Asian Institute of Technology
School of Environment, Resources and Development
School of Engineering and Technology
Disaster Preparedness, Mitigation and Management

IN84.11 Mitigation of Earthquake Disasters 3(3-0) **Semester: January**

Course Objective:
An earthquake can create a variety of detrimental effects to people in the affected area. To effectively minimize these effects, a mix of knowledge from many disciplines is required. The objective of this course is to provide this required mix of knowledge, which includes the nature of earthquakes and their consequences, methodologies for assessing earthquake hazard and earthquake-induced losses, and strategies for earthquake risk mitigation, emergency response, and disaster recovery, etc.

Learning Outcomes:
On completion of the course, the students will be able to:
- Recognize various possible impacts and losses caused by earthquakes (liquefaction, landslide, tsunami, etc.)
- Carry out a preliminary assessment of seismic hazard of a given city or town
- Conduct a preliminary estimation of potential losses in an earthquake scenario
- Develop effective strategies for earthquake risk mitigation, emergency response, and disaster recovery

Prerequisite: None

Course Outline:

I. Basic Seismology
1. Types of Earthquakes, Causes of Earthquakes
2. Plate Tectonics, Active Faults
3. Seismic Waves, Seismographs
4. Earthquake Magnitude, Ground Shaking Intensity

II. Seismic Hazard Assessment
1. Types of Seismic Hazards
2. Deterministic and Probabilistic Seismic Hazard Assessments
3. Modelling of Seismic Sources
4. Ground Motion Attenuation Relationships
5. Probabilistic Seismic Hazard Analysis
6. Seismic Hazard Maps and their uses for Earthquake Disaster Mitigation

III. Tsunami
1. Causes and Nature of Tsunami
2. Characteristics of Tsunami Waves
3. Damage and Impacts by Tsunami
4. Tsunami Warning System
5. Tsunami Hazard Maps, Tsunami Risk Mitigation Measures

IV. Earthquake-Induced Ground Failures
1. Soil Liquefaction
2. Evaluation of Liquefaction Hazard
3. Mitigation Measures for Liquifaction

4. Earthquake-Induced Landslides
5. Surface Rupture along Fault

V. Seismic Vulnerability of Buildings and Structures

1. Lessons Learned from Past Earthquakes
2. Seismic Vulnerability of Different Building Classes
3. Key Concepts in Seismic Resistant Design of Structures
4. Various Possible Failures in Structures caused by Earthquakes
5. Strengthening and Mitigating Seismic Risk

VI. Seismic Loss Estimation

1. Methodology for Seismic Loss Estimation
2. Vulnerability Assessment for Buildings, Lifelines, and Other Structures
3. Estimation of Physical Damage, Number of Casualties, and Economic Losses
4. Application of Seismic Loss Estimation in Emergency Response & Risk Mitigation

VII. Strategies for Earthquake Protection

1. Getting the General Public Prepared
2. Construction Control & Building Stock Management
3. Earthquake Education
4. Earthquake Insurance
5. Earthquake Emergency Management (Search & Rescue, Medical Emergency, etc.)
6. Earthquake Recovery
7. Physical Reconstruction
8. Roles of National and Local Governments in Earthquake Risk Reduction
9. Roles of Urban and Regional Planners in Earthquake Risk Reduction

Laboratory Session(s): None

Learning Resources:

Textbooks: No designated textbook, but class notes and handouts will be provided.

Reference Books:

1. Andrew Coburn and Robin Spence (2002), Earthquake Protection, 2nd Edition, Wiley.
2. Bruce A. Bolt (2006), Earthquakes, 5th Edition, W.H. Freeman and Company.
3. Wai-Fah Chen and Charles Scawthorn (2003), Earthquake Engineering Handbook, CRC Press.

Journals and Magazines:

1. Earthquake Spectra, EERI.
2. Natural Hazards, Springer

Others:
Global Earthquake Model: http://www.globalquakemodel.org/

Teaching and Learning Methods:
Lecture, Discussion on questions raised, Assignments, Presentations of Solutions

Time Distribution and Study Load:

- Lectures: 45 hours
- Self-study: 135 hours
- Assignments, presentations and group activities: 18 hours

Evaluation Scheme:
The final grade will be computed according to the weight distribution as
Mid-Semester Exam: 30%
Final Exam: 40%
Assignments/Project Work: 30%
Both Mid-semester and Final examinations will be open book.

Grade "A" will be awarded if a student can demonstrate thorough knowledge and mastery of concepts and techniques and understanding of subject matter with high degree of skill to relate them with real world situations, Grade "B" will be awarded if a student can demonstrate good knowledge and understanding of subject matter with good skill of relating them with real cases. Grade "C" will be given if a student can demonstrate some knowledge of the concepts and understanding but lacks skill of relating them with real world cases. Grade "D" will be given if a student has poor understanding of concepts and techniques with no or little skill to relate with real world cases. Grade "F" will be given if student demonstrates very poor and limited knowledge and understanding of concepts and lacks the skill to relate with real world cases.

Instructor(s): Prof. Pennung Warnitchai