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**Course: Dynamics of Structures**

Lecturer: Dr. Halûk Sucuoğlu

Teaching Assistant: Mr. Numan Eren

Date: 21/09/2020 – 20/10/2020

Classroom: Online

**Brief Contents Description and Course Syllabus**

It is commonly accepted that every structural engineering major should have a minimum introduction to dynamics of structures to serve as a prelude to more advanced courses in earthquake engineering, blast-resistant design, random vibrations and wind engineering. This course is designed to serve this purpose. It is a basic graduate level course which studies the vibration characteristics and dynamic response of structural systems to dynamic excitations generated by earthquakes, wind, impact and blast.

By the end of the course, the student is expected to have a basic understanding of:

* Discrete single-degree, multi-degree and continuous vibratory systems,
* Free and forced vibration response of discrete and continuous systems,
* Applications in structural design.

The only requirement for this course is a customary exposure to an introductory course on dynamics, such as the basic undergraduate course: Dynamics of Rigid Bodies. The knowledge of basic mathematics, particularly the solution differential equations and numerical methods are also used extensively in this course.

**Suggested reading material**

In addition to specific papers and handouts indicated/delivered during classes, the following general textbooks are recommended.

• Chopra A., “Dynamics of Structures”, Prentice Hall, Third Edition, 2007

• Clough R.W., Penzien J., "Dynamics of structures", Computers & Structures Inc, 2003

**Software**

• Matlab: The Mathworks, 2012. MATLAB 2012b Release, Statistics Toolbox, available at http://www

.mathworks.com/products/matlab/.

• Seismosoft: “SeismoStruct - A computer program for static and dynamic nonlinear analysis of framed structures”. 2018. ([http://www.seismosoft.com/seismostruct](about:blank))

• SAP2000, Computers and Structures, Inc., 2020.

• Mazzoni et al.: “OpenSEES - The open system for earthquake engineering simulation”, PEER, UC Berkeley, 2006. (http://opensees.berkeley.edu)

**Grading**

Homework assignments: 35%

Midterm: 30%

Final exam: 35%

**Course schedule**

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| **Week** | **Date** | **Lecture hours**  **From 9:00 To 12:00** | Tutorial hours  From 14:00 To 16:00 | **Subject**  **Dynamics of Structures** | **Tot**  **h** |
| 1 | 21.09.20 Mo | 10-13 |  | Equation of motion for SDOF systems, its solution | 3 |
| 23.09.20 We | 9-12 |  | Free vibration response, viscous damping | 3 |
| 25.09.20 Fr | 9-12 |  | Response to harmonic excitation | 3 |
| 23.09.20 We |  | 14-16 | Problem session | 2 |
| 25.09.20 Fr |  | 14-16 | Problem session | 2 |
| 2 | 28.09.20 Mo | 9-12 |  | Response to general excitation | 3 |
| 30.09.20 We | 9-12 |  | Numerical evaluation of dynamic response | 3 |
| 02.10.20 Fr | 9-12 |  | Generalized SDOF systems | 3 |
| 30.09.20 We |  | 14-16 | Tutorial on numerical integration | 2 |
| 02.10.20 Fr |  | 14-16 | Problem session- Solution of homework problems | 2 |
| 3 | 05.10.20 Mo | 9-12 |  | Midterm Exam | 3 |
| 07.10. 20 We | 9-12 |  | Equations of motion and free vibration analysis for MDOF systems | 3 |
| 09.10. 20 Fr | 9-12 |  | Modal expansion, damping in structures, damping matrix | 3 |
| 07.10. 20 We |  | 14-16 | Tutorial on the modelling of MDOF systems | 2 |
| 09.10. 20 Fr |  | 14-16 | Solution of homework problems | 2 |
| 4 | 12.10. 20 Mo | 9-12 |  | Modal response analysis of undamped systems | 3 |
| 14.10. 20 We | 9-12 |  | Modal response analysis of damped systems | 3 |
| 16.10. 20 Fr | 9-12 |  | Torsional response of 3D systems | 3 |
| 14.10. 20 We |  | 14-16 | Tutorial on forced vibration analysis | 2 |
| 16.10. 20 Fr |  | 14-16 | Tutorial on homework problems | 2 |
| 20.10. 20 Tu | 10-13 |  | Final Exam | 3 |