

CVEN9886 ENVIRONMENTAL MICROBIAL PROCESSES

COURSE DETAILS

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|---------------------------------------|---|---------------|--------|
| Units of Credit | 6 | | |
| Contact hours | 4 hours per week | | |
| Lecture | Tuesday | 12:00 – 14:00 | Online |
| Workshop | Thursday | 14:00 – 16:00 | Online |
| Course Coord. and Lecturer | Dr Bojan Tamburic b.tamburic@unsw.edu.au | | |

INFORMATION ABOUT THE COURSE

CVEN9886 is a core postgraduate course in Environmental Engineering. There are no prerequisites beyond a basic curiosity about microbial processes and their applications in engineering. It is expected that students would take CVEN9886 in the first year of their postgraduate study.



Microbes are all around us. There are more microbial cells in one drop of water than there are stars in our galaxy! Some microbes cause harm, while others are extremely useful to society. As engineers, we need to understand **how** microbes affect natural and constructed systems, and **what we can do** to influence these processes.

Would you like to learn how to work with microbiologists and other specialists to **deliver multidisciplinary engineering projects**? CVEN9886 will equip you with the knowledge and the tools – critical analysis, teamwork and communication skills – to tackle real-world assignments. You will **address crucial global challenges**, including:

- How can we improve water quality and health outcomes around the world?
- Can we use microbial processes to increase prosperity and wellbeing?
- How do we protect vulnerable communities and ecosystems in a changing climate?

HANDBOOK DESCRIPTION

See link to virtual handbook:

<https://www.handbook.unsw.edu.au/postgraduate/courses/2021/CVEN9886>

OBJECTIVES

This course aims to equip students with the following attributes:

- Knowledge of the fundamentals of applied and environmental microbiology, as they may be encountered by environmental engineers
- Ability to assess reports and data presented by specialists in the areas of microbiology, molecular biology, microbial ecology and biochemistry
- Skills for effective communication, project-based teamwork and collaborative multidisciplinary work
- Capacity for analytical and critical thinking and for creative problem solving
- Ability to engage in independent and reflective learning

TEACHING STRATEGIES

| | |
|----------------------|--|
| Lectures | <ul style="list-style-type: none">• 2 hours/week• Online delivery via Blackboard Collaborate• Introduction to fundamentals of applied and environmental microbiology• Interactive learning environment with friendly quizzes and opportunities to ask questions |
| Workshops | <ul style="list-style-type: none">• 2 hours/week• Online group activities via Blackboard Collaborate• Develop assignment submissions and practice exam-style questions• 1 or 2 guest lectures over the trimester |
| Assessments | <ul style="list-style-type: none">• Combination of individual (Assignment 1 & 2, Exam) and team-based assessment (Assignment 3)• Demonstrate your knowledge and skills |
| Private Study | <ul style="list-style-type: none">• 8 hours/week (expected)• Review lecture materials and workshop exercises• Work on assignments• Read recommended articles and publications to build background knowledge• Prepare for exam |

EXPECTED LEARNING OUTCOMES

*This course is designed to address the learning outcomes below and the corresponding Engineers Australia Stage 1 Competency Standards for Professional Engineers as shown. The full list of Stage 1 Competency Standards may be found in **Appendix A**.*

| Learning Outcome | | EA Stage 1 Competencies |
|------------------|--|---|
| 1. | <i>Demonstrate declarative knowledge in relation to Environmental Microbial Processes, including latest advances in the field</i> | PE1.1, PE1.2, PE1.3, PE1.4 |
| 2. | <i>Develop ability to critically assess articles, reports, publications and data relating to Environmental Microbial Processes</i> | PE1.3, PE1.4, PE3.2, PE3.4 |
| 3. | <i>Work in teams to generate novel solutions to environmental engineering challenges and evaluate their effectiveness</i> | PE2.1, PE2.2, PE3.2, PE3.3, PE3.4, PE3.5, PE3.6 |

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| COURSE PROGRAM |
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Term 3 2021

| Week | Date | Topic and Content | Assessments Due |
|-------------|----------------------|---|------------------------|
| 1 | 13 th Sep | What is Life? <ul style="list-style-type: none"> • From Genes to Cells • Life as Chemistry • Life as Information | |
| 2 | 20 th Sep | Introduction to Microbiology <ul style="list-style-type: none"> • Cell Structure • Microbial Groups • Macromolecular Building Blocks | |
| 3 | 27 th Sep | Molecular Biology for Engineers <ul style="list-style-type: none"> • DNA • (Meta)Genomics • Transcriptomics and Metabolomics | Assignment 1 |
| 4 | 4 th Oct | Health-Related Microbiology <ul style="list-style-type: none"> • Pathogens • Toxins • Antibiotics and Resistance | |
| 5 | 11 th Oct | Microbial Risk Assessment <ul style="list-style-type: none"> • Indicator Organisms • Procedures and Guidelines • Risk Communication | Assignment 2 |
| 6 | 18 th Oct | <i>Flexibility Week</i> | |
| 7 | 25 th Oct | Natural Microbial Systems <ul style="list-style-type: none"> • Carbon and Nitrogen Cycles • Microbes in Water, Soil and Air • Microbial Biofilms | |
| 8 | 1 st Nov | Engineered Microbial Processes (I) <ul style="list-style-type: none"> • Water and Wastewater Treatment • Organic Waste Management • Constructed Waterbodies | |
| 9 | 8 th Nov | Engineered Microbial Processes (II) <ul style="list-style-type: none"> • Bioremediation of Water and Soil • Microbial Biofuels • (Bio)Geoengineering | Assignment 3 |
| 10 | 15 th Nov | Summary, Conclusions and Future Perspectives | |

ASSESSMENT

CVEN9886 uses a combination of individual (Assignment 1 & 2, Exam) and team-based assessment (Assignment 3) to address the course learning outcomes and Engineers Australia competencies. Key information about assessments is provided here – further details are available on Moodle.

Assignment 1 [10%]

Format: Poster (1 page)

Task: Choose one microbial species of interest and design a poster to describe its taxonomy, structural features, environmental niche and key metabolic functions.

Target Audience: High school students

Criteria for Success: You should aim for a high degree of factual correctness, clear poster design, and the ability to engage and entertain your audience.

Assignment 2 [15%]

Format: Report (1,500 words + 3 diagrams)

Task: For your chosen microbial species, prepare a detailed report to explain its importance to natural microbial systems and/or its value to engineered microbial processes.

Target Audience: Environmental engineering professionals

Criteria for Success: Your report should be complete and factually correct, concise, professionally presented, illustrated with relevant diagrams, and pitched to a knowledgeable audience.

Assignment 3 [25%]

Format: Team Presentation (5 minutes, 15 slides) [20%], Private Reflection (500 words) [5%]

Task: Working in teams of 3, choose one global challenge and explain how it can be addressed using microbial processes in novel and innovative ways.

Target Audience: Clients of an environmental engineering consultancy

Criteria for Success: Your team needs to work together effectively to deliver a highly professional presentation, based on novel cutting-edge research, which clearly targets the needs of your clients.

Private Reflection: Take time to reflect on how well your team functioned, and to consider your own role and contribution.

Exam [50%]

The final exam will be composed of short, written questions, which will allow you to demonstrate comprehensive mastery of the subject material covered in lectures, workshops and online resources.

The exam will be administered online, and you will be required to hand-write your answers.

The 2-hour exam will be held between **26th November and 9th December 2021**. If needed, a supplementary exam will be held between 10th January and 14th January 2022. You are required to be available during these dates.

PENALTIES

Late assignments will be penalised with a 10% reduction in marks for each day submitted after the deadline.

Plagiarised assignments will receive 0 marks.

Students that cheat in the exam will fail the course.

ASSESSMENT OVERVIEW

| Item | Length | Weighting | Learning outcomes assessed | Assessment Criteria | Due date and submission requirements | Marks returned |
|------------------------------|---------------------------------|------------------|-----------------------------------|--|---|---|
| Assignment 1 (individual) | 1 page | 10% | 1, 2 | Factual correctness and clear design, engagement with audience | 5 pm, 1 st Oct (Week 3) PDF via Turnitin | by 8 th Oct (within 1 week) |
| Assignment 2 (individual) | 1,500 words 3 diagrams | 15% | 1, 2 | Completeness and factual correctness, professional writing and document presentation, engagement with audience | 5 pm, 15 th Oct (Week 5) PDF via Turnitin | by 29 th Oct (within 2 weeks) |
| Assignment 3 (team) | 5 min 15 slides 500 words | 25% | 1, 3 | Completeness and factual correctness, novelty and innovation, professional oral presentation, engagement with audience, reflection on teamwork | 5 pm, 12 th Nov (Week 9) MP4 via Moodle | by 26 th Nov (within 2 weeks) |
| Exam (individual) | 2 hours | 50% | 1, 2, 3 | Mastery of subject knowledge examined through short written questions | TBA Online, handwritten | TBA (within 2 weeks) |

RELEVANT RESOURCES

- There are no prescribed textbooks for CVEN9886 – all course materials will be available on Moodle
- Suggested reading material to build background knowledge will be provided for each week of study

DATES TO NOTE

Refer to MyUNSW for Important Dates available at:

<https://student.unsw.edu.au/dates>

PLAGIARISM

Beware! An assignment that includes plagiarised material will receive a 0% Fail, and students who plagiarise may fail the course. Students who plagiarise are also liable to disciplinary action, including exclusion from enrolment.

Plagiarism is the use of another person's work or ideas as if they were your own. When it is necessary or desirable to use other people's material you should adequately acknowledge whose words or ideas they are and where you found them (giving the complete reference details, including page number(s)). The Learning Centre provides further information on what constitutes Plagiarism at:

<https://student.unsw.edu.au/plagiarism>

ACADEMIC ADVICE

Useful information and resources:

- Key Staff to Contact for Academic Advice (log in with your zID and password):
<https://intranet.civeng.unsw.edu.au/key-staff-to-contact-during-your-studies-at-unsw>
- CVEN Student Intranet (log in with your zID and password):
<https://intranet.civeng.unsw.edu.au/student-intranet>
- Student Life at CVEN, including Student Societies: <https://www.unsw.edu.au/engineering/civil-and-environmental-engineering/student-life>
- Special Consideration: <https://student.unsw.edu.au/special-consideration>
- General and Program-Specific Questions: [The Nucleus: Student Hub](#)

Appendix A: Engineers Australia (EA) Competencies

Stage 1 Competencies for Professional Engineers

Competencies addressed in CVEN9886 are highlighted

| | Program Intended Learning Outcomes |
|--|---|
| PE1: Knowledge and Skill Base | PE1.1 Comprehensive, theory-based understanding of underpinning fundamentals |
| | PE1.2 Conceptual understanding of underpinning maths, analysis, statistics, computing |
| | PE1.3 In-depth understanding of specialist bodies of knowledge |
| | PE1.4 Discernment of knowledge development and research directions |
| | PE1.5 Knowledge of engineering design practice |
| | PE1.6 Understanding of scope, principles, norms, accountabilities of sustainable engineering practice |
| PE2: Engineering Application Ability | PE2.1 Application of established engineering methods to complex problem solving |
| | PE2.2 Fluent application of engineering techniques, tools and resources |
| | PE2.3 Application of systematic engineering synthesis and design processes |
| | PE2.4 Application of systematic approaches to the conduct and management of engineering projects |
| PE3: Professional and Personal Attributes | PE3.1 Ethical conduct and professional accountability |
| | PE3.2 Effective oral and written communication (professional and lay domains) |
| | PE3.3 Creative, innovative and pro-active demeanour |
| | PE3.4 Professional use and management of information |
| | PE3.5 Orderly management of self, and professional conduct |
| | PE3.6 Effective team membership and team leadership |