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| Course Title: | **Earthquake Engineering and Structural Dynamics** |
| Course Code: | **ENBU801** |
| Descriptor Start Date: | **31/01/2025** |
| Descriptor End Date: | **31/12/2026** |
| POINTS: | **15.00** |
| LEVEL: | **8** |
| PREREQUISITE/S: | **ENBU702** |
| COREQUISITE/S: | **None** |
| RESTRICTION/S: | **None** |

## LEARNING HOURS

Hours may include lectures, tutorials, online forums, laboratories. Refer to your timetable and course information in Canvas for detailed information.

**Total learning hours: 150**

## PRESCRIPTOR

This course aims at giving students an understanding of the seismic waves as well as dynamic behaviour of structures and the means of predicting their response to the effects of dynamic excitations, especially earthquakes. Subsequently, the basic principles of structural earthquake engineering will be presented, including different types of seismic resisting systems and their behaviour, the effects of structural properties such as regularity and symmetry on seismic response, and the roles of ductility, damping and isolation in reducing earthquake induced damage. The application of NZ standards for seismic loading is also explained.

## LEARNING OUTCOMES

1. Analyse the basics of earthquake generated seismic waves (a).
2. Develop and solve the governing equation of motion for simple mass-spring-damper systems and determine the response of Single Degree Of Freedom (SDOF) systems under harmonic force or base excitation as well as arbitrary dynamic load or ground excitation (a, b, c, e, j, l).
3. Develop and explain the governing equations of motion for simple Multi Degree Of Freedom (MDOF) systems to obtain natural frequencies and modes of vibrations (a, b, c, e, j, l).
4. Evaluate the basics of the common seismic resisting structural systems' behaviour and design approaches (a, b, c, j, l).
5. Analyse the basis of the provisions of the NZ Structural Design Actions Standard (NZS 1170.5:2004) for earthquake actions and apply them to simple structural problems s (a, b, c, j,l).

## CONTENT

- Basics of earthquake engineering, seismology, and different types of earthquake waves;
- Free vibration of undamped and damped SDOF systems. Determination of the nature and magnitude of damping.;
- Forced vibration of SDOF systems - excitation by harmonic force or ground motion; resonance and vibration isolation.;
- Free, undamped vibration of simple MDOF systems - natural modes and frequencies;
- Introduction to different seismic resisting structural systems;
- Seismic loading methods and background to NZS 1170.5 :2004.

Key to Graduate Capabilities Profile
a. Engineering knowledge
b. Problem analysis
c. Design/development of solutions
d. Investigation
e. Modern tool usage
f. The engineer and society
g. Environment and sustainability
h. Ethics
i. Individual and team work
j. Communication
k. Project management and finance
l. Lifelong learning

## LEARNING & TEACHING STRATEGIES

Both online resources and on campus delivery mode are employed to achieve the outcomes of the course

## ASSESSMENT PLAN

| Assessment Event | Weighting % | Learning Outcomes |
|---|---|---|
| Mid-semester Test | 50.00 | 1,2 |
| Final Exam | 50.00 | 2,3,4,5 |

**Grade Map** **MAP1**

A+ A A- Pass with Distinction
B+ B B- Pass with Merit
C+ C C- Pass
D Fail

**Overall requirement/s to pass the course:**

To pass this course, students must achieve a minimum overall grade of C-.

## LEARNING RESOURCES

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**For further information, contact:** Te Ara Auaha - Faculty of Design & Creative Technologies

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| Principal Programme: | **AK3751, Bachelor of Engineering (Honours)** |
| Related Programme/s: | **AK1296**<br>**AK1325**<br>**AK3566**<br>**ICE1**<br>**INEXCH1**<br>**SABRD1** |