IIT Mandi

Proposal for a New course

Course Number: CE 605
Course Name : Engineering Seismology and Seismic Hazard Assessment
Credits : 3-0-0-3
Prerequisites : Structural Dynamics with Application to Earthquake Engineering (CE 511) or equivalent course
Intended for : B.Tech. 4th year/ M.S./ M.Tech./ Ph.D.
Distribution : Discipline Elective (UG, 4th year); Discipline Elective (PG)
Semester : Odd/Even

1. **Preamble:** The goal earthquake – resistance design is to produce a structure or facility that can withstand a certain level of shaking without excessive damage. The level of shaking is described by a design ground motion and its parameters. Estimation of design ground parameters is one of the most difficult and challenging problem in Engineering Seismology. The main objective of this course is to teach basic principles of engineering seismology and different methods to estimate region specific ground motions and its parameters. This course also discusses about the uncertainties in size, location, and time of occurrence of earthquakes.

   It is well known that Himalayan region is one of the seismically active region in the world. This region has experienced many large earthquakes in past and has the potential to produce many more in future. This course emphasis on seismic activity and hazard assessment of the Himalayan region.

2. **Course Modules with Quantitative Lecture Hours:**

   Module 1: Introduction **(5 contact hours)**
   Internal Structure of the Earth; Plate tectonics and boundaries; Faults; Focal mechanisms; Location of Earthquakes; Size of Earthquakes; Major Earthquakes in the world; Important Indian Earthquakes.

   Module 2: Wave Propagation in Elastic Medium **(11 contact hours)**
   Waves in Infinite Medium; longitudinal and Shear waves; Waves in Semi – infinite medium; Reflection and refraction of waves; Rayleigh waves and Love waves; Response of an elastic Half – Space due to surface and buried forces. Seismic moment tensor. Time dependence.

   Module 3: Strong Ground Motion and Parameters **(12 contact hours)**
   Strong – Motion measurement; International and Local strong motion networks; Synthetic strong ground motions; Stochastic seismological models; Empirical Green's

Function method; One – Dimensional Ground response analysis; Ground motion parameters.

Module 4: Seismic Hazard Analysis **(14 contact hours)**

Definitions- seismic hazard, disaster and risk; Deterministic seismic hazard analysis; Probability; Earthquake occurrence models; Estimation of maximum magnitude, maximum credible earthquake, design basis earthquake; Ground motion prediction equations; Return periods and strong motion exceedance rates; seismic Hazard curves; Deaggregation. Seismic microzonation, Case studies/Project on estimating the seismic hazard of important Himalayan Cities.

3. Text books:

(i) S. L. Kramer (2004), "Geotechnical Earthquake Engineering", 2nd Edition, Person Education, Inc.

(ii) K. F. Graff (1991), "Wave Motion in Elastic Solids", Dover Publications, Inc.

4. References

(i) D. M. Boore (2003), "Simulation of Ground Motion Using the Stochastic Method", *Pure and Applied Geophysics,* 160, 635 – 676.

(ii) Keiiti AKI and Paul G Richards (2002). "Quantitative Seismology", 2nd Edition, University Science Books, U.S.A.

(iii) A. Udias (1999), "Principles of Seismology", 1st Edition, Cambridge University Press.

(iv) NDMA (2011), Development of probabilistic seismic hazard map of India, Technical Report, Working Committee of Experts (WCE), National Disaster Management Authority (NDMA), New Delhi, India.

(v) NPTEL course on "Geotechnical Earthquake Engineering" (online resources).

5. Similarity content declaration with existing courses:

S. N.	Course Code	Similarity Content	Approximate % of Content
NIL	Not Applicable	Not Applicable	Not Applicable

6. Justification for new course proposal if cumulative similarity content is > 30%:

Not Applicable

Approvals:

Other Faculty interested in teaching this course: None

Proposed by: Dr. Maheshreddy Gade School: School of Engineering (SE)

Signature: _____ Date:

Recommended / Not Recommended, with comments:

_____ Date: _____

Chairman, CPC

Approved / Not Approved:

_____ Date: _____

Chairman, Senate