Organization for Tropical Studies

African Ecology & Conservation in South Africa

Semester Study Abroad Program - Syllabi

Summary:
These are some of the critical challenges that ecologists and conservationists in Kruger National Park, one of the world's premier wildlife parks, and other South African parks are currently facing. This field-based, experiential learning program includes lectures, skills workshops, and fieldwork designed to introduce you to these types of challenges and guide you through research projects that will help address critical issues including wildlife diseases, poaching pressures and ecosystem management strategies. You will have the unique opportunity to live in KNP, and learn from invited professors from universities as well as experts in the fields of ecology, environmental economics and conservation. You will work with your professors to design research projects that will contribute meaningful scientific data to the South African National Parks. As part of your history and culture courses, you will spend three nights with a family in a rural village community to gain important socio-economic context for the ecology courses. At the end of the semester, you will conduct a three-week capstone research project and present your findings.

- How do conservationists manage the extensive ecosystems required to maintain the world's largest land mammals?
- How might savanna ecosystem dynamics change if rhinos were extirpated?
- How can human communities and protected area managers collaborate to create sustainable landscapes for both people and wildlife?

Courses:

- South African Ecosystems and Diversity – 4 credits
- Directed Field Experience – 4 credits
- Conservation, Biodiversity, Management, and Protected Area Design in South Africa – 4 credits
- South Africa: Special Topics in History – 3 credits
- Field Experience in South African History – 1 credit

OTS South Africa Semester

The key aim of the Organization for Tropical Studies SA Semester is to immerse students in South African ecology and culture through an active learning experience. Student will develop knowledge of natural and cultural history as well as experience in the scientific process. Through studying in some of Africa's most diverse ecosystems in and outside of protected areas, students will gain experience in conducting conservation relevant research.

On the OTS South Africa Course you will gain

- A holistic science education through instructional and experiential learning to develop an understanding of social-ecological systems in South Africa;
- Experience in field problem-based learning, focusing on natural history and personal experience as a vehicle for further education;
- Close mentorship from professors who actively research South African ecology and history;
- Exposure to a range of top researchers and sites that best illustrate key course concepts;
- Experience conducting conservation relevant independent research;
- An understanding of the socio-economic context of South Africa: the country provides a unique combination of social realities facing a developing nation, which inspires constant engagement and innovation;
- Critical skills necessary for ecology and conservation through exposure to global environmental issues within a South African context. You will leave with a deeper understanding of the interaction between science, policy and society that will inform your thinking as a future scientist;
- Cultural exchanges and friendships with students from RSA and the US, which are central to the success of the program;
- An unforgettable semester filled with exposure to protected areas, new friendships, and a deeper understanding of science and nature.

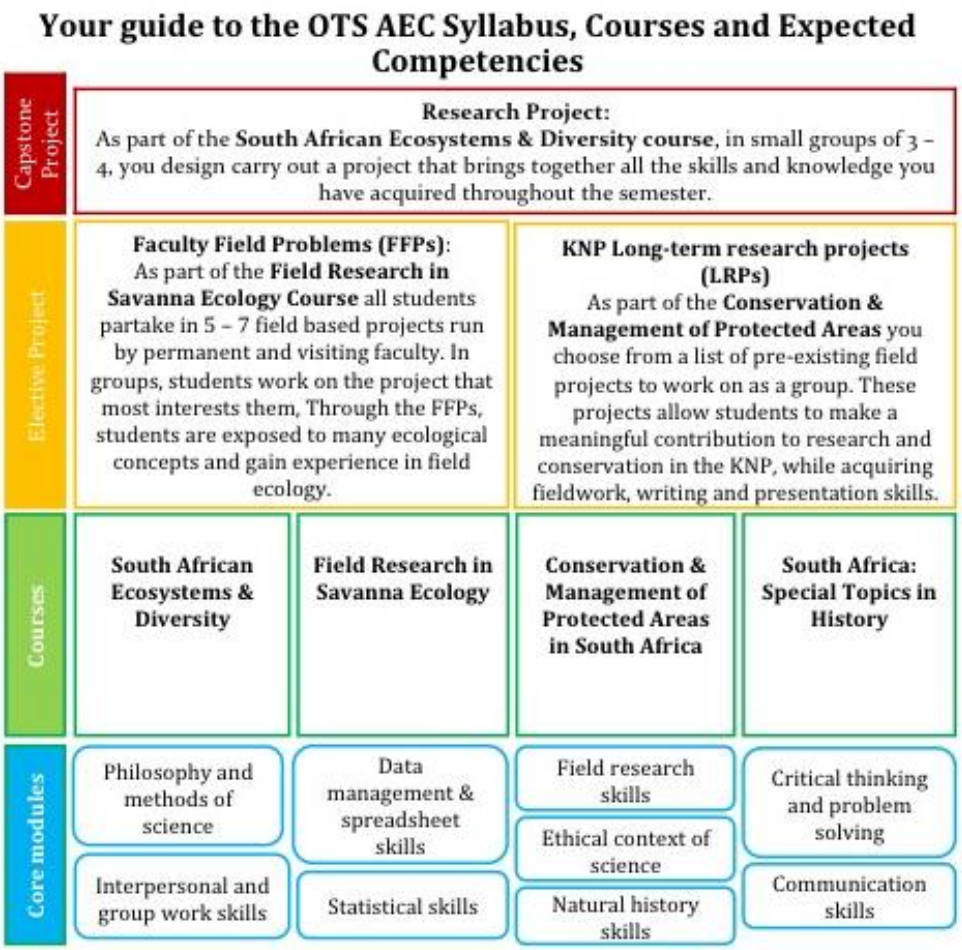
OTS AFRICAN ECOLOGY AND CONSERVATION (AEC): Semester Syllabi

Semester overview

The AEC syllabus is designed to provide you with an integrated understanding of South African ecosystems, their management and the decision making required within the socio-economic determinants of SA Society. Whilst the courses are distinctive, each with their own deliverables, they run concurrently to maximize the benefit of the sites we visit. Material from one course can be used to cross reference the learning of another. This parallels modern conservation science, a trans-disciplinary endeavor, which requires broadly skilled professionals. Science is now considered to be a social enterprise, and we train students to demonstrate 21st century skills, emphasizing collaboration, inclusive leadership and flexibility.

Program structure

The diagram below represents a conceptual model of the academic structure of the program.



- At the base lie the **expected competencies** or hard skills that you will acquire during the program, as part of the course-work and projects. These are all aimed at providing you with a "tool kit" for a more effective engagement with science.
- Academically, the four courses lie at the heart of the program. Each course comprises of a series of lectures and workshops and requires several deliverables from you (see *marking rubric* below).
- The **elective projects** of the course are made up of the **Faculty Field Problems (FFPs)** and the **Long-term Research Projects (LRP).** These elective projects offer you experience in diverse approaches to science and afford you the opportunity to contribute to research in Kruger National Park (KNP).
- Finally, the program culminates in the **Capstone Project (CP)**, in which you apply all the skills, theory and approaches to science you have learned during the program to a final independent research project.

COURSE DESCRIPTIONS AND DELIVERABLES

South African Ecosystems and Diversity

Course description

This course serves to integrate field and classroom instruction to provide an integrated understanding of South Africa's diverse ecosystems with an emphasis on savannas. We concentrate on factors that determine the form and function of both individual organisms and ecosystems, using a range of African examples (marine, freshwater, savannas, arid-lands, and fynbos). In engaging with ecological theory, the course also aims to highlight characteristics distinctive of South African ecology, such as climatic variability, the importance of geology (bottom-up controls), the role of disturbance by large herbivorous mammals, the importance of fire, and the long history of people in ecosystems (top-down controls). Course topics will focus on conceptual problems and issues that guide current ecological research in South Africa. Classroom instruction will include lectures given by program faculty and visiting faculty as well as discussions of assigned readings. Throughout the semester, researchers working at Kruger National Park (KNP) and other South African field sites, including invited faculty from the University of the Witwatersrand (Wits) and the University of Cape Town (UCT), will deliver lectures outlining the results of on-going projects. Consequently, students will have frequent exposure to current research in South Africa.

Fieldwork is the central component of the course. During the semester, the course is based primarily at Kruger National Park and visits several distinct field sites within the park. In addition, the course travels to other sites in South Africa to highlight the climatic and biotic diversity of the country. For significant portions of the course, you will visit sites outside the KNP such as the arid northern Limpopo regions, Barberton mountain range, Cape Floristic Kingdom and coastal regions. Field orientation at each site will include the identification and natural history of important plant and animal species. These sessions will also serve to stimulate questions you may address in research projects.

At the end of the semester, you will complete an independent research project (of about 12 days' duration from start to finish). Working in small groups, you will present a research protocol to the class, collect and analyze data, and prepare a report in the style of a scientific paper. You will also present your data orally in a research symposium. You will be mentored by a faculty member throughout the process who will help guide the development of your research and writing skills.

Specific Goals:

- Explore the evolution of southern African landscapes, how this influences climate and geology and how this affects the distribution of biomes;
- Assess the patterns and processes governing ecosystem dynamics in savanna, fynbos, freshwater and marine ecosystems;
- Gain an introduction to the origin and maintenance of the remarkable diversity of South African Ecosystems;
- Explore key ecological themes relevant to these systems including ecological effects of mega-herbivores, the role of fire, disease as a top down control and plant animal interactions;
- Examine and apply contemporary ecological theory in a South African context;
- Link ecological dynamics to conservation and management practices in the KNP.

Course outcomes

Upon completion of this course, you should be able to demonstrate the following knowledge and skills:

a) Apply critical thinking skills to examine ecological questions;
b) Analyze ecological data sets and interpret results effectively;
c) Acquire and synthesize scientific research from a variety of sources
d) Exercise leadership and collaborate positively with your peers and broader science community;
e) Communicate effectively with scientists and the broader public both orally and in writing

Deliverables:
Ecology Proposal – individual work - 25%
Capstone Research Project – group work - 50%
Final Exam – individual - 25%

Instructors:
Dr. Lisa Nupen, Dr. Tara Massad, Dr. Bernard Coetzee, Donovan Tye, Dr. Laurence Kruger and visiting faculty.

Textbooks:
Prescribed:
Du Toit, J.T., Rogers, K.H., and H.C. Biggs. 2003. *The Kruger Experience.* Island Press, Washington D.C., USA

Available in South Africa
Scholes, R.J., and B.H. Walker. 1993. *An African Savanna: Synthesis of the Nylsvley Study*. Cambridge: Cambridge University Press.

The course travels with an extensive library of textbooks, field guides, and scientific reprints. Research articles are assigned throughout the course.

Directed Field Experience

Course description

This course, the scientific "toolbox" of the program, introduces you to research design (approach, methods, and techniques) in the context of South African ecosystems. Several approaches to scientific inquiry are demonstrated and discussed, with special emphasis on hypothesis testing and statistical analysis. You will also be trained in the design and implementation of long-term ecological monitoring and research projects. Tutoring sessions to reflect on Faculty Field Problems (FFPs) will highlight the different approaches adopted by visiting faculty to anticipate approaches to independent field projects.

The emphasis of the statistics component of this course is to get you comfortable with 1) curating and managing ecological data, 2) selecting and interpreting appropriate statistical tests, and 3) writing-up and graphically presenting your findings. The course starts by discussing the role of statistics as a part of the scientific method, and aims to get students to a point where they are equipped with the necessary design and analysis skills to carry out their own research projects. This includes orientation to software packages (Excel, R and Primer).

This course also includes workshops dealing with philosophy and methods of science and culminates in a science-writing workshop, which focuses on the product of your scientific project. The science-writing workshop introduces you to the standards of science writing that will apply in this course.

In faculty-guided field projects (FFPs), visiting faculty members select the topic focusing on novel issues in the ecology and/or conservation of savannas, fynbos or marine systems. They guide you through the process of identifying narrower questions about the topic, developing relevant hypotheses, designing tests of these hypotheses and interpreting data. Fieldwork for projects are each two to three days in length, and we usually invite 5 – 7 faculty to teach on the course. Although all of you will participate in data collection, only a core group will produce a report on the topic. You will choose a project and mentor per your interest and lead the design and management of the project under the guidance of the visiting faculty.

An additional requirement of the course is to participate in a biodiversity survey to learn methods important to conservation biology. You will create an insect, plant and small vertebrate collection. Not only do these collections provide practical skills and experience in collecting and curating of specimens, but they also afford the opportunity to learn more about the taxonomy and natural history of the collected species. Furthermore, student collections provide SANParks with valuable specimens from key sites on the long-term research plots (the Granite "supersite"). These are then accessioned in the herbarium and museum at Skukuza.

Specific Goals:

- Critical review of methods of scientific inquiry and their application to field savanna ecology (understanding approaches to science);
- Instruction in key principles of design of quantitative research (surveys and experiments), analysis, and long-term ecological monitoring;
- Training in the logic and procedures of statistical inference;
- Use of statistical tests, such as chi-squared tests, t-tests, regression analyses, ANOVAs, and various nonparametric tests for analyzing data;

- Intensive training in writing scientific papers and preparing papers outlining research findings;
- Training in presentation of oral reports (following the format of scientific meetings) describing research projects;
- Experience in contributing to and interpreting long-term data sets;
- Introduction to and experience in the basic procedures for collecting, trapping, handling, identifying and curating taxa, with emphasis on plants, mammals, birds, reptiles, and insects.

Course outcomes

On completion of this course you should be able to demonstrate the following:

a) Knowledge of the concepts and logic of the scientific method and the ability to apply these in research;
b) The ability to design, plan and conduct taxa specific research associated with an ecological/conservation issue in savanna, fynbos or marine systems;
c) Skills in biodiversity inventories required for field collections including trapping or collection of taxa, field identification and effective handling of specimens;
d) The knowledge and skills needed to build and curate natural history collections;
e) Data management skills and an understanding of the fundamentals of statistical analysis of ecological data;
f) Understand the ethical context for ecological research and decision making in conservation management;

Deliverables:
Writing workshop – individual work - 20%
Statistics exercise – individual work - 10%
Field Faculty Project - group work - 45%
Biodiversity Collection – group work - 25%

Instructors:
Dr. Laurence Kruger, Dr. Bernard Coetzee, Dr. Lisa Nupen, Dr. Tara Massad, and visiting faculty.

Textbooks:
Prescribed:
Fowler, J., L. Cohen, and P. Jarvis. 1998. *Practical Statistics for Field Biology*. New York: John Wiley & Sons.

Available in RSA:
Strunk, W. and White, E. B. 2000. *The Elements of Style*. New York: Longman Publishing. Scientific writing
Krebs, C.J. 1999. *Ecological Methodology*. Second Edition. Menlo Park, CA USA: Addison, Wesley, Longman, Inc.
Zar, J. H. 1999. *Biostatistical Analysis*. Fourth Edition. Upper Saddle River, New Jersey, USA: Prentice-Hall Inc.

Conservation, Biodiversity, Management, and Protected Area Design in South Africa

Course description

The Conservation and Management of Protected Areas in South Africa course explores the history of conservation biology as a science and practice and highlights the importance of maintaining biodiversity to ensure ecosystem functioning. Emphasis is placed on understanding; 1) the links between pattern and process, 2) the strategies and tools available to conservationists to maintain biodiversity and ecosystem functioning and 3) the debates around the maintenance of biodiversity in human-dominated landscapes.

You will learn about current global of conservation biology concepts and how these apply in the South African context. Given the diversity of our ecosystems and the need to find balance between the development needs of an emerging economy and conservation goals, South Africa is the ideal laboratory to study threats to biodiversity and how to manage these. We will introduce you to international conservation science concepts, as well as local innovations and demonstrate how these are to achieve conservation goals locally. Finally, you will also gain extensive knowledge on the realities of conservation management in Kruger National Park. You will study major issues relevant to the management of the Kruger Park, such as control of invasive exotic species, fire as a management tool, the management of disease, rhino poaching and elephant management. Strategic Adaptive Management lies at the heart of conservation management philosophy in the Kruger Park, and we will explore how this is applied to these key management challenges and its applicability abroad. Critical to the success of management of common property resources (e.g. water and rare and threatened taxa) is the partnership between national parks and local human communities, water quality and management within the Park and surrounding communities, relocation of big game, and transfrontier parks.

The course poses three broad questions: 1) What is biodiversity conservation? 2) Why conserve biodiversity? and 3) How do we currently understand best practice for biodiversity conservation? Through these questions students will grapple with definitions of biodiversity, how it is measured, why it is important and its current state both globally and within South Africa.

The history of and ethical motivations for conservation will be covered with emphasis on the shifting paradigms from species based conservation to that of functional ecosystems. The role of ecology and the contribution of ecological theory to conservation biology, both past and present will be covered through teachings on island biogeography, meta-population and patch dynamic theory as well as complexity theory, resilience, and adaptive management. You will then examine how our understanding of systems better allows us to conserve them both within and outside protected areas by learning about systematic conservation planning, and integrated conservation strategies.

You will also confront the problem of identifying what is “natural” in a landscape with a long and complex human influence and will learn about community-based conservation, natural resource use and common property resource management. You will also debate the feasibility of simultaneously achieving conservation and development goals.

Instruction consists of lectures, discussions, case studies and faculty-led field projects. In addition, research papers and review articles are regularly assigned as readings. Work conducted in the Kruger National Park and exposure to park scientists will highlight major conceptual themes as well as practical challenges faced by South Africa and other African countries. The primary focus will be an in-depth analysis of management issues within Kruger National Park, with additional visits to HaMakuya and Pullen Farm outside of the park, and to the fynbos ecosystems on the Southeastern coast.

Specific Goals:

- To create the links between biodiversity in maintaining ecosystem integrity and functioning;
- Developing an understanding the Anthropocene and highlight the key threats to biodiversity in South Africa, in particular climate change, invasive species, light pollution and habitat fragmentation as a consequence of land use change;
- Gain insight into the conservation science that has given rise to current conservation practices and protected area management;
- Debate issues surrounding the design, effectiveness and efficiency of protected areas for maintaining biodiversity patterns and processes;
- Gain an introduction to the management philosophy of Kruger National Park, the impact of different management strategies and their relative costs and benefits;
- Study of issues in mega-herbivore and rare antelope management (e.g., elephants, roan antelope and rhino);
- Understand community conservation in the South African context; and
- Explore the relationship between the protected areas and surrounding communities, including the challenges of land restitution, human wildlife conflict and economic development opportunities.

Course outcomes

On completion of this course, you should be able to demonstrate the following knowledge and skills:

a) An understanding of biodiversity, interactions between patterns of diversity (e.g. hotspots) and processes which drive these and threats to diversity;
b) Understanding the effect of humans on ecosystems;
c) The ability to apply the knowledge and skills acquired to address the management of social-ecological systems;
d) Understand biodiversity management policy and practice within and outside of protected areas;
e) Understand the principles of community based conservation and its risks and benefits to biodiversity management;
f) The ability to analyze the importance of biodiversity in terms of human wellbeing through the lens of ecosystem services and apply this knowledge in conservation planning and biodiversity management;
g) The ability to apply biogeographic principles in the design of biodiversity management systems, such as bioregional plans.

Deliverables:

Long-term Research Project – group work
Write-up – 35%
Poster – 10%
Conservation Seminar – individual work - 30%

Exam – individual work - 25%

Instructors:
Dr. Tara Massad, Dr. Bernard Coetzee, Dr. Lisa Nupen, Dr. Laurence Kruger and visiting faculty.

Course Textbook:

Conservation Biology for All. Edited by Navjot S. Sodhi and Paul R. Ehrlich (Available online for free http://conbio.org/publications/free-textbook)

Supplemental Textbooks (these are available in South Africa):

Carruthers, Jane. 1995. *Kruger National Park: A Social and Political History.* International Specialized Book Service.
Du Toit, J.T., Rogers, K.H., and H.C. Biggs. 2003. *The Kruger Experience.* Island Press, Washington D.C., USA
Keller, D. 2010. *Environmental Ethics: The Big Questions.* Wiley-Blackwell Publishing.
Lockwood, M., Worboys, G., and A. Kothari. 2006. *Managing Protected Areas: A Global Guide.* Earthscan.
Loreau, M., Naeem, S., and P. Inchausti. 2002. *Biodiversity and Ecosystem Functioning: Synthesis and Perspectives.* Oxford University Press.
Sodhi, N., and P. Erlich. 2010. *Conservation Biology for All.* Oxford University Press.

South Africa: Special Topics in History + Field Experience in South Africa

Course description
These courses introduces you to the history and culture of South Africa, the challenges faced by an emerging democracy, and the implications for conservation and management of natural resources. The principal goals of these courses are to introduce you to the human history of South Africa and exposure to a broad range of cultural and social aspects of South African society, to provide socio-economic context for the other courses. Emphasis will be on the origin and maintenance of the tremendous cultural diversity of the region e.g. the archaeological record, early migration patterns of humans throughout the African continent, cultural and linguistic diversity in South Africa, ethnobiology, as well as the recent recorded social and political history of the region. Key social and cultural issues in South Africa will be emphasized, along with specific themes chosen to enhance your familiarity with customs or cultural institutions that shape daily life. The courses will include a variety of activities including the following:

- Discussions of readings from South African literature (fiction and nonfiction)
- Visits to archaeological sites (Thulamela/Mapungubwe) museums (including the Apartheid Museum, and Robben Island where Nelson Mandela was jailed for 18 years)
- Cultural exchanges with South African communities
- Participation in contemporary South African arts and culture
- Workshops on the role of scientists in natural resource management in an emerging democracy

The courses will be integrated into the 15-week field program, with some invited professors and practitioners incorporated into activities within Kruger. There will also

be visits to sites of cultural significance, museums and communities outside the park. By the end of the courses, you are expected to have a broad overview and understanding of the social, political, cultural diversity, and a better appreciation of the historical basis of contemporary issues in South Africa.

Courses outcomes
On completion of these courses you will have demonstrated the following:

a) A grasp of the history and culture of South Africa and the challenges faced by an emerging democracy;
b) The ability to analyze the influence of cultural diversity on science and options for the management of biodiversity to contribute to human welfare;
c) The ability to align research and biodiversity management with the influence of customs and cultural institutions that shape daily life;
d) An understanding of the link between social-economic drivers and the management of the protected areas.

Deliverables:
Cartoon Analysis – group work -15%
Science and Society Essay – individual work - 35%
History & Culture Project – individual work - 50%

Instructors:
Dr. Lannie Birch and Dr. Laurence Kruger

Textbooks and Reference Materials:
Selected works on the history of Southern Africa; contemporary fiction and nonfiction; published articles in peer-reviewed journals. The OTS South Africa program has amassed an impressive library on these topics and you will have access to all materials as background information as they prepare their independent projects for oral presentation. The course will also make use of music, film, and videos and will develop workshops on topics such photographic and literature analysis.

Marking Rubric. To come to grips with the difference between South African and US grading systems, we provide the following marking (grading) rubric.

SA grade	Description	US Grade
85%	Excellent work; ideas are insightful, original, ambitious, exciting; command of fundamentals is excellent (e.g. Latin, Greek, English prose, research methods); may tackle especially challenging scholarly puzzles. Work shows considerable promise of scholarly excellence, and gives supervisor new insights into the topic.	A+
75 – 84%	Very good work; solid command of fundamentals; shows facility for formulating insightful and original arguments, and defending them with clear, compelling scholarly prose. Range depends on degree of originality, synthesis of ideas in literature and technical excellence.	A
70 – 74%	Good, solid work; makes valid scientific argument and uses appropriate substantiation to back it up. Shows decent command of fundamentals--work to do, but a solid foundation from which to do it. May have insightful, even original, ideas, but some difficulty expressing them.	A-
68 -69%	More than adequate; work exceeds the minimum stated	B+

	requirements and expectations; Understands the key issues, with some appropriate substantiation, argument and evidence of own reading/thinking about the topic. Shows competence in fundamentals and provides a solid framework for the argument. Good work, but let down by instances of weak expression/logic and/or technical flaws	
64 – 67	Adequate; work exceeds the minimum stated requirements and expectations; Understands the key issues with some appropriate substantiation, argument and evidence of own reading/thinking about the topic. May demonstrate competence in fundamentals but suffers from, thin evidentiary support, weak expression/logic, solid use of scholarly resources.	B
61 - 63	As above. Place in the mark range depends on the seriousness or frequencies of flaws.	B-
58 - 60	Above acceptable work but less than fully adequate and some serious flaws e.g. weak command of fundamentals and expression, factual errors, no clear argument or unsubstantiated arguments. Little sign of own thinking or reading on the topic.	C+
55 – 57	Acceptable basic work but less than fully adequate and several serious flaws e.g. weak command of fundamentals and expression, factual errors, no clear argument or unsubstantiated arguments. Little sign of own thinking or reading on the topic.	C
52 – 54	As above. Mark range depends on the seriousness and frequency of the flaws.	C-
50 – 51	Barely acceptable as undergraduate-level work.	D
<50	Unacceptable work; may be characterized by inadequate command of fundamentals, absence of ideas or critical thought. Did not perform the required tasks	F

Plagiarism and Academic Honesty

The staff at OTS takes academic ethics very seriously. Cheating, forgery, plagiarism or dishonest conduct will lead to a fail in any course. Each fact or opinion that you obtain from a published source must be referenced when writing a scientific paper or an assignment, you may not copy text from a journal article, textbook, website, or any other source of information unless you clearly indicate that the text is a quotation. See the section on plagiarism in "How to write a scientific paper".

Conducting Group Work

Group work is becoming a more prevalent in university courses as it promotes intercultural skills and teamwork, a highly valued skill by employers and the scientific community, and because it develops communication and interpersonal skills. You will have several group assignments and these next pages are some tips, gathered from several universities and organizations, which might help you engage better for group tasks.

Top Group Work Tips from OTS staff

- *Effective and open communication*
- *Accountability and consensus*
- *Structure and organization*
- *Enthusiasm and humility*

Make sure that any assessed work reads as a whole document (i.e. – rather than it being obvious that each section is of a different style and standard). Continually review the document as a group to ensure that each section "speaks" to the other and that there is a well-established logical flow throughout the document.

Effective group work

Group work can be stressful: not everyone works in the same way or at the same pace, and you may need to find ways to negotiate these issues. Some advice:

- ***Understand roles***: members of a team naturally adopt different roles, or where roles overlap, need to learn to manage conflict to make progress
- ***Manage conflict:*** Clarify and if necessary revisit your common purpose, stay as objective as possible - focus on the issue that you disagree on, not on the personal qualities of people in the group,
- ***Learn facilitation skills:*** agree on the facilitation role, ensuring that you take turns sharing ideas and opinions; be open to constructive criticism
- ***Practice reflective listening:*** make time and space to reach a common understanding by exploring what each other means in their statements; ask dumb questions
- ***Get organized****:* decide when and where to meet, set a realistic schedule to complete your task, and participate
- ***Give constructive feedback:*** put yourself in the other's shoes; think about how you would feel if someone criticized your ideas, and keep this in mind when giving feedback. Be empathetic and supportive.
- If the group cannot agree after discussing the pros and cons of the idea, then have a vote and go with the majority decision or discuss with lecturers.

Be inclusive: **Help all group members to feel involved. Play on strengths and nurture weaknesses of team members to build a stronger unit.**