16-21, 2009.</p> <p>2. Arlai, P. and M. Koch , The Importance of Density-Dependent Flow and Solute Transport Modeling to simulate Seawater Intrusion into a Coastal Aquifer System, International Symposium on Efficient Groundwater Resources Management (IGS-TH 2009), Bangkok, Thailand, February 16-21,</p>

								<p>2009.</p> <p>3. Sun, H., R. Feistel, M. Koch and A. Markoe, New Equations for Density, Potential Temperature and Entropy of a Saline Thermal Fluid, Deep Sea Research I , 55, 1304-1310, 2008.</p> <p><i>etc.</i></p> <p>Research</p> <p>22 Projects financed by US. and German:</p> <p>1. Agency: DAAD</p> <p>Title: Quantification of climate change in Hong Kong using stochastic analysis of long hydro-meteorological time series ;Exchange project with University of Hongkong, <i>etc.</i></p>
2		Univ.Prof.	Dr.-Ing.Stephan Theobald	Dr.-Ing. Diploma	Hydraulic Engineering and Hydromechanics Civil Engineering	University of Karlsruhe University of Karlsruhe	1999 1990	<p>Publications</p> <p>34 Publications in Hydraulic and Water Resources Engineering:</p> <p>1. Theobald, Stephan, 2008: Simulation Tools for the Automated Operation of Hydropower Plants in: Wasserwirtschaft, Heft 6/2008, S. 10-13.</p> <p>2. Theobald, Stephan und Weiß, Andreas, 2007: Efficient tools and measures for stream</p>

								<p>development in: Wasser und Umwelt, Gesellschaft fuer Weiterbildung in der Wasserwirtschaft e.V. (GWV), Hannover, S. 10-12.</p> <p>3. Shrestha R. R., Theobald S. and Nestmann F. (2004) "Combined Hydrodynamic - Neural Network Model for Flood Flow Simulation", Proceedings of the 6th International Conference on Hydroinformatics Vol.2, 21 -24 June 2004, Singapore, P. 1489 - 1496 <i>etc.</i></p> <p>Research 9 Projects:</p> <p>1. Agency: Bundesministry for Education and Research Title: Climate Change in North Hessen. <i>etc.</i></p>
3	3760400244690	Instructor	Dr.-Ing.Phatcharasak Arlai	Dr.-Ing. M.Eng. B.Eng.	Civil Engineering Water Resources Engineering Water Resources Engineering	The University of Kassel Chulalongkorn University Kasetsart University	2007 2001 1998	<p>Publications 20 International Publications:</p> <p>1. Arlai, P. and M. Koch , The Importance of Density-Dependent Flow and Solute Transport Modeling to simulate Seawater Intrusion into a Coastal Aquifer System,</p>

							<p>International Symposium on Efficient Groundwater Resources Management (IGS-TH 2009), Bangkok, Thailand, February 16-21, 2009.</p> <p>2. Arlai, P., T. Kitpaisalsakul, M. Yongprawat and R. Onchang, THE SENSITIVITY ANALYSIS OF GROUNDWATER RECHARGE INTO BANGKOK AQUIFERS SYSTEM TO REMEDIATE FLOOD IN LOWER CHAO PHRAYA RIVER BASIN, 2008 Asian-Pacific Regional Conference on Practical Environmental Technologies, University of Philippines, Diliman, Quezon City, Philippines, June 30th to July 1st, 2008.</p> <p>3. Arlai,P. and M. Koch,, Cost-economical Optimization and Feasibility Investigation of Groundwater Management Schemes for Groundwater Flow and Density-dependent Solute Transport in the Bangkok</p>
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								<p>Aquifer System , XVII International Conference on Computational Methods in Water Resources (CMWR 2008) , San Francisco, July 6-10, 2008. <i>etc.</i></p> <p>Research 8 Projects: 1. Agency: Higher Education Commission Title: Integrating of Climate and Hydrological Models to develop an Early Flood Warning System in the Chao-Phraya River Basin; Co-research with Water Resources Research Center, DPRI, Kyoto University. <i>etc.</i></p>
4	3100904932510	Full Professor	Dr. Tawatchai Tingsanchali	D.Eng. M.Eng B.Eng (Hons)	Water Resources Engineering Hydraulic Engineering Mechanical Engineering	AIT AIT Chulalongkorn University	1974 1970 1968	<p>Publications 230 International Publications: 1. TINGSANCHALI, T., WATANABE, T. and CHINSHED, K. “Evaluation and Improvement of Environmental Impact Mitigation Plan of a Hydropower Project in Thailand”, Water International, IWRA, Taylors and Francis, U.K.,</p>

								<p>12 p, 2008.</p> <p>2. TINGSANCHALI, T., “Flood Impact Assessment in The Surrounding Area of Suvarnabhumi Airport, Thailand”, Advances in Geosciences, Vol. 11 (Hydrological Sciences), World Scientific Publishing Co., Singapore, 14 p., 2008.</p> <p>3. KHAN Md. N. and TINGSANCHALI, T., “Optimization and simulation of reservoir operation with sediment evacuation: a case study of the Tarbela Dam, Pakistan”, Journal of Hydrological Processes, Vol.22, John Wiley and Sons, U.K., 18 p., 2008. <i>etc.</i></p> <p>Research 36 Projects</p> <p>1. Agency: IMMS Company Limited Title: Study of Airfield Pavement Areas and Remedial Measures, Suvarnabhumi Airport. <i>etc.</i></p>
5	3102000206348	Instructor	Dr.Jakrapong Keawkao	Ph.D. M.Sc.	Physics Physics	KMUTT Silapokorn	2008 2003	Publications 42 International

				B.Sc.	Physics	University Silapokorn University	1999	<p>Publications:</p> <p>1.Kaewkhao J.,Rhianphumikarakit S. and Udomkan N.,2008, “ESR and Absorption Spectra of Copper (II) Ions in Glasses”, Advance Materials Research, 55-57, pp.849-852.</p> <p>2. Kaewkhao J., Pokaipisit A. and Chewpraditkul W., 2008, “Effect of Bi₂O₃ Content on the Properties of Bi₂O₃-BaO-B₂O₃ Glass System”, Advance Materials Research, 55-57, pp.869-872.</p> <p>3. Kaewkhao J.,</p>
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								<p>Udomkan N., Chewpraditkul W. and Limsuwan P., 2009, “Effect of Excess Bismuth on the Synthesis of Bismuth Silicate (Bi₄Si₃O₁₂) Polycrystals”, International Journal of Modern Physics B (IJMPB), 23(5), pp.1-7. <i>etc.</i></p>
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12.2 Responsible Curriculum Faculty Member

No.	ID Code	Academic Position	Full Name	Educational Degree	Educational Fields	University	Graduated Year	Text/ Research
1		Full Univ.Prof. (C4-Highest Level)	Dr.rer.nat Manfred Koch	Dr.rer.nat. Diploma Maitrise (Master) Vordiploma	Geophysics Geophysics Physics Physics and Mathematics	University of Karlsruhe University of Karlsruhe University of Paris XI The University of Göttingen	1983 1977 1974 1973	<p>Publications</p> <p>80 International Publications:</p> <p>1. Bejranonda, W., M. Koch and S. Koontanakulvong, Improving traditional conjunctive Use Management with Surface Water and Groundwater dynamic Interactions Modeling, International Symposium on Efficient Groundwater Resources Management (IGS-TH 2009), Bangkok, Thailand, February 16-21, 2009.</p> <p>2. Arlai, P. and M. Koch , The Importance of Density-Dependent Flow and Solute Transport Modeling to simulate Seawater Intrusion into a Coastal Aquifer System, International Symposium on Efficient Groundwater Resources Management (IGS-TH 2009), Bangkok, Thailand, February 16-21, 2009.</p> <p>3. Sun, H., R. Feistel, M. Koch and A. Markoe,</p>

								<p>New Equations for Density, Potential Temperature and Entropy of a Saline Thermal Fluid, Deep Sea Research I , 55, 1304-1310, 2008. ,etc. Researches 22 Projects financed by US. and German: 1. Agency: DAAD Title: Quantification of climate change in Hong Kong using stochastic analysis of long hydro-meteorological time series ;Exchange project with University of Hongkong, etc.</p>
2		Univ.Prof.	Dr.-Ing.Stephan Theobald	Dr.-Ing. Diploma	Hydraulic Engineering and Hydromechanics Civil Engineering	University of Karlsruhe University of Karlsruhe	1999 1990	<p>Publications 34 Publications in Hydraulic and Water Resources Engineering: 1. Theobald, Stephan, 2008: Simulation Tools for the Automated Operation of Hydropower Plants in: Wasserwirtschaft, Heft 6/2008, S. 10-13. 2. Theobald, Stephan und Weib, Andreas, 2007: Efficient tools and measures for stream development in: Wasser und Umwelt, Gesellschaft fuer Weiterbildung in der</p>

								<p>Wasserwirtschaft e.V. (GWV), Hannover, S. 10-12.</p> <p>3. Shrestha R. R., Theobald S. and Nestmann F. (2004)</p> <p>"Combined Hydrodynamic - Neural Network Model for Flood Flow Simulation", Proceedings of the 6th International Conference on Hydroinformatics Vol.2, 21 -24 June 2004, Singapore, P. 1489 - 1496 etc.</p> <p>Researches</p> <p>9 Projects:</p> <p>1. Agency: Bundesministry for Education and Research Title: Climate Change in North Hessen. etc.</p>
3	3760400244690	Instructor	Dr.-Ing.Phatcharasak Arlai	Dr.-Ing. M.Eng. B.Eng.	Civil Engineering Water Resources Engineering Water Resources Engineering	The University of Kassel Chulalongkorn University Kasetsart University	2007 2001 1998	<p>Publications</p> <p>20 International Publications:</p> <p>1. Arlai, P. and M. Koch , The Importance of Density-Dependent Flow and Solute Transport Modeling to simulate Seawater Intrusion into a Coastal Aquifer System, International Symposium on Efficient Groundwater Resources Management</p>

							<p>(IGS-TH 2009), Bangkok, Thailand, February 16-21, 2009.</p> <p>2. Arlai, P., T. Kitpaisalsakul, M. Yongprawat and R. Onchang, THE SENSITIVITY ANALYSIS OF GROUNDWATER RECHARGE INTO BANGKOK AQUIFERS SYSTEM TO REMEDIATE FLOOD IN LOWER CHAO PHRAYA RIVER BASIN, 2008 Asian-Pacific Regional Conference on Practical Environmental Technologies, University of Philippines, Diliman, Quezon City, Philippines, June 30th to July 1st, 2008.</p> <p>3. Arlai,P. and M. Koch,, Cost-economical Optimization and Feasibility Investigation of Groundwater Management Schemes for Groundwater Flow and Density-dependent Solute Transport in the Bangkok Aquifer System , XVII International Conference on Computational</p>
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								<p>Methods in Water Resources (CMWR 2008) , San Francisco, July 6-10, 2008. etc.</p> <p>Researches 8 Projects: 1. Agency: Higher Education Commission Title: Integrating of Climate and Hydrological Models to develop an Early Flood Warning System in the Chao-Phraya River Basin; Co-research with Water Resources Research Center, DPRI, Kyoto University. etc.</p>
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								<p>Assessment in The Surrounding Area of Suvarnabhumi Airport, Thailand”, Advances in Geosciences, Vol. 11 (Hydrological Sciences), World Scientific Publishing Co., Singapore, 14 p., 2008.</p> <p>3. KHAN Md. N. and TINGSANCHALI, T., “Optimization and simulation of reservoir operation with sediment evacuation: a case study of the Tarbela Dam, Pakistan”, Journal of Hydrological Processes, Vol.22, John Wiley and Sons, U.K., 18 p., 2008.</p> <p>etc.</p> <p>Researches 36 Projects</p> <p>1. Agency: IMMS Company Limited Title: Study of Airfield Pavement Areas and Remedial Measures, Suvarnabhumi Airport. etc.</p>
5	3102000206348	Instructor	Dr.Jakrapong Keawkao	Ph.D. M.Sc. B.Sc.	Physics Physics Physics	KMUTT Silapokorn University Silapokorn University	2008 2004 2000	Publications 42 International Publications 1.Kaewkhao

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12.3 Teaching Faculty Member

No.	ID Code	Academic Position	Full Name	Educational Degree	Educational Fields	University	Graduated Year	Text/ Research
1		Full Univ.Prof. (C4-Highest Level)	Dr.rer.nat Manfred Koch	Dr.rer.nat. Diploma Maitrise (Master) Vordiploma	Geophysics Geophysics Physics Physics and Mathematics	University of Karlsruhe University of Karlsruhe University of Paris XI The University of Göttingen	1983 1977 1974 1973	<p>Publications</p> <p>80 International Publications:</p> <p>1. Bejranonda, W., M. Koch and S. Koontanakulvong, Improving traditional conjunctive Use Management with Surface Water and Groundwater dynamic Interactions Modeling, International Symposium on Efficient Groundwater Resources Management (IGS-TH 2009), Bangkok, Thailand, February 16-21, 2009.</p> <p>2. Arlai, P. and M. Koch , The Importance of Density-Dependent Flow and Solute Transport Modeling to simulate Seawater Intrusion into a Coastal Aquifer System, International Symposium on Efficient Groundwater Resources Management (IGS-TH 2009), Bangkok, Thailand, February 16-21, 2009.</p> <p>3. Sun, H., R. Feistel, M. Koch and A. Markoe,</p>

								<p>New Equations for Density, Potential Temperature and Entropy of a Saline Thermal Fluid, Deep Sea Research I , 55, 1304-1310, 2008. ,etc. Researches 22 Projects financed by US. and German: 1. Agency: DAAD Title: Quantification of climate change in Hong Kong using stochastic analysis of long hydro-meteorological time series ;Exchange project with University of Hongkong, etc.</p>
2		Univ.Prof.	Dr.-Ing.Stephan Theobald	Dr.-Ing. Diploma	Hydraulic Engineering and Hydromechanics Civil Engineering	University of Karlsruhe University of Karlsruhe	1999 1990	<p>Publications 34 Publications in Hydraulic and Water Resources Engineering: 1. Theobald, Stephan, 2008: Simulation Tools for the Automated Operation of Hydropower Plants in: Wasserwirtschaft, Heft 6/2008, S. 10-13. 2. Theobald, Stephan und Weiß, Andreas, 2007: Efficient tools and measures for stream development in: Wasser und Umwelt, Gesellschaft fuer Weiterbildung in der</p>

								<p>Wasserwirtschaft e.V. (GWV), Hannover, S. 10-12.</p> <p>3. Shrestha R. R., Theobald S. and Nestmann F. (2004)</p> <p>"Combined Hydrodynamic - Neural Network Model for Flood Flow Simulation", Proceedings of the 6th International Conference on Hydroinformatics Vol.2, 21 -24 June 2004, Singapore, P. 1489 - 1496 etc.</p> <p>Researches</p> <p>9 Projects:</p> <p>1. Agency: Bundesministry for Education and Research Title: Climate Change in North Hessen. etc.</p>
3	3760400244690	Instructor	Dr.-Ing.Phatcharasak Arlai	Dr.-Ing. M.Eng. B.Eng.	Civil Engineering Water Resources Engineering Water Resources Engineering	The University of Kassel Chulalongkorn University Kasetsart University	2007 2001 1998	<p>Publications</p> <p>20 International Publications:</p> <p>1. Arlai, P. and M. Koch , The Importance of Density-Dependent Flow and Solute Transport Modeling to simulate Seawater Intrusion into a Coastal Aquifer System, International Symposium on Efficient Groundwater Resources Management</p>

								<p>(IGS-TH 2009), Bangkok, Thailand, February 16-21, 2009.</p> <p>2. Arlai, P., T. Kitpaisalsakul, M. Yongprawat and R. Onchang, THE SENSITIVITY ANALYSIS OF GROUNDWATER RECHARGE INTO BANGKOK AQUIFERS SYSTEM TO REMEDIATE FLOOD IN LOWER CHAO PHRAYA RIVER BASIN, 2008 Asian-Pacific Regional Conference on Practical Environmental Technologies, University of Philippines, Diliman, Quezon City, Philippines, June 30th to July 1st, 2008.</p> <p>3. Arlai,P. and M. Koch,, Cost-economical Optimization and Feasibility Investigation of Groundwater Management Schemes for Groundwater Flow and Density-dependent Solute Transport in the Bangkok Aquifer System , XVII International Conference on Computational</p>
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								<p>Methods in Water Resources (CMWR 2008) , San Francisco, July 6-10, 2008. etc.</p> <p>Researches 8 Projects: 1. Agency: Higher Education Commission Title: Integrating of Climate and Hydrological Models to develop an Early Flood Warning System in the Chao-Phraya River Basin; Co-research with Water Resources Research Center, DPRI, Kyoto University. etc.</p>
4	3100904932510	Full Professor	Dr. Tawatchai Tingsanchali	D.Eng. M.Eng B.Eng (Hons)	Water Resources Engineering Hydraulic Engineering Mechanical Engineering	AIT AIT Chulalongkorn University	1974 1970 1968	<p>Publications 230 International Publications: 1. TINGSANCHALI, T., WATANABE, T. and CHINSHED, K. "Evaluation and Improvement of Environmental Impact Mitigation Plan of a Hydropower Project in Thailand", Water International, IWRA, Taylors and Francis, U.K., 12 p, 2008. 2. TINGSANCHALI, T. , "Flood Impact</p>

								<p>Assessment in The Surrounding Area of Suvarnabhumi Airport, Thailand”, Advances in Geosciences, Vol. 11 (Hydrological Sciences), World Scientific Publishing Co., Singapore, 14 p., 2008.</p> <p>3. KHAN Md. N. and TINGSANCHALI, T., “Optimization and simulation of reservoir operation with sediment evacuation: a case study of the Tarbela Dam, Pakistan”, Journal of Hydrological Processes, Vol.22, John Wiley and Sons, U.K., 18 p., 2008.</p> <p>etc.</p> <p>Researches 36 Projects</p> <p>1. Agency: IMMS Company Limited Title: Study of Airfield Pavement Areas and Remedial Measures, Suvarnabhumi Airport. etc.</p>
5	3102000206348	Instructor	Dr.Jakrapong Keawkao	Ph.D. M.Sc. B.Sc.	Physics Physics Physics	KMUTT Silapokorn University Silapokorn University	2008 2003 1999	<p>Publications 42 International Publications: 1.Kaewkhao</p>

								<p>J.,Rhianphumikarakit S. and Udomkan N.,2008, “ESR and Absorption Spectra of Copper (II) Ions in Glasses”, Advance Materials Research, 55-57, pp.849-852.</p> <p>2. Kaewkhao J., Pokaipisit A. and Chewpraditkul W., 2008, “Effect of Bi₂O₃ Content on the Properties of Bi₂O₃-BaO-B₂O₃ Glass System”, Advance Materials Research, 55-57, pp.869-872.</p> <p>3. Kaewkhao J., Udomkan N.,</p>
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								Chewpraditkul W. and Limsuwan P., 2009, "Effect of Excess Bismuth on the Synthesis of Bismuth Silicate ($\text{Bi}_4\text{Si}_3\text{O}_{12}$) Polycrystals", International Journal of Modern Physics B (IJMPB), 23(5), pp.1-7. etc.
6	3101501471426	Instructor	Dr.Suwimol Makviboonchai	Ph.D. M.Sc. B.Sc.	Computer Science Applied Statistics Statistics	Edith Cowan University NIDA Thammasart University	2003 1995 1991	Publications 6 International Publications: 1. Chansilp, K., & Mukviboonchai, S. (2005, 19-21 September). The design and development of dynamic interactive visualization tool in teachnig data structure. Paper presented at the IIWAS, Kualalumper, Malaysia. 2. Makviboonchai, S., The Mediated Integration

								<p>Architecture for heterogeneous data integration. Paper presented at the Proceeding of the 17 th IEEE Region International Conference on Computers, Communications, Control and Power Engineering (IEEE TENCON'02),Beijing, CHINA, 2005.</p> <p>3. Makviboonchai, S., A Mediated Data Model for heterogeneous data Integration. Paper presented at the Proceeding of the 2th Annual International Conference on Computer and Information Science (ICIS'02), Seoul, Korea.</p> <p>Researches: 2 projects: 1.Agency: NECTEC Animal Identification System</p>
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12.4 External Adjunct Faculty Member

No.	Academic Position	Full Name	Educational Degree	Educational Fields	University	Graduated Year	Text/ Research
1	Assoc.Prof.	Dr.Tuantan Kitpaisalsakul	D.Eng M.Eng B.Eng	Water Resources Engineering Water Resources Engineering Civil Engineering	AIT Chulalongkorn University Chulalongkorn University	1996 1991 1983	Publications 16 International Publications Researches 4 Projects
2	Assist.Prof.	Dr.Kanchit Likitdecharote	D.Eng. M.Eng. B.Eng.	Irrigation Engineering Irrigation Engineering Civil Engineering	Ensa, France Technion-Israel Institute of Technology Chulalongkorn University		Publications 10 Publications in Hydraulic and Water Resources Engineering Researches 3 Projects
3	Civil Engineer	Dr. Kanapoj Wandee	Ph.D. M.Sc. B.Eng.	Hydraulic Engineering Hydraulic Engineering Civil Engineering	UNESCO-IHE, Delft, The Netherlands UNESCO-IHE, Delft, The Netherlands Chiang Mai University	2005 2001 1983	Publications 1 Publication in Hydraulic and Water Resources Engineering Researches 3 Projects
4	Hydrogeologist	Dr. Kriangsak Pirarai	Ph.D. M.Sc.Eng. B.Sc.	Civil Engineering Environmental Management of Urban Land and Water Geology	The University of Sheffield, UK The University of Sheffield, UK Chiang Mai University	2007 2004 1995	Researches 5 Projects

13. Student Enrollment and Graduation

13.1 Projected Number of Student Enrollments

Students	Year 2009	Year 2010	Year 2011	Year 2012	Year 2013
1 st Year	15	15	15	15	15
2 nd Year	-	15	15	15	15
Total	15	30	30	30	30

Remark: Student numbers are obtained from the total number of type A and B students.

13.2 Projected Number of Student Graduation

Year	Number of Student Graduation
2009	-
2010	-
2011	15
2012	15
2013	15

14. Study Locations and Facilities

14.1 Locations

- a. Program of Civil and Environmental Engineering, Nakhon Pathom Rajabhat University, 85 Malaiman Road, Muang, Nakhon Pathom, Thailand, 73000
- b. Department of Geohydraulics and Engineering Hydrology, University of Kassel, Kassel, D34100, Kassel, Republic of Germany.

14.2 Laboratories and Facilities

14.2.1 Nakhon Pathom Rajabhat University's Laboratories and Softwares

- a. Hydraulic Laboratory
- b. Hydrology Laboratory
- c. Survey Laboratory
- d. Soil Mechanic Laboratory
- e. Hydrodynamic Software
- f. Groundwater and Solute Transport Modeling Software
- g. GIS softwares

14.2.2 The University of Kassel Laboratories and Softwares

- a. Hydraulic Laboratory
- b. Groundwater and Solute Transport Tank
- c. Hydrodynamic Software
- d. Groundwater and Solute Transport Modeling Software
- e. GIS software
- f. Geophysics Investigation Instruments

14.3 Services and Centers

Additional facilities and services available at the collaborating universities are:

14.3.1 Nakhon Pathom Rajabhat University

- a. University officers will assist students in finding either on campus or nearby off-campus private accommodation.
- b. University restaurant services are available on campus from 8.00 a.m. until 4.00 p.m. or alternatively off-campus private food vendors/restaurants are available from around 8.00 a.m. until 11.00 p.m.
- c. The on campus Computer Center services are available from 08.00 hrs until 20.00 hrs and students can also access the 24 hour university wireless network.
- d. Language Center services are available from 08.00 hrs until 16.00 hrs.
- e. Students are allowed to work in the Graduate Student Room for the whole day.

14.3.2 The University of Kassel

- a. University officers will assist students in finding either on campus or nearby off-campus private accommodation.
- b. University restaurant services are available on campus from 8.00 a.m. until 9.00 p.m. or alternatively off-campus private food

vendors/restaurants are available from around 8.00 a.m. until 9.00 p.m.

- c. The on campus Computer Center services are available from 08.00 hrs until 16.00 hrs.
- d. Language Center services are available from 08.00 hrs until 16.00 hrs.
- e. Students are allowed to work in the Graduate Student Room for the whole day.

15. Library

Library	Publications	Currently Available	Plan of Purchasing Publications					Planned Totals
			2009	2010	2011	2012	2013	
NPRU	Texts	100	20	20	20	20	20	200
	Journals	>100	20	20	20	20	20	>200
UNIK	Texts	3,000						
	Journals	>1,000						
Total		4,200	40	40	40	40	40	>4,400

16. Budgets

16.1 Planned by Fiscal Budget

Fiscal Year	Budget Type (Baht)		Total (Baht)
	Direct	Indirect	
2009	-	1,200,000	1,200,000
2010	-	2,400,000	2,400,000
2011	-	2,400,000	2,400,000

Fiscal Year	Budget Type (Baht)		Total (Baht)
	Direct	Indirect	
2012	-	2,400,000	2,400,000
2013	-	2,400,000	2,400,000

16.2 Estimated Cost per Head

Student Type	Cost/Head/Year (Baht)					Remark
	2009	2010	2011	2012	2013	
Regular Student	80,000	80,000	80,000	80,000	80,000	

17. Curriculum

This program is offered only in the English Language.

17.1 Total Credit Requirement

The Thesis Program comprises of both coursework and a Thesis dissertation. The total credits are at least 36 credits.

The Independent Study program comprises coursework and an Independent Study project. The total credits are at least 36 credits.

17.2 Structure

Thesis Program

Core Courses	12	Credits
Elective Courses	12	Credits
Thesis	12	Credits

Independent Study Program

Core Courses	12	Credits
Elective Courses	18	Credits
Thesis	6	Credits

Additional Courses Available

English for Graduate Students	3	Credits
Computer for Graduate Students	3	Credits

Note

- a. Type A students (see 6.1) will study according to the following programs (see 17.3.2 below).
- b. Type B students (see 6.2) will initially study four non-credit prerequisite courses at 17.3.1 below. Students must pass these courses with at least a “P” grade. Thereafter, these students will study coursework as a type A student.
- c. Additional courses are non-credit courses.

17.3 List of Academic Courses

17.3.1 Type B Students: 12 Credits Prerequisite Courses

Course Code	Course Title	Credits
5505011	Fluid Mechanics	3 (3-0-6)
5505012	Introduction to Hydrology	3 (3-0-6)
5505013	Hydraulic Engineering	3 (3-0-6)
5505014	Water Resources Engineering	3 (3-0-6)

After successfully completing prerequisite courses with at least grade “P”, the type B–student will engage in the same study program above as the type A - students.

17.3.2 Core Courses 12 Credits

Course Code	Course Title	Credits
5515111	Advanced Fluid Mechanics	3 (3-0-6)
5515112	Advanced Hydrology (or select 5511117*)	3 (3-0-6)
5515113	Advanced Hydraulic Engineering (or select 5511118*)	3 (3-0-6)
5515114	Hydraulic Laboratory	1 (0-3-0)
5515115	Hydrological Laboratory	1 (0-3-0)
5515116	Research Methodology in Water Resources Engineering	1 (1-0-2)

Alternative Core Courses for a student focusing on groundwater and solute transport field

Course Code	Course Title	Credits
5515117	Groundwater of Hydrology*	3 (3-0-6)
5525118	Hydrogeology*	3 (3-0-6)

Note: * Those students wishing to focus on the groundwater and solute transport field will be able to substitute courses of 5515117 and 5515118 as indicated above.

17.3.3 Elective Courses

At least 12 credits must be chosen from the following multi-discipline course list, after approval of the advisor and in accordance with the approved student's plan.

Section "Groundwater and Solute Transport" (or groundwater modeling)

Course Code	Course Title	Credits
5525201	Hydraulics of Groundwater Flow	3 (3-0-6)
5525202	Hydrogeochemistry	3 (3-0-6)
5525203	Contaminant Hydrogeology	3 (3-0-6)

Course Code	Course Title	Credits
5525204	Groundwater Flow Modeling	3 (3-0-6)
5525205	Numerical Modeling of Contaminant Transport Processes	3 (3-0-6)
5525206	Geostatistics	3 (3-0-6)
5525207	Stochastic Subsurface Hydrology	3 (3-0-6)
5525208	Multiphase Fluid Transport	3 (3-0-6)
5525209	Groundwater Resource Management	3 (3-0-6)
5525210	Special Topics in Groundwater and Solute Transport	3 (3-0-6)

Section “General Hydrology”

Course Code	Course Title	Credits
5525301	Stochastic Process in Hydrology	3 (3-0-6)
5525302	Urban Hydrology and Hydraulics	3 (3-0-6)
5525303	Numerical Modeling in Hydrology	3 (3-0-6)
5525304	Introduction to GIS in Hydrology	3 (3-0-6)
5525305	Advanced Topics in Hydrology	3 (3-0-6)

Section “Water Resources Engineering”

Course Code	Course Title	Credits
5525401	Water Resources Planning and Management	3 (3-0-6)
5525402	River and Flood Water Management	3 (3-0-6)
5525403	Advanced Topics in Water Resources Engineering	3 (3-0-6)

Section “Hydraulic Engineering”

Course Code	Course Title	Credits
5525501	Design of Hydraulic Structures	3 (3-0-6)
5525502	River Engineering	3 (3-0-6)
5525503	Erosion and Sedimentation	3 (3-0-6)
5525504	Numerical Modeling in Hydraulic Engineering	3 (3-0-6)
5525505	Advanced Topics in Hydraulic Engineering	3 (3-0-6)

Section “Climate Change”

Course Code	Course Title	Credits
5525601	Introduction to Climate Change	3 (3-0-6)
5525602	Statistical Methods in Climate Change Analysis	3 (3-0-6)
5525603	Advanced Topics in Climate Change	3 (3-0-6)

Section “Selected Topics”

Course Code	Course Title	Credits
5525701	Selected Topics in Water and Environmental Fields	3 (3-0-6)

17.3.4 Thesis Courses

Course Code	Course Title	Credits
5535801	Thesis	12 (12-27-0)

17.3.5 Independent Study Courses

Course Code	Course Title	Credits
5535941	Independent Study	6 (6-18-0)

17.3.6 Additional Courses

Course Code	Course Title	Credits
1005906	English for Graduate Students	3 (3-0-9)
1005907	Computer for Graduate Students	3 (3-0-9)

17.4 Meaning of Course Code

17.4.1 Course Code

All course codes contain eight digits.

- a) The first three digits give the subject section
 - a. 550 = Prerequisite Course
 - b. 551 = Core/Required Course
 - c. 552 = Elective Course
 - d. 553 = Thesis/Independent Study
- b) The fourth digit indicates a Graduate Course
- c) The fifth digit shows the “Section Courses”
 - a. 0 = Prerequisite Courses
 - b. 1 = Core/Core Courses
 - c. 2 = Groundwater and Solute Transport
 - d. 3 = General Hydrology
 - e. 4 = Water Resources Engineering
 - f. 5 = Hydraulic Engineering
 - g. 6 = Climate Change
 - h. 7 = Selected Topics in Water and Environmental Fields
 - i. 8 = Thesis
 - j. 9 = Independent Study

d) The sixth digit indicates the Semester. A zero means a student will register this course in a semester after the approval of the advisor and in accordance with the approved student's plan.

e) The seventh, final, digit shows the sequence of courses.

17.4.2 Credits

A credit course is composed of three numbers; e.g. (6-18-0)

- a. The first number shows the time, in hours per week, for theory study.
- b. The second number is the time, in hours per week, for practice.
- c. The third number is the time, in hours per a week, for research.

17.5 Study Plan

17.5.1 Type A – Student (Thesis Program)

First Semester at Nakhon Pathom Rajabhat University

Course Code	Course Title	Credits
1005906	English for Graduate Students**	3 (3-0-9)
5515111	Advanced Fluid Mechanics	3 (3-0-6)
5515112	Advanced Hydrology (or select 5511117*)	3 (3-0-6)
5515113	Advanced Hydraulic Engineering (or select 5511118*)	3 (3-0-6)
5515114	Hydraulic Laboratory	1 (0-3-0)
5515115	Hydrological Laboratory	1 (0-3-0)
5515116	Research Methodology in Water Resources Engineering	1 (1-0-2)
Total		15

Note: * Those students wishing to focus on the groundwater and solute transport field will be able to substitute courses of 5515117 and 5515118 as indicated above.

** 1005906 is a non-credit course.

Second Semester at Nakhon Pathom Rajabhat University

Course Code	Course Title	Credits
1005907	Computer for Graduate Students**	3 (3-0-9)
552xxxx	Elective Course (or select 5525201*)	3 (3-0-6)
552xxxx	Elective Course (or select 5525204*)	3 (3-0-6)
5535801	Thesis I	3
Total		12

Note: * A student who would like to focus on the groundwater and solute transport field is recommended to study the elective courses 5525201 and 5525204.

** 1005907 is a non-credit course.

Third Semester at the University of Kassel

Course Code	Course Title	Credits
552xxxx	Elective Course	3 (3-0-6)
552xxxx	Elective Course	3 (3-0-6)
5535801	Thesis II	3
Total		9

Fourth Semester at either the University of Kassel or Nakhon Pathom Rajabhat University

Course Code	Course Title	Credits
5535801	Thesis III	6
Total		6

17.5.2 Type A – Student (Independent Study Program)

First Semester at Nakhon Pathom Rajabhat University

Course Code	Course Title	Credits
1005906	English for Graduate Students**	3 (3-0-9)
5515111	Advanced Fluid Mechanics	3 (3-0-6)
5515112	Advanced Hydrology (or select 5511117*)	3 (3-0-6)
5515113	Advanced Hydraulic Engineering (or select 5511118*)	3 (3-0-6)
5515114	Hydraulic Laboratory	1 (0-3-0)
5515115	Hydrological Laboratory	1 (0-3-0)
5515116	Research Methodology in Water Resources Engineering	1 (1-0-2)
Total		15

Note: * Those students wishing to focus on the groundwater and solute transport field will be able to substitute courses of 5515117 and 5515118 as indicated above.

** 1005906 is a non-credit course.

Second Semester at Nakhon Pathom Rajabhat University

Course Code	Course Title	Credits
1005907	Computer for Graduate Students**	3 (3-0-9)
552xxxx	Elective Course (or select 5525201*)	3 (3-0-6)
552xxxx	Elective Course (or select 5525204*)	3 (3-0-6)
552xxxx	Elective Course	3 (3-0-6)
Total		12

Remark: * Those students wishing to focus on the groundwater and solute transport field are recommended to study elective courses of 5525201 and 5525204.

Third Semester at the University of Kassel

Course Code	Course Title	Credits
552xxxx	Elective Course	3 (3-0-6)
552xxxx	Elective Course	3 (3-0-6)
552xxxx	Elective Course	3 (3-0-6)
Total		9

Fourth Semester at either the University of Kassel or Nakhon Pathom Rajabhat University

Course Code	Course Title	Credits
5535941	Independent Study	6
Total		6

17.5.3 Type B – Student (Thesis Program)

First Semester at Nakhon Pathom Rajabhat University

Course Code	Course Title	Credits
5505011	Fluid Mechanics	3 (3-0-6)
5505012	Introduction to Hydrology	3 (3-0-6)
5505013	Hydraulic Engineering	3 (3-0-6)
5505014	Water Resources Engineering	3 (3-0-6)
Total		12

Second Semester at Nakhon Pathom Rajabhat University

Course Code	Course Title	Credits
1005906	English for Graduate Students**	3 (3-0-9)
5515111	Advanced Fluid Mechanics	3 (3-0-6)
5515112	Advanced Hydrology (or select 5511117*)	3 (3-0-6)
5515113	Advanced Hydraulic Engineering (or select 5511118*)	3 (3-0-6)
5515114	Hydraulic Laboratory	1 (0-3-0)
5515115	Hydrological Laboratory	1 (0-3-0)
5515116	Research Methodology in Water Resources Engineering	1 (1-0-2)
Total		15

Note: * Those students wishing to focus on the groundwater and solute transport field will be able to substitute courses of 5515117 and 5515118 as indicated above.

** 1005906 is a non-credit course.

Third Semester at Nakhon Pathom Rajabhat University

Course Code	Course Title	Credits
1005907	Computer for Graduate Students**	3 (3-0-9)
552xxxx	Elective Course (or select 5525201*)	3 (3-0-6)
552xxxx	Elective Course (or select 5525204*)	3 (3-0-6)
5535801	Thesis I	3
Total		12

Note: * A student who would like to focus on the groundwater and solute transport field is recommended to study the elective courses 5525201 and 5525204.

** 1005907 is a non-credit course.

Fourth Semester at the University of Kassel

Course Code	Course Title	Credits
552xxxx	Elective Course	3 (3-0-6)
552xxxx	Elective Course	3 (3-0-6)
5535801	Thesis II	3
Total		9

Fifth Semester at either the University of Kassel or Nakhon Pathom Rajabhat University

Course Code	Course Title	Credits
5535801	Thesis III	6
Total		6

17.5.4 Type B – Student (Independent Study Program)

First Semester at Nakhon Pathom Rajabhat University

Course Code	Course Title	Credits
5505011	Fluid Mechanics	3 (3-0-6)
5505012	Introduction to Hydrology	3 (3-0-6)
5505013	Hydraulic Engineering	3 (3-0-6)
5505014	Water Resources Engineering	3 (3-0-6)
Total		12

Second Semester at Nakhon Pathom Rajabhat University

Course Code	Course Title	Credits
1005906	English for Graduate Students**	3 (3-0-9)
5515111	Advanced Fluid Mechanics	3 (3-0-6)
5515112	Advanced Hydrology (or select 5511017*)	3 (3-0-6)
5515113	Advanced Hydraulic Engineering (or select 5511018*)	3 (3-0-6)
5515114	Hydraulic Laboratory	1 (0-3-0)
5515115	Hydrological Laboratory	1 (0-3-0)
5515116	Research Methodology in Water Resources Engineering	1 (1-0-2)
Total		12

Note: * Those students wishing to focus on the groundwater and solute transport field will be able to substitute courses of 5515117 and 5515118 as indicated above.

**1005906 is a non-credit course.

Third Semester at Nakhon Pathom Rajabhat University

Course Code	Course Title	Credits
1005907	Computer for Graduate Students**	3 (3-0-9)
552xxxx	Elective Course (or select 5525201*)	3 (3-0-6)
552xxxx	Elective Course (or select 5525204*)	3 (3-0-6)
553xxxx	Elective Course	3 (3-0-6)
Total		12

Note: * A student who would like to focus on the groundwater and solute transport field is recommended to study the elective courses 5525201 and 5525204.

** 1005907 is a non-credit course.

Fourth Semester at the University of Kassel

Course Code	Course Title	Credits
552xxxx	Elective Course	3 (3-0-6)
552xxxx	Elective Course	3 (3-0-6)
553xxxx	Elective Course	3 (3-0-6)
Total		9

Fifth Semester at either the University of Kassel or Nakhon Pathom Rajabhat University

Course Code	Course Title	Credits
5535941	Independent Study	6
Total		6

17.6 Course Descriptions

Prerequisite Courses

5505011 Fluid Mechanics 3 (3-0-6)

Properties of fluids, fluid statics; momentum and energy equations; equation of continuity and motion; similitude and dimensional analysis; steady incompressible flow; pipe flow and open channel flow.

5505012 Introduction to Hydrology 3 (3-0-6)

Hydrologic cycle; Hydrological data measurement; hydrological data and rainfall data analysis; Detention, Retention, Evaporation, Evapotranspiration and Percolation; Runoff Measurement; Hydrograph Computation; Hydrograph Analysis; Flood Routing; Water balance in Reservoir; Introduction to groundwater; Sedimentation in reservoir and river; Applications of Hydrology.

5505013 Hydraulic Engineering 3 (3-0-6)

Application of Fluid Mechanics principles to study and practice of hydraulic engineering, piping systems, water hammer, pumps, turbines, open channel flow ,design reservoir, dams, spillways and hydraulic models.

5505014 Water Resources Engineering 3 (3-0-6)

Basic hydrology for water resources management efforts, legal aspects of water use; physical works utilized in water resources development projects, basic engineering economy in water resources management, principal water uses, planning procedure for single and multipurpose projects.

Core Courses

5515111 **Advanced Fluid Mechanics **3 (3-0-6)****

The principal concepts and methods of fluid dynamics are presented. Topics include mass conservation, momentum, and energy equations for continua, the Navier-Stokes equation for viscous flows, similarity and dimensional analysis, lubrication theory, boundary layers and separation, circulation and vorticity theorems, potential flow, an introduction to turbulence, lift and drag, surface tension and surface tension driven flows.

5515112 **Advanced Hydrology **3 (3-0-6)****

Subsurface water, infiltration, surface water, streamflow hydrograph, SCS curve number method, unit hydrograph, lumped flow routing, distributed flow routing, dynamic wave routing, hydrologic statistics, frequency analysis, rainfall hyetograph design, tidal level hydrograph design, stochastic time series models, artificial neural network, genetic algorithms.

5515113 **Advanced Hydraulic Engineering **3 (3-0-6)****

Unsteady flow in pipes, computational methods, design application; water hammer, mass oscillation, unsteady flow in open channels, movement of flood waves, computer-aided design in hydraulic engineering

5515114 **Hydraulic Laboratory **1 (0 -3-0)****

Experiments on the Laboratories which are involved with hydraulic theories in order to study the flow behaviors and characteristics, i.e., Hydrostatics, Buoyancy, Losses, Open Channel Flow, Turbine, Pump and so on.

5515115 Hydrological Laboratory 1 (0 -3-0)

Laboratory and field techniques in operation, calibration and maintenance of equipment used for measurements of hydrologic data, preparation of reports of experimental results.

5515116 Research Methodology in Water Resources Engineering 1(1-0-2)

Research Methodology in Water Resources Engineering using analytical, experimental, and field investigation methods, techniques of presentation, discussion and conclusion of research results, assessment of research performance and illustration of previous and current interesting research works in water resources engineering at the master level.

5515117 Groundwater Hydrology 3 (3-0-6)

A general course in groundwater hydrology, emphasizing fundamental principles and their applications to practical problems. Topics included are hydrologic cycles, geologic environments and controls, unsaturated and saturated zones, Darcy's law, continuity and energy principles, Navier-stokes equations, flow equations, steady and unsteady hydraulics, aquifer tests, analytical and numerical models and computer codes.

5515118 Hydrogeology 3 (3-0-6)

A basic understanding of geologic concepts and processes, focusing on understanding the formation and characteristics of water-bearing formations; The theory of groundwater flow, the hydrology of aquifers, well hydraulics, groundwater-resource evaluation, and groundwater chemistry; The relationship between the geologic concepts/processes and the groundwater resource are discussed.

Elective Courses

Section “Groundwater and Solute Transport”

5525201 Hydraulics of Groundwater Flow 3 (3-0-6)

Hydraulics of groundwater from first principles to the complete mathematical statement of forecasting regional aquifer response to management activities. A comprehensive approach is presented and the basic subject-Hydraulics of the flow and accumulation of water and containments in aquifers-is dealt with in the framework and for the purpose of management.

5525202 Hydrogeochemistry 3 (3-0-6)

An overview of the major physic-chemical processes involved in water-rock reactions within the Earth's crust, understanding of which has important applications to understanding mineral deposits, oil & gas generation & migration and metamorphic processes.

5525203 Contaminant Hydrogeology 3 (3-0-6)

Introduction to contaminant hydrogeology, including properties of organic and inorganic contaminants, chemical and physical processes affecting concentration of solutes in the subsurface, mass transport, multiphase flow, contaminant monitoring, and site remediation.

5525204 Groundwater Flow Modeling 3 (3-0-6)

Introduction to groundwater flow modeling, equations and numerical methods; the conceptual model and grid design; boundaries; Sources and Sinks; Profile Models; Special Needs for Transient Simulations; Model Execution and the Calibration Process; Documenting and Reporting Your Modeling Study; Postaudits: How Good Are Predictions? Particle Tracking of Groundwater Flow and Advective Transport of Contaminants.

5525205 Numerical Modeling of Contaminant Transport Processes**3 (3-0-6)**

An overview of transport theory as applied to groundwater problems, an indepth look at the numerical transport code MT3DMS, and an introduction to the application of transport models to field problems. MT3DMS is a popular and widely-used 3-D transient transport code, which uses output from the groundwater flow code MODFLOW. Both MODFLOW and MT3DMS are supported by the pre/post-process.

5525206 Geostatistics**3 (3-0-6)**

Numerical and statistical treatment of geological data emphasizing the analysis of spatially and temporally distributed variables and unique aspects of geological variables. Topics include methods of sampling geological data, quantitative procedures for reducing the dimensionality of geological data sets, and techniques for presentation and interpretation of results.

5525207 Stochastic Subsurface Hydrology**3 (3-0-6)**

Introduction to stochastic subsurface hydrology; Stochastic description; Temporally variable subsurface flow; Spatial variable in subsurface flow; Transport process in heterogeneous media; Stochastic Characterization and Geostatistics

5525208 Multiphase Fluid Transport**3 (3-0-6)**

Gas-Liquid systems, fluid-solid systems, and solid-liquid-gas systems. Design criteria for two-phase and three-phase flow systems. Application of two-phase flow in pollution treatments. Application of two-phase flow in separation technology. Application of three phase flow in fluidized bed, petrochemical process, and petroleum engineering.

5525209 Groundwater Resource Management 3 (3-0-6)

Introduction to groundwater resources engineering and management, with an emphasis on groundwater resources protection and water supply; technical aspects as well as the legal, regulatory and policy aspects of groundwater resources management; Development of groundwater supplies; Conjunctive use of groundwater and surface water and planning of groundwater resources projects.

5525210 Special Topics in Groundwater and Solute Transport 3 (3-0-6)

Students familiarize themselves with the advance topics of Groundwater and Solute Transport through discussion and reading of journal or academic publications.

Section “General Hydrology”**5525301 Stochastic Process in Hydrology 3 (3-0-6)**

Basic concepts and classification of hydrologic processes; Autocorrelation and lag cross correlation; Spectral and cross spectral analysis; Range analysis of hydrologic series; Analysis of hydrologic series by runs; Transient components in hydrologic series; Analysis of intermittent hydrologic processes; Computer Technology and the experimental methods in hydrology.

5525302 Urban Hydrology and Hydraulics 3 (3-0-6)

Rainfall-runoff; hydrograph prediction; unsteady flow, flood routing; culvert hydraulics; flood control structures; storm water management; storage concepts; river restoration; case studies.

5525303 Numerical Modeling in Hydrology 3 (3-0-6)

Apply hydrological models (HEC, SWAT) to calculate the relationship between precipitation and runoff for research and hydrologic works.

5525304 Introduction to GIS in Hydrology 3 (3-0-6)

The state-of-the-art GIS methods and tools specifically targeting hydrological applications including: spatial and terrain analysis, geostatistical analysis, watershed delineation and identification of river networks, time series analysis and development of GIS integrated Hydrological models.

5525305 Advanced Topics in Hydrology 3 (3-0-6)

Students familiarize themselves with the advance topics of Hydrology through discussion and reading of journal or academic publications.

Section “Water Resources Engineering”**5525401 Water Resources Planning and Management 3 (3-0-6)**

Principles and practice of water resources planning and management; Protocols employed at local, state, federal, regional and international levels; Plan formulation, evaluation, and implementation; Stakeholder involvement in planning processes; Analytical tools. Case studies.

5525402 River and Flood Water Management 3 (3-0-6)

Principles of River Basin Management; Flood Protection: Principles, flood area management, technical flood protection, flood prevention; Planning tools: GIS and Models.

5525403 Advanced Topics in Water Resources Engineering**3 (3-0-6)**

Students familiarize themselves with the advance topics of Water Resources Engineering through discussion and reading of journal or academic publications.

Section “Hydraulic Engineering”**5525501 Design of Hydraulic Structures****3 (3-0-6)**

Types, advantages and functions of hydraulic structures; Flow through orifices, culverts, under gates, over weirs and spillways; Energy dissipation below hydraulic structures; Hydraulic design of culverts, weirs, spillways, syphons, regulators and dams; Computer applications.

5525502 River Engineering**3 (3-0-6)**

River morphology, regime theory, erosion and sedimentation, sediment transport, effect by construction of various hydraulic structures in the river.

5525503 Erosion and Sedimentation**3 (3-0-6)**

Sediment transport measurement and computation, sedimentation and erosion in river and reservoir, mitigation and prevention methods, sediment routing, dredging, excavation, reservoir storage survey.

5525504 Numerical Modeling in Hydraulic Engineering**3 (3-0-6)**

This course is an introduction to numerical methods and computer software, with emphasis on their applications to Hydraulic Engineering.

5525505 Advanced Topics in Hydraulic Engineering**3 (3-0-6)**

Students familiarize themselves with the advance topics of Hydraulic Engineering through discussion and reading of journal or academic publications.

Section “Climate Change”

5525601 Introduction to Climate Change 3 (3-0-6)

Exchange of energy, water and momentum through the atmosphere, surface vegetation and oceans. Paleoclimate, climate change, variability and feedbacks.

5525602 Statistical Methods in Climate Change Analysis 3 (3-0-6)

Advanced techniques especially applicable to climatology; space-time random field analysis applied to stochastic models, parameter estimation, statistical forecasting, data interpolation and signal detection; applications to real data and climate model output.

5525603 Advance Topics in Climate Change 3 (3-0-6)

Students familiarize themselves with the advance topics of Climate Change through discussion and reading of journal or academic publications.

Section “Selected Topics”

5525701 Selected Topics in Water and Environmental Fields 3 (3-0-6)

This course covers a number of advanced "selected topics" in the fields of water and environmental resources.

Thesis Courses

5535801 Thesis 12 credits

A student completes the master thesis under the supervision of his/her advisor and the student passes an oral defense of a master thesis.

Independent Study Courses

5535941 Independent Study 6 credits

Independent research and study in currently relevant water or environmental resource problems whose topics are not covered in the graduate courses based on laboratory and field research or current literatures. A student must complete his/her Independent study report.

Additional Courses

1005906 English for Graduate Students 3(3-0-6)

Train to speak, listen, reading and writing. It focuses on reading and summarizing the important contents of abstract and academic documents. Furthermore, train to write the academic English through publishing, Electronic .for graduate study

1005907 Computer for Graduate Students 3(3-0-6)

Study the basic computer system, usable program and applications of computer in various works which involve with sciences. Study the basic knowledge of the information technology system, computer network and internet.

18. Assurance of Curriculum

18.1 Curriculum Administration

Administrative curriculum committee authorizes to draw the policy, planning and active plan as follows:

- a. Draw the philosophy and objective of curriculum to synchronize with National Economic and Social Development Plan under the academic standard Commission on Higher Education.
- b. Develop and improve the curriculum to comply with the society, academic- and professional standard.
- c. Propose a suitable faculty member in each subject and evaluate his/her teaching and educating performance.
- d. Develop the projects to request for budget in order to develop and keep the teaching and educating on the standard.

18.2 Academic Resources

- a. Provide and support needed materials and equipments for study and research to the students sufficiently.
- b. Provide and support text books, journals, ICT and the other learning sources adequately.
- c. Coordinate Academic Resources and Information Technology Center to facilitate the students for searching information for study and research.
- d. Provide enough study rooms and computer resources for students.

18.3 Support and Advice for Students

- a. Establish the activities to develop the students on the academic, professional, ethic and moral aspect.
- b. Provide a qualified advisor and committee of thesis or independent study to take care a student from entrance until completing his/her thesis or independent study on time.
- c. Provide scholarships to the qualified students for their study or research.

18.4 Demand of Labor Market, Society and Satisfaction of Employer

- a. Track the development of students for their entire study; survey the statistical employment of graduated students and satisfaction of

employers after their graduation. This information will be induced to improve the curriculum later.

- b. Dynamically survey the market demand and trend in order to improve and modernize the curriculum and education to synchronize with the present technology and knowledge.

19. Curriculum Development

- a. Appoint the committee for quality assurance of study to control the study quality in order to comply with the standard and index of the office for National Education Standards and Quality Assessment.
- b. Evaluate the courses and teaching which are offered in the curriculum so that these information can be used to modernly improve the course descriptions and educating processes.
- c. Dynamically develop and improve the curriculum in every 5 years.
- d. The course syllabuses of every subject in each semester are offered for students.
- e. Provide qualified faculty members who comply with the academic standard to give lectures for student.
- f. Survey the quality of graduated students and the satisfactory of employers.
- g. Provide enough study rooms and laboratories for students.
- h. The number of curriculum-, teaching- faculty members and advisors who graduated in Ph.D. or equivalent must be at least 80 percent.

Appendix