Physical & Environmental Sciences
UNIVERSITY OF TORONTO
SCARBOROUGH

2016 WINTER

UNDERGRADUATE COURSE OUTLINE

EES C21: Environmental challenges in urban environments

Tuesday 7-9 pm starting January 5th in HW214

Instructor: Nick Eyles (eyles@utsc.utoronto.ca)

Teaching Assistant: Kirsten Kennedy

Scope

This course will interest students from a broad range of disciplines ranging from specialist environmental scientists to those interested in urban planning and design, city studies or urban ecology.

What you learn in this course can be applied to any urban area and it will be interest to students wishing to seek professional accreditation under the Association of Professional Geoscientists of Ontario (APGO).

Our world is increasingly urban and by 2050 it is estimated that 5 billion people worldwide will live in an urban area. The growth of large poorly-planned and rapidly growing 'supercities' (defined by populations greater than 2 million) is proceeding at an astonishing pace. In 1950 there were 43 such cities, today more than 200 with 19 of them having more than 20 million inhabitants.

Currently, a sixth of the world's population (>1 billion people) live in urban slums and by 2030 fully one third of the world's population will live in an active tectonic area: recurring earthquakes, landslides, wastes, droughts, food and security are major environmental issues.

Increased urban populations result in a markedly reduced 'resilience' in the face of environmental challenges.

The global rush to the city is also paralleled here in Canada. Today, 80% of Canadians live in an urban area, a complete reversal of the situation 100 years prior. The effects are far reaching creating what is called an 'urban shadow'. This refers to regional and global environmental impacts (i.e., well outside the city itself) that arise from the need to import energy, food, construction materials and other resources matched by the complementary export of waste materials (municipal, industrial and radioactive waste etc). The risk from natural hazards (e.g., earthquakes, severe weather) increases as urban areas become larger and denser; the regional climate is also altered and there are massive negative impacts on watersheds, air and water quality, hydrological cycles and groundwater systems. Most cities have to deal with the legacy of 'historic wastes' disposed of in the past under more lax environmental regulations. Large areas of cities are underlain by 'fill' (often contaminated waste materials) which requires the use of geophysical techniques to map, and a variety of geochemical tools to remediate. The high cost is a major impediment to reuse of 'brownfield' sites.

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This course will provide you with an overview of the impact of urban development on watersheds and waterfronts principally across the Greater Toronto Area but we will also touch on global issues. You will become familiar with the geology and environmental settings of the principal urban areas Canada and Ontario. We will emphasize the geology of ice-age glacial deposits and the principal geophysical and other techniques employed by to explore the shallow (<50 m depth) subsurface. Many contaminants move through the subsurface in water and attached to sediments so it is fundamental to have a detailed knowledge of likely transport routes both in the surface and subsurface. This requires detailed knowledge of local geological conditions, which in Canada tend to be dominated by 1) fractured rock 2) glacial sediments, and 3) man-made ground (fill) underlying the so-called 'built landscape'.

We will examine the geological aspects of site assessment (what is there? How do we find it?), cleanups and remediation. We have 4 invited lectures by experts in groundwater contamination, site investigation and clean-up and nuclear waste disposal.

A weekend field trip (March 19-20th) will familiarize you with many of these issues by visiting contaminated sites in Ontario and New York State (e.g., Love Canal).

Preliminary timetable and topics

Week 1: (5th January) Introduction, scope of course, grading practice, learning outcome and expectations.

Weeks 2, 3: (12th and 19th January) 'Geological and environmental setting of Canadian cities: a four layer model typically 1: Precambrian 'basement' rocks, 2: Paleozoic and Mesozoic 'cover' rocks, 3: glacial sediments and 4: fill (also called 'man-made ground') of the 'built landscape.'

Readings: Chapters 1 and 2 of textbook and Chapter 22 of Eyles (2002).

Week 4: (26th January) Landfilling and the legacy of historic wastes in urban watersheds

Weeks 5, 6 (2nd and 9th February) Invited lectures: Dr. Kathy Wallace: *Assessment and remediation of contaminated lands: case studies and methods (Collingwood Harbour, Port Hope, Port Industrial District)*

Week 7: (16th February) No Class: Reading week

Week 8: (23rd February) Impact of urbanization of surface waters and watersheds

Week 9: (1st March): Invited lecture: Dr. Mandy Meriano: *Impact of urbanization on groundwater* **8pm.**

Week 10: (8th March): Class presentations

Week 11: (15th March) Earthquakes and urban areas in Canada

Field Trip: Saturday-Sunday March 19-20th: Impacts of urbanization on watersheds and waterfronts e.g., the Port Industrial District, Frenchman's Bay, Hamilton Harbour, Love Canal, Hyde Park (NY State) etc.

Overnight accommodation on Saturday will be in Niagara Falls.

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Note: **A current passport with six months remaining or US entry visa is required. If you require a US visa, *start applying as soon as possible.***

Week 12: (22nd March) Invited lecture: Dr. Monique Hobbs, Nuclear Waste Management Ontario:

Week 13: (29th March) Urban development in Canada's north: living on permafrost in a warming climate.

Assessment and distribution of marks

Students will submit a brief in-class group presentation on an assigned topic (or of their choosing) on March 8th. Details of format will be circulated later.

In-class group presentation:	**30 Marks**
Attendance on weekend field trip:	**5 Marks**
Mid-term exam:	**30 Marks**
Final Exam:	**35 Marks**

Course material: The prime source of information is: Eyles, N. 1997: (Editor) Environmental Geology of Urban Areas, Geological Association of Canada Geotext No. 3 (especially Chapter 2: Environmental geology of the Greater Toronto Area). This is on short-term loan from the library.

Eyles, N. 2002: Ontario Rocks. Fitzhenry and Whiteside, Markham.
Eyles, N. and Miall, A.D. 2010. Canada Rocks: The Geologic Journey. Fitzhenry and Whiteside, Markham.

Other readings will be assigned on a week-by-week basis.

Note: Last date to drop course without penalty is Sunday March 20th

ACCESSIBILITY NEEDS

The University of Toronto is committed to accessibility. If you require accommodations for a disability, or have any accessibility concerns about the course, the classroom or course materials, please contact The UTSC Accessibility Services as soon as possible:
http://www.utsc.utoronto.ca/~ability/
We also suggest you also refer to the following University of Toronto Scarborough Library link:
http://utsc.library.utoronto.ca/services-persons-disabilities

PLAGIARISM

University of Toronto code of Behaviour on Academic Matters states that "it is an offense for a student knowingly to represent as one's own any idea or expression of an idea or work of another in any academic examination or term test or in connection with any other form of academic work, i.e., to commit plagiarism."

For accepted methods of standard documentation formats, including electronic citation of internet sources please see the U of T writing website at:
http://www.writing.utoronto.ca/advice/using-sources/documentation

The full Code of Behaviour regulations could be found from consulting
http://www.sgs.utoronto.ca/facultyandstaff/Pages/Academic-Integrity.aspx

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December 2015
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