

Republic Of The Philippines  
MINDANAO POLYTECHNIC STATE COLLEGE  
SCHOOL OF ENGINEERING AND ARCHITECTURE  
Cagayan de Oro City

**Two Phased (MPSC-AIT)  
Master Degree in Environmental Geotechnics and  
Management**

November 2007

# Part 1: Overview

## 1.1. Introduction

This two-phased Masters Degree in Environmental Geotechnics and Management is another field of specialization of Masters of Engineering Science (MES) program in the School of Engineering and Architecture of Mindanao Polytechnic State College.

This masters program is established based on high demands of professional development in the Philippines. Its curriculum will combine the existing master degree programs in Geotechnical and Geoenvironmental Engineering (GTE), Construction Engineering and Infrastructure Management (CEIM) and Environmental Engineering and Management (EEM) which are currently offered at AIT Thailand.

The two-phased master's degree program is a partnership between the Mindanao Polytechnic State College (MPSC) and Asian Institute of Technology (AIT) in Bangkok, Thailand. The program will run for four (4) semesters, tentatively starting this August 2008. The first and fourth semesters will be undertaken in MPSC, Cagayan de Oro City and the second and third semesters will be conducted at Asian Institute of Technology, Bangkok, Thailand.

## 1.2. Objectives

Environmental issues have been a significant component of Geotechnical Engineering since about 1980. At that time, the primary issues facing geotechnical engineers were: (1) the design and construction of new waste containment facilities, such as engineered landfills used for disposal of municipal solid waste (MSW) and hazardous waste, and (2) the assessment and remediation of site contaminated by past industrial practices and posing threat to public health and environment. The significance of environmental issues in Geotechnical Engineering has grown to the extent such that a new sub-discipline in Geotechnical Engineering, commonly referred to as Environmental Geotechnics, has been established. Accordingly, seven current and/or future environmental issues in Geotechnical Engineering may consist of the following: (1) long-term performance of waste containment systems, (2) acceptance of alternative barriers and barrier material, (3) need for innovative barrier materials, (4) emergence of new waste forms, (5) increasing significance of biological processes, (6) role of modeling, and (7) importance of professional identity. Environmental issues will continue to represent a major sub-category within Geotechnical Engineering in the foreseeable future. In addition to the above topics, courses in Environmental Engineering and Management (EEM) and Construction Engineering and Infrastructure Management (CEIM) will be added.

## 1.3. Who should apply?

#### Prospective candidates

- Faculty members and staff in private and public higher education institutions (HEIs) in the Philippines
- Project managers and engineers with work experience
- Government officials responsible for landfill construction and operation
- Financial officials involved in project financing

#### Target Industries/Sectors

- State Colleges and Universities and private HEIs
- Construction
- Design and Engineering firms
- Build-Operate-Transfer (BOT) Consortium
- Government
- Financial Institutions

### **1.4. Admission Eligibility**

The considered eligible candidates for admission to this two-phased Masters, Diploma or Certificate program must:

- hold at least a bachelor's degree in Engineering or Science in related fields i.e. Civil Engineering, Environmental Engineering, Geology, Physics, and other interrelated fields.
- have undergraduate grades significantly above average; the minimum GPA requirement for admission to the master's program is 2.75 or equivalent at the Bachelor degree level.
- be in satisfactory physical and mental health, and have a record of good conduct.

## Part 2: Program Structure

### 2.1. Credit Requirements

Students can obtain a master degree in Environmental Geotechnics and Management by completing the minimum requirements consisting of 26 credits of courses and 22 credits of thesis (see Table 1A). The research option is shown in Table 1B.

### 2.2. Program Delivery

This program is conducted in two phases. The first phase is delivered at MPSC in Cagayan de Oro, Philippines and the second phase at AIT (Bangkok, Thailand).

Table 1A. Two Phased Program – Thesis Option

|                                   | 1st Phase                |                          | 2nd Phase                     |                      |             |
|-----------------------------------|--------------------------|--------------------------|-------------------------------|----------------------|-------------|
| <b>TWO PHASED - THESIS OPTION</b> | Semester 1               | Semester 2               | Summer Break                  | Semester 3           | Semester 4  |
| Location                          | MPSC                     | AIT                      | AIT                           | AIT                  | MPSC        |
| Period                            | August-December          | January-May              | June-July                     | August-December      | January-May |
| Programs                          | 13 Credits of Coursework | 13 Credits of Coursework | Coursework or Thesis Proposal | 22 Credits of Thesis |             |

Table 1B. Two Phased Program – Research Option

|                                     | 1st Phase                |                          | 2nd Phase                     |                          |                        |
|-------------------------------------|--------------------------|--------------------------|-------------------------------|--------------------------|------------------------|
| <b>TWO PHASED - RESEARCH OPTION</b> | Semester 1               | Semester 2               | Summer Break                  | Semester 3               | Semester 4             |
| Location                            | MPSC                     | AIT                      | AIT                           | AIT                      | MPSC                   |
| Period                              | August-December          | January-May              | June-July                     | August-December          | January-May            |
| Programs                            | 13 Credits of Coursework | 13 Credits of Coursework | Coursework or Thesis Proposal | 12 Credits of Coursework | 10 Credits of Research |

During the 1<sup>st</sup> phase, all courses will be taught 15 hours every week (see Table 2) with a maximum of 4 hours in a day. The projected professors will be tapped from Northern Mindanao's highly qualified local lecturers i.e. the AIT alumni and the high-ranking officers in government agencies with allied Doctoral degrees, and faculty members from GTE, CEIM and EEM in AIT, Thailand.

Table 2. Course Delivery During 1<sup>st</sup> Phase at MPSC (4 Courses in a Semester)

| Courses  | Weeks |    |   |    |    |   |    |    |    |    |    |    |    |    |    |    |    | Total Hours |
|----------|-------|----|---|----|----|---|----|----|----|----|----|----|----|----|----|----|----|-------------|
|          | 1     | 2  | 3 | 4  | 5  | 6 | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |             |
| Course 1 | 15    |    |   | 15 |    |   | 15 |    | 15 |    |    |    |    |    |    |    |    | 60          |
| Course 2 |       | 15 |   |    | 15 |   |    | 15 |    |    |    |    |    |    |    |    |    | 45          |
| Course 3 |       |    |   |    |    |   |    |    | 15 |    |    | 15 |    |    |    | 15 |    | 45          |
| Course 4 |       |    |   |    |    |   |    |    |    | 15 |    |    | 15 |    |    |    | 15 | 45          |

During the second phase, students will take courses and conduct part of the research/thesis work at AIT – Thailand.

## 2.3. Study Plan

### THESIS OPTION

#### Semester 1 (13 Credits)

Students can take 13 credits of courses (R = required course; E = elective course)

#### A) GTE Courses

- CE71.11 Soil Mechanics and Laboratory/Field Tests (4 credits) (E)
- CE71.98 Waste Containment and Lining Technology (3 credits) (R)

#### B) EEM Course

- ED78.07 Solid Waste Management (3 credits) (R)

#### C) CEIM Courses

- CE70.12 Management of Construction Organizations (3 credits) (E)

(See Appendix A for details description of courses)

#### Semester 2 (13 Credits)

#### A) GTE Courses

- CE71.21 Geoenvironmental Engineering (3 credits) (E)
- CE71.52 Ground Improvement and Geosynthetics (4 credits) (E)

#### B) EEM Course

- ED78.05 Waste Reuse and Recycling (3 credits) (E)

#### C) CEIM Courses

- CE70.22 Legal and Contractual Risk Management (3 credits) (E)

(See Appendix A for detailed description of courses)

Summer Break (Inter-Semester)

- Thesis Proposal
- Coursework

Semester 3 (Thesis - 12 Credits)

Students can choose the thesis topics according to their specific interests. The thesis study will start in Semester 3.

Semester 4 (Thesis - 10 Credits)

The thesis study will be continued in Semester 4.

**RESEARCH OPTION**

Semester 1 (13 Credits)

Students can take 13 credits of courses.

A) GTE Courses

- CE71.11 Soil Mechanics and Laboratory/Field Tests (4 credits) (E)
- CE71.98 Waste Containment and Lining Technology (3 credits) (R)

B) EEM Course

- ED78.07 Solid Waste Management (3 credits) (R)

C) CEIM Courses

- CE70.12 Management of Construction Organizations (3 credits) (E)

(See Appendix A for details description of courses)

Semester 2 (13 Credits)

B) GTE Courses

- CE71.21 Geoenvironmental Engineering (3 credits) (E)
- CE71.52 Ground Improvement and Geosynthetics (4 credits) (E)

B) EEM Course

- ED78.05 Waste Reuse and Recycling (3 credits) (E)

C) CEIM Courses

- CE70.22 Legal and Contractual Risk Management (3 credits) (E)

(See Appendix A for detailed description of courses)

Summer Break (Inter-Semester)

- Thesis Proposal
- Coursework

Semester 3 (Courses - 12 Credits)

Students can take 12 credits of elective courses upon the approval of the academic advisor. Examples of courses offered currently are:

- CE71.12 Rock Mechanics 3 (2-3) (E)
- CE71.31 Engineering Geology 3(2-3) (E)
- CE74.13 Water Resources Systems 3(3-0) (E)
- CE74.81 Planning and Development of Hydropower 3(3-0) (E)
- ED78.08 Environmental Quality Management 3 (3-0) (E)
- ED78.19 Environmental Impact Assessment 3(3-0) (E)
- ED79.16 Environmental Conflict Resolution and Mediation 3(3-0) (E)
- SM70.62 Total Quality Management 3(3-0) (E)
- SM91.42 Cross-Cultural Management 2(2-0) (E)

(See Appendix A for detailed description of courses)

Semester 4 (Research - 10 Credits)

Students can choose the research topics according to their specific interests. The research will be carried out in Semester 4.

Appendix A:  
Course Catalogue

### **CE71.11 Soil Mechanics and Laboratory/Field Tests (3 credits) Semester: August**

*Rationale:*

The soil-engineering field of study involves three categories. The first category deals with the principles and mechanics of soil behavior both under laboratory and field conditions. The second deals with applied topics such as foundations and earth structures, while the third category is more advanced in nature and research oriented. This course on "Mechanics of Soils", which belongs to the first category, deals with the fundamental principles of soil behavior as a prerequisite for courses related to the design of foundations and earth structures.

*Catalog Description:*

Soil formations and their relevance to engineering properties, mechanical analysis, index properties and soil classifications, effective stress principle for saturated and partially saturated soils, permeability, seepage analysis, stress-history and compressibility of soils, stress distribution in soils, stress-strain behavior and strength characteristics, introduction of stress path method and stress-strain theories, laboratory and field tests.

### **CE71.12 Rock Mechanics (3 credits) Semester: August**

*Rationale:*

Rock mechanics is a principal subject in geotechnical engineering, with applications in civil and mining engineering, infrastructure development, oil exploration, and natural hazard mitigation. It plays a vital role in the exploration and development of oil and other natural resources; mining, construction of civil infrastructures, transportation routes and water resource facilities; and in the prevention and mitigation of natural hazards particularly landslides. As the Asian region is in an era of major economic and infrastructure development, knowledge of rock mechanics is indispensable.

*Catalog Description:*

Properties of intact rock, rock mass and discontinuities; index properties and classifications; strength and deformability properties, moisture-sensitive and time-dependent properties of weak rocks and related problems; deformability of rock mass and related problems; groundwater in rock mass, foundations on rocks; shear strength along discontinuities, rock slope engineering.

### **CE71.21 Geoenvironmental Engineering (3 credits) Semester: January**

*Rationale:*

Geotechnical engineers are increasingly challenged to solve environmental problems related to the reduction of construction waste, waste disposal facilities and cleanup of contaminated sites. This effort has given rise to a new discipline of specialists in the field of geoenvironmental engineering. To be effective, geoenvironmental engineers must be armed not only with the traditional knowledge of field such as soil mechanics and geology, but also with the knowledge of principles of hydrogeology, geochemistry, and biological processes. The purpose of this course is to teach principles and phenomena in geoenvironmental engineering, which are required as basic knowledge for landfill designs, remediation for contaminated lands, and site monitoring.

*Catalog Description:*

Sources and types of ground contamination, characteristics of aquifer, hydraulic conductivity and dispersivity of soils, solute contaminant transport in saturated porous media, chemical and biological reaction in subsurface environments, non-aqueous phase liquids, environmental problems associated with geotechnical construction works.

### **CE71.31 Engineering Geology (3 Credits)**

**Semester: August**

*Rationale:*

To provide a balanced and comprehensive understanding of the methods and approaches that is useful in dealing with the great variety of geologic conditions encountered in engineering works.

*Catalog Description:*

Qualitative and quantitative description of soils and rock masses with emphasis on the physical properties; identification of the influence of geological structures on engineering projects; geological processes, e.g. weathering that influence soil/rock engineering properties; practical application with case studies and histories.

### **CE71.52 Ground Improvement and Geosynthetics (3 credits)**

**Semester: January**

*Rationale:*

As more engineering structures are built, it becomes increasingly difficult to find a site with suitable soil properties. The properties at many sites must be improved by the use of some form of soil improvement methods, such as: static or dynamic compaction, reinforcement, drainage or by the use of admixtures. Thus, it is important for the soil engineers to know the different soil improvement methods; the degree to which soil properties may be improved; and the costs and benefits involved. In this way, the soil engineer can gain knowledge in order to design ground improvement projects as well as to advise the client regarding value engineering to save cost and obtain maximum benefits for the specific project. In this course, we will be studying the latest state-of-the-art techniques of soil improvement including the following:

*Catalog Description:*

Surface compaction, deep compaction, preloading, vertical drains, vacuum drainage, mechanically stabilized earth (reinforced earth), granular piles, micropiles, lime stabilization, cement stabilization, chemical stabilization, grouting, geotextiles; lightweight embankment materials.

### **CE71.98 Waste Containment and Landfill Lining Technology (3 credits)**

**Semester: August**

*Rationale:*

Geotechnical engineers are often faced with the challenge of solving environmental problems caused by waste disposal and contamination. This course introduces the student not only to the general principles and concepts involved in the design of waste containment facilities but also with proper construction procedures that are protective of human health and environment.

*Catalog Description:*

Waste generation and disposal, components of waste containment systems, types, properties, design and construction of liners, soil drainage systems, geosynthetic lining and drainage systems, stability analysis and designs.

### **ED78.07 Solid Waste Management (3 credits)**

**Semester: August**

*Catalog Description:*

Solid waste generation and characterization; waste collection and transportation; waste separation and recycling; waste treatment; landfill composting; incineration, public and private participation in solid waste management

### **ED78.08 Environmental Quality Management, 3(3-0)**

**Semester: August**

*Catalog Description:*

Basic concepts of environmental management; environmental issues and priorities; environmental management approaches; environmental standards and criteria setting; environmental indicators and indices; environmental information systems; environmental organization; enforcement and economic aspects of environmental control; environmental monitoring

### **ED78.05 Waste Reuse and Recycling (3 credits)**

**Semester: January**

*Catalog Description:*

Engineering principles of waste reuse and recycling; biochemical and design criteria; recycling and recovery processes such as composting, anaerobic digestion (biogas), biomass and biofuel production, algae and fish production, aquatic weeds and their uses, and land treatment of wastewater and sludge; engineering applications and utilization of the reclaimed products; environmental and social impact of the recycling processes

### **CE70.12 Management of Construction Organizations (3 credits) Semester: January**

*Rationale:*

This course explores the management functions applied in construction management. It is divided into three modules. The first module discusses the management functions that are fundamental for managing construction organizations and projects. The second module takes a broad view of the organization theory employed in managing construction teams: owner, contractor and consultant, as well as their relationships; which is referred to as 'Project Delivery System' or 'Contract Strategy'; while the third module discusses the application of management functions in managing construction project resources.

*Catalog Description:*

Management Functions, Project Delivery System, and Project Resources Management.

### **CE70.22 Legal and Contractual Risk Management (3 credits)**

**Semester: January (Required Course)**

*Rationale:*

This course provides a general foundation in construction law, risk and contracts that construction practitioners need to protect themselves, their employers and the works. To facilitate smooth running of construction projects, construction professionals need to be

aware of their rights, obligations and liabilities when they enter into contractual relations either as individuals or on behalf of their employers.

*Catalog Description:*

Construction risks, general principles of law, contract principles, construction contracts, tortious liabilities, laws relating to land, construction statutes, construction claims prevention and management, disputes and their resolution, construction insurance.