SCHOOL OF CIVIL AND ENVIRONMENTAL ENGINEERING

THE UNIVERSITY OF NEW SOUTH WALES

Semester 2 2016 – Course Profile

CVEN 3702 Solid Waste and Contaminant Transport

(Amended 22-9-2016)

COURSE DETAILS

Units of Credit	6		
Contact hours	5 hours per week		
Lectures & Exercises	Wednesday	9:00 – 12:00	CLB 5
	Wednesday	13:00 – 15:00	Mathews 102

Course Coordinator
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Lecturers
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RELATIONSHIP OF THE COURSE TO OTHER COURSES IN THE PROGRAM

Courses undertaken prior to CVEN3702 provide support for the content in CVEN3702 in the following areas:

- BIOS1301, CHEM1011, and CVEN2701 provide the biochemistry and chemistry to understand anaerobic digestion of organics in landfills, aerobic treatment of organics in composting, and partitioning of substances through physical, biological and chemical processes used in waste processing facilities.

- CVEN1701 enables students to take the components of waste management systems introduced in the course, and combine them in optimal ways to achieve the overall aims of regional waste management systems; it also introduces material accounting techniques of Life Cycle Assessment and Material Flux Analysis that can be used to analyse the environmental impact of waste processes, and be can used to optimize the design of facilities and waste management systems at corporate and regional level

- CEIC2009 is one of the most important preparatory courses, enabling students to undertake mass balances of goods and substances through waste processes such as material recovery facilities and waste incinerators.

- CVEN2501 includes the fundamental principles of fluid flow (viz continuity, energy and momentum) in pipes (closed conduits) and open channels (free surface flows). These

principles are based on the balances of influxes and effluxes of mass, energy and momentum associated with control volumes.

- CVEN3701 describes the international, national and NSW laws governing waste management; and outlines EISs and EMSs that can be applied to waste facilities.

After completing CVEN3702, the following courses complement and supplement content in CVEN3702:

- CVEN4701 enable the development of waste management systems at a regional level; components of regional waste systems not included in this course, may be covered here.
- CVEN9881 extends the course into the area of hazardous waste management; it is a S2 course, generally offered in alternate years.

HANDBOOK DESCRIPTION

An introduction to waste management systems, from generation to treatment and disposal; may include waste characterisation, waste minimisation, transfer stations, recycling facilities, composting waste to energy and landfill design. Contamination of receiving environments from poor waste disposal, including pollutant sources, spreading of contaminants in air and water, transport processes in rivers, estuaries, lakes and coastal waters.

Link to virtual handbook:
http://www.handbook.unsw.edu.au/undergraduate/courses/2016/CVEN3702.html

OBJECTIVES

In the **Solid Waste** component, the objectives of this course are to:

- Provide an appreciation of the management of solid waste in a systems context; ie to understand the nature of the various functional elements in regional waste management systems and the relationships among them, so that optimal systems can be designed.

- Provide an understanding of the characteristics of urban solid waste, and be able to estimate the composition and quantities for any region.

- Be able to understand the data requirements for, and then be able to prepare concept designs of, common functional elements (such as transfer stations, material recovery facilities, landfills, treatment plants) in solid waste management systems.

In the **Contaminant Transport** component, the objectives are to:

- Provide an understanding of the fundamental processes of tracer or pollutant movement in the biosphere. Specifically, this will include surface waters (rivers, estuaries, tidal inlets, lakes, the nearshore coastal region) and the atmosphere.

- Provide you with the skills to enable you to apply theory to solve problems and make estimates of pollution levels in the environment.

HOW DO ASESSMENT STRATEGIES ASSIST IN ACHIEVING THESE OBJECTIVES, AND HOW DO THE OBJECTIVES CONTRIBUTE TO ACHIEVEMENT OF PROGRAM OUTCOME ATTRIBUTES

Contaminant transport component:
The capacity for analytical and critical thinking and for creative problem solving: You will be exposed to, and be required to solve, numerous and varied problems in the Lectures, the Exercises and the assignments - “the learning is in the doing”. All these problems will cover a variety of scenarios, and where possible, will be drawn from engineering practice. You will be furnished with the Exercise solutions to all problems on Moodle so that you are able to check your analyses.

Solid Waste component:
Assignments make up 20 of the 50 marks for the assessment for this component of the course, and you are required to work in small groups of up to 3, for both the site visit and the assignment. Refer to Moodle for group self-selection procedure. Briefing and data provision will be similar to that available

in real world situations, and you will need to make professional judgments to be able to prepare reasonable designs that have the ability to be developed by other engineers, such as structural and geotechnical engineers, so that a working facility can be implemented. The lecturer will take the role of a Principal Engineer in a consulting office, and will assist student groups in exercises and via Moodle discussion forum. Overall project management skills requiring coordination within the group is required in the preparation of the assignment reports. These skills have been learned in previous courses and you need to practice and demonstrate your acquisition of them in this course.

In general terms, all waste assignments will be assessed against the following general criteria, to encourage the achievement of the objectives:

- Evidence of understanding of concepts; exact correct numerical answers will rarely be required or be appropriate, but gross numerical errors which are left unchecked, and which indicate that the student does not understand the concepts, will be marked down heavily.

- Ability to apply concepts to real world problems, and to make judgments based on incomplete data and the need to simplify systems in order to develop solutions.

- Clarity of description, explanation and attention to the focus of the assignment.

- Ability to structure an assignment logically and limit it to a reasonable length.

The course objectives, content and assessment concentrate on encouraging the development of the following attributes in students, with particular application to Waste Management as described:

- *An in-depth engagement with the relevant disciplinary knowledge in its inter-disciplinary context:* the influence of socio-economic circumstances on waste generation will need to be included in waste generation predictions, and in the commentary on the implementation stages of waste facility establishment, in the design of one of the facilities in a region.
- *The capacity for analytical and critical thinking and for creative problem solving:* Data will be incomplete, and an analysis of the fundamental influences on waste generation will need to be made to arrive at reasonable projections; then creative designs for facilities to suit the circumstances of the hypothetical region will need to be produced in the second assignment.
- *The ability to engage in independent and reflective learning:* lectures will give standard procedures for the design of waste facilities such as material recovery facilities; you will then need to independently develop appropriate solutions for the hypothetical region, and draw on the Principal Engineer (lecturer) for reactive advice after you have developed and reflected on their own designs – the Principal Engineer will not do creative design work for you.
- *Information literacy:* you will need to find appropriate web sites, and use suggested texts and journals to find supplementary information to enable them to go into sufficient detail to produce workable concept designs for facilities – all details will not be given in lectures. **You must not directly contact by any means, private or public organisations. This can only be done by the Principal Engineer (lecturer).**
- *The skills for collaborative and multi-disciplinary work:* you will work in group of up to 3 and will need to manage their time and inputs to meet deadlines; the inputs of other disciplines that would need to be included in real world situations will need to be recognized and commented upon. All students in each group get the same assignment marks.

In general, both components of the course aim to facilitate:

- *A respect for ethical practice and social responsibility:* you will need to conduct the preparation and submission of their assignment projects in accordance with UNSW policies on academic conduct as detailed at:
  http://www.gs.unsw.edu.au/policy/documents/studentcodepolicy.pdf

  and in accordance with the IEAust's code of ethics as at(search code of ethics there):
  http://www.engineersaustralia.org.au

- *The skills of effective communication:* in this course, memo's and technical reports need to be appropriate for a technical audience in Councils and consulting engineers. They are not novels. They are technical reports, typically using an introductory sentence and point form, and provided with at least 2 levels of numbered headings. Harvard referencing system must be used.

TEACHING STRATEGIES

Solid Waste Component:
Lectures will provide an explanation of procedures to follow to quantify waste generation in a region, and then to prepare conceptual designs of waste management facilities, particularly in the urban solid waste area. Examples will be given in these lectures. You then need to learn these procedures by characterizing waste generation in a region, and preparing conceptual designs for selected waste facilities to a standard typical in a consulting office.

All material will be provided on Moodle. Printed and photocopied notes, overheads etc. will not be provided.
The approaches to learning are:

Private Study	• Review lecture material, reference books, pdf's on eLearning MOODLE. • Do set problems and assignments. • Reflect on class problems and assignments.
Lectures	• Take notes on skeleton .ppt overheads provided to get a full set of reference notes for the course; using "Normal" or "Notes Page" view. • Learn methods of design of waste facilities that are not well documented in reference books. • Participate in working out example problems in class.
Exercises	• Work actively on problems set in class and Exercises. • Ask questions on assignment problems.
Assessment	• Formative and summative assessment of knowledge and skills in assignments, with students encouraged to seek formative informal assessment via consultation with the Principal Engineer/lecturer during preparation of assignments. • Demonstrate higher understanding and problem solving on real world problems in a hypothetical region/context. • Exams are summative assessments on knowledge gained in the course, particularly as indicated by the ability to quickly undertake exercises set in the Exercise problems.
Site visit (to be confirmed)	• Hands on work to set studies in context, to see operating problems with facilities in Sydney, with the aim of improving the conceptual design of waste facilities when you are a practicing engineer.
Email	• You are strongly advised to check your UNSW emails daily for course related messages that are sent via News forum in Moodle. Use Q&A in Moodle to ask questions, as this builds an archive for all students in the course.
MOODLE	• Solutions to the Contaminant Transport Exercise Problems will be placed on MOODLE approximately 1–2 weeks after the relevant Workshop • The Waste Management and Contaminant Transport Lecture Notes can be found on MOODLE. • From time to time, other information will be placed on MOODLE. This may include notes on assignments and the data section of the final exam.

EXPECTED LEARNING OUTCOMES

At the completion of the course, you will be able to:

Solid Waste component:

- Describe a regional urban solid waste management system, showing the flow of goods between processes and being able to calculate material balances throughout the system.
- Characterise the waste generation in a region and make predictions.
- Prepare concept designs of some of the following waste facilities:
    - Transfer stations
    - Waste to energy facilities
    - Material recovery facilities
    - Landfills

Contaminant Transport component:

- Explain the fundamental principles, and their limitations, of pollutant movement in pipes, channels, rivers and estuaries.
- Assess pollutant levels by carrying out computations of pollutant movement.
- Have an understanding into the mechanisms responsible for pollutant movement which will enable you to design and undertake investigations, be they in the field and/or by applying the appropriate software packages.
- Be able to carry out self checks on your estimates for pollution levels from simple models or calculations.

For each hour of contact it is expected that you will put in **at least** 1.5 hours of private study.

ASSESSMENT

Assessment	Value (%)		Due Date & Time
Waste quizzes	2	Participation in open book quiz on previous week's content	9:00- 9:10 in weeks 2, 3, 4, 5.
Site Visit Report on waste management	3		12:00noon Mon 5 September 2016, via Turnitin
Waste Facility Design Assignment	15		12:00noon Mon 12 September 2016 , via Turnitin
Contaminant Transport Assignment	10		17:00 Friday 14 October (Week11) *Please lodge in wooden box labelled "Cathers" on 1st floor western end of CE Building.*
Contaminant Transport Online Quiz	5	On lecture material in Weeks 7 -10	Week 12 (exact times TBA)
Exam (2hr, closed book)	30 35	Waste Management Contaminant Transport	Formal exam period

There will be a 2hour closed book exam. The exam questions for the Waste Management component will be derived from workshop exercises and the assignments.

Generally, marking schedules for each assignment are included with the assignments; these show

where you should place emphasis. There may be conflicts between the due dates for CVEN3702 assignments and other course assignments – only students know these conflicts. Please advise the course coordinator by 9:30am in the Week 2 lecture so that due dates can be adjusted if necessary. Due dates remain in place after 10:00am in Week 2.

COURSE PROGRAM

The course schedule tabulated below shows the main topics and approximately how long will be spent on each topic in lectures. Please note that the lecture durations and sequence of topics is a guide only; there may be some variation. However, details on the associated assessment tasks should not be affected; if they are, you will be informed.

Week	Lecturer	Wednesday 9:00-12:00 CLB 5	Wednesday 13:00–15:00 Mathews 102	Assessment
1	SM	Introduction and Overview Guest lecture on Waste management at UNSW	(No workshop in Week 1)	
2	SM	Waste Characterisation	Waste characterisation workshop	
3	SM	Waste to energy	Waste to energy workshop	
4	SM	Waste minimisation & MRF	Waste to min. & MRF workshop	
5	SM	Composting and MBT	Worksop & Assignment consultn	
6	SM	Site Visit all day		
7	BC	**Lecture**: Processes of transport, diffusion and decay (2hrs) Diffusion (1hr)	**Workshop:** Transport, diffusion and decay (2hrs)	Waste site visit report due Monday 5 Sept at 12:00 noon; Turnitin
8	BC	**Lecture:** Diffusion (1hr) Dispersion in laminar and turbulent flows (2hrs)	**Workshop:** Diffusion (1hr) Dispersion (1hr)	Waste Asst due noon Mon 12 Sept, Turnitin.
9	BC	**Lecture:** Jets (2hrs) Plumes (1hr)	**Workshop:** Jets (2hrs)	Contaminant Transport Assignment to be issued 23 Sept Week 9
Break				
10	BC Dr Peter Tate Ass. Prof. Denis O'Carroll	**Lecture:** Plumes and buoyant jets (1hr) **Guest lecture:** Diffusion and dispersion case studies (1hr) Estuaries 1: classification and circulation (1hr**)**	**Workshop:** Plumes and buoyant jets (2hrs)	
11	Ass. Prof. Denis O'Carroll BC	**Lecture:** Estuaries 1: classification and circulation (1hr) Estuaries 2 (1hr) Atmospheric dispersion (1 hr)	**Workshop:** Estuaries 1 and 2 (2hrs)	Contaminant Transport Assignment due 17:00 Friday14 October Week 11
12	BC	**Lecture:** Atmospheric dispersion (1hr) Random walk and Monte-Carlo modelling (2hrs)	**Workshop:** Atmospheric dispersion (1hr) Stochastic modelling (1hr)	Online quiz – details TBA
13	BC/SM		**Review Exercise** on Waste Management (1hr) **Questions** on Contaminant transport (1hr)	

EXAM

The exam will be a ***2 hour closed book exam*** during the formal exam period. The questions will generally be similar to the shorter questions in assignments and the Exercise problems. All topics covered in the course are examinable. Formulae of interest for the course will be provided in the exam question paper, and students may bring in one A4 sheet of paper with any writing or printing on both sides of the paper.

Examinations - religious obligations

UNSW recognizes that there are students whose religious faith prohibits sitting examinations during certain periods, or on particular holy days. Wherever possible, the University will attempt to accommodate students so that they may fulfill both their religious and University obligations. Where examinations administered by UNSW Examinations conflict with a student's religious obligations, a Request for Alternative Exam Arrangements for Religious Reasons form should be completed and returned to UNSW Examinations **no later than one week after the publication of the final examination timetable**. See Les Brown in the 4th floor School Office.

RELEVANT RESOURCES

Contaminant Transport Component:

There is no textbook prescribed for this part of the course. The Lecture Notes are reasonably detailed and numerous references are cited within them. The main references are:

1. Ippen, A. T. (editor), *Estuary and Coastline Hydrodynamics, M*cGraw-Hill Company, Inc., New York, 1966, [UNSW Library – 1 copy]
2. Bowden, K. F., *Physical Oceanography of Coastal Waters*, John Wiley & Sons, Ellis Horwood Series in Marine Science, Chichester, 1983, ISBN 0 85312 686 0, [UNSW Library – 1 copy]
3. Lewis, R. *Dispersion in Estuaries and Coastal Waters*, John Wiley & Sons, Chichester, 1997, ISBN 0 471 96162 0, [UNSW Library – 1 copy]
4. Fischer, H. B., List, E. J., Koh, R. C. Y., Imberger, J. and Brooks, N., *Mixing in Inland and Coastal Waters*, Academic Press Inc., 1979, ISBN 0 12 258150 4, [UNSW Library – 1 copy]
5. Chapra, S. C., *Surface Water-Quality Modeling*, The McGraw-Hill Companies, Inc., New York, 1997, ISBN 0 07 115242 3, [UNSW Library – 1 copy]
6. Appelo, C.A.J., Postma, D., 2005. Geochemistry, Groundwater, and Pollution, 2nd Ed. A.A. Balkema, Rotterdam, 649 pp. ISBN 04 1536 428 0.
7. Fetter C.W., 2008. Contaminant Hydrogeology. 2nd Ed. Waveland Press. 500 pp. ISBN-13: 978-1577665830

Waste Management Component:

Discussion can be done via the MoodleQ&A Forum.

Pdf files from web sites will be provided via MOODLE.

Students who wish to build a professional library in this subject area should consider purchase of the following reference:

Tchobanoglous, G et al, 1993; Integrated Solid Waste Management, McGraw - Hill

The following references may be useful for assignments and to practitioners. They are available from the Library.

Brunner, P.H. and Rechberger, H.*, Practical Handbook of Material Flow Analysis*, Lewis (Publ,), 2004, ISBN 1-5667-0604-1

Christensen, T.H., Cossu, R., Stegmann, R., *Sanitary Landfilling: Process, Technology and Environmental Impact,* Academic Press, London, 1989.

Baccini, P. (Ed.), *The Landfill, Reactor and Final Storage*, Springer-Verlag, Berlin, 1989.

Technical papers and news items in the field of solid waste management are provided in the following:

- Waste Management & Research, Journal of the International Solid Waste Association.
- Newsletters of the Waste Management Association of Australia (contact S. Moore for membership details). Students interested in a career in waste management should become student members of this Association. It is a low fee for students, enables you to go to technical meetings and is a good way to meet prospective employers.

TOPIC	SUGGESTED REFERENCES
Introduction to Regional Environmental Management	1 Brunner and Baccini 1992; Regional material management and environmental protection, WM&R, Vol 10, N0 2, April 1992, p 203 2 Baccini and Brunner 2012; Metabolism of the Anthroposphere, 2nd Ed. MIT Press, Chapter 1 and 2
Solid Waste Characterisation	Brunner and Ernst 1986; Alternative Methods for the Analysis of MSW, WM&R, Vol 4, p 147 – 160 http://www.environment.nsw.gov.au
Waste Minimisation	http://www.environment.gov.au http://www.environment.nsw.gov.au
Transfer Stations and MRFs	Tchobanoglous et al, 1993; Integrated Solid Waste Management - Engineering Principles and Management Issues, McGraw - Hill
Waste to Energy	See Moodle for reference material
Landfills	1 Baccini, P; 1988; The Landfill, Reactor and Final Storage, Springer Verlag, Berlin 2 Christensen, Cossu, Stegmann, 1989; Sanitary Landfilling : Process, Technology and Environmental Impact, Academic Press, London

COMMON SCHOOL INFORMATION
Common School information may be found at:
http://www.engineering.unsw.edu.au/civil-engineering/

And information on academic advice can be found at:
http://www.engineering.unsw.edu.au/civil-engineering/resources/academic-advice

The **Common School Information and Academic Advice** sites have information on the following:

1. **Dates to Note** - important dates relating to enrolling and disenrolling, and a University website (via MyUNSW) with a calendar of other important UNSW dates (session dates, recess weeks, stuvac dates and exam periods).

2. **School Contacts**

   i. for enrolment or timetable difficulties,

   ii. referral chain of contacts for course difficulties:
   Course Coordinator/Lecturer -> Year Coordinators -> Grievance Officer,

   iii. Advanced Standing, and

   iv. Mentoring.

3. **Course Requirements**

   i. attendance at lectures, exercises and laboratory classes,

   ii. participation in exercises, and

   iii. completion of assessment work.

4. **Notes on Assessment**

   i. plagiarism (with link to UNSW Learning Centre web site on plagiarism),

   ii. keep a copy of written submissions,

   iii. submitting assignments, and

   iv. late submissions (obtaining extensions and special consideration)

5. **Supplementary Exams** – includes link to School website with School policy on supplementary exams.

   i. Special Consideration – includes link to UNSW website (New South Q) for downloading forms, requirements for lodging special consideration forms.

6. **Solutions to Problems – Troubleshooters**

   i. Learning Centre,

   ii. student counsellors, and

   iii. student support services.

7. **CEVSOC** – student committee membership and link to (unofficial) student CEVSOC website.