Faculty of Engineering and the Built Environment,
University of Cape Town

Master of Philosophy

SPECIALISING IN SUSTAINABLE MINERAL RESOURCE DEVELOPMENT

A trans-disciplinary and inter-institutional Master of Philosophy (MPhil) Degree, offered through the Minerals to Metals Research Initiative

Preamble

Mining in Africa, as in the rest of the world, has changed from simply balancing production targets with cost control to a complex set of interrelationships including safety, health, the environment, sustainable development and proactive stakeholder management. This programme is aimed at providing an interdisciplinary postgraduate qualification that highlights the critical factors of sustainable development in the context of mining and minerals processing in Africa; including an understanding of, and a sensitivity and progressive approach to, managing and interacting with communities, environmental challenges, safety cultures, health-related issues and regulatory frameworks.

Programme Description

This two-year Master of Philosophy (MPhil) Degree is offered by the Faculty of Engineering and the Built Environment at the University of Cape Town, through the Department of Chemical Engineering, and accredited by the Higher Education Quality Committee (HEQC) of South Africa. Candidates are required to complete advanced study by coursework with a total value of 60 credits, and a research dissertation with a value of 120 credits.

This programme has been developed as part of the Education for Sustainable Development in Africa (ESDA) project of the United Nations University Institute for Sustainability and Peace (UNU-ISP). A twin programme is run at the University of Zambia and the coursework is jointly taken by the two cohorts, with one course offered Stellenbosch University.

Objectives

This MPhil degree aims to educate and train graduates who can develop knowledge at an advanced level in and around the African mining industry, through research. In particular, it aims to:

- Impart a high-level understanding of, and a sensitivity and progressive approach to, the critical factors of sustainable development in the context of mining and minerals processing in Africa.

- Develop an appreciation of the inter-relationships between safety, health, the environment, economic development and proactive stakeholder management, and the concomitant integration of technical skills, ethics and global citizenship.
- Promote experimentation with interdisciplinary and systemic approaches to environmental protection and socio-economic development in the context of geo-extractive industries in Africa.

Delivery

Core courses are delivered in blocks of approximately 10 days each within the first year of study, with attendance by the entire cohort of students from the two universities involved. Course assignments are presented via on-line learning systems, and contact with the students maintained via the internet and e-mail. The research project accounts for 67% of the total course credits for the Masters degree, and is undertaken within the second year of study, through the Department of Chemical Engineering. Inter-disciplinary research is promoted through the joint supervision of student dissertations across faculties and universities.

Course Description	Convening Institute	Credits
Core Courses		
Sustainable Development	University of Stellenbosch (in collaboration with the Sustainability Institute)	16
Strategic Social Engagement Practice	Graduate School of Business, University of Cape Town	16
Environmental Stewardship in Mining & Minerals Beneficiation	Department of Chemical Engineering, University of Cape Town and School of Mines, University of Zambia	12
Research Communication and Methodology	Department of Chemical Engineering, University of Cape Town	16
Sustainable Development in Africa Internship	Department of Chemical Engineering, University of Cape Town	0
Dissertation	Department of Chemical Engineering, University of Cape Town	120

In accordance with the HEQF model, 10 hours is equivalent to 1 credit, with contact/lecture time accounting for approximately 1/5 of total time.

Admission Requirements and Procedures

This programme targets graduates from across a spectrum of disciplines, who have an interest in pursuing or advancing their careers in the field of mining and minerals beneficiation in a variety of areas e.g. geologists, engineers, economists, planners, lawyers, regulators, health & safety specialists, environmental officers, social scientists, etc.

The basic entry requirement is a four-year Bachelor's degree or an Honours degree in any relevant field. HND (Higher National Diploma) or its equivalent embodying relevant specialization will be considered as a basis for entry, subject to appropriate experience. The number of students accepted into the programme in any year will be restricted by the resource capacity of the programme. Selection is based on an applicant's academic record; the duration, level and relevant work experience; and the availability of a suitable programme and research project supervisor. In keeping with the inter- and cross-disciplinary nature of this programme, selection is also be aimed at promoting diversity amongst the students in terms of fields of study, expertise and/or experience.

In order to be accepted onto this programme, candidates are required to submit a 1000 word statement of interest in the Master's programme, together with a CV, to the course convener Professor Harro von Blottnitz (harro.vonblottnitz@uct.ac.za). This statement should include a motivation for attending the course and a short statement on the area(s) the candidate is considering for the research dissertation. Further information and procedures for formal application are available from the programme administrator, Mrs Eunice Jacobs (eunice.jacobs@uct.ac.za).

Applicants for the 2017 intake are invited to indicate whether they want to initially register as an occasional student taking the course work only, or immediately register for the full degree programme, either on a part time or full time basis. Applications will be accepted until the end of October 2016.

Programme Fees and Financial Support

The total cost of the programme is made up of course fees to the three universities plus accommodation costs whilst attending the block courses at the Sustainability Institute in Stellenbosch, the Graduate School of Business in Cape Town and the School of Mines in Zambia. Total direct costs for the two-year MPhil programme are estimated at R103 000. This includes course fees at R 44 000 for year 1 (2017) and R 24 000 for year 2 (2018), excluding the international student fee. Ancillary costs amounting to R 35 000 will cover accommodation, catering and transport during the coursework periods. Fees do not cover internship (transport, accommodation, subsistence etc.) and research (fieldwork, laboratory running costs, analytical costs etc.) costs. Transport to and from these venues will also be to the candidate's own cost.

Funding is available on a competitive basis to enable participation in the short courses (South African students only), for internships (all students registered for the full MPhil) and research costs (for specific deliverables). Applicants are advised to contact the course administrator for further details regarding financial arrangements and funding opportunities.

ADDENDUM 1: COURSE MODULES

Sustainable Development

This is an existing Master's level course convened by the School of Public Leadership in the University of Stellenbosch, South Africa and delivered in collaboration with, and at the Sustainability Institute. The course combines classroom work, a group project for completion during the week, written assignments, personal reflection, and practical involvement in local community projects. Two written assignments must be completed within 6 weeks after the course, in lieu of an examination.

Rationale

This course focuses on the rise to global prominence of the challenge of sustainability in general and sustainable development in particular. Public policy debates at the global levels of governance are increasingly focussing on the challenges posed by natural resource limits to the ways production and consumption are currently structured and managed within a world that is sharply divided between the rich (located mainly in the global North) and poor (located mainly in the global South). The adopting by the UN of the Sustainable Development Goals in September 2015 marks a turning point in global world history because it is the first time that there has been a global commitment to eradicating poverty and doing this in a way that is ecologically sustainable. The challenge facing the world today is not just about the redistribution of resources to ensure greater levels of social equity, but also about how to reorganise the extraction, use and disposal of those resources in order to ensure longer-term survival of the eco-systems that sustain all life. Indeed, addressing the latter holds the key to addressing the former challenge appropriate. This epochal challenge raises key questions: How do we rethink the relationship between society and natural resources so that the development of the former is not at the expense of the latter? What are the implications of this new relationship for strategies to reduce inequalities, and in particular is poverty eradication possible without consumption reduction amongst the rich? What will the transition to a more sustainable global economy look like? This course will address these questions.

Aim

This course provides course participants with an overview of the most significant global environmental, social and economic challenges that face humankind, and an insight into the solutions suggested by the universal commitment to sustainable development. Course participants will be able to recognise, understand and apply the divergent interpretations of sustainable development that currently exist. Three questions will guide the lectures and discussions:

- What does sustainability – and sustainable development in particular - mean?
- What is the relationship between inequality and unsustainability? Or, alternatively, what is the relationship between strategies to reduce inequality (via poverty eradication for the poor and consumption reduction for the rich) and sustainable development?
- What is the relationship between human life and all life forms and how has this relationship evolved over time?

Learning Outcomes

By the end of the course, participants will have understood and grappled with the complex challenges that arise from the global call for a more sustainable future. To achieve this general learning outcome, course participants will:

- understand the most important environmental problems, such as climate change, waste and pollution, biodiversity destruction, and resource depletion;
- understand the most significant social challenges, including demographic change and expansion, pandemics, poverty, over-consumption, endemic violence, migration, and urbanisation;
- understand the key global economic trends that currently determine and shape the dynamics of national and local economies, and the centrality of socio-economic inequality;
- comprehend the history of, and different approaches to, the notion of sustainable development, and apply these to different interpretations of specific developmental contexts; and
- relate the challenge of transition to a sustainable future to the current global economic crisis; and
- appreciate the complex dynamics of human-nature relationships from a deep ecology perspective.

Course Content

The course is divided into four parts which all relate to and feed off each other. The four parts are Classroom Work, Community Work, a Group Project, and Written Work.

Classroom Work

Theme 1: What does sustainability and sustainable development mean?
Theme 2: Transitions to sustainable development
Theme 3: Key elements of the global economy, and the nature of inequality
Theme 4: An introduction to deep ecology
Theme 5: Fault lines and applications

Community Work.

After breakfast, course participants will work in small groups for one hour in one of the following:

- Organic farming
- Gardening
- House cleaning
- Meal preparation

Group Project

Working in groups, course participants will be required to formulate and present a group project at the end of the course. Guidelines for how to go about this will be presented at the start of the week. You will be required to work with your group in the afternoons between 14h00 and 16h00, and if required, into the evenings. Class will end at 13h00 on Saturday which means all flight bookings for those flying back home must be from 14h30 onwards.

Written Work

Written work will consist of four components:

- Class test: students will be tested at some point during the week on their reading done before the module starts;
- A Learning Journal that will contain reading summaries and personal reflections on the various learning experiences during the week;
- First written assignment that contains a literature review (between 3500 – 5000 words);
- Second written assignment that contains a case study that applies the argument developed in the literature review (between 3500 – 5000 words)

Strategic Social Engagement Practice

This course is designed and coordinated by Elspeth Donovan of the University of Cambridge Institute for Sustainable Leadership on behalf of the Executive Education department at the UCT Graduate School of Business (GSB). The course is delivered largely through lectures, interactive sessions and group work, and is followed by a project task in which each student is required to apply the tools and practices developed in the course into their daily work practice.

Rationale

One implication of environmental change or resource scarcity is the increasing likelihood of conflict among people or nations. Thus it becomes imperative to understand and be able to engage with complex challenges of environmental, social and economic that arises from the global call for a more sustainable future. In this course students will comprehend the principles of, and be able to develop and implement, strategic social engagement programmes and practices.

Aim

The aim of the course is to enable students to:

- Make sense of the social and environmental context of an organisation;
- Understand the mutual interaction between, and the impact on, the organisation and its social and environmental context;
- Engage with and manage the relationships between an organisation and the communities and other social partners that populate its context;
- Develop and implement strategic social engagement programmes and practices.

Learning Outcomes

This course is designed to build the capacity of all managers and professionals in organisations to respond effectively and innovatively to emerging system pressures and trends affecting the socio-economic development agenda. In the context of increasing societal expectations, the course aims to develop the ability of participants to engage positively with all stakeholders impacted by their organisation's operations. After the course, the student is expected to:

- Understand the emerging global pressures and trends, and their impact on mineral resource development.
- Have the capacity to anticipate change and develop appropriate responses
- Be able to engage with diverse perspectives
- Be capable of designing, delivering and evaluating social development interventions
- Exhibit enhanced dialogue skills, particularly within conflict situations
- Be able to develop a framework for social performance and impact within his/her sphere of influence

Course content

- *Community and Social Partner Assessment:* developing an understanding of the social and environmental context of an organization; community theory: socio-cultural, economic, political structures, practices processes and behaviours; social impact assessment and evaluation; understanding the concept of "wicked problems".
- *Community and Social Partners and the Communication Process:* the communication process; communicating technical, social, political risk and crises issues and opportunities; information gathering and management tools.
- *Engaging Communities and Social Partners:* Identifying and managing conflict and opportunities for engagement; understanding of the strategic nature of relationship management.

Environmental Stewardship in Mining & Minerals Beneficiation

This is a new course, convened jointly by the Department of Chemical Engineering at the University of Cape Town and the School of Mines at the University of Zambia. Key lecturers include Dr Jewette Masinja (UNZA), Professor Sue Harrison (UCT), Prof Harro von Blottnitz (UCT) and Dr Jenny Broadhurst (UCT). This course provides exposure to the mining world and will offer students the opportunity to conduct case studies on real mine sites. Students are required to complete an assignment within 6-8 weeks of attendance.

Rationale

Despite the apparent commitment to improving its environmental performance, the mining and mineral industry still suffers from the same negative image that it had in the late 20th century, and many mining companies continue to find themselves embroiled in environmental controversies which threaten their license to operate and their access to natural capital. Natural resources are also becoming more valued and as a result the cost of using these resources is increasing dramatically and legislation governing their protection becoming more prolific and stringent. An understanding of the environmental challenges of particular relevance to mining and minerals beneficiation operations, and their broader significance in terms of the sustainable development of mineral resources, is becoming increasingly important for many professionals operating in this industry. Put bluntly, environmental stewardship no longer is a box-ticking exercise in which the already-decided on project and technology is shoe-horned into compliance format by the environmental management department – it requires a range of specialists to review their options and choices based on sound understanding of what is at stake.

Aim

The course aims to

i) review and deepen students' understanding of environmental challenges of particular relevance to the mineral industry, with emphasis on the relationship between mining and minerals beneficiation activities and environmental impact categories;

ii) Provide students with an opportunity to learn how environmental management and stewardship tools and approaches are used in the industry, leading to an ability to critique the effectiveness of pro-active and reactive uses thereof, and interpret what selected approaches mean for own professional practise.

Course content

- *Overview of Relevant Environmental Issues:* land use issues; solid waste management; noise/air pollution; effluent/water management/AMD; biodiversity conservation; global warming/climate change; socio-economic considerations – and interpretation of these relative to the 'natural capital' category of the five capitals approach.
- *Principles and Criteria for Environmentally Conscious Development of Mineral Resource:* cradle to grave mine design and life cycle thinking; cleaner production; eco-efficiency/industrial ecology; material stewardship; carbon neutrality; multi-criteria vs environmental economics approaches to decision-making and trade-offs
- *Environmental Legislation and Guidelines*, relevant international protocols; examples of key elements of national mining legislation in developed and developing nations (mining policy, mining code, provisions of environmental management)
- *Environmental Technologies and Innovations*, incl. mine and process water treatment and recycling; noise and air pollution control; solid waste management; AMD management and prevention; operation, closure and rehabilitation of mine sites (including cost provision); alternative energy sources and efficient utilization of energy
- *Environmental Measurement and Control Techniques,* environmental monitoring and sampling techniques, environmental impact assessment and prediction.
- *Environmental Assessment, Auditing and Management* incl. environmental impact assessment; strategic environmental assessment; environmental management systems (ISO 14000); auditing

Research Communication and Methodology

This course is convened by the Department of Chemical Engineering at the University of Cape Town. The lecturers are Professors Susan Harrison and J-P Franzidis and Dr Jenny Broadhurst. The course is delivered largely through lectures, tutorials and seminars, with reading assignments, group work, and projects forming a core part of the learning environment. This course is delivered in discrete modules which are integrated into the overall course programme in such a manner that the students develop their research skills and research project scope in parallel with their learnings from the other courses.

Aim

The aim of this course is to provide postgraduate students with competency to execute meaningful research in a structured way, to critically analyse the results of this research and to communicate these results effectively. An additional objective of this course is to assist students in synthesizing and applying the knowledge gained from the taught modules to real-life case studies of relevance to the sustainable development of mineral resources in Africa.

Learning Outcomes

At the end of the course a student is expected to be able to:

- Critically read and synthesize the relevant literature
- Plan, develop and execute a meaningful research programme;
- Communicate research outputs effectively.
- Integrate and apply knowledge from different disciplines, stakeholders and sources to complex problems within the context of sustainable mineral resource development.

Course Content

- Literature review and synthesis skills
- Research philosophy and methodologies
- Research planning and hypothesis development
- Structuring, writing and presentation of research outputs
- Research tools and techniques
- Developing and applying integrative knowledge

Sustainable Development in Africa Internship

This is a non-credit bearing course, listed with the postgraduate course office of the Dean of the Faculty of Engineering and the Built Environment. As an academic offering, it is grounded in the realizations that sustainable development i) requires professionals to be able to negotiate disciplinary truth boundaries so as to minimize externalization of costs and damages to 3rd parties or future generations; and ii) requires an understanding of the complexity of coupled social-ecological systems, which can only partly be learnt in the classroom.

Aim

- To facilitate field-based inter-disciplinary learning especially through on-site structured engagements with problem-solving approaches in the actual developmental setting of the host organization;
- To provide an opportunity to experience possible career options in the area of sustainable development;
- To make a service contribution that will not only be useful to the host organization, but also contribute to the university's social responsiveness objectives.

Course Structure

The student will select, with the aid of the course convener, a placement with any one of the listed internship host organizations or suitable alternative. The specific content and aims of the internship, tailored to the needs of the student relative to the theoretical demands of the student's academic programme, will be recorded in an MOU between the student, the host and the course convener ahead of the start of the internship. The student will keep a logbook and will complete an internship report for the host and for submission to the University. The academic time spent on the course, incl. the academic preparation, preparation of the report and theoretical reflections (as recorded in the logbook) must be equivalent to approximately 80 hours of student time.

ADDENDUM 2: PROVISIONAL PROGRAMME SCHEDULE FOR 2017/2018

Period	Component	Details		
		Schedule	**Location**	**Activities**
Year 1 **March 2017**	Coursework Block 07-18 March 2017	Day 1-2	Department of Chemical Engineering, UCT	Orientation & Research Communication & Methodology course: *The nature of academic and trans-disciplinary research; finding, reading and reviewing the literature*
		Day 3		Site visit
		Day 4-5		Environmental Stewardship course: *Overview of Relevant Environmental Issues;* *Principles and Criteria for Environmentally Conscious Development of Mineral Resources*
		Day 6 (Sun)	Free	
		Days 7-12: (Mon - Sat)	Sustainability Institute, Lynedoch, Stellenbosch	Sustainable Development course
March - May 2016	Off-site*/ Self study	• Written assignment for the Sustainable Development course • Research Communication & Methodology assignment on critical analysis of the literature.		
June 2016	Coursework Block 2: 13-24 June 2017	Days 1–3 (Tues-Thurs)	Department of Chemical Engineering, UCT	Research Communication & Methodology course: *Research methodologies; developing the research hypothesis and project proposal; academic writing*
		Days 4-5 (Fri – Sat)		Environmental Stewardship course:

				Environmental Legislation, EIA *Environmental Technologies & Innovation*
		Day 6 (Sun)	Free	
		Day 7-12; (Mon-Fri)	UCT Graduate School of Business, Breakwater Lodge	Strategic Social Engagement Practice course
July-September 2017	Off-site*/Self study period	• Complete assignment for Strategic Social Engagement Practice course • Preparation of research proposal presentation • Environmental stewardship assignment		
October 2017	Coursework Block 3: tbc	Day 1-2 (Mon-Tues)	Zambia, on the Copperbelt	Environmental Stewardship course: *EIA to EMS, auditing, measurement & monitoring tools.* *Project group-work: case-study based development of critiquing skill.*
		Day 4-5 (Wed-Thurs)		Environmental stewardship site visit and case study
		Day 5-6 (Fri-Sat)		Research Communication & Methodology course: *Proposal presentations, knowledge integration; research tools and techniques*
November-December 2017	Off-site*/ Self study period	• Complete assignment for Environmental Stewardship course • Complete project proposals - to be presented in structured webinars		
<u>Year 2</u> January - December 2018	• Research dissertation • Project work and research dissertation-progress updates to be provided in regular webinar sessions			

** working students only, full-time students will be required to work towards their research dissertations during these periods*