

ENVIRONMENTAL & RESOURCE STUDIES PROGRAM TRENT UNIVERSITY

ERSC 3660Y: Biological Effects of Electromagnetic Fields 2009-10 FW; Peterborough

Instructor: Dr. Magda Havas Email: mhavas@trentu.ca Phone: 748-1011 x 7882
Office: ESB B309 Office Hours: Thursday 1-2 pm & tba

Secretary: Deb Mills Email: dmills@trntu.ca Phone: 748-1011 x7199
Office: ESB B202

Course Description:

Concern and controversy about the health effects of electromagnetic fields produced by power lines, microwave ovens, computers, and more recently by cell phones, telecommunication antennas and a growing variety of wireless technology continues to grow. Some of the older studies on naturally produced geomagnetic and geoelectric fields and their effects on organisms, especially humans, are receiving renewed attention. Society's focus on chemicals has overshadowed the fact that most physiological functions in living organisms are electrochemical in nature. This perspective has opened up vast new frontiers for research including the healing effects of electromagnetic energy. The purpose of this course is to provide students with a basic understanding of the biological effects (both positive and negative) of electromagnetic energy and to enable students to pursue a more focused area of interest within this broad field of study. Students have the opportunity to do primary research (instead of one essay topic) as well as critical literature reviews. Research projects may focus on energy fields (natural or anthropogenic) and their effects on the environment, with the environment defined in very broad terms; on the adequacy of current guidelines in Canada and elsewhere; on the response to and impact of transmission lines or telecommunication antennas on local communities; on energy medicine; on energy physiology; etc. Students work independently and in pairs. Emphasis is on class discussion and sharing of ideas.

Course Pre-requisites: ERSC 100 plus 8 university credits. Enrollment limited to 20 with permission of instructor.

Course Fees: none.

Course Format:

Type	Day	Time	Location
Lecture/Seminar	Thursday	11:00 am – 12:50 pm	GCS 111

Course Evaluation:

Type of Assignment	Weighting	Due Date
Attendance & participation (5% per term)	10%	Sept to April
Seminar #1	10%	Oct 1 to Dec 3
Essay #1	25%	Nov 12
Seminar #2	10%	Jan 21 to Mar 3
Oral Presentation of Essay	10%	Mar 11 to Apr 8
Essay #2	25%	Mar 18
Test	10%	April 8

Required Readings: All students are expected to read these references.

Extremely Low Frequency Electromagnetic Fields

1. Brodeur, Annals of Radiation: The Hazards of electromagnetic fields: 1-Power Lines, New Yorker, pg 51.
2. NIEHS Report on Health Effects from Exposure to Power-Line Frequency Electric and Magnetic Fields. 1999. Chapters 3, 4+5
3. Bonneville Power Authority. 1996. Electrical and Biological Effects of Transmission Lines: A Review; chapters 1, 2, 3, 4.
4. NRPB. 2004. Review of the Scientific Evidence for Limiting Exposure to Electromagnetic Fields (0-300 GHz) chapter 4
5. Connecticut Siting Council, docket No. 272. 2004. Testimony on Behalf of Ezra Academy, March 16, 2004.

Radio Frequency Radiation

6. Havas, 2007. Analysis of Health and Environmental Effects of Proposed San Francisco Earthlink WiFi Network. San Francisco Earthlink Wi-Fi Network.
7. Cherry. 1999. Criticism of the Proposal to adopt the ICNIRP Guidelines for cellsites in New Zealand. ICNIRP Guideline Critique, Lincoln University. 60 pp.
8. Ormsby, T (translator). 2001. Influence of High-frequency Electromagnetic Radiation at Non-thermal Intensities on the Human Body (A review of work by Russian and Ukrainian Researchers). No Place to Hide: Volume 3(1)-Supplement, 33 pp.NRPB. 2004. Review of the Scientific Evidence for Limiting Exposure to Electromagnetic Fields (0-300 GHz) Chapter 5
9. Royal Society of Canada. 2001. Recent Advances in Research on Radiofrequency Fields and Health: 2001-2003. Journal of Toxicology and Environmental Health, Part B, Vol. 4-4, 2001.
10. Newman vs Motorola, Civil No. CCB-00-2609, Memorandum US District Court for the District of Maryland. 23 pp.

Power Quality and Intermediate Frequency Fields

11. International EMF Project Information Sheet. 2005. Electromagnetic Fields and Public Health, Intermediate Frequencies (IF), 4 pp. plus additional research.
12. Floderus et al. 2002. Occupational Exposures to High Frequency Electromagnetic Fields in the Intermediate Range (> 300 Hz –10 MHz). Bioelectromagnetics 23:568-577.
13. SCENIHR 2007. Possible effects of Electromagnetic Fields (EMF) on Human Health. Health and Consumer Protection Directorate-General. 64 pp.
14. Havas, 2006. Dirty Electricity: An invisible pollutant in schools. OSSTF/FEESC Education Forum Vol 32(3) Fall 2006. 4 pp.
15. Havas and Stetzer 2004. Dirty Electricity and Electrical Hypersensitivity: Five Case Studies. WHO Workshop on electrical Hypersensitivity, 25-26 October, 2004. Prague, Czech Republic. 13 pp.

ElectroHypersensitivity

16. Johansson. 2006. Electrohypersensitivity: State of the Art of the Functional Impairment. Electromagnetic Biology and Medicine. 25:245-258.
17. Johansson. 2009. Disturbance of the immune system by electromagnetic fields-A potentially underlying cause for cellular damage and tissue repair reduction which could lead to disease and impairment. Pathophysiology. 21 pp. (in press).
18. Schooneveld and Kuiper. 2007. Electrohypersensitivity (EHS) in the Netherlands-A Questionnaire survey. EHS in the Netherlands, Stichting EHS (Dutch EHS Foundation) 20 pp.
19. Eltit et al. 2007. Development and Evaluation of the Electromagnetic Hypersensitivity Questionnaire. Bioelectromagnetics 28:137-151.
20. Sears. 2007. The Medical Perspective on Environmental Sensitivities. Canadian Human Rights Commission. 86 pp.
21. Mild et al. 2006. Electromagnetic Hypersensitivity. Proceedings of the International Workshop on EMF Hypersensitivity, Prague, Czech Republic, October 25-27, 2004. 196 pp.

Recommended Texts: Robert O. Becker. *Cross Currents*. 1990.

MyLearning: Grades and assignments will be listed on myLearning. Students can use this resource for group discussions.

Week-by-week schedule:

Wk	Date	LECTURE/Seminar Topics	Assignments Due
1	Sept 17	Course Introduction, test, assignment 1	
2	Sept 24	Electromagnetic Spectrum Introduction	assignment 1
3	Oct 1	ELF EMF: Brodeur & NIEHS	Readings 1 & 2 (10%)
4	Oct 8	ELF EMF: BPA & NRPB	Readings 3 & 4
5	Oct 15	ELF EMF: Testimony	Reading 5
6	Oct 22	Overview	
<i>Reading Week</i>			
7	Nov 5	no class	
8	Nov 12	Microwave Radiation Introduction	Essay #1 (25%)
9	Nov 19	MWR: Havas & Cherry	Readings 6 & 7
10	Nov 26	MWR: Russian/Ukrainian & HC	Readings 8 & 9
11	Dec 3	MWR: Hearing	Readings 10
12	Dec 10	Overview	participation (5%)
<i>Christmas Break</i>			
13	Jan 14	Power Quality & Intermediate Frequencies: Introduction	
14	Jan 21	IF: International & Occupational	Readings 11 & 12 (10%)
15	Jan 28	IF: SCENHIR & Havas	Readings 13 & 14
16	Feb 4	IF: 5 Case Studies	Readings 15
17	Feb 11	Overview	
<i>Reading Week</i>			
18	Feb 25	Electrohypersensitivity Introduction & Johansson	Readings 16 & 17
19	Mar 4	EHS: Netherlands & Questionnaires	Readings 18 & 19
20	Mar 11	Essay topic Presentations	(10%)
21	Mar 18	Essay topic Presentations	Essay #2 (25%)
22	Mar 25	Essay topic Presentations	
23	Apr 1	Essay topic Presentations	
24	Apr 8	Essay topic Presentations	test (10%)

Assignments

1. **Electromagnetic Spectrum:** All students in course are to complete this assignment.

Assigned: September 17, 2009

Due: September 24, 2009

Sign-up for part of the spectrum in class with Rob Loney on September 17th.

Note: Depending on class size more than one student may sign up for a region of the spectrum although each student is expected to work independently.

Each student is to take a part of the electromagnetic spectrum and answer the following questions about it:

- a. Describe this part of the spectrum.
- b. What units are used to measure the intensity of the fields (electric, magnetic, other)?
- c. Identify what generates these energies both natural and anthropogenic.
- d. Is this part of the EM spectrum associated with **adverse** biological outcomes? Describe these and be specific.
- e. Is this part of the EM spectrum associated with **beneficial** biological outcomes? Describe these and be specific.
- f. Can humans, animals, and/or plants **sense** these energies? Give examples.
- g. Do humans, animals, and/or plants **generate** these energies? Give examples.
- h. Other interesting information about the spectrum region.

EM Spectrum	Student A	Student B
1 static electric & magnetic fields (DC)	_____	_____
2 extremely low frequency (ELF) EMF (1 to 49 Hz)	_____	_____
3 power frequency fields (50 Hz & 60 Hz)	_____	_____
4 harmonics of power frequency fields (from 2nd to 9th harmonic)	_____	_____
5 300 Hz to 2 KHz	_____	_____
6 2 kHz to 100 kHz	_____	_____
7 AM/FM Radio	_____	_____
8 TV signals	_____	_____
9 Microwaves	_____	_____
10 Radar	_____	_____
11 Infrared	_____	_____
12 Visible Light	_____	_____
13 Ultraviolet Light	_____	_____
14 Soft X-Rays	_____	_____
15 Hard X-Rays	_____	_____
16 Gamma Rays	_____	_____
17 Cosmic Rays	_____	_____

The answers may be in a powerpoint presentation or a written document. If written, text should not exceed 1000 words and if ppt it should not exceed 8 slides. Use figures/tables as required. You will be asked to comment on your assignment and to submit your document in class on September 24th.

2. Seminar Assignments (2 worth 10% each)

Pairs of student will sign up for 2 articles in the required reading list (one per each term) on previous page. Working together you will be required to summarize and critically review the article and to lead a class discussion. Total time ~40 minutes. Assignment is worth 10% in each term. Sign up in class for these assignments. No extensions for this assignment. If student does not present on the date assigned, s/he will receive 0 for assignment. Seminars will be presented from Oct 1 to Dec 3 (first term) and from Jan 20 to Mar 3 (second term).

3. Essays (2 worth 25% each)

Students are expected to write two major papers (essays), one in each term worth 25% each. Essay topics will be provided in class. You will be expected to write a 4000 to 5000 word essay with a thesis statement and supporting arguments, fully referenced with a minimum of 20 (primary and secondary) references.

An option to one essay is to conduct some original research or write a review paper on selected topics (to be discussed with and approved by instructor).

4. Oral Presentation of Essay (10%)

In second term you have the option of selecting which of the two essays you would like to present to the class during a 20-minute presentation.

Department and/or Course Policies:

Attendance and participation in class is mandatory and will be assessed as part of the final grade. Assignments are expected to be presented/handing in on time. Late assignments will be accepted except for Assignment 2 above.

University Policies

Academic Integrity:

Academic dishonesty, which includes plagiarism and cheating, is an extremely serious academic offence and carries penalties varying from a 0 grade on an assignment to expulsion from the University. Definitions, penalties, and procedures for dealing with plagiarism and cheating are set out in Trent University's *Academic Integrity Policy*. You have a responsibility to educate yourself – unfamiliarity with the policy is not an excuse. You are strongly encouraged to visit Trent's Academic Integrity website to learn more: www.trentu.ca/academicintegrity.

Access to Instruction:

It is Trent University's intent to create an inclusive learning environment. If a student has a disability and/or health consideration and feels that he/she may need accommodations to succeed in this course, the student should contact the Disability Services Office (BL Suite 109, 748-1281, disabilityservices@trentu.ca) as soon as possible. Complete text can be found under Access to Instruction in the Academic Calendar.

Please see the **Trent University academic calendar** for University Diary dates, Academic Information and Regulations, and University and departmental degree requirements.

Last date to withdraw from Fall/Winter full courses without academic penalty in 2009-10 is February 9, 2010.