DEPARTMENT OF ENVIRONMENTAL ENGINEERING

The aim of the Department of Environmental Engineering is to teach and train students to be engineers with a competent knowledge (theoretical and practical) of surveying, planning and design, consulting and operating in the following fields:

1. water supply and treatment
2. drainage system and wastewater treatment
3. environmental sanitation
4. industrial environment
5. air pollution control
6. water pollution control and management
7. urban and rural sanitation
8. solid waste management
9. hazardous wastes treatment
10. environmental management

Moreover, students are obliged to use their own creative idea and self-responsibility. They are also encouraged to take an interest in techniques, foresee problems in the future and develop a sustainability of man and nature.

HEAD:
Khemarath Osathaphan, Ph.D. (Oregon State)

ASSOCIATE PROFESSORS:
Chavalit Ratanatamkskul, Ph.D. (Tokyo)
Chanathip Pharino, Ph.D. (MIT)
Orathai Chavalparit, Ph.D. (Chula)
Petchporn Chawakitchareon, Ph.D. (ENTPE-LYONI)
Nisut Painmanakul, Ph.D. (INSA-Toulouse)
Sutha Khaothiian, Ph.D. (Oregon State)
Sirima Panyamethakul, Ph.D. (Imperial College)
Thares Srisatit, Ph.D. (Oklahoma State)
Khemarath Osathaphan, Ph.D. (Oregon State)
Patiparn Punyapalakul, Ph.D. (Tokyo)
Tawan Limpiyakorn, Ph.D. (Tokyo)
Wiboonluk Pungrasmi, Ph.D. (Tokyo)

ASSISTANT PROFESSORS:
Achariya Suriyawong, Ph.D. (Washington)
Benjamorn Suwannasiling, Ph.D. (Stanford)
Chaiyaporn Puprasert, Ph.D. (INSA-Toulouse)
Manaskorn Rachakornkij, Ph.D. (New Jersey)
Pichaya Rachdawong, Ph.D. (Wisconsin-Milwaukee)
Sarun Tejasen, Ph.D. (Oregon State)
On-anong Lavpraparsudthi, Ph.D. (Coventry)
Viboon Sricharoenchai, Ph.D. (Georgia Tech)

LECTURERS:
Dao Suwansang Jancharoen, Ph.D. (Illinois at Urbana-Champaign)
# Environmental Engineering Curriculum

## First Year Curriculum

Common to all engineering students

<table>
<thead>
<tr>
<th>COURSE NO.</th>
<th>SUBJECT</th>
<th>CREDITS</th>
<th>COURSE NO.</th>
<th>SUBJECT</th>
<th>CREDITS</th>
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</thead>
<tbody>
<tr>
<td>2103213</td>
<td>ENG MECH I</td>
<td>3</td>
<td>2107452</td>
<td>PHYSICO-CHEMICAL TREATMENT</td>
<td>3</td>
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<tr>
<td>2107311</td>
<td>BIO ENV ENG</td>
<td>3</td>
<td>2107462</td>
<td>HAZ WASTE TREAT</td>
<td>3</td>
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<td>2107214</td>
<td>AQUA CHEM ENV ENG</td>
<td>3</td>
<td>2107481</td>
<td>INT ENV IMP ASSESSMENT</td>
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<td>2107346</td>
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<td>2108302</td>
<td>FIELD PRACTICE I</td>
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<td>2</td>
<td>2100311</td>
<td>ENGINEERING ESSENTIALS</td>
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<td>xxxxxxx</td>
<td>GENERAL EDUCATION</td>
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<td>APPROVED ELECTIVE</td>
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<td>xxxxxxx</td>
<td>FREE ELECTIVE</td>
<td>3</td>
<td>xxxxxxx</td>
<td>GENERAL EDUCATION</td>
<td>3</td>
</tr>
</tbody>
</table>

**Total Credits for Graduation = 147**
NAME OF THE DEGREE
: Master of Engineering
: M.Eng.

DEPARTMENT STAFFS
Khemarath Osathaphan, Ph.D. (Oregon State)

ASSOCIATE PROFESSORS:
Chavalit Ratanatamskul, Ph.D. (Tokyo)
Chanathip Phario, Ph.D. (MIT)
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Tawan Limpiyakorn, Ph.D. (Ph.D. (Tokyo))
Wiloon Luk Pungrasmi, Ph.D. (Ph.D. (Tokyo))

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Viboon Sricharoenzaikul, Ph.D. (Georgia Tech)

LECTURERS:
Dao Suwansang Jancharoen, Ph.D. (Illinois at Urbana-Champaign)

ADMISSION
The applicant must hold either a Bachelor's Degree in Engineering or related degrees and met the requirements of the Graduate School.

DEGREE REQUIREMENTS
This program consists of 24 credits of course work, of which 17 are required and 7 are electives.
A student must present an acceptable thesis and pass an oral examination in the field of specialization for a quantity of not less than 12 credits.

COURSE REQUIREMENTS

1) Prerequisite Courses
Students with bachelor's degree other than environmental engineering degree must take and pass these following four prerequisite courses with S/U grade or obtain the exemption from the department:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>2107667</td>
<td>Fundamental Engineering for Environmental Engineering</td>
</tr>
</tbody>
</table>

All Students must take and pass the following prerequisite course with S/U grade:

<table>
<thead>
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<th>Course Code</th>
<th>Course Name</th>
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<tbody>
<tr>
<td>2107701</td>
<td>Seminar in Environmental Engineering I</td>
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2) Required Courses 20 credits

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
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<tr>
<td>2107658</td>
<td>Theory and Design of Advanced Water Treatment Processes</td>
</tr>
<tr>
<td>2107659</td>
<td>Theory and Design of Advanced Wastewater Treatment Processes</td>
</tr>
<tr>
<td>2107670</td>
<td>Air Quality Management and Engineering</td>
</tr>
<tr>
<td>2107671</td>
<td>Solid and Hazardous Waste Management</td>
</tr>
<tr>
<td>2107673</td>
<td>Principles for Environmental Engineering Management</td>
</tr>
<tr>
<td>2107702</td>
<td>Seminar in Environmental Engineering II</td>
</tr>
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</table>

3) Elective Courses 74 credits

Students must choose at least two elective courses from one particular field and at least another elective course from any fields with consent from the advisor.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
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</thead>
<tbody>
<tr>
<td>2107530</td>
<td>Advanced Techniques In Physical And Chemical Treatment</td>
</tr>
<tr>
<td>2107607</td>
<td>Environmental Analysis</td>
</tr>
<tr>
<td>2107608</td>
<td>Technology of Solid and Hazardous Waste Treatment</td>
</tr>
<tr>
<td>2107616</td>
<td>Air Quality Management</td>
</tr>
<tr>
<td>2107622</td>
<td>Environmental Control Planning</td>
</tr>
<tr>
<td>2107626</td>
<td>Stream Sanitation</td>
</tr>
<tr>
<td>2107627</td>
<td>Advanced Sanitary Engineering Laboratory</td>
</tr>
<tr>
<td>2107628</td>
<td>Design of Water Retaining Structures</td>
</tr>
<tr>
<td>2107630</td>
<td>Treatment and Disposal of Industrial Waste</td>
</tr>
<tr>
<td>2107632</td>
<td>Environmental Impact Assessment</td>
</tr>
<tr>
<td>2107633</td>
<td>Water Quality and Agriculture Practice</td>
</tr>
<tr>
<td>2107634</td>
<td>Advances in Environmental Pollution Research</td>
</tr>
<tr>
<td>2107635</td>
<td>Reading in Environmental Engineering</td>
</tr>
<tr>
<td>2107638</td>
<td>Plumbing Design</td>
</tr>
<tr>
<td>2107639</td>
<td>Atmospheric Chemistry</td>
</tr>
<tr>
<td>2107641</td>
<td>Air Polluting Control Technology</td>
</tr>
<tr>
<td>2107642</td>
<td>Engineering Practices for Solid Waste</td>
</tr>
</tbody>
</table>


### DEPARTMENT STAFFS

**HEAD:**  Chaiyaporn Puprasert, Ph.D. (INSA-Toulouse)

**ASSOCIATE PROFESSORS:**
- Chavalit Ratanatamskul, Ph.D. (Tokyo)
- Orathai Chavalparit, Ph.D. (Chula)
- Petchpoom Chawakitshareon, Ph.D. (ENTPE-LYONI)
- Pisut Painmanakul, Ph.D. (INSA-Toulouse)
- Thares Sirisatt, Ph.D. (SAVOIE)
- Sutha Khaothian, Ph.D. (Oregon State)
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- Wiboonluk Pungprasmi, Ph.D. (Tokyo)
- Patiparn Punyapalaikul, Ph.D. (Tokyo)
- Manaskorn Rachakornkij, Ph.D. (New Jersey)
- Viboon Sricharoenchaikul, Ph.D. (Georgia Tech)

### ADMISSION

1) The applicant must have a Bachelor's Degree in Engineering with a minimum of second class honors or
2) The applicant must have a Master's Degree in Environmental Engineering or Sanitary Engineering.

### DEGREE REQUIREMENTS

**Pattern 1** for a Master's Degree student who has a grade point average minimum of 3.5 - require 48 credits of doctoral dissertation

**Pattern 2(1)** for a Bachelor's Degree student - require 72 credits of which 24 credits are course work and 48 credits are doctoral dissertation

**Pattern 2(2)** for a Master's Degree student who has a grade point average less than 3.5 - require 60 credits of which 12 credits are course work and 48 credits are doctoral dissertation

### COURSE REQUIREMENTS

#### 1) Required Courses  6 credits

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>2107791</td>
<td>Advanced seminar in Environmental Engineering I</td>
</tr>
<tr>
<td>2107792</td>
<td>Advanced seminar in Environmental Engineering II</td>
</tr>
<tr>
<td>2107793</td>
<td>Advanced seminar in Environmental Engineering III</td>
</tr>
<tr>
<td>2107794</td>
<td>Advanced seminar in Environmental Engineering IV</td>
</tr>
<tr>
<td>2107795</td>
<td>Advanced seminar in Environmental Engineering V</td>
</tr>
<tr>
<td>2107796</td>
<td>Advanced seminar in Environmental Engineering VI</td>
</tr>
</tbody>
</table>

#### 2) Elective Courses  12 or 24 credits

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>2107607</td>
<td>Environmental Analysis</td>
</tr>
<tr>
<td>2107608</td>
<td>Technology of Solid and Hazardous Waste Technology</td>
</tr>
<tr>
<td>2107615</td>
<td>Advanced Environmental Biology</td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Title</td>
</tr>
<tr>
<td>------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>2107616</td>
<td>Air Quality Management</td>
</tr>
<tr>
<td>2107618</td>
<td>Water and Wastewater Treatment Plant Operation</td>
</tr>
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<td>Environmental Control Planning</td>
</tr>
<tr>
<td>2107626</td>
<td>Stream Sanitation</td>
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<tr>
<td>2107627</td>
<td>Advanced Sanitary Engineering Labor</td>
</tr>
<tr>
<td>2107630</td>
<td>Treatment and Disposal of Industrial Waste</td>
</tr>
<tr>
<td>2107631</td>
<td>Environmental System Engineering</td>
</tr>
<tr>
<td>2107633</td>
<td>Water Quality and Agriculture Practice</td>
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<td>2107634</td>
<td>Advances in Environmental Pollution Research</td>
</tr>
<tr>
<td>2107635</td>
<td>Reading in Environmental Engineering</td>
</tr>
<tr>
<td>2107636</td>
<td>Industrial Hygiene Practices</td>
</tr>
<tr>
<td>2107637</td>
<td>Advanced Wastewater Technology</td>
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<tr>
<td>2107638</td>
<td>Plumbing Design</td>
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<td>Air Polluting Control Technology</td>
</tr>
<tr>
<td>2107642</td>
<td>Engineering Practices for Solid Waste Disposal</td>
</tr>
<tr>
<td>2107643</td>
<td>Public Health Engineering</td>
</tr>
<tr>
<td>2107644</td>
<td>Advanced Study in Environmental Engineering I</td>
</tr>
<tr>
<td>2107645</td>
<td>Advanced Study in Environmental Engineering II</td>
</tr>
<tr>
<td>2107646</td>
<td>Chemistry for Water and Wastewater Treatment</td>
</tr>
<tr>
<td>2107647</td>
<td>Process Chemistry of Water Treatment</td>
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<td>2107648</td>
<td>Industrial Water Conditioning</td>
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<tr>
<td>2107649</td>
<td>Treatment Plant Hydraulics for Environmental Engineers</td>
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<tr>
<td>2107650</td>
<td>Process Design for Nitrogen Control in Wastewater Treatment Plants</td>
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<tr>
<td>2107652</td>
<td>Upgrading Wastewater Treatment Plants</td>
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<tr>
<td>2107653</td>
<td>Modeling of Biochemical Reactors Sampling and Analysis of Air Pollutants</td>
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<tr>
<td>2107654</td>
<td>Statistics for Environmental Engineers</td>
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<td>2107655</td>
<td>Thermal Processes for Waste Minimization and Utilization</td>
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<td>2107657</td>
<td>Energy and Environment</td>
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<td>2107658</td>
<td>Theory and Design of Advanced Water Treatment Processes</td>
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<td>2107660</td>
<td>Industrial and Hazardous Waste Management</td>
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<td>Industrial Waste Management</td>
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<td>Dissertation</td>
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<td>2107894</td>
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**Qualifying Examination:** 0(0-0-0)

**COURSE DESCRIPTIONS IN ENVIRONMENTAL ENGINEERING (B.ENG.)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>2107211</td>
<td>Introduction to Environmental Sanitation and Engineering</td>
<td>3(3-0-6)</td>
</tr>
</tbody>
</table>

An introduction course to the field of Sanitary and Environmental Engineering for rural and urban development; topics include the communicable diseases and methods of communication, control of disease vectors, excreta disposal, refuse collection and disposal, building sanitation, industrial hygiene, air and noise pollution, sources of water supply and treatment, wastewater collection, treatment and disposal.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>2107212</td>
<td>Chemistry for Environmental Engineering I</td>
<td>2(1-3-2)</td>
</tr>
</tbody>
</table>

**Condition:** Prerequisite 2302127, 2302163

Chemical and physical characteristics of water, general considerations, methods for determination and application of data to environmental engineering practice; instrumentation; laboratory analysis of water; interpretation of water analysis results as related to their treatment: neutralization, precipitation, coagulation, water softening, ion exchange, corrosion, adsorption, chlorination.

<table>
<thead>
<tr>
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<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>2107213</td>
<td>Chemistry for Environmental Engineering II</td>
<td>2(1-3-2)</td>
</tr>
</tbody>
</table>

**Condition:** Prerequisite 2302127, 2302163

Chemical and physical characteristics of wastewater, general considerations, methods for determination and application of data to Environmental Engineering practice; sample collection and preservation; determinations of solids, DO, BOD, COD, Nitrogen (in all forms related to Environmental Engineering practice), phosphorus and phosphates, grease and oil, volatile acids and sulfides; instrumentation for wastewater analysis.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>2107214</td>
<td>Aquatic Chemistry for Environmental Engineering</td>
<td>3(2-3-4)</td>
</tr>
</tbody>
</table>

Chemical and physical characteristics of water, general considerations, methods for determination and application of data to environmental engineering practice; instrumentation; laboratory analysis of water; interpretation of water analysis results as related to their treatment; neutralization, precipitation, coagulation, water softening, ion exchange, corrosion, absorption, chlorination; basic principles of acid-base equilibria, solubility equilibria, oxidation-reduction equilibria, fundamentals of process kinetics, fundamental of surface and colloidal chemistry, water stabilization, water softening and neutralization.

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<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>2107215</td>
<td>Wastewater Chemistry for Environmental Engineering</td>
<td>2(1-3-2)</td>
</tr>
</tbody>
</table>

Chemical and physical characteristics of wastewater, general considerations, methods for determination and application of data to environmental engineering practice; sample collection and preservation; determinations of
solids, DO, BOD, COD, nitrogen (in all forms related to environmental engineering practice), phosphorus and phosphates, grease and oil, volatile acids, sulfides and gas analysis; instrumentation for wastewater analysis.

2107219* Urban Environments Engineering 3(3-0-6)
Urban environments in general, pollution problems in urban area: wastewater, solid waste, noise pollution, air pollution, and hazardous waste: sources of pollution; destruction of the urban environment; especially solution to its urban problems in such scientific, especially engineering aspect; management of pollution, especially pollution control and treatment; improvement guidelines for urban development; regulations and laws related to buildings in urban area, participation of people living in urban are, and case studies.
(* Elective course for non Environmental Engineering Students)

2107220 Environments and Daily life 3(3-0-6)
A learning process of environment in daily life; the un of case studies and social knowledge which are key information in analyzing the importance of in dairy life; integrated ecological system; natural resources and related environment; integration the of outcome of the study with related disciplines in order to understand and realize the importance of environment and guidelines for participation for better environment.

2107221 Environmental Studies 3(3-0-6)
Basic knowledge and important perspectives on global environment with emphasis on case studies; ecosystem; biogeochemical cycles; population studies; energy; wetland; water pollution; air pollution; noise pollution; solid waste disposal; hazardous waste; waste treatment system design; environmental responsibility.

2107311 Biology for Environmental Engineering 3(2-3-7)
Cell and its structure, principles of bacteriology, population growth, roles of bacteria in public health, coliform bacteria, methods of collection and bacteriological examination of water & sewage, principles of immunization, disinfection and sterilization, actions of enzymes as related to stabilization of organic matter, biodegradation of organic compounds, fundamental concepts related to energy, food chain, productivity and limiting factors, positive and negative interactions among microbial populations, basic concept of ecology, habitat and ecological niche, Nitrogen, Carbon, Sulfur; Phosphorus cycles, freshwater ecology and biota dynamics in wastewater treatment environments.

2107312 Unit Operations for Environmental Engineering 3(3-0-6)
An overview of unit processes and application of unit operations in water and waste treatment as well as air pollution control: aeration and gas transfer, mixing, sedimentation, aerosol separation, filtration, coagulation, precipitation, ion exchange, adsorption.

2107313 Unit Process for Environmental Engineering

2107411 Water Supply Engineering and Design 4(3-3-6)
Condition: Prerequisite 2107212, 2107312
Sources of public water supply, quality and quantity requirements: water standards, population prediction, water consumption and flow variation; design of water distribution systems; design of water treatment plant; planning.

2107412 Wastewater Engineering and Design 4(3-3-6)
Condition: Prerequisite 2107311, 2107312, 2107213
Wastewater flow rates and characteristics; collection, transportation and pumping; wastewater treatment objectives; methods and design fundamental of process analysis; facility design of physical, chemical and biological treatment for primary and secondary processes; land treatment and disposal.

2107441 Air Pollution Control 3(3-0-6)
Basic knowledge in air pollution: major pollutants, sources, effects on health and welfare, meteorological transport. Sampling and analysis, techniques for control of emissions of particulates and gas, air pollution control regulations and standards, air quality management, enforcement systems.

2107444 Building Sanitation 3(3-0-6)
Fundamentals of Building Sanitation; law & regulations; design of building water supply (hot, cold & drinking water), building drainage and vent systems; fire protection; site drainage; building wastewater and solid wastes disposal and treatment, swimming pool system design.

2107445 Air Pollution Control and Design 4(3-3-6)
Basic knowledge in air pollution: major pollutants, sources, effects on health and welfare, meteorological transport, sampling and analysis, techniques for control of emissions of particulates and gas, air pollution control regulations and standards, air quality management, enforcement systems.

2107446 Treatment of Industrial Wastewater 3(3-0-6)
Condition: Prerequisite 2107412
Industrial wastewater effluent standards; laws and regulations; industrial wastewater monitoring systems; sources, quantity and qualification characteristics of industrial wastewater; industrial wastewater treatment technology; water pollution control and management in major industries; case studies on wastewater reuse and product recovery.

2107448 Noise and Vibration Control 2(2-0-4)
Reactor design, flow model, reaction kinetics, screening; sedimentation, filtration, coagulation-flocculation, absorption, stripping, sorption, stoichiometry of biological process, microbial growth kinetics, activated sludge system.
Behavior of sound waves; instrumentation; practical measurements; environmental impact of noise and vibration; regulations and criteria for noise and vibration control in environmental systems; use of acoustic materials, noise and vibration barriers.

2107449 **Industrial Safety Management** 2(2-0-4)
Nature of accident in industry and need of accident prevention; planning for safety such as plant layout, machine guarding and maintenance, etc; safety in industry; management of safety program; safety training; case studies in accident analysis.

2107450 **Environmental Systems and Management** 3(3-0-6)
Basic interrelating effects on environmental in terms of environmental engineering aspects; the functions of government and other agencies in environmental management; an analysis for decision making in environmental protection programs; public policy and action; arrangement of organizations and institutes related to environmental management including their structures and roles; policy development; management approaches and program implementation; case studies of specific environmental protection.

2107451 **Principles of Public Health** 2(2-0-4)
Health aspects of environmental quality; some principles of epidemiology with special emphasis on community and occupational environment; environmental health standards and requirements; engineering control of some urban and rural pollution problems; other topics in application of engineering principles in environmental protection.

2107452 **Physico-chemical Treatment** 3(3-0-6)
Theoretical approach to physico-chemical treatment processes : Chemical reaction treatment, Oxidation-reduction treatment, Flocculation, Sedimentation, Precipitation, Separation units, Floatation, Adsorption, Membrane Processes.

2107453 **Public Health Engineering** 3(3-0-6)
Public health and safety in different environmental quality settings; principles, of managing the environment and safety of working places; managing and promoting the safety during work; law and regulations related to public health; Implementation of engineering principles to manage and minimize environmental problems in working places, communities and metropolitan.

2107460 **Introduction to Hazardous Waste Treatment** 3(3-0-6)
An introduction course to hazardous waste treatment technology : topics include definition, classification, regulations, sources, impacts on environment, chemical, biological, thermal, stabilization/solidification treatment, and final disposal method.

2107462 **Hazardous Waste Treatment** 3(3-0-6)
Basic principles of management and treatment of both organic and inorganic hazardous waste; the treatment system includes physical, chemical, biological, or thermal process as well as final disposal method.

2107480 **Sanitary System in Architecture** 2(2-0-4)
Fundamentals of building sanitary engineering ; conceptual design and installation of building water supply and hot water supply, wastewater collection, rain water drainage, wastewater treatment, fire protection, swimming pool water treatment , solid wastes collection and disposal.

2107481 **Introduction to Environmental Impact Assessment** 3(3-0-6)
Development of environmental impact study with emphasis on environment parameters including physical resources, ecological resources, human use values and quality of life values. Interrelationship between engineering aspects and environmental parameters and case studies.

2107482 **Environmental Engineering Project I** 1(0-3-1)
Practical interesting project on problems in various fields of Environmental Engineering.

2107483 **Environmental Engineering Project II** 2(0-3-2)
Practical interesting project on problems in various fields of Environmental Engineering.

2107484 **Solid Waste Engineering** 3(3-0-6)
*Condition : Prerequisite 2107213*
Quantity and composition of solid wastes; impacts to environment; disposal methods - alternatives and selection, leachate problem; volume and size reduction; transportation; components separation; landfilling; incineration; composting; integrated process and management.

2107491* **General Water Supply Engineering** 3(3-0-6)
Sources of Water supply; drinking water standards; quantity required, ground water collection; water transmission and distribution; water treatment technique: screening, coagulation and flocculation, sedimentation, filtration, disinfection, softening, iron removal, taste and odor removal.

2107494* **Industrial Water Supply and Wastewater Treatment** 3(3-0-6)
Sources of water supply; industrial water standards; water treatment techniques: screening, coagulation and flocculation, sedimentation, filtration, softening, demineralization and disinfection; industrial wastewater characterization; effluent standards; industrial wastewater treatment processes.

2107495 **Advanced Topics in Environmental Engineering I** 3(3-0-6)
*Condition : Senior Standing*
Study topics of current interest and new developments in various fields of environmental engineering.

2107496 Advanced Topics in Environmental Engineering II 3(3-0-6)
Condition : Senior Standing
Study topics of current interest and new developments in various fields of environmental engineering.

2107497 Special Problems in Environmental Engineering I 3(2-3-4)
Condition : Senior Standing
Study or investigation of special problems in Environmental Engineering.

2107498 Special Problems in Environmental Engineering II 3(2-3-4)
Condition : Senior Standing
Study or investigation of special problems in Environmental Engineering.

2107499 Environmental Engineering Project 3(0-6-3)
Condition : Senior Standing
Practical interesting project on problems in various fields of Environmental Engineering.

(* Elective course for non Environmental Engineering Students)
2107530 Advanced Techniques in Physical and Chemical Treatment 3(3-0-9)
Applications of theoretical approaches to the following physical and chemical treatment processes: absorption, adsorption, stripping, distillation, sedimentation, flotation, coagulation, flocculation, neutralization, gas / liquid transfer, heavy metal removal, membrane filtration.

2107551 Environmental management System ISO 14000 3(3-0-6)
Environmental management system and ISO 14000 series; ISO 14001 criteria and requirements; environmental situation review; search for environmental aspect, policy and action plans; environmental management system auditing and management review.

2107607 Environmental Analysis 3(3-0-9)
Procedures and details of environmental sample analysis; methods of sample collection, sample handling; analytical method selection; details of analysis and data presentation.

2107608 Technology of Solid and Hazardous Waste Treatment 3(3-0-9)
Basic principles of solid and hazardous materials; atom structure and chemical reaction; combustion mechanisms of reactive materials; laws governing gas temperature, pressure and volume; behavior of compressed and cryogenic gases; explosive mechanism; shock waves; toxicity, corrosive and radiation; hazardous waste treatment technologies, physical chemical and biological treatments; precipitation, sedimentation, chemical oxidation, neutralization, extraction, incineration, landfill, land treatment, ocean disposal; sources, types and composition of waste to be treated and utilized; advantages and disadvantages in recycling waste; processes of basic technologies; processes of utilizing; organic and inorganic waste.

2107611 Advanced Water Treatment Processes 3(3-0-9)
Condition : Prerequisite 2107212 or Consent of Faculty

2107612 Advanced Wastewater Treatment Processes 3(3-0-9)
Condition : Prerequisite 2107213, 2107311 or Consent of Faculty
Development in wastewater technology: wastewater collection and transportation, design of sewers and appurtenances, advanced wastewater treatment, treatment by microbial and biological control techniques, laws relating to effluent disposal, wastewater treatment plant organization and management.

2107613 Design of Water Treatment Plant and Distribution System 3(1-6-5)
Condition : Prerequisite 2107611 or Consent of Faculty
Development of design criteria for water sources, pipe lines distribution and storage facilities, water treatment and softening, engineering design of water distribution system, functional and hydraulic design of complete water treatment plant.

2107614 Design of Wastewater Treatment Plant and Collection System 3(1-6-5)
Condition : Prerequisite 2107612 or Consent of Faculty
Combined and separate system: pumping stations, functional and hydraulic design of complete wastewater treatment plant.

2107616 Air Quality Management 3(3-0-9)
Interaction among air, water and land pollutions, effects of air pollutants, standards and regulations, technical aspects of air pollution control programs, the organization and management of control programs in governmental and private sectors.

2107617 Solid Wastes and Hazardous Wastes Management 3(3-0-9)
Quantity and composition of solid wastes and hazardous wastes; impacts to environment; legislation; collection and transportation system; disposal technique; choice of disposal site; planning and management; case study.

2107622 Environmental Control Planning 2(2-0-6)
Fundamental of comprehensive environmental planning; planning for environmental health : program planning process; rural and urban development; ecosystem concepts; energy; toxicology; environmental health standards; economic principles of pollution control; social cost and pollution damage functions and their economic, social and health implication; problems associated with environmental management.

2107626 Stream Sanitation 2(2-0-6)
Patterns of pollution and natural purifications; bacterial self purification; deoxygenation rate; reoxygenation rate; DO sag curve; detection and measurement of pollution; pollution of tidal & coastal waters; BOD loading of receiving waters.

2107627 Advanced Sanitary Engineering Laboratory 3(1-6-5)
Laboratory and pilot plant techniques used to obtain design data, to control plant operation, and to investigate processes for the treatment of water, sewage and wastes.

2107628 Design of Water Retaining Structures 3(1-6-5)
General design principles of water retaining structures; cylindrical and rectangular tanks; open and covered reservoirs; tanks with conical and pyramidal bottoms; swimming pools and tanks with sloping floors; water tower storage; some special design problems.
Treatment and Disposal of Industrial Wastes 3(2-3-7)
Industrial waste problems; categories of waste; nature and characteristics of liquid waste; effect of waste on environment; laws for disposal of waste in Thailand and other countries; method of treatment of various kinds of waste; preventive measures.

Environmental Impact Assessment 2(2-0-6)
Environmental changes and its impact on communities; assessment methodology; environmental planning and decision making; case studies.

Water Quality and Agriculture Practice 3(3-0-9)
Water pollution from agricultural practices; sediment, plant nutrients, pesticides, and animal waste; implications of agricultural pollution; control policy and methods.

Advances in Environmental Pollution Research 2(2-0-6)
Selected research topics in water and wastewater treatment, air pollution control and abatement, and solid waste disposal and management.

Reading in Environmental Engineering 1(1-0-3)
Selected topics in environmental engineering issues and discussion.

Plumbing Design 3(3-0-9)
Plumbing systems, materials, and flow in pipes. Design of water supply systems, hot water supply systems, sanitary drainage and vent systems, storm drainage, fire protection system, public swimming pools, valves, pumps. Installation and testing a system.

Atmospheric Chemistry 3(3-0-9)
Photochemistry of small quantity gas; surface reaction and adsorption phenomena; physical and chemical of aerosol; origin; coagulation and precipitation of dust in ambient and reaction with gas.

Air Pollution Control Technology 3(3-0-9)
Overview of air pollution control methods. Control of particulates and gaseous emissions by settling chambers, cyclones, scrubbers, filters and electrostatic precipitators. Design of equipment, maintenance and evaluation of control efficiency.

Engineering Practices for Solid Waste Disposal 3(3-0-9)
Municipal and industrial solid wasters, their volume and characteristics; heat value methods of handling, storage and disposal. Size and volume reduction. Separation of components. landfill and leachate effects. Ocean disposal. Incineration.

Advanced Study in Environmental Engineering I 3(3-0-9)
Study of recent topic and technology development in various fields of environmental engineering.
conversion technology including pyrolysis and gasification; biogas from fermentation; prospect of hydrogen economy.

2107658 Theory and Design of Advanced Water Treatment Processes 4(3-3-10)
Condition : Prerequisite: 2107661 or C.F.
Water sources; water chemistry and quality, aeration, coagulation, sedimentation, filtration, ion exchange, membrane processes, disinfection absorption, neutralization and stabilization; water conditioning for boiler and cooling system; design criteria for water sources, lines distribution and storage facilities, water treatment and softening, engineering design of water distribution system, functional and hydraulic design of complete water treatment.

2107659 Theory and Design of Advanced Wastewater Treatment Processes 4(3-3-10)
Condition : Prerequisite: 2107311, 2107661 or C.F.
Development of wastewater technology; wastewater collection and transportation; design of sewers and appurtenances; advanced wastewater treatment by microbial and biological control techniques, law related to effluent disposal; wastewater law relating to effluent disposal, wastewater treatment plant organization and management; combined and separate system pumping stations; functional and hydraulic design of complete wastewater treatment system.

2107660 Industrial and Hazardous Waste Management 3(3-0-9)
Terms and definitions, types and sources of waste, law, regulations, disposal and management standards, related organizations; reduction of waste and case studies, unit operations for waste management; reuse and recycle of industrial waste and case studies; treatment of industrial waste; sample collection and characterization of waste; physical and chemical treatment of industrial waste; stabilization and solidification; disposal of industrial waste and monitoring, disposal guidelines; design of industrial waste landfill, monitoring and checking of the landfill; international industrial waste management, transport of hazardous waste across international borders, case studies, Basel accord.

2107661 Fundamental Chemistry for Environmental Engineering 3(2-3-7)
Chemical and physical characteristics of water and wastewater, general considerations, methods for determination and application of data to environmental engineering practice; instrumentation; sample collection and preservation; laboratory analysis of water; interpretation of water analysis results as related to their treatment; neutralization, precipitation, coagulation, water softening, ion exchange, corrosion, absorption, chlorination; determinations of solids, DO, BOD, COD, nitrogen (in all forms related to environmental engineering practice), phosphorus and phosphates, grease and oil, volatile acids, sulfides and gas analysis.

2107662 Unit Processes for Environmental Engineering 3(3-0-9)
An overview of unit processes and application of unit operations in water and waste treatment by physical, chemical and biological processes as well as air pollution control processes.

2107663 Industrial Waste Management 3(3-0-9)
Analysis of material and energy flow in industrial system to enhance eco-efficiency; relationships between industrial production and economic development; waste minimization, pollution prevention, prevention, design for environment, life cycle analysis (LCA) and waste exchange; linkage of Industrial activity with environmental and social sciences; integration of environmental management and environmental ethics; environmental policies and laws.

2107664 Anaerobic Wastewater Treatment Technology 3(3-0-9)
Types of biological wastewater treatment; Theory and basic mechanism of anaerobic wastewater treatment; microbiology and biochemistry of anaerobic fermentation; Kinetics of anaerobic treatment system; various types of anaerobic wastewater treatment system; design and operation of anaerobic treatment processes; current status of anaerobic technology; consideration and selection of anaerobic process in industrial, municipal and agricultural wastewater treatment.

2107665 Mass Transfer and Separation Processes in Environmental Engineering 3(3-0-9)
Theory of molecular diffusion and mass transfer; fundamental of phase equilibrium; mass transfer operation and separation process; interface mass transfer; absorption and desorption; adsorption and ion exchange; distillation; physical separation process; membrane separation process; finishing process.

2107666 Fundamental Biology for Environmental Engineering 3(2-3-7)
Cell and its structure, principles of bacteriology, population growth, roles of bacteria in public health, coliform bacteria, methods of collection and bacteriological examination of water and sewage, principles of immunization, disinfection and sterilization, actions of enzymes as related to stabilization of organic matter, biodegradation of organic compounds, fundamental concepts related to energy, food chain, productivity and limiting factors, positive and negative interactions among microbial populations, basic concept of ecology, habitat and ecological niche; nitrogen, carbon, sulphur, phosphorous cycles; freshwater ecology and its inhabitants, lake stratification, river pollution, roles of inhabitants and biota dynamics in wastewater treatment environments.

2107667 Fundamental Engineering for Environmental Engineering 3(3-0-9)
Basic principles of mathematics, statistics, calculus, ordinary differential equation, mechanic, hydraulics and hydrology required for environmental engineering.

2107668 Clean-up of Contaminated Sites by Biological Processes 3(3-0-9)
Pollutants and their properties: site characterization; physical and chemical properties of a site; risk assessment; fate and transport of pollutants; fundamental of microbiology; microbial metabolism process; microbial destruction of pollutants process; bioremediation approach; factors influencing bioremediation; bioremediation technology; design of bioremediation systems; detection of microorganisms by molecular tools: phytoremediation: case studies.

2107669 Environmental Impact Assessment 3(3-0-9)
Selection of feasible projects by engineering, socio-economic and environment; environmental changes and its on communities, assessment methodology; environmental planning and decision making; risk assessment caused by chemical of hazardous waste; case studies.

2107670 Air Quality Management and Engineering 4(3-3-10)
Effects of air pollutants, standards, law and regulations, the organization and management of mitigation programs, emission source inventory, pollutant dispersion and mathematical modeling, principles and design of air pollution control system, measurement and monitoring system.

2107671 Solid and Hazardous Waste Management 4(3-3-10)
Overview of management schemes, sources and generation of solid and hazardous wastes, important physical, chemical, and biological characteristics of wastes, regulations, international laws and standards, collection and transfer, transport of hazardous wastes and code of practices, resource recovery of solid wastes, treatment procedures and stabilization of hazardous wastes, thermal processes, various disposal means of solid and hazardous wastes including landfill.

2107672 Adsorption for Water and Wastewater Treatment 3(3-0-9)
Adsorption theory in aqueous phase; type of adsorbents; characterization adsorbents of physico-chemical adsorption phenomena; adsorption kinetics; adsorption isotherm; effects of water and wastewater characteristics on adsorption efficiency; adsorption processes design for water production and wastewater treatment; adsorbent regeneration; case studies on adsorption phenomena of pollutants in aqueous phase.

2107673 Principles for Environmental Engineering Management 3(3-0-9)
Principles of planning and setting policies for environmental management; example of policy application in working; principles of using economic instruments in setting policies for natural resource conservation and environmental protection; methods of cost survey and estimation; effectiveness and advantages of policies for environmental management; comparison of advantages and disadvantages of each type of policies in order to achieve the objective as planned; analysis and comparison of current guidelines and policies for environmental management by using case studies in Thailand and abroad; related projects.

2107674 Treatment of Wastewater Contaminated with Oil and Small Particles in Environmental Engineering 3(3-0-9)
Oil and small particles in environment; analysis of oil and small particles: overview of treatment and separation processes; fundamental knowledge of separation process; oil skimmer; gravity separation (decantation); coalescer; flotation; hydrocyclone; membrane processes; thermal processes; chemical treatment processes; electro-chemical processes; hybrid treatment processes; finishing process.

2107701 Seminar in Environment Engineering I 1(1-0-3)
A once a week seminar series on work done in sanitary engineering points of view. Invited speakers from government industry and various professionals will present these seminar. Every student is expected to present paper on his own research.

2107702 Seminar in Environment Engineering II 1(1-0-3)
A once a week seminar series on work done in sanitary engineering points of view. Invited speakers from government industry and various professionals will present these seminar. Every student is expected to present paper on his own research.

2107791 Advanced Seminar in Environmental Engineering I 1(1-0-3)
Seminar on recent and interesting topics in the field of environmental engineering, and report presentation.

2107792 Advanced Seminar in Environmental Engineering II 1(1-0-3)
Seminar on recent and interesting topics in the field of environmental engineering, and report presentation.

2107793 Advanced Seminar in Environmental Engineering III 1(1-0-3)
Seminar on recent and interesting topics in the field of environmental engineering, and report presentation.

2107794 Advanced Seminar in Environmental Engineering IV 1(1-0-3)
Seminar on recent and interesting topics in the field of environmental engineering, and report presentation.

2107795 Advanced Seminar in Environmental Engineering V 1(1-0-3)
Seminar on recent and interesting topics in the field of environmental engineering, and report presentation.

**2107796**  Advanced Seminar in Environmental Engineering VI 1(1-0-3)

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