

| Course Information                                                                                                         |                                                                                                                                                                                                                                                                                           |
|----------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Course title                                                                                                               | Structural Control (I)                                                                                                                                                                                                                                                                    |
| Semester                                                                                                                   | 114-2                                                                                                                                                                                                                                                                                     |
| Designated for                                                                                                             | COLLEGE OF ENGINEERING GRADUATE INSTITUTE OF CIVIL ENGINEERING, STRUCTURAL ENGINEERING DIVISION                                                                                                                                                                                           |
| Instructor                                                                                                                 | <a href="#">Chia-Ming Chang</a>                                                                                                                                                                                                                                                           |
| Curriculum Number                                                                                                          | CIE7098                                                                                                                                                                                                                                                                                   |
| Curriculum Identity Number                                                                                                 | 521EM6480                                                                                                                                                                                                                                                                                 |
| Class                                                                                                                      |                                                                                                                                                                                                                                                                                           |
| Credits                                                                                                                    | 3.0                                                                                                                                                                                                                                                                                       |
| Full/Half Yr.                                                                                                              | Half                                                                                                                                                                                                                                                                                      |
| Required/ Elective                                                                                                         | Elective                                                                                                                                                                                                                                                                                  |
| Time                                                                                                                       | Wednesday 7,8,9(14:20~17:20)                                                                                                                                                                                                                                                              |
| Remarks                                                                                                                    | Restriction: MA students and beyond<br>The upper limit of the number of students: 34.                                                                                                                                                                                                     |
| Course introduction video                                                                                                  |                                                                                                                                                                                                                                                                                           |
| Table of Core Capabilities and Curriculum Planning                                                                         | <a href="#">Table of Core Capabilities and Curriculum Planning</a>                                                                                                                                                                                                                        |
| Course Syllabus                                                                                                            |                                                                                                                                                                                                                                                                                           |
| Please respect the intellectual property rights of others and do not copy any of the course information without permission |                                                                                                                                                                                                                                                                                           |
| Course Description                                                                                                         | Review of Structural Dynamics; Review of Earthquake Engineering; Energy Principle; Damping Modification Factors; Viscous Dampers; Viscoelastic Dampers; Design Code for Structures w/ Passive Energy Dissipators; Seismic Isolation; Design of Seismically Isolated Buildings             |
| Course Objective                                                                                                           | The objective of this course is to make student learn the fundamental understanding and background knowledge of passive damping and isolation systems for seismic protection of structures. Moreover, the associated design codes and design procedures are also provided in this course. |

| Course Requirement                                                          | Mechanics of Materials, Structural Analysis, Structural Dynamics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |     |                                 |     |      |   |                                 |    |          |     |  |    |              |     |  |    |            |     |  |    |              |     |  |
|-----------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|---------------------------------|-----|------|---|---------------------------------|----|----------|-----|--|----|--------------|-----|--|----|------------|-----|--|----|--------------|-----|--|
| Student Workload<br>(Expected weekly study hours before and/or after class) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |     |                                 |     |      |   |                                 |    |          |     |  |    |              |     |  |    |            |     |  |    |              |     |  |
| Office Hours                                                                | Appointment required. Note: If you need an office hour, please contact me via email first.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |     |                                 |     |      |   |                                 |    |          |     |  |    |              |     |  |    |            |     |  |    |              |     |  |
| Designated reading                                                          | <ul style="list-style-type: none"> <li>• Dynamics of Structures, 2nd ed., Ray W. Clough and Joseph Penzien, McGraw-Hill, 1993</li> <li>• Dynamics of Structures: Theory and Applications to Earthquake Engineering, 4th ed., Anil K. Chopra, Pearson, 2011</li> <li>• Fundamentals of Structural Dynamics, 2nd ed., Roy R. Craig, Andrew J. Kurdila, 2006.</li> <li>• Design of Seismic Isolated Structures: From Theory to Practice, Naeim, F., and J. M. Kelly, John Wiley &amp; Sons, 1999.</li> <li>• Passive and Active Structural Vibration Control in Civil Engineering, Soong, Tsu T., and Michalakis C. Costantinou, Vol. 345. Springer, 2014.</li> <li>• Passive Energy Dissipation Systems for Structural Design and Retrofit, Constantinou, Michalakis C., Tsu T. Soong, and Gary F. Dargush, Monograph Series, MCEER, Buffalo, NY, 1998.</li> <li>• 建築物耐震設計規範與解說-內政部 113.3.1</li> <li>• Building Seismic Safety Council (BSSC). (2003). “NEHRP Recommended Provisions for Seismic Regulations for New Buildings and Other Structures.” 2003 Edition, Report Nos. FEMA-450 and FEMA-451, Federal Emergency Management Agency, Washington, D.C.</li> </ul> |     |                                 |     |      |   |                                 |    |          |     |  |    |              |     |  |    |            |     |  |    |              |     |  |
| References                                                                  | Lecture Notes and Supplemental Materials                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |     |                                 |     |      |   |                                 |    |          |     |  |    |              |     |  |    |            |     |  |    |              |     |  |
| Grading                                                                     | <table border="1"> <thead> <tr> <th>No.</th><th>Item</th><th>%</th><th>Explanations for the conditions</th></tr> </thead> <tbody> <tr> <td>1.</td><td>HOMEWORK</td><td>30%</td><td></td></tr> <tr> <td>2.</td><td>Midterm Exam</td><td>15%</td><td></td></tr> <tr> <td>3.</td><td>Final Exam</td><td>15%</td><td></td></tr> <tr> <td>4.</td><td>Term Project</td><td>40%</td><td></td></tr> </tbody> </table> <ol style="list-style-type: none"> <li>1. NTU has not set an upper limit on the percentage of A+ grades.</li> <li>2. NTU uses a letter grade system for assessment. The grade percentage ranges and the single-subject grade conversion table in the NATIONAL TAIWAN UNIVERSITY Regulations Governing Academic Grading are for reference</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                     |     |                                 | No. | Item | % | Explanations for the conditions | 1. | HOMEWORK | 30% |  | 2. | Midterm Exam | 15% |  | 3. | Final Exam | 15% |  | 4. | Term Project | 40% |  |
| No.                                                                         | Item                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | %   | Explanations for the conditions |     |      |   |                                 |    |          |     |  |    |              |     |  |    |            |     |  |    |              |     |  |
| 1.                                                                          | HOMEWORK                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 30% |                                 |     |      |   |                                 |    |          |     |  |    |              |     |  |    |            |     |  |    |              |     |  |
| 2.                                                                          | Midterm Exam                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 15% |                                 |     |      |   |                                 |    |          |     |  |    |              |     |  |    |            |     |  |    |              |     |  |
| 3.                                                                          | Final Exam                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 15% |                                 |     |      |   |                                 |    |          |     |  |    |              |     |  |    |            |     |  |    |              |     |  |
| 4.                                                                          | Term Project                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 40% |                                 |     |      |   |                                 |    |          |     |  |    |              |     |  |    |            |     |  |    |              |     |  |

only. Instructors may adjust the percentage ranges according to the grade definitions. For more information, see [the Assessment for Learning Section](#).

### Progress

| Week    | Date | Topic                                                                                                       |
|---------|------|-------------------------------------------------------------------------------------------------------------|
| Week 1  |      | Overview; Review of Structural Dynamics                                                                     |
| Week 2  |      | Review of Earthquake Engineering & Energy Equation                                                          |
| Week 3  |      | Invited Talk (TBD)                                                                                          |
| Week 4  |      | Viscous Dampers & Viscoelastic Dampers & Composite Damping                                                  |
| Week 5  |      | Tuned Mass Dampers                                                                                          |
| Week 6  |      | Special Energy Dissipation Devices (Inerter & TSD)                                                          |
| Week 7  |      | Seismic Design of Structures with Energy Dissipators (Design Code) & Visit NCREC                            |
| Week 8  |      | Numerical Modeling and Analysis of Energy Dissipation System (Using SAP2000/ETABS)                          |
| Week 9  |      | Midterm Exam                                                                                                |
| Week 10 |      | Structural Isolation Devices (FPB& LRB&HDRB)                                                                |
| Week 11 |      | Seismic Isolation Design Code for Buildings in Taiwan (Design Code) & Structural Design of Isolation System |
| Week 12 |      | Numerical Modeling and Analysis of Isolation System (Using SAP2000/ETABS)                                   |
| Week 13 |      | Equipment Isolation Devices (Iso base & SRB)                                                                |
| Week 14 |      | Special Energy Dissipation Devices & Visit the Isolation Floor of NTU-CERB                                  |
| Week 15 |      | Final Exam                                                                                                  |
| Week 16 |      | Term Project Presentation                                                                                   |