This course introduces and defines the concept of “appropriate technology” and traces its evolution over the last 10 years. Factors that have challenged the appropriate technologies movement are highlighted and emerging concepts such as designing for affordability and sustainability and exploiting the wealth in the bottom of the economic pyramid (BoP) are introduced. The status report on the United Nations MDG is reviewed and the 2030 Agenda for Sustainable Development is introduced. The course focuses on the need to develop environmentally sustainable and affordable technologies to meet the needs of the world’s economically poor (the nearly 4 billion people in the BoP). Attention is paid to critical human needs, such as housing, affordable energy, safe water, sanitation and wastewater management.

The general objectives are for the student to be able to:

- Understand the United Nations Post 2015 Development Agenda and list the Sustainable Development Goals.
- Appreciate basic human needs in international development and identify the role of technology in meeting some of these needs
- Understand cultural sensitivities in applying technologies in developing countries
- Understand fundamental principles and theories underlying low-cost water and wastewater treatment, design and construction of sustainable sanitation systems, waste degradation and biodegradation, and energy supply
- Explore low cost housing construction methods and how to adapt them to developing countries and at-need communities in developed countries using local materials.
- Appreciate the challenges associated with financing sustainable waste management, water and sanitation provision in developing countries
- Develop out-of-the box solutions for providing alternative and cost-effective energy
- Improve communication and team skills by undertaking and submitting individual written assignments and making group presentations.
- Recognize the need for life-long learning by keeping abreast of emerging environmental issues and policies.

Prerequisite: Completion of the 2nd year of the Civil and Environmental Engineering and the Chemical and Biochemical Engineering Programs.

Note: It is the student’s responsibility to ensure that all Prerequisite and Corerequisite conditions are met or that special permission to waive these requirements has been granted by the Faculty. It is the student’s responsibility to ensure that he/she has not taken a course listed as an Antirequisite. The student may be dropped from the course or not given credit for the course towards their degree if he or she violates the Prerequisite, Corerequisite or Antirequisite conditions.

Corerequisite: None

Antirequisite: None

Contact Hours

3 lecture hours and 2 tutorial hours each week.
**Required:**
1. Instructor Course Notes and Assigned Reading Materials
2. Transforming our world: the 2030 Agenda for Sustainable Development, United Nations Department of Economics & Social Affairs
3. Appropriate Technologies for Environmental Protection in the Developing World
   Selected Papers from ERTEP 2007, July 17-19 2007, Ghana, Africa
   Yanful, Ernest K. (Ed.)
   2009, Approx. 300 p., Hardcover
   ISBN: 978-1-4020-9138-4
4. Recommended Weekly Articles from Instructor

**Instructor**

Dr. E. K. Yanful, P. Eng.
Professor
Department of Civil and Environmental Engineering
Spencer Engineering Building Room 3079

E-mail: eyanful@uwo.ca

**Administrative Assistant**

Ms. Sandra McKay
Spencer Engineering Building Room 3005

E-mail: civil@uwo.ca

**Topics and Specific Learning Objectives**

Review of United Nations MDGs and 2030 Agenda for Sustainable Development (3 Lecture Hours and 2 Tutorial Hours). At the end of this section, the student should be able to:
(a) Identify the key achievements of the MDGs and what they did not achieve.
(b) List the objectives of the Post 2015 or 2030 Agenda for Sustainable Development
(c) Discuss the new 17 Sustainable Development Goals and the target areas for action (the 5 Ps)
(d) Appreciate challenges involved in making technological interventions in development
(e) Understand the meanings of “appropriate technology”, “adaptive technology” and “intermediate technology”

The World Economic Pyramid (3 Lecture Hours and 2 Tutorial Hours)
At the end of the section, the student should be able to:
(a) Understand the concept of the world economic pyramid and the associated four tiers
(b) Appreciate the importance of the geographical locations of the fourth or bottom tier of the Pyramid
(c) Understand the implications of the size and purchasing power of the bottom or fourth tier of the Pyramid (BoP) in the development of technology
(d) Understand the paradigm shift from appropriate technology to environmentally sustainable and affordable technology with regards to the BoP.
(e) Understand and be ready to implement the principles involved in the design cycle of sustainable and affordable technology: “from cradle to field”.

Low-cost wastewater treatment and environmental sanitation (9 Lecture Hours and 6 Tutorial Hours). At the end of this section, the student should be able to:
(a) Understand basic principles underlying wastewater treatment
(b) Compare and contrast decentralized small, modular wastewater treatment systems on the basis of economy and environmental sustainability.
(d) Understand the design, operation and maintenance of waste stabilization ponds.
(e) Understand the design and operation of bio-toilets.
(f) Re-design and upgrade traditional toilet systems encountered in rural areas in developing countries
(f) Design and recommend appropriate and environmentally sustainable sanitation systems

Energy for Development (3 Lecture Hours and 2 Tutorial Hours)
At the end of this section, the student should be able to:
(a) Appreciate global energy consumption and trends
(b) Understand the energy gap in developing countries (especially Sub-Saharan Africa)
(c) Identify alternate supplies for electricity for the BoP
(d) Design and test the feasibility of low cost briquette production from waste as a viable energy source
(e) Discuss energy from waste options for developing countries.

Housing schemes in developing countries (3 Lecture Hours and 2 Tutorial Hours)
At the end of this section, the student should be able to:
(a) Identify different housing schemes in developing countries
(b) Identify barriers to affordable housing in developing countries, and recommend solutions.
(c) Discuss low cost housing design and construction methods for developing countries (focusing on the BoP).

Units
SI unit systems will be adopted in assignments, quizzes and examination.

Evaluation

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<th>Component</th>
<th>Percentage</th>
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<td>Assignments</td>
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<td>Tests</td>
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<td>Project Report and Presentation</td>
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<tr>
<td>Final Examination</td>
<td>50%</td>
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A student must pass the final examination and submit all assignments to pass the course. A student who fails the final examination will be assigned the aggregate mark as determined above, or 48%, whichever is less.

Examination and Tests

Two 1-hour tests
One 3-hour final examination.

1. Tests are Closed Book. Only approved calculators are allowed, but NO communication devices or external sources of information, including mobile phone, laptop computer, IPad, IPod, Tablet, books, notes or crib sheets, are allowed.

2. The Final Examination is Open Book. Nonprogrammable calculators, books, notes or crib sheets are allowed, but NO communication devices (e.g. laptop computer, cell phone, IPod and IPad) are allowed.
Weekly Assignments

Due every Friday at 11:30 am

Cheating

University policy states that cheating, including plagiarism, is a scholastic offence. The commission of a scholastic offence is attended by academic penalty 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 or tutorial periods in the course, 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 final examination in the course.

In accordance with Senate and Faculty policy, students may be penalized up to 10% of the marks on all assignments, tests and examinations for improper use of English. Additionally, poorly written work with the exception of final examinations 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.

Consultation Hours

Students are encouraged to discuss problems with the teaching assistant and/or instructor during tutorial sessions. Other individual consultation may be arranged by appointment.

Conduct

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

Sickness or other Problems

Students should immediately consult with the instructor or Associate Dean of Undergraduate Affairs if they have any problems 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 Associate Dean regarding how best to deal with the problem. Failure to notify the instructor or Associate Dean immediately (or as soon as possible thereafter) will have a negative effect on any appeal.
Note

1) Students are responsible for regularly checking their e-mail and notices posted at the course OWL site and outside the Student Liaison Office EB2097, or the CEE Department Office, SEB 3005.

2) The attached document *Instructions for students unable to write tests or examinations or submit assignments as scheduled* is part of this course outline.

**CEAB Course Breakdown**

Engineering Science = 30%: 15.3 AUs
Engineering Design = 25%: 12.75 AUs
Basic Science = 20%: 10 AUs
Complementary Studies = 25%: 12.75 AUs
Total = 50.8 AUs

**General Learning Objectives**

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The document *“Instruction for students unable to write tests or examinations or submit assignments as scheduled”* is attached and is part of this course outline.

Professor E.K. Yanful
December 19, 2018