The objectives are for the student to become able to:

- Understand the fundamentals of structure dynamics.
- Perform seismic analysis of buildings manually and using computer modelling.
- Apply the seismic provisions of the building code of Canada.
- Understand the concept of capacity design.
- Design seismic-resistant steel buildings.
- Design seismic-resistant reinforced concrete buildings.

Prerequisites:
Bachelor degree in Structural Engineering and CEE 9512a or equivalent

Contact Hours:
3 lecture hours per week.

Instructor:
Dr. A. Musa, P.Eng., email: amusa5@uwo.ca;

Lecture Notes:
Lecture notes prepared by Dr. El Damatty will be available for the students.

References:
Elements of earthquake engineering and structural dynamics, by Filiatrault, André., Cursus, 2013.

Units:
SI units will be used in lecture and examinations

Computing:
A number of assignments will involve computer modelling of structures using the commercial programs SAP2000 and ETABS. The two programs are available at the PC lab in the Spencer Engineering building.
Specific Learning objectives:

EARTHQUAKE GROUND MOTIONS CHARACTERISTICS
Causes and effects of earthquakes
Seismic waves
Characteristics of earthquakes
Characteristics of ground record accelerations
Attenuation relationship
Return periods
Design intensity

RESPONSE OF A SINGLE DEGREE OF FREEDOM SYSTEM
Free vibration response
Response to harmonic loads
Response to earthquake loading using numerical integration (time history analysis)
Concept of elastic response spectrum
Seismic response of a single degree of freedom using the response spectrum procedure
Seismic response of a single degree of freedom using the time history procedure
Seismic response of generalized single degree of freedom systems

SEISMIC ANALYSIS OF MULTI DEGREES OF FREEDOM STRUCTURES
Dynamic analysis of MDOF systems using the modal analysis procedure
Dynamic analysis of MDOF systems using the time history procedure
Linear seismic analysis using modal analysis
Linear seismic analysis using time history approach

CODE PROCEDURES FOR EARTHQUAKE RESISTANT STRUCTURES
Inelastic behaviour and ductility
Concept of capacity design
Code Provisions for dynamic analysis

SEISMIC DESIGN OF STEEL BUILDINGS
Seismic behaviour and design provisions of ductile moment resisting steel frames
Seismic behaviour and design provisions of ductile steel braced frames
Solved example: Seismic Design of a steel building

SEISMIC DESIGN OF REINFORCED CONCRETE STRUCTURES
Seismic behaviour and design provisions of ductile moment resisting reinforced concrete frames
Seismic behaviour and design provisions of ductile reinforced concrete shear walls
Solved example: Seismic design of a reinforced concrete building

Evaluation:
The final course mark will be determined as follows:
Class Participation 5%
Final Exam 35%
Final Project 35%
Assignments 25%
Total 100%
Use of English:
In accordance with Senate and Faculty Policy, students may be penalised up to 10% of the marks on all assignments, tests, and examinations for the improper use of English. Additionally, poorly written work with the exception of the final examination may be returned without grading. If resubmission of the work is permitted, it may be graded with marks deducted for poor English and/or late submission.

Cheating:
University policy states that cheating is a scholastic offence. The commission of a scholastic offence is attended by academic penalties that might include expulsion from the program. If you are caught cheating, there will be no second warning.

Attendance:
Any student who, in the opinion of the instructor, is absent too frequently from class, laboratory, or tutorial periods will be reported to the Dean (after due warning has been given). On the recommendation of the Department concerned, and with the permission of the Dean, the student will be debarred from taking the regular final examination in the course.

Conduct:
Students are expected to arrive at lecture on time, and to conduct themselves during class in a professional and respectful manner that is not disruptive to others.

Sickness and Other Problems:
Students should immediately consult with the instructor regarding any problem that could affect their performance in the course. Where appropriate, the problems should be documented (see attached). The student should seek advice from the Instructor or Department Chair regarding how best to deal with the problem. Failure to notify the Instructor or Department Chair immediately (or as soon as possible thereafter) will have a negative effect on any appeal.

Notice:
Students are responsible for regularly checking their e-mail, the course owl site.

Consultation:
Office hours will be arranged for the students to see the instructor. Other individual consultation can be arranged by appointment with the instructor or the TA.