ADDI ABABA INSTITUTE OF TECHNOLOGY
SCHOOL OF CIVIL AND ENVIRONMENTAL ENGINEERING

CE 6506 EARTHQUAKE ENGINEERING **March 2020**
Second Semester - 2019/20 A.Y. (2012 EC)

COURSE OUTLINE

1. Introduction to Seismology
   - Seismicity
   - Earthquake Faults and waves
   - Structure of the earth and plate tectonics
   - Measures of Earthquake Size and Intensity
2. Earthquake response of linear SDOF systems
   - Response history and response spectrum concept
   - Construction and characteristics of response spectrum
   - Peak structural response from response spectrum
   - Elastic design spectrum
3. Earthquake response of inelastic SDOF systems
   - Force deformation relations
   - Normalized Yield strength, yield reduction factor and ductility factor
   - Effects of yielding
   - Responses spectrum for yield deformation and yield strength
   - Design of yield strength
   - Inelastic design spectrum
4. Earthquake analysis of MDOF linear systems
   - Response History Analysis (RHA)
     - Modal analysis
     - Multistory buildings with symmetric and unsymmetric plan
   - Response Spectrum Analysis (RSA)
     - Peak response from earthquake response spectrum
     - Multistory buildings with symmetric and unsymmetric plan
5. Earthquake response and design of multistory buildings
   - Earthquake response of linearly elastic buildings
     - Influence of fundamental period an stiffness ratio on response
     - How many modes are significant to the total response
   - Earthquake response of linearly inelastic buildings
     - Allowable ductility and ductility demand
     - Buildings with soft story
6. Geotechnical Aspects in Earthquake Engineering
   - Dynamic analysis of soil-structure systems
   - Influence of local soils (site effects)
   - Liquefaction of soils
   - Soil models for dynamic analysis
   - Soil-structure interaction (SSI) analysis
7. Base Isolation and Structural Controls
   - Base isolation systems

- Effectiveness of base isolation
- Structural control/Energy dissipative devices
  - Passive controls
  - Active controls
  - Hybrid controls/Semi-active controls

8. Building codes for Seismic Design of Structures
   - Major Building codes
     - American codes: UBC 94, UBC 97 and IBC 2006
     - European Codes: EN 1998:2004
     - Ethiopian Codes: ES EN 1998:2015 and EBCS 8:1995
9. Basic Concepts in Earthquake resistant design
   - Structural configurations for earthquake resistance
   - Criteria for earthquake resistant design
   - Basic design guidelines (lessons from past EQ)
10. Additional Topics
    - Overview of seismic design philosophies
    - Experimental setups for seismic performance evaluations
    - Vulnerability assessment and seismic retrofitting of structures
    - Lateral force resisting systems for tall structures
    - Seismic performance and EQ resistance Design of RC, steel, masonry and timber structures

References

1. Chopra, A.K., Dynamics of Structures: Theory and Applications to Earthquake Engineering, 4th Edition, Prentice Hall, 2012.
2. Clough, R. W. & Penzien, J., Dynamics of Structures, McGraw Hill, 2nd Edition,1993.
3. Wiegel, R. L., Earthquake Engineering, Prentice-Hall Inc., 1970.
4. Newmark N. M. & Rosenblueth E., Fundamentals of Earthquake Engineering, Prentice-Hall Inc., 1971.
5. Dorwick D. J., Earthquake Risk Reduction, John Wiley and Sons, 2003.
6. Penelis G. G. & Kappos A. J., Earthquake resistant Design Concrete Structures, E & FN SPON, 1995.
7. Paulay T. & Priestley M. J. N., Seismic Design of Reinforced Concrete and Masonry Buildings, Jon Wiley and Sons Inc. 1992.
8. Gioncu V. & Mazzolani F., Earthquake Engineering for Structural Design, Spons Press, 2011
9. Chen W.-F. & Scawthorn C., Earthquake Engineering Handbook, CRC Press,2002.
10. Naeim, F., Seismic Design Handbook, 2nd Edition, Kluer Press, 2001.
11. Elnashai A. S. & Di Sarno L., Fundamentals of Earthquake Engineering, John Wiley and Sons, 2008.
12. Borzorgnia, Y, & Bertero V., Earthquake Engineering: From Seismology to Performance Based Design, CRC Press, 2006.
13. Kramer, S. L., Geotechnical Earthquake Engineering, Prentice-Hall, 1996
14. Ghosh S. K. & Fanella D. A., Seismic and Wind Design of Concrete Buildings, International Code Council Inc., 2003.
15. Any other Structural Dynamics or Earthquake Engineering Book.

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