University of Damascus
Higher Institute of Earthquake Studies and Research(HIESR)
Earthquake Structural Engineering Department

Professional Master in Earthquake Engineering (P.M.E.E)

Syllabus

Course 1	*principals of* ***Structural Dynamics***
Hours	***4 hours weekly -first semester - first year -***
Teaching Staff	

- *The study of single-degree systems of freedom: equations of motion*
- *Free vibration, Response to Harmonic and periodic Excitations*
- *Response of SDOF system to special forms of excitation- impulsive load*
- *Study of multiple degrees of freedom: equations of motion*
- *Free vibration - damping in installations*
- *Analysis of the response of linear systems - seismic analysis in linear systems*
- *Numerical assessment of seismic response*
- *Systems with distributed mass and stiffness*
- *Seismic response, design and evaluation of multi-story buildings: seismic response to linear flexible structures ,and nonlinear structures*
- *seismic dynamics in buildings that base isolation*
- *Structural dynamics in building codes*
- *Structural Dynamics in the Building Evaluation Manual*

Course 2	***Geotechnical Earthquake Engineering***
Hours	***4 hours weekly -first semester - first year***
Teaching Staff	

- *Introduction- Principles of Soil liquefaction*
- *Main Factors that govern the soil liquefaction*
- *Laboratory tests used for evaluation of soil liquefaction*
- *Simplified method for assessing the possibility of soil liquefaction*
- *Problems.*
- *Remedial actions to mitigate soil liquefaction*
- *Static and dynamic bearing capacity of soil .*
- *Static and dynamic bearing capacity of soil .*
- *Static and seismic design of retaining wall.*
- *Static and seismic design of retaining wall.*
- *Sheet piles*

Course 3	***Principles of Earthquake Engineering***
Hours	***4 hours weekly - First semester - first year***
Teaching Staff	

Description *:*

The course is 8 chapters. It starts by the elementary principals of seismology, then the properties of strong ground motion, and their parameters, the recording systems and the processing methods. The next chapters present the topics of seismic response in sites, and buildings, measurement methods and processing. The last chapter discuss the topics of seismic risk and vulnerability ***.***

Aims & Objectives*:*

The purpose of this course is to present the essential theoretical background of the earthquake engineering in the strong ground motions and their effects on sites and buildings ***.***

Course Outline:

- *The elementary principals of seismology*
- *The elementary principals of seismology*
- *The properties of strong ground motion, and their parameters*
- *The properties of strong ground motion, and their parameters*
- *The recording systems of strong ground motion*
- *The processing methods (1)*
- *The processing methods (2)*
- *A program for signal processing*
- *The seismic site response*
- *The seismic building response*
- *The seismic risk and vulnerability*

Course 4	***Soil Dynamic***
Hours	***4 hours weekly second semester - first year***
Teaching Staff	

Description

This course will provide basic nations concerning seismic and vibration problems connected with soil, as soil behavior under cyclic and dynamic loading conditions, introductory earthquake engineering including dynamic ground response assessments, field and laboratory techniques for determination of dynamic soil properties.

Aims & Objectives:

Give to the students the main aspects of the dynamic behavior of soils.

Syllabus:

- *General Introduction and principles of vibration*
- *Behavior of gravel and sandy soils under rapid loading conditions*
- *Determination the dynamic properties of the soils using the resonant column test*
- *Determination of the dynamic properties of the soil using Cyclic Direct Shear, Cyclic Shear and Cyclic Triaxial tests.*
- *Cyclic Plate Load Test.*
- *Experimental equations for determination the shear Modulus and damping ratio in sand and clay.*
- *Calculation procedure for foundation response due of Vertical vibration.*
- *Calculation procedure for foundation response due of Rocking vibration.*
- *Calculation procedure for foundation response due of Sliding vibration.*
- *Calculation procedure for foundation response due of Torsional vibration.*
- *Vibration of foundations under Impact machines*

Course 5	***Earthquake Engineering***
Hours	***4 hours weekly second semester - first year***
Teaching Staff	

- *Preliminary principles and development of earthquake codes*
- *Seismic analysis procedures using multiple and modern codes*
- *Seismic insulation as passive and positive insulation*
- *Base insulation system*
- *Base isolation provisions and requirements*
- *Ground vibrations and dynamic analysis of structures*
- *Study of vibration modes and mode participations of multi-degree structures under earthquake loads*
- *Seismic response of buildings and response spectrum*
- *Analysis concepts based on response spectrum and response spectrum design*

Course 6	***Seismic Engineering***
Hours	***4 hours weekly second semester - first year***
Teaching Staff	

- *Introduction –principles of seismic waves.*
- *Theory of elasticity .*
- *Seismic equipment (power sources and seismic recording equipment).*
- *Refractive seismic methods*
- *reflective seismic methods.*
- *SASW, Spectral analysis of surface waves.*
- *MASW, multi-channel analysis of surface waves.*
- *MAM & ReMi.*
- *Up hole - Down hole.*
- *Cross hole methods.*

Course 7	***design of Concrete and stone structures for earthquakes resistance***
Hours	***4 hours weekly first semester - second year***
Teaching Staff	

- *Introduction to concrete structures, characteristic strength of materials, materials factors, stress – strain relationships for materials, design formulae for RC sections, design of RC members.*
- *Design of special structures under the seismic loads (electrical towers, silos, bridges, warehouses).*
- *Use the **Adaptive 3-D Pushover** procedure to determine the capacity of the existing irregular RC structures and evaluate their performance.*
- *Evaluation of the performance of concrete structures by procedure of static nonlinear analysis- comparison of global codes.*
- *Retrofit and rehabilitation of existing RC buildings.*
- *Introduction to masonry buildings, Design formulae for masonry sections -Members strength exposed to bending moments, Members strength exposed to bending moments additional to axial force, anchorage and bond, Design of masonry members.*
- *A systematic study of the conservation and rehabilitation of masonry buildings-the characteristics of mortar and masonry.*
- *Numerical modeling, linear and nonlinear analysis of masonry buildings.*
- *Setting the seismic design spectra for different masonry systems.*
- *Ductility of members and concrete and masonry structures*

Course 8	***Design of soil structures and retaining walls to resist earthquakes***
Hours	***4 hours weekly first semester - second year***
Teaching Staff	

- *Study of geological and tectonic structures that generate earthquakes.*
- *Mechanical cracking and deformations of the crust.*
- *Stress analysis and patterns of tectonic structures in relation to stress field compounds.*
- *Seismic cycle - tectonic and rheological factors affecting the characteristics of seismic activity.*
- *Seismic torque - Seismic focus spectrum.*
- *Study of crustal deformations based on Geographic spatial integration between seismic and geodetic studies in Sismotectonic Investigations*
- *Studying the historical seismic and seismic situation in Syria and neighboring regions.*

Course 9	***design of Steel structures for earthquakes resistance***
Hours	***4 hours weekly first semester - second year***
Teaching Staff	

- *Properties of steel*
- *Loads and design methods*
- *Analysis and design of elements exposed to tensile strength*
- *Analysis and design of elements exposed to pressure*
- *Analysis and design of beams*
- *structural systems for the various beams, linear and nonlinear analysis*
- *Evaluation of the various beams, linear and nonlinear analysis performance.*
- *Numerical modeling techniques for steel structures,*
- *ductility for steel structures*

Course 10	***graduation project***
Hours	***4 hours weekly Second semester - second year***
Teaching Staff	

- *The student chooses a subject approved by the department and continues for the second semester of the second year*

Dean of the higher Institute of Earthquake Studies and Research ***Vice dean*** ***head of the Department Earthquake Structural Engineering***