Programme Handbook for Students

Bachelor of Science
Environmental Management

Offered by

ROYAL THIMPHU
COLLEGE

In affiliation with

Royal University of Bhutan

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Acknowledgements:

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Programme Definition

College/Institute(s):	Royal Thimphu College, Ngabiphu, Thimphu, Bhutan
Name of programme:	Bachelor of Science in Environmental Management
Duration and mode of study:	Three years, full-time
Awarding/accrediting body:	Royal University of Bhutan
Date of start programme:	July 2015
Date of documentation:	May 2015

Aims and Objectives of the Programme

The BSc Environmental Management (EM) programme provides the theoretical knowledge along with practical skills that future leaders will need in order to help create and maintain sustainable societies in Bhutan and beyond. Some of the critical issues any development practitioners and leaders must work to address include: management of scarce natural resources, pollution and waste management, climate change, and population growth. At the same time, the programme aims to inculcate the opportunities and benefits that can arise from the sustainable management of natural resources and innovative eco-friendly practices.

EM students will gain a core foundation in natural and social sciences, economics and humanities, as well as business and policy, with environmentally-focused coursework in these areas. The programme will instil students with the notion that integrative and interdisciplinary approaches are vital for environmental management and sustainable socio-economic development. Some basic science is also included, because those who will set serve as leaders for the current environmental challenges must have some understanding of natural science. The programme graduates should be the translators between the hard science and the policies and practices that the government, organizations, or businesses implement. Through the programme, some of the specific areas students will be learning about include conservation biology, GIS, forest and wildlife management, urban ecology, natural resource policy, watershed management, impact assessment, waste and hazards management, urban environmental management, basic weather and climate studies, and other areas related to natural resources management. The programme also covers topics such as environmental ethics and values, environmental economics, and the importance of social capital.

The programme will help provide Bhutan with home-grown undergraduates in the field of environment conservation and management. The programme is developed in the view of current professional gaps in this discipline with the ultimate aim to enhance Bhutan's capacity to achieve a sustainable society. Using an integrative approach, students will learn how to develop local solutions that are sustainable and ethical at larger, and global scales. Local environmental issues such as land-use change and planning, conservation biology, energy use, climate change, renewable resource management, and community-based management of resources will be addressed. Field measurements and field skills are important components of this course, and help students internalize and deepen their understanding of theoretical concepts.

The programme also allows students some opportunity for specialization in a subject of their interest related to environmental management through research methods training and an independent project. Students may thus develop independent study and research skills and the ability to present logical, scientific and cogent arguments on a range of environmental and population science and/or management issues, and use these skills as a basis for lifelong learning. In addition to the discipline-specific topics, the core competencies included in the curriculum are intended to give students at RTC a very strong foundation in important lifelong skills such as personal development and analytical skills.

EM graduates will be prepared for careers in a variety of diverse fields, including environmental compliance at government, corporate and industrial bodies, environmental consulting, non-governmental environmental advocacy, or public policy. EM graduates are expected to apply their knowledge and skills to infuse innovative ideas into planning processes, help resolve crucial environmental issues and provide leadership in decision-making and strategy formation. They will also be well educated in ethics and communication, and should be able to understand the implications of their decisions on environmental matters and effectively communicate these, as well as what actions to take. Graduates may also consider the course an appropriate grounding for higher studies (Master's degrees) in fields such as Environmental Management, Sustainable Development, or Natural Resources Management. Graduates could also pursue a school teaching career in environmental studies.

Specific Objectives

Upon successful completion of the programme, graduates should be able to:

1. Analyse environmental issues to identify their scientific, social, ethical, political, and economic aspects.
2. Identify and describe population factors and the anthropogenic connections to, and impacts on, the physical and biological factors that make up the environment.
3. Discuss, compare the relative advantages of, and implement the methods and instruments that can be used to analyse environmental issues when taking into account their multidisciplinary nature, complexity, and the many actors involved.
4. Analyse the different environmental ethics, values, and worldviews that exist globally.
5. Conduct basic field studies in natural settings.
6. Analyse the status of water resources in Bhutan, their importance, major issues, and approaches to managing them.
7. Contribute in evaluating the underlying policy frameworks, planning processes, and implementation of development activities in Bhutan.
8. Assist in planning and performing impact assessment studies for new developmental activities.
9. Adapt to, assimilate, and use new information and tools as part of a continuous learning process.
10. Apply the tools and recognize the capabilities of GIS applications for environmental management.
11. Effectively communicate well-reasoned positions on environmental and other issues.
12. Work effectively in teams as well as lead them.
13. Propose and conduct relevant research projects.

Curriculum Structure and Map

All modules shown are 12-credit modules except for RSP301, which comprises 24 credits. Core competencies modules are shown in grey.

Yr	Sem	Modules				
1	I	ENV101 Introduction to the Environment	ECL101 Principles of Ecology	ENV102 Population, Development, and Environment	EAP101 English for Academic Purposes I	PRD101 Personal Development
	II	CLM101 Introduction to Climate and Weather Studies	ENM101 Energy Resources and Materials Management	STS101 Applied Statistics	EAP102 English for Academic Purposes II	IPS101 IT and Basic Problem Solving
2	III	BDC201 Biodiversity Conservation and Management I	ENM202 Water Resources Management	ETH201 Environmental Ethics	GIS201 Geographic Information Sciences I	ANS101 Analytical Skills
	IV	BDC202 Biodiversity Conservation and Management II	EEC201 Environmental Economics	ENM203 Agriculture and Land Management	GIS202 Geographic Information Sciences II	DZG101 Dzongkha Comm.
3	V	ENM304 Environmental Hazards Management	ENM305 Urban Environmental Management	ENM306 Environmental Impact Assessment	RSP301 Undergraduate Research Project I	
	VI	ENM307 Waste Management	BES301 Bhutanese Economy and Social Capital	ECL302 Restoration Ecology	ENM308 Frontiers in Env. Mgt. and Sus. Dev.	RSP302 Undergraduate Research Project II

There are no elective modules in this programme. Twenty-four modules are environment / technical skills modules (RSP301 is counted as two for this purpose) and the other six are core competency modules.

Classification/breakdown of curriculum into broad component categories

Category	Modules	% of curriculum
Core environment subject modules	ENV101, ECL101, ENV102, CLM101, ENM101, BDC201, ENM202, ETH201, BDC202, EEC201, ENM203, ENM304, ENM305, ENM306, ENM307, BES301, ECL302, ENM308	18/30 = 60%
Technical and research skills development related to environment	STS101, GIS201, GIS202, RSP301 (x2), RSP302	6/30 = 20%
Core competencies	EAP101, EAP102, PRD101, IPS101, DZG101, ANS101	6/30 = 20%
Total		100%

Based on the cumulated theory/practical components from each module's teaching-learning approach (credit hours expected for either component) and assessment scheme, the overall **theory: practical ratio** for the 24 environment-related & technical modules of the programme (excluding the 6 core competencies modules; RSP301 is counted as 2) is conservatively estimated to be approximately

69:31 as highlighted below. Accounting for the more active aspects of classroom learning for each module, data-analysis based activities, and practical self-directed student activities, would result in a greater practical weight.

Module	Thr. %	Prac. %	Practical components
ENV101 Introduction to the Environment	90	10	• Field trip to a nearby site that highlights an emerging environmental issue in Bhutan.
ECL101 Ecology	70	30	• Field trip from Lobesa to Dochula (dry subtropical to alpine zones) to see and learn various ecosystems intact and degradation and to observe biodiversity in various type of forests. • Data collection on flora and fauna and ecosystems in RTC compound.
ENV102 Population, Development, and Environment	90	10	• Preparing country profiles.
CLM101 Introduction to Climate and Weather Studies	70	30	• Reading and recording meteorological instruments and maintaining them regularly. • Learning to locate reliable sources of current weather observation and making forecasts.
ENM101 Energy Resources and Materials Management	85	15	• Short field visits in the locality to gain exposure to various kinds energy usage patterns in Bhutan accompanied by short response/reflection; field trips to briquette factory in Thimphu, and a mining site in Bjemina or Genekha.
STS101 Applied Statistics	50	50	• Apply Excel or SPSS package in IT labs to analyse data, apply statistical analyses, and interpret results.
BDC201 Biodiversity Conservation and Management I	60	40	• Field trip to National Biodiversity Centre to see gene bank, demonstration of seed selection for storage in gene bank. • Identification of (and determination of the uses of) prominent plants and animals using appropriate tools and instruments in and around the College. • Field study for learning forest management through good silvicultural practices (FMU). • Field study to identify birds available in a particular place (in and around college campus and out of college). • Block-week trip to Nobding and back or equivalent areas, shared with other modules in this semester, for biodiversity observations and measurements.
ENM202 Water Resources Management	70	30	• Measuring water quality using testing kits. • Study visits to see and learn about watershed management (Wochu in Paro or Lingmetechu in Bajo). • Data collection on water in urban and rural areas (comparative study). • Visit to a hydropower project as part of the block-week field trip shared with other modules in this semester.
ETH201 Environmental Ethics	90	10	• Research on local beliefs and ways of thinking about the natural environment, in the context of major themes in philosophy and ethics and global worldviews. • Case study on different approaches for conservation and management of environment: ecofeminism, animal rights, environmental aesthetics, religious approaches, etc.
GIS201 and GIS202 Geographic Information Sciences I and II	50	50	• Substantial work using ArcGIS in the computer laboratory as well as field work on ground truthing and field measurements with the use of GPS.

BDC202 Biodiversity Conservation and Management II	60	40	• Visit to Royal Botanical Garden to study plants and to identify pros and cons of Royal Botanical garden establishment. • Forest biodiversity measurement work. • Apiculture work. • Making herbarium specimens. • Field visit RNR-RDC Yusipang to understand the system of research under RNR sector in Bhutan; see and know the uses and importance of medicinal plants in Bhutan. • Field trip particularly to any kind of protected area for ecotourism development in Bhutan as part of block-week study tour shared with other modules in this semester.
EEC201 Environmental Economics	90	10	• Data collection of economic development of communities and how it is helping to conserve and protect the environment and ecosystems.
ENM203 Agriculture and Land Management	60	40	• Soil tests using testing kits. • Visit to National Mushroom Centre. • Block-week field visits including various agro-ecological zones to see crop growth patterns and systems (agroforestry, social forestry, farm forestry, piggery, dairy farming); agro-industry to see food production procedures and management practices; visit to see and learn the names and importance of pasture (e.g. Yusipang, Bjemina).
ENM304 Environmental Hazard Management	80	20	• Basic air quality testing, including dust records using dust sampler machine and other testing kits. • Basic survey pertaining to hazard occurrence and preparedness, or mitigation measures.
ENM305 Urban Environmental Management	80	20	• Study visit around Thimphu for observations on urban planning and impacts of the urbanization. • Information collection on storms, floods, urban heat, changes in species and pathogens (comparative study between towns and villages).
ENM306 Environmental Impact Assessment	65	35	• Application of EIA and Sustainable Development Principles to projects - Exercises on NEC's eight sectoral EA guidelines in RTC campus and nearby areas.
ENM307 Waste Management	70	30	• Block-day study tour: Memelakha land fill, sewerage treatment in Babesa, hospital, VAST, Greener Way. • Data collection and project on organic waste production from CFM, Chhubachu
BES301 Bhutanese Economy and Social Capital	85	15	• Conduct small-scale research to understand that social capital is an integral part for conserving various ecosystems for sustainable socio-economic growth in Bhutan, e.g. data collection and writing on household welfare (from nearby villages)
ECL302 Restoration Ecology	80	20	• Independent small-group field visits to areas related to: riparian zone, invasive species, rangeland management, and forest fire management.
ENM308 Frontiers in Env. Mgt. and Sus. Dev.	100	0	
RSP301 Undergraduate Research Project I	50	50	• Writing/ designing research proposal • Research administration- selection of topic, tentative work plan, research code of conduct- ethics
RSP302 Undergraduate Research Project II	20	80	• Completion of independent research projects and write up of the research report; research presentations and thesis defence
Total	69.4	30.6	(weighted average out of 24 x 12-credit modules)

Core Competencies

The Wheel of Academic Law, Section B5 (Expectations of RUB Graduates) sets out the professional, personal, and academic attributes that all graduates are expected to have developed within their RUB degree courses. In principle, skill development could be happening alongside the acquisition of content knowledge in every module of a course. In practice, a holistic approach has been difficult to achieve, and the sum of knowledge and skills gained from individual modules has not necessarily added up to full achievement of the expectations set out in WAL Section B5. It may be the case that fundamental skills need specific focus and modules of their own, such that students may be able to practice, develop, and enhance these in their other modules. As already recognized in WAL B6 (Languages and ICT competencies), some of these fundamental skills are treated as competencies that must be achieved within a programme (English, Dzongkha, IT skills). This programme includes a broader range of competencies that students should specifically seek to achieve.

The structure is intended to give students a strong foundation in basic lifelong skills. By working around a single subject major, the student will get even greater depth in that subject than is now possible through the dual subject programmes, while at the same time allow for approximately one fourth of the modules to focus on skills development. Being skills-development focused, the modules' learning outcomes would be largely based on demonstration of the competencies, not necessarily specific subject content knowledge. As such, they have a common scaffold in mind, but may be expected to have some infusion of subject-specific content (as the vehicle for developing those competencies).

Note on 'Academic Skills' replacement with English for Academic Purposes modules: RTC seeks to add greater language competency throughout its curricula while emphasizing skills that can aid students in their academic pursuits. The English for Academic Purposes modules (I and II) allow for greater depth of student engagement in English language learning while focusing on language use for academic purposes and incorporating discipline-specific content. The modules include fundamental English language skills important for academics (currently bypassed in the current ACS 101 Academic Skills module), while also adding more depth to and going beyond the ACS 101 curriculum.

The core competencies modules (shown in grey above) are:

1. EAP101: English for Academic Purposes I
2. EAP102: English for Academic Purposes II
3. PRD101: Personal Development
4. DZG101: Dzongkha Communication
5. IPS101: IT and Basic Problem Solving
6. ANS101: Analytical Skills

Entrance Requirements

Students' Background:	**Min. Entrance Requirements / Eligibility Criteria**
Bhutanese Students	• BHSEC Class XII pass (or equivalent for Bhutanese studying outside Bhutan) • Pass in Dzongkha • 50% aggregate in best 4 subjects • 50% marks in English • Non-science students: bridge course in biology and/or mathematics*

Non-Bhutanese**	• Passing score on ISCE/BHSEC, or equivalent secondary education certificate from home country • 50% aggregate in best 4 subjects • 50% marks in English • Non-science students: bridge course in biology and/or mathematics*

** During admissions, priority will be given to Class XII science students who have passed biology. Students who have not studied mathematics or biology at the higher-secondary level will need to complete a bridge course in the required subject.*

*** Note: DZG101: Dzongkha Communication will be substituted with a module from a collection of approved alternative modules for foreign students, including the one proposed here (DFL 101: Introductory Dzongkha as a Foreign Language).*

Progression Criteria, Final Results and Awards

The criteria for progression from one semester to the next and final award criteria are as per the guidelines given under section D1 in The Wheel of Academic Law (July 2011), RUB (latest version available at http://www.rub.edu.bt/), subject to any amendment or revision as made by the Academic Board of the University. Briefly:

Students must pass all modules in a RUB programme in order to graduate with a degree. To progress to the next semester, students must not fail more than 30% of the total number of modules offered, rounded to the nearest number. In this programme, that means students must pass at least three out of the five modules each semester, or they are considered semester failures – they may repeat if they wish in the following year with a junior cohort. To pass a module, students must obtain a minimum mark of 50% overall and at least 40% in each of the components of Continuous Assessment (CA) and Semester-End (SE) Examination. Any module failure must be cleared through reassessment and module repeat.

Overall marks (given as percentages) are aggregated in proportion to the module credit weight within a particular year. The final percentage mark over all three years of the programme is a weighted average of aggregate marks in each year in the following ratio – 20:30:50 (1st year : 2nd year : 3rd year).

The final marks for each semester must be endorsed by the Programme Board of Examiners (see below, section on “Programme Management”).

Learning and Teaching Approaches

- Classroom teaching will focus on specific learning outcomes and the student actions that will need to be taken in order to achieve those. This will therefore require more in-class guided time to be spent on student-centric activities, than would be required for a purely teacher-centric approach. The average in-class instruction time for a 12-credit module is thus expected to be 4-5 hrs/wk for 15 weeks. These periods should be used for lectures, discussions, guest speakers, debates, videos, student presentations, demonstrations, tutorials, and in-class assessments such as quizzes and tests. Different modules will also incorporate varying levels of practical components within these times.
- As a general theme, problem-based learning will be encouraged in modules wherever possible to allow students to take stock of what they know, think about what they need to know, and figure out how to get required information for themselves in order to solve specific problems related to their subjects.
- In terms of promoting student involvement in their own learning, projects, field visits, data collection and analysis, report writing, presentations and discussions will constitute essential components of the learning process.
- A plethora of reading materials from a wide variety of sources (books, articles, and coursepacks) will be made available to students to allow them the opportunity to engage in topics to the depths they see fit. The College network infrastructure allows for sharing of online resources within the College campus (also accessible via login from off-campus). Good, comprehensive core

textbooks will be encouraged for purchase by students at the beginning of the programme that can support the teaching-learning for the entirety of their three years. Currently this is Miller, G.T., and Spoolman, S.E. (2014). Environmental Science 14th Ed. Belmont: Brooks/Cole. (Primary textbook, also available as an eBook). These are supplemented with compiled coursepacks with readings and tutor-generated materials specific to each module, and additional library books that cover subject-specific topics in greater depth.

- For practical components, students will participate in block-week studies outside Thimphu, block-day programmes within Thimphu valley, and projects within and around the RTC campus. A block-week programme involves a week-long (5 day) excursion involving a minimum of 30 hrs of educational/field experience. A block-day programme involves a day-long excursion involving a minimum of 6 hrs of educational/field experience. Field visits and field works will be included in most of the modules to expose students to the natural environment as well as every-day realities within the Bhutanese context. All field visits should be structured to ensure that students engage themselves as much as possible and derive maximum meaningful learning from the exposure. Field visits will involve direct participation (focused observations, data collection and recording, other practical work) and/or related structured tasks (worksheets, outcome reports and presentations).
- A long-term forest health monitoring project in and around the RTC vicinity will continuously involve students in a variety of aspects of environmental management.
- Students will learn techniques for, and carry out, small authentic research assignments starting with modules early in the programme to learn the basic tools for carrying out research. The actual independent research work will be done at the later stage. The Undergraduate Research Project In the final year will equip students to join research projects professionally in the agencies that they will be working in near future, as well as help prepare them for higher studies.
- Industry standard materials, tools and, implements will be used for field studies. The students will themselves be managing the tools and implements that will be set up for study purposes, such as the meteorology station.
- A small-size (40 dc.) agricultural plot will be used in the RTC campus to grow organic vegetables as part of specific modules as well as through environmentally-minded student clubs. This may encourage a more positive and nature-friendly attitude in addition to teaching simple horticultural concepts.
- Laboratory works in the college (in IT labs) as well as through collaboration with other agencies (National Soil Lab, Mushroom Centre, RNR-RDC Yusipang, Agro-industries, Dept. of Geology and Mines), will be used to provide additional hands-on practice for students.
- As in the past, the college will also be using the facilities, expertise, and technical support of some agencies (NBC, RNR-RDC Yusipang, Greener Way, Thimphu Thromde, to mention a few) to augment knowledge and skills.
- Guest lecturers from relevant agencies (NEC, WWF, Social Forestry, NBC, to name a few) will be invited occasionally to present on relevant topics.
- Although each module has a Module Coordinator, team teaching is strongly encouraged, and it is expected that faculty members routinely visit and guest lecture in each other's classes when called for according to their specialization and interests.

Assessment

- The assessments in this programme are divided into two broad categories: Continuous Assessment (CA) that happens throughout the main teaching-learning time of the semester, and the Semester-End Exams (SE) at the end. In order to promote greater focus on continuous, regular learning throughout the semester, the CA components of modules are weighted more than the SE component (not exceeding 40%). Details of assessments are provided in each module descriptor except for the general details of the SE, midterm exam and class participation, which are described below.
- SE is intended to be a type of summative assessment. The exams will focus on assessing all the modules' learning outcomes as best as can be possible to do through exams. In many cases, the exams may have to have separate theory and practical components. The exam should be comprehensive. In some cases, the SE may not be able to adequately address certain learning

outcomes, which should therefore be substantially addressed in a CA component (e.g. mid-to-long-term projects).

- Most modules incorporate CA tests, including typically a mid-semester (midterm) exam. These are intended to ensure students are studying regularly and keeping up with classes and self-study materials such as readings. A midterm examination is generally intended to be half a final examination in scope, depth, and duration (90 min). The weight is 10-20% of the final mark for a module.
- CA components will also include, variously, Written Assignments, Case Analyses, Field Visit Reports, Lab/Practical Exercises and Reports, Presentations, Debates and Class Discussions, Projects, Quizzes and Tests.
- Group work should be marked including criteria based on a cohesive group effort as well as individual effort put in by group members.
- Many modules, especially earlier in the programme, involve a CA component of Class Participation – this is encouraged in order to promote more dynamic classrooms, with teachers being seen more as facilitators of learning rather than as delivery persons for knowledge transmission. Teachers are provided with printed student galleries to continuously and systematically track class participation. As a sample marking scheme: For each instance of substantial contribution to a class discussion (e.g. asking a question to the tutor or in the Q&A after fellow classmate's presentation, answering a tutor question, raising interesting/valid points, or demonstrating strong contribution to in-class group work), the tutor may indicate a 'point' for the student in the printed student gallery. At the end of a semester, the contribution points may be scaled from 0 – X% where X is the maximum weight.
- The programme promotes more frequent, smaller coursework assessments to continuously engage students in their own learning. Continuous assessment components should be spread out throughout the semester, coordinated between the module tutors of section of students as well as possible, and either avoid the final teaching week of the semester close to exams, or be formative in a way that contributes to students' preparation for their final exams.
- CA components, including CA exams such as the midterms, are intended to be formative assessments. Module tutors are encouraged to treat CA components as opportunities for giving feedback to students and students are encouraged to improve work based on feedback given. This is typically done through allowing multiple drafts of submitted work, for which marks can be incrementally improved in a limited fashion. This must be based on students' own initiatives to put in the effort and time required to improve. A careful balance should be struck between allowing improvement of graded work and rewarding more the work that has been submitted properly the first time so as not to disadvantage stronger students. Previously failed work that was plagiarized or of excessively poor quality cannot be redone and resubmitted for more than the bare minimum pass mark.
- Academic dishonesty should be addressed as per the provisions of section D4 of The Wheel of Academic Law. In particular, marks for plagiarized work should reflect gravity and extent of the plagiarism involved. In cases of substantially plagiarized work where no adequate attempt has been made to acknowledge sources, the work should be awarded a mark of zero. If a new substitute/make-up work is allowed, this should be marked out of a maximum of 50% of the marks possible in the original assignment.

Programme Management

The roles of the Programme Leader, the Programme Committee, the Head of Subject/Department, the Head of the College/Institute, the Institute Academic Committee are as defined in the RUB Wheel of Academic Law (2011) Sections A7.6, A7.7, and F6. Briefly:

The RTC Academic Committee (AC) is convened by the Director and chaired by the Dean of Academic Affairs. Members of the committee include the Registrar (head of Student Services), the Associate Dean, Senior Advisors, faculty representatives (all programme leaders and department heads), three representatives of non-teaching staff, the head librarian, and three elected student representatives. The AC is the overarching authority on all academic issues and ultimate guarantor of standards and quality at the college-wide level and for the University. All programme management committees and examiners report to the AC. The AC should be consulted at the beginning of each

semester to approve minor changes to modules in the programme under guidelines specified by the University on allowable changes.

The programme is based within the Environment department within the College and managed by a Programme Committee responsible for the effective conduct, organisation, and development of the programme. The committee comprises all teaching faculty of the core (host) department as well as a Programme Leader, Mr. GP Sharma, who is also the Head of the host department and provides the academic and organisational leadership for the programme. These are indicated below under "Academic Staff". Representatives of other departments teaching within the programme are also committee members. Additionally, the committee includes elected class representatives (CRs) of each section of students in the programme at all levels. Student involvement in the monitoring of the programme is thus done at this level as well as the level of the AC. In addition, student-staff consultation is done regularly through meetings with CRs across all programmes with the Dean, as well as within the programme with the Programme Leader. In addition to addressing general programme-independent concerns, the consultations seek to incorporate constructive discussion of the programme, its demands on students, and possible improvements.

The authority for matters regarding assessment and progression is delegated to the Programme Board of Examiners (PBE). The board includes a Chair from outside the programme's management and teaching faculty, the Programme Leader, each faculty teaching within the programme, and an external examiner on a regular basis as and when appointed by the Academic Board. Each semester's results are declared after endorsement of the PBE. The PBE is accountable to the AC.

Additional quality assurance mechanisms within the College

- *Quality Assurance and Enhancement Committee* – In addition to RUB quality assurance requirements, the College has instituted a Quality Assurance and Enhancement Committee (QAEC) with representatives from the Academic Affairs Department (Dean, Associate Dean, three senior faculty), the Student Services Department (Registrar), and the Finance and Administration Department (Department Head). The QAEC is responsible for providing a strategic view, guidance, and recommendations on overall institutional quality at RUB standards and in line with the Bhutan Accreditation Council (BAC) framework, principles, and specific guidelines and criteria.
- *Faculty performance management and enhancement* – Faculty performance is monitored regularly and evaluated at the end of each semester. Each semester, programme leaders sit in on and complete observations of faculty in-class performance (quality of the teaching), and out-of-class performance (quality of the conduct of general faculty duties, student advising). Where issues affecting teaching-learning are identified, these may trigger specific action plans for the concerned faculty member to pursue to improve in targeted areas. Each faculty also completes a self-appraisal at the end of each semester, coupled to further feedback from the Programme Leader and Dean. In addition to general faculty meetings, the College's Academic Affairs Department also holds regular Continuous Professional Development (CPD) sessions for all faculty, incorporating guest presentations, teaching development workshops, and peer strategy sharing. These are held approximately every two weeks within a semester. Topics for the 2013-2014 academic year included: strategies for advising students, utilizing peer-tutoring to enhance learning among students, the art of statistics, workshops on plagiarism, navigating information and information literacy, and various presentations on strategies for formative assessment.

  For cross-fertilization, stability and sustainability, and to improve the programme quality at par with international standards, RTC may recruit more senior faculty, including some who may be older/retiring, from other universities on a contract basis. The College also recruits national adjunct/visiting lecturers (who are experienced in the subject/ modules) on a part-time basis. The college has been using the resources and expertise of some agencies to enhance knowledge and skills of the students, and this will be continued with proper formality and networking.

  On the other end of the spectrum, to improve programme quality and make the programme relevant to changing times and needs, training will be provided as necessary to

up-grade the expertise of faculty members who are in need of it. Moreover, faculty members new to teaching are asked to join the College's Teaching Development Group that works to enhance core teaching skills among its members through activities such as peer observation partnerships, and teacher training programmes. The College also sends early career faculty to the Samtse College of Education to participate in its Post-graduate Certificate/Diploma programme in Higher Education.

- *Module coordination* – Any module for which multiple sections are taught has a module coordinator who organizes and synchronizes the teaching-learning for the module across sections. For assessments that involve testing (quizzes, class tests, midterm and semester-end examinations), question papers are made jointly. Where possible, cross-grading techniques are also employed. In certain modules wherein the content is found to be modular (the order of teaching certain units can be switched around without affecting the logical flow of the syllabus), cross-teaching of specific units across sections is also employed to maintain maximum consistency.
- *Student information systems* – The curriculum, class schedules, and mode of assessments and marks thereon are made transparent and available to students and other stakeholders such as parents/guardians through the RTC Classes database system.
- *Student feedback* – A system is in place in the College whereby each student evaluates each module taught and the tutor at the end of each semester in order to help programme leaders and teachers monitor the success and effectiveness of the delivery of the programme and make future improvements.
- *Peer review* – The College institutes peer-review mechanisms within and across programmes for its examinations. The use of college-wide formal midterm examinations, with the same quality assurance mechanisms that go into semester-end examinations, helps ensure that continuous assessment in all programmes is proceeding on track and provides an opportunity for peer review and moderation at the half-way point in a semester. All question papers are peer-reviewed and moderated (involving the module coordinator and other tutors of a module, and at least two other reviewers). In addition to ensuring the overall quality of the question paper itself, this mid-semester event involves review of the progress of continuous assessment to date in each module. A similar peer-review and moderation is conducted for semester-end examination question papers and continuous assessment progress approximately two to three weeks prior to the start of semester-end exams.
- *Module repeats* – If a student has failed a module (but not the whole semester) and has also failed in the re-assessment of that module, the student must meet all assessment requirements, essentially repeating the module as per section D1 of The Wheel of Academic Law. However, as he/she has already progressed (albeit with a prior module failure), attendance in lectures is not mandatory. At RTC, a standardized mechanism has been instituted for conducting module repeats. Students must formally register for the repeats at the beginning of any semester in which the failed module is being re-offered. A module repeat tutor will be assigned (usually the same tutor teaching the module in its regular offering in the current semester). A schedule of meetings will be set in which the tutor and repeat student(s) must meet a minimum of two hours per week. A work plan is also set in which the coverage of syllabus topics and assessments are organized. Assessments are to be on par with what students would have to do in the regular course of that module.
- *Student Advising* – All first years students will have faculty advisors support and advice on their studies, food, lodge, transport, and any other personal problems. Each tutor has five - ten students to guide. Additionally, weaker students in the second or third year who have un-cleared prior module failures will be paired with an advisor to guide and motivate them. The advisor and advisees meet in groups and individually four to eight times in a semester as necessary.

The Modules

Module Code and Title: **ENV101 Introduction to the Environment**

Programme(s): BSc Environmental Management

Credit Value: 12

Module Tutor(s): Samir Patel (Coordinator)
Jesse Montes
Deki Phuntsho Yonten
Nima Wangmo

General objective(s) of the module:

This module will provide students with a first introduction to the environment and encourage them to think about the social science and natural resource aspects of environmental studies. This initial grounding and introduction to a variety of aspects of environmental studies aims to prepare students for more advanced modules that delve into these aspects in much greater detail.

Learning outcomes – Upon successful completion of the module, students will be able to:

- Define the focus, scope and limitations of environmental science as a multi-disciplinary and problem-solving approach to the natural and man-built environment.
- Describe the historical development of environmental problems and environmentalism.
- Discuss the different environmental worldviews and how they lead to different approaches to environmental management.
- Describe the moral and ethical aspects of natural resource use and conservation.
- Describe the various kinds of natural resources
- Discuss the challenges associated with managing natural resources.
- Explain the state of the environment in Bhutan, including its key environmental issues, and its approaches to managing the environment.

Skills to be developed:

- Students should be able to demonstrate information literacy regarding the media by evaluating information from news sources and presenting some recent developments/news related to the environment.

Learning and teaching approaches used:

The module will be conducted over 15 teaching weeks as follows:

- 3 hrs/wk lecture & discussions.
- 1 hr/wk tutorial section for student presentations, quizzes, and small group discussions.
- 5 hrs/wk outside of class, on average, for independent study.
- Two guest speakers sometime during the semester, generally those who are specialists/experts in their field related to the environment, substituted with film screenings of environmental movies (e.g. Economics of Happiness, An Inconvenient Truth, or equivalent more recent films) if suitable speakers are unavailable, along with discussions afterward.
- One field visit to an environmental site or agency, of half-day to full-day duration.

Assessment:

Semester-End Examination (SE):40%
Continuous Assessment (CA): 60%

CA Assessment	Weight	Assessment Detail

Individual Assignment	15%	Individual argumentative essay of 1500 words
Quizzes (5 x 2%)	10%	Short written individual quizzes of 30 min duration each, covering approximately 2 weeks of subject matter.
Class Participation	5%	
Presentation on a news story	10%	Individual 10 min presentation with 2-5 min Q&A.
Group Field Report	5%	Report of 1000 words (excluding diagrams) done in groups of 3-4.
Midterm Exam	15%	

Pre-requisite knowledge:

Subject matter:

I. Introduction to environmental studies
    a. The scope, focus and limitations of environmental studies
    b. Common environmental issues and concerns
II. Historical context of humans and the natural environment
    a. Major societies in human history
        i. Description and origin of the societies (Hunter-gatherer, Pastoral-horticultural, Agrarian, Industrial, Post-industrial)
        ii. Revolutions / transitions between the societies (Neolithic/domestication revolution, Agricultural revolution, Industrial revolution, Information revolution); others such as “Green” revolution
        iii. How each of these societies have affected the environment
        iv. Major environmental disasters
    b. The different stages of conservation history and environmentalism
        i. History of environmentalism in the West (USA), internationally (globally), and locally (India, Bhutan); environmental problems, their consequences, and societal reactions
        ii. Most important contributors to the development of environmentalism and their specific contributions
    c. Human population and the environment: Basic principles of population growth and environmental resistance
III. Environmental conservation
    a. Motives for environmental conservation
        i. Ethical/Cultural arguments
        ii. Ecological arguments
        iii. Economic arguments
    b. Environmental organizations
    c. Fundamental principles for environmental conservation and sustainable development (general principles, internationally-agreed principles, major global initiatives)
    d. Challenges to conservation
IV. Introduction to environmental ethics
    a. Philosophical approaches to environmental ethics (anthropocentrism, biocentrism, ecocentrism)
    b. Environmental worldviews (individual-centered vs. Earth-centered; management, stewardship, environmental wisdom)
    c. Environmental attitudes/approaches (development, preservation, conservation, sustainable development)
    d. Religion and environment
    e. Environmental justice and environmental racism
    f. Societal environmental ethics
    g. Corporate environmental ethics
    h. Individual environmental ethics
    i. Ecological footprint, global environmental ethics

V. Overview of natural resources
    a. Introduction to natural resources
        i. Classification of natural resources
        ii. Benefits and challenges of using natural resources
        iii. Consumption and depletion of natural resources
        iv. Protection and management of natural resources
    b. Overview of major types of natural resources
        i. Energy
        ii. Water/Hydrogeological resources
        iii. Minerals/Geological resources
        iv. Atmospheric resources
        v. Biodiversity/Biological resources
    c. Introduction to natural resources management
        i. Natural resource economics
        ii. Ownership regimes; rights and use; tragedy of the commons
        iii. Management approaches
        iv. Natural resources conflicts and conflict management

VI. Introduction to Environment in Bhutan
    a. Environmental issues in Bhutan
    b. Overview of Bhutan's natural resources
    c. Environmental policies in Bhutan

Essential Readings:

1. Berg, L., Hager M., Hassenzahl, D. (2011). Visualizing Environmental Science 3rd Ed. John Wiley & Sons.
2. Enger, E.D. and Smith, B.F. (2010). Environmental Science, 12th Ed. McGraw-Hill.
3. Karan, P.P. (1994). Environmental Movements in India. Geographical Review, 84(1): pp. 32-41.
4. Miller, G.T., and Spoolman, S.E. (2014). Environmental Science 14th Ed. New Delhi: Cengage Learning.
5. Nolan, P. And Lenski, H. (2011). Human Societies: An Introduction to Macrosociology, 11th Ed. London: Paradigm Publishers.
6. US Environmental Protection Agency. (2005). The Quest for Less. http://www.epa.gov/wastes/education/quest/quest.htm
7. Wright, R.T., Boorse, D.F. (2011). Environmental Science, 11th Ed. New Delhi: PHI Learning Pvt Ltd.

Additional Readings:

1. Acts & Regulations on Environment in Bhutan. Available online from www.nec.gov.bt & http://www.bhutan.gov.bt/government/index.php
2. Bhargava, O.N. (1995). The Bhutan Himalaya: A Geological Account. Geological Survey of India. Special Publication, vol. 39, pp. 1–245. Compiled by S.A. Chore, Department of Geology and Mines, MoEA, Bhutan.
3. Botkin, D.B. & Keller, E.A. (2011). Environmental Science, 8th Ed. John Wiley & Sons.
4. Cunningham, W.P., and Cunningham, M.A. (2012). Environmental Science: A Global Concern, 12th Ed. McGraw Hill.
5. De, A.K. and De, A.K. (2005). Environmental Studies, 2nd Ed. New Delhi: New Age Intl Ltd.
6. Department of Geology and Mines (2010). http://www.moea.gov.bt/DGM/Pages/DGM.html
7. Department of Geology and Mines (2011). Draft Mineral Policy of Bhutan. http://www.gnhc.gov.bt/wp-content/uploads/2011/05/Mineral-Development-Policy.pdf
8. Holland, A. and K. Rawles. (1996). The ethics of conservation. The Thingmount Working Paper Series on the Philosophy of Conservation TWP 96-01. Retrieved from http://www.lancs.ac.uk/depts/philosophy/awaymave/onlineresources/thingmount.htm
9. MIT Mission. (2012). Clean Water. Problem: Agriculture. http://web.mit.edu/12.000/www/m2012/finalwebsite/problem/agriculture.shtml

10. National Biodiversity Centre. (2009). Biodiversity Action Plan. Ministry of Agriculture, Royal Government of Bhutan.
11. National Environment Commission. (1998). The Middle Path, National Environment Strategy for Bhutan. Royal Government of Bhutan
12. National Environment Commission Secretariat. (2008). Bhutan Environment Outlook. National Environment Commission, RGOB. Retrieved from http://www.nec.gov.bt/nec1/wp-content/uploads/2012/10/Bhutan-Environment-Outlook-2008.pdf
13. National Environment Commission Secretariat. (2012). Bhutan Environment Outlook. National Environment Commission, RGOB. Retrieved from http://www.nec.gov.bt/nec1/wp-content/uploads/2013/01/BEO-2012-Zero-Draft-working-file_PK_2_Jan.docx
14. National Forest Policy of Bhutan. (2010). Retrieved from http://www.gnhc.gov.bt/wp-content/uploads/2011/05/National-Forest-Policy.pdf
15. Natural Resources. (n.d.). Wikipedia. http://en.wikipedia.org/wiki/Natural_resource
16. Planning Commission. (1999). Bhutan 2020: A Vision for Peace, Prosperity and Happiness. Royal Government of Bhutan
17. RGoB. (1995). Mines and Minerals Management Act. MoEA. http://www.moea.gov.bt/DGM/downloads/MMMA.pdf
18. RGoB. (2002). Mines and Minerals Management Regulations. MoEA. http://www.moea.gov.bt/DGM/downloads/MMMR_2002.pdf
19. RGoB. (2011). Water Act. NEC. http://www.nec.gov.bt/nec1/wp-content/uploads/2012/10/zero-draft-water-regulation.pdf
20. RGOB Ministry of Agriculture. Retrieved from http://www.moaf.gov.bt
21. Schultz, P. W. (2000). Empathizing with Nature: The effects of perspective taking on concern for environmental issues. Journal of Social Issues, 56(3), 391-406.
22. Shi, L. (2011). The Mineral Industries of Bhutan and Nepal. USGS. http://minerals.usgs.gov/minerals/pubs/country/2011/myb3-2011-bt-np.pdf
23. UN Global Issues: Environment. Retrieved from http://www.un.org/en/globalissues/environment/
24. USGS. (2013). Aquifers. http://ga.water.usgs.gov/edu/earthgwaquifer.html
25. World Business Council for Sustainable Development. (2009). Water Facts and Trends. http://www.unwater.org/downloads/Water_facts_and_trends.pdf
26. WWF. (n.d.). Dam Problems – Social Impacts. http://wwf.panda.org/what_we_do/footprint/water/dams_initiative/problems/social/

Date last updated: May 30, 2015

Module Code and Title: **ECL101 Principles of Ecology**

Programme(s): BSc Environmental Management

Credit Value: 12

Module Tutor(s): Jesse Montes (Coordinator)
GP Sharma
Bach-Lien Ngo

General objective(s) of the module:

This module seeks to inspire students to learn how nature works, how its various parts interact, and how humanity can impact its ecological balance. It will introduce students to the basic concepts, principles, laws and ideas of ecology, many of which form the backbone of environmental issues and are thus necessary for their proper understanding. The module will lay a foundation for the further study of biological natural resources and their management and conservation.

Learning outcomes – Upon successful completion of the module, students will be able to:

- Explain the concept of scientific inquiry and the basis for its approach towards understanding nature.
- Define the main ecological principles, concepts and laws.
- Analyse the importance of ecological principles for environmental management.
- Define the basic scientific principles governing matter and energy.
- Describe the different levels of organization used in ecology.
- Explain how matter cycles through ecosystems.
- Explain how energy flows through ecosystems.
- Explain how single species populations grow and are regulated.
- Describe the principal interactions between different species.
- Describe the major forces structuring communities.
- Explain how life might have originated and evolved by natural selection.
- Explain the large scale patterns of biodiversity and how it is affected by climate.
- Investigate a local ecosystem.

Learning and teaching approaches used:

The module will be conducted over 15 teaching weeks as follows:

- 3 hrs/wk lecture & discussions.
- 1 hr/wk tutorial section for student presentations, quizzes, and small group discussions.
- 1 hr/wk outdoor project work / practical including data collection of butterflies / birds and ecosystems in RTC campus.
- 3 hrs/wk outside of class, on average, for independent study.
- A Field trip from Lobesa to Dochula (dry subtropical to alpine zones) to see and learn about various ecosystems intact and degradation and to observe biodiversity in various type of forests.

Assessment:

Semester-End Examination (SE):40%
Continuous Assessment (CA): 60%

CA Assessment	Weight	Assessment Detail
Group Project & Presentation	25%	Project in groups of 3-4 on mapping and describing a local ecosystem – includes a written report (15%) and a group presentation of 20 min (10%).
Quizzes (3 x 5%)	15%	Short written individual quizzes of 30 min duration each, covering approximately 2 weeks of subject matter.
Class Participation	5%	
Midterm Exam	15%	

Pre-requisite knowledge:

Subject matter:

I. Introduction to science and ecology
   a. Basic philosophical overview of science as the search for order in nature
   b. Scientific inquiry
      i. Hypothesis testing
      ii. Scientific theories and laws
      iii. Establishing reliability in science
      iv. Limitations in science
   c. Ecology and its aim and scope
      i. Hierarchical levels of organization
      ii. Abiotic and biotic components of ecosystems

II. Matter and energy basics
    a. Matter: a brief review
        i. Atoms; elements; molecules; compounds
        ii. Law of conservation of matter
        iii. Ions; pH; organic molecules
        iv. Living matter – cells
        v. Matter in the four spheres of Earth's environment
        vi. Phases of matter
        vii. Matter interactions – air, water, minerals
        viii. Quality and usefulness of different kinds of matter
    b. Energy: a brief review
        i. Matter vs energy
        ii. Kinetic and potential energy
        iii. Energy conversions; Laws of thermodynamics
        iv. Energy changes in living organisms
III. Flow of matter in ecosystems: Biogeochemical cycles
    a. Geologic (tectonic) cycle
    b. Hydrologic (water) cycle
    c. Carbon cycle
    d. Phosphate cycle
    e. Nitrogen cycle
    f. Sulfur cycle
    g. Overview of other cycles; cycles compared; interactions between cycles
IV. Ecological principles
    a. Environmental factors; conditions and resources
    b. Optimum, zones of stress, limits of tolerance
    c. Law of limiting factors; environmental indicators
    d. Habitat and niche
    e. Competitive exclusion and resource partitioning
V. Populations and communities
    a. Dynamics of natural populations
        i. Dynamics and growth; population growth curves
        ii. Biotic potential vs. environmental resistance; limits on populations
    b. Community interactions
        i. Competition; Predation; Symbiotic relationships (parasitism, mutualism, commensalism)
        ii. Keystone species
VI. Evolution
    a. Principles of evolution by natural selection (Darwin's theory)
    b. Adaptations
    c. Speciation
    d. Isolation
    e. Implications for human management; introduced species and invasive species
VII. Energy flow and disturbances in ecosystems
    a. Transfer of energy through ecosystems
    b. Characteristics of ecosystems; trophic levels
    c. Flow of energy through food webs
        i. Energy flow and efficiency
        ii. Biomass pyramids; biomagnification/bioaccumulation
    d. Ecosystem responses to disturbance
        i. Ecological succession
        ii. Disturbance and resilience

Essential Readings:

1. Begon, M, Townsend, C.R. and Harper, JL. (2005) Ecology: From Individual to Ecosystems, 4th Edition, Wiley-Black, USA.
2. Botkin, D.B. & Keller, E.A. (2011). Environmental Science, 8th Ed. John Wiley & Sons.

3. Cunningham, W.P., and Cunningham, M.A. (2012). Environmental Science: A Global Concern, 12th Ed. McGraw Hill.
4. Odum, E., Barrick, M., and Barrett, G.W. (2005). Fundamentals of Ecology, 5th Ed. Brooks/Cole.
5. Ohsawa, M., ed. (1991). Life zone ecology of the Bhutan Himalaya II. Laboratory of Ecology, Chiba University, Japan. *(eBook).*
6. Miller, G.T., and Spoolman, S.E. (2014). Environmental Science 14th Ed. Belmont: Brooks/Cole.
7. Understanding Evolution. (2014). University of California Museum of Paleontology. 22 August 2008. Retrieved from http://evolution.berkeley.edu/
8. Wright, R.T., Boorse, D.F. (2011). Environmental Science, 11th Ed. New Delhi: PHI Learning Pvt Ltd.

Additional Readings:

1. Berg, L., Hager M., Hassenzahl, D. (2011). Visualizing Environmental Science 3rd Ed. John Wiley & Sons.
2. Enger, E.D. and Smith, B.F. (2010). Environmental Science, 12th Ed. McGraw-Hill.
3. National Biodiversity Centre. (2009). Biodiversity Action Plan. Ministry of Agriculture, Royal Government of Bhutan.
4. Sodhi, N.S. and Ehrlich, P.R. (2010). Conservation Biology for All. OUP Oxford, London.
5. Sokolva et al. (2012). Energy homeostasis as an integrative tool for assessing limits of environmental stress tolerance in aquatic invertebrates. *Marine Environmental Research* 79:1-15. Retrieved from http://www.sciencedirect.com/science/article/pii/S0141113612000712

Date last updated: May 30, 2015

Module Code and Title: **ENV102 Population, Development, and Environment**

Programme(s): BSc Environmental Management

Credit Value: 12

Module Tutor(s): Leishipem Khamrang (Coordinator)
Radhika Chhetri
Tshering Dolkar

General objective(s) of the module:

The module will introduce students to the main concepts, ideas and theories that underlie population studies and demography. The module will also deal with issues of ever-growing importance associated with population growth and development, namely migration, urbanization and employment and thus prepare students with the necessary theoretical background to understand some of the most pressing social problems of our times. Students will become aware of how the development process in developing countries is affected by and in turn affects population structure, population growth and the environment, and how current and future problems result from these interactions can be approached and solved.

Learning outcomes – Upon successful completion of the module, students will be able to:

- Describe major demographic theories related to population structure and dynamics, fertility, mortality, and migration.
- Calculate basic demographic metrics related to population structure and dynamics, fertility, mortality, and migration.

- Evaluate claims made about demographic topics (such as in the media and political arena).
- Communicate major trends and issues in national, regional, and global population dynamics.
- Apply the basic theories of interaction between population, development, and environment.
- Identify sources of demographic data like population censuses, surveys, vital registrations, etc., and how they are implemented.
- Describe the socioeconomic issues associated with developing populations.
- Produce an analysis of the demographic situation of Bhutan.

Skills to be developed:

- Students should exhibit basic proficiency in working with figures and data, e.g. selecting and constructing appropriate graphs.

Learning and teaching approaches used:

The module will be conducted over 15 teaching weeks as follows:

- 3 hrs/wk lecture & discussions.
- 1 hr/wk tutorial section for student presentations, quizzes, and small group discussions.
- 4 hrs/wk outside of class, on average, for independent study.
- Two guest speakers sometime during the semester: those who are local specialists/experts in their field related to population and development, along with discussions afterward.

Assessment:

Semester-End Examination (SE):40%
Continuous Assessment (CA): 60%

CA Assessment	Weight	Assessment Detail
Individual Assignment	10%	Case analyses – country profiles: Report of 1000 words along with appropriate data.
Quizzes (2 x 5%)	10%	Short written individual quizzes of 30 min duration each, covering approximately 3 weeks of subject matter.
Class Participation	5%	
Presentation on country memos	20%	Group presentation with 3-4 members presenting their individual country profiles along with a regional analysis – approx. 10 min per person, followed by Q&A.
Midterm Exam	15%	

Pre-requisite knowledge:

Subject matter:

I. Introduction to population studies
   a. Review of natural population dynamics (growth, biotic potential, environmental resistance, and carrying capacity)
   b. Essential demographic concepts for human populations (birth, death, migration)
   c. Common population characteristics
      i. Sex and age structure / population pyramids
      ii. Literacy rates and levels of educational attainment
      iii. Labour participation rates / economically active population
      iv. Wealth and income distribution
   d. World population growth, trends and patterns
      i. World population- its size, growth & distribution by continents, regions, and developed and developing countries

        ii. Spatial distribution of world population by countries; regions; its determinants – (a) physical (climate, topography, resource availability, space relationship), (b) economic and social (types of economic activities, techniques of production, irrigation, transportation, government policies etc.), (c) physical and social disasters, and (d) differentials in demographic factors
    e. Population and resources
        i. Malthusian and neo-Malthusian/pessimistic theories
        ii. Alternative viewpoints (technological/optimistic theories)
    f. Population dynamics and demographic transitions
    g. Debates and controversies
II. Development studies and socioeconomic issues associated with developing populations
    a. Introduction to development studies: historical contexts, concepts and purpose of development, global human security
    b. Indicators of development
    c. Development paradigms and metrics (GDP/GNP growth, GNH, Human development index, Human vulnerability index, Poverty gap ratio, Gender empowerment index, Gender development index, etc.)
    d. Economic, social, demographic and cultural aspects of development and modernization
    e. Poverty
    f. Roles and status of women
III. Population and environment interactions
    a. Natural capital degradation
    b. Agriculture, climate change, and population
    c. Population, health, and environment
    d. Migration and the environment
    e. Urbanization and the environment
    f. Population and environmental conflicts
    g. Limits to growth: carrying capacity, ecological overshoot, and ecological footprint; applications of the concepts in terms of impact of development and population on the environment
    h. Society and environment: environmental issues and politics of development at the local, regional and global levels
    i. Environmental justice; Interrelationships of resource use and development politics: the North-South divide
IV. Population planning
    a. Concepts and objectives of planning and formulating population policies
    b. Various approaches to planning
        i. Choices and criteria for choosing suitable strategies
        ii. Conflicting considerations
    c. Case studies

Essential Readings:

1. Jhingan, M.L. (2014). The Economics of Development and Planning, 40th Ed. Vrinda Publications, P. Ltd., India.
2. Miller, G.T., and Spoolman, S.E. (2014). Environmental Science 14th Ed. Belmont: Brooks/Cole. *(Primary textbook, also available as eBook)*
3. Sharma, R.K. (2004). Demography and Population Problems. Atlantic.
4. Tyson, T (2010). Population and development: The demographic Transition. London, Zed Books.
5. UN. (n.d.). Data and resources available at www.unpopulation.org.

Additional Readings:

1. Castree, N. (2014). Making Sense of Nature. New York: Routledge.
2. Gould, W.T.S. (2009). Population and development, London, Taylor and Francis.

3. Hess, P. and Ross, C. (1997). Economic development: Theories, evidence and policies. Orlando, The Dryden Press.
4. Ives, J.D. and Messerli, B. (1989). The Himalayan Dilemma: Reconciling Development and Conservation. Routelage.
5. National Statistics Bureau annual reports and statistical publications. http://www.nsb.gov.bt/
6. Robbins, P. (2012). Political Ecology: A Critical Introduction. New York. Wiley Blackwell.
7. Todaro, M.P. and Smith, S.C. (2009). Economic development, 10th Ed. New Jersey, Pearson.
8. UN. (2013). Population, Development and the Environment 2013 Wall Chart. http://www.un.org/en/development/desa/population/publications/pdf/development/pde_wallchart_2013.pdf
9. UN. (2013-). Population Fact Sheets. http://www.un.org/en/development/desa/population/publications/factsheets/index.shtml
10. Weeks, J.R. (2012). Population: An introduction to concept and issues. Wadsworth, Cengage Learning, CA.

Date last updated: May 30, 2015

Module Code and Title: **CLM101 Introduction to Climate and Weather Studies**

Programme(s): BSc Environmental Management

Credit Value: 12

Module Tutor(s): GP Sharma (Coordinator)
Jesse Montes
Radhika Chhetri

General Objectives

The module will introduce students to the fundamentals of weather, climate and climate changes, and relevant scientific and technological advancements. The module encompasses topics on basic physical principles on weather phenomena such as wind, temperature, humidity, cold/warm fronts, thunderstorms and tropical cyclones; introductory weather analysis, forecasting and climate. Through real-life examples, students will get familiarized with weather/climate science and interpretation of meteorological information, climatology and climate change.

Learning outcomes – Upon successful completion of the module, students will be able to:

- Describe the elements and controls of weather and climate.
- Identify the distribution and characteristics of climatic regions.
- Explain the common daily weather events, their causes and impacts.
- Recall the basic principles of weather and climate.
- Utilize basic knowledge of atmospheric processes to dissect and explain weather phenomenon or climate systems.
- Interpret data presented in graphs, weather maps, and statistical data.
- Locate reliable sources for current weather observations, forecasts, and timely information on inclement weather, while recognizing the limitations.
- Use graphical, symbolic and statistical methods to analyse data in a manner appropriate to the discipline.
- Explain the differences of weather and climate in Bhutan as compared to other parts of the world.
- Explain the fundamental principles behind weather forecasting.
- Explain and interpret climate change phenomena, history, governance and present policies and gaps and needs.

- Examine the local adaptation and mitigation options for climate change.

Skills to be developed

- Students should be able to read, record meteorological instruments, and maintain them regularly.
- Students should be able to use graphic, symbolic and statistical method to organize, analyse and interpret meteorological data.
- Students should be able to locate reliable sources of current weather observation and forecasts.

Learning and teaching approaches used:

The module will be conducted over 15 teaching weeks as follows:

- 3 hrs/wk of lecturing on the theory components.
- 1 hr/wk of tutorial, seminars, and discussions.
- 1 hr/wk meteorology field work, discussion, and laboratory practical.
- One field trip to a national forecasting centre.
- 3 hrs/wk outside of class, on average, for independent study.

Assessment:

Semester-End Examination (SE):40%
Continuous Assessment (CA): 60%

CA Assessment	Weight	Assessment Detail
Practical Work	15%	Daily recording and data entry, with a summary report and basic analysis.
Individual Assignment	15%	Written report of 1000-1500 words on interpretation of data presented in graphs, weather maps.
Group Presentation	15%	Use graphic, symbolic, and statistical method to organize, analyse and interpret meteorological data in a group of 3-4.
Class Participation	5%	
Midterm Exam	10%	

Pre-requisite knowledge:

Subject Matter:

I. Introduction to weather and climate
   a. Scope of climatology and meteorology
   b. History
   c. Importance and use
   d. Weather and climate
   e. Different approaches
      i. Paleoclimatology
      ii. Paleotempestology
      iii. Historical Climatology
   f. Global climate models
II. Weather basics (definition, calculation, interpretation)
   a. Temperature
   b. Humidity
   c. Pressure
   d. Precipitation
   e. Cloud cover
   f. Sunshine
   g. Wind speed

h. Wind direction
i. Evaporation
j. Fronts and storms
k. Jet streams
l. Cyclones/tornadoes and hurricanes

III. Numerical Weather Prediction
a. Overview of forecast model physics
b. Data assimilation process
c. Global model output
d. GIS meteorology

IV. Forecasting
a. Utilizing and interpreting Model data
b. Pattern recognition
c. Practical forecasting examples

V. Brief introduction to environmental hazards and risks associated with weather and climate
a. Natural hazards and disasters
b. GLOF, flood and draught in Bhutan
c. Natural disaster issues in Bhutan
d. Strategies to manage natural disasters

VI. Overview of climate change
a. Causes: natural and anthropogenic
b. Evidences of climate change; technical parameters: temperatures (atmospheric and ocean), sea level, atmospheric CO_2 levels, levels of ice and snow at poles and other reservoirs, extreme weather, ocean acidification
c. Emerging strategies for addressing climate change
d. Basic concepts in climate change adaptation and mitigation; approaches in Bhutan

VII. Case Studies: Global pattern of trends in stream flow and water availability in a changing climate

Essential Readings:

1. Bonan, G. (2008) Ecological Climatology, 2nd Ed. Cambridge University Press, UK.
2. IPCC: Intergovernmental Panel on Climate Change. (2014). Fifth Assessment Report (AR5). (http://www.ipcc.ch/report/ar5/).
3. Miller, G.T., and Spoolman, S.E. (2014). Environmental Science, 14th Ed. Belmont: Brooks/Cole.
4. Wright, R. T, Boorse, D.F (2011). Environmental Science – Towards a Sustainable future, 11th Ed., PHI Learning Private Limited, New Delhi.
5. World Meteorological Organization, 2003. Meteorological systems for hydrological purposes. Retrieved from the website http://lccn.loc.gov/2005419787.

Additional Readings:

1. Baer, F., Canfield N.L., and Mitchell J.M. (1991).Climate in Human Perspective : a Tribute to Helmut E. Landsberg, Kluwer Academic Publishers, Dordrecht ; Boston
2. Burroughs, W. (2003). Climate: Into the 21st century, Cambridge University Press, U.K.; New York.
3. Milwaukee, WI: World Almanac Library, (2002). Climate and the environment. North American ed., http://lccn.loc.gov/2002022705
4. Quarrie, J. (1992). Earth Summit '92; The United Nations Conference on Environment and Development. Rio de Janerio., Published by the Regency Press, London.
5. Russell D. Thompson and Allen Perry. (1997). Applied Climatology: Principles and Practice, London; New York: Routledge
6. Sinha, P.C. (2006). Hazardous Wastes, Organic Pollutants and Prior Informed Consent. New Delhi: SBS Publishers and Distributers Pvt. Ltd.

Date last updated: May 30, 2015

Module Code and Title: **ENM101 Energy Resources and Materials Management**

Programme(s): BSc Environmental Management

Credit Value: 12

Module Tutor(s): Jesse Montes (Coordinator)
GP Sharma

General objective(s) of the module:

This module will provide students with a significant understanding of the importance of energy resources, non-renewable and renewable. It will also expose students to the various methods and trends regarding energy utilization and, especially in the case of the non-renewable energy and material resources, an overview of their management, conservation and alternatives that exist.

Learning outcomes – Upon successful completion of the module, students will be able to:

- Describe the various kinds of energy resources and their availability.
- Describe the methods of their extraction and use.
- Describe the global and local trends in energy extraction and usage.
- Discuss the advantages and disadvantages of their extraction, processing and use.
- Assess the future scenario regarding the availability and possibility of continued use of these resources.
- Describe and methods of their conservation in order to extend their supplies well into this century.
- Evaluate the alternative options that exist for non-renewable energy.
- Analyse the current state of energy use in Bhutan
- Evaluate possible future scenarios for energy use with respect to the economy and the environment in Bhutan.
- Explain the rationale for managing materials to reduce environmental degradation associated with resource use.
- Evaluate the mineral resource and mining situation in Bhutan.
- Propose balanced approaches to mineral resource development in Bhutan.

Skills to be developed:

- Students should be able to demonstrate scientific quantitative skills, such as the ability to read and evaluate graphs, and understand and use information from scientific and other data-heavy writing.

Learning and teaching approaches used:

The module will be conducted over 15 teaching weeks as follows:

- 3 hrs/wk lecture & discussions.
- 1 hr/wk tutorial section for reading and analysis of scientific articles, opinion articles, guest lectures, and for presentations and discussions.
- 4 hrs/wk outside of class, on average, for independent study.
- Independent short field trips in the locality to gain exposure to various kinds energy usage patterns in Bhutan accompanied by short response/reflection.
- Class field trips to briquette factory in Thimphu, and one mining sites either in Bjemina or Genekha.

Assessment:

Semester-End Examination (SE):40%
Continuous Assessment (CA): 60%

CA Assessment	Weight	Assessment Detail
Group discussion/debate	15%	Each group of 4 students should perform a debate or lead a class discussion for 45 min.
Quizzes (5 x 2%)	10%	Short written individual quizzes of 30 min duration each, covering approximately 2 weeks of subject matter
Class Participation	5%	
Reflection/response papers (3 x 5%)	15%	Written works of 500 words each on field observations and current events related to energy usage patterns in Bhutan
Midterm Exam	15%	

Pre-requisite knowledge: ENV101 Introduction to the Environment, ECL101 Ecology

Subject matter:

I. Overview of non-renewable and renewable natural resources
II. Introduction to energy sources and uses
    a. Energy use throughout history
    b. Fossil fuels use and development through history
    c. Energy conversions
    d. Primary and secondary sources
    e. Fundamentals of electrical power generation
    f. Energy flow and energy efficiency; matching sources to uses
III. Fossil fuels
    a. Origin and formation of fossil fuels
        i. The three kings: coal, oil, natural gas
        ii. Others: oil shale, oil sand, etc.
    b. Extraction and processing of fossil fuels
        i. Coal (surface and subsurface mining, different types of coal)
        ii. Crude oil (extraction, refining)
        iii. Natural gas
    c. Use, pros and cons, and impacts of fossil fuels
        i. General environmental effects of using nonrenewable resources
        ii. Coal (mining, transporting and converting, burning)
        iii. Oil (recovery: land and marine, refining, delivery and use)
        iv. Natural gas
        v. Others: oil shale, oil sand, etc.
IV. Nuclear energy
    a. Nuclear power in perspective, use for electricity generation
    b. Science of nuclear energy
        i. From mass to energy, nuclear chain reaction
        ii. Nuclear fuel, nuclear reactor
    c. Hazards of nuclear power, safety
    d. Waste disposal, nuclear fuel cycle
    e. Economics of nuclear power; coal/fossil fuels vs. nuclear
    f. Pros and cons of nuclear power
    g. Advanced nuclear reactors
    h. Status and future of nuclear power
V. Renewable energy resources
    a. Origin of all energy from the Sun (except geothermal)
    b. Types of solar energy and uses

        i. Passive solar; solar thermal energy; solar heating
        ii. Photovoltaics
    c. Wind power
    d. Hydropower
    e. Tidal and wave power
    f. Geothermal energy
    g. Biomass energy, biofuels; carbon neutrality of biomass energy
    h. Hydrogen power
    i. Advantages, trade-offs, environmental impacts of different types of renewable energy resources
VI. Energy efficiency and conservation
    a. Concept of energy efficiency, laws of thermodynamics, net energy
    b. Efficiency of various energy sources and conversion processes
    c. Energy waste; major sources of waste; reducing waste
    d. Conservation and efficiency; benefits and challenges thereof
VII. Global energy trends
    a. World total primary energy supply and use
        i. World status of coal, oil, natural gas, nuclear, hydro and other minor sources
        ii. Concept of peak oil, permanent depletion of fossil fuels
        iii. Global electricity generation
        iv. Global CO_2 emissions and carbon trends
    b. Energy trends in Bhutan
        i. Total energy consumption
        ii. Electrical energy
        iii. Thermal energy
        iv. Economics of energy use in Bhutan
VIII. Materials Management
    a. Concept and goals of materials management
    b. Mineral resources
        i. Basics of Earth's geological processes
        ii. Types of mineral resources
        iii. Mining of minerals resources
        iv. Environmental effects of extracting, processing, and using mineral sources
        v. Minerals and mining in Bhutan
    c. Introduction to waste management w.r.t. materials management

Essential Readings:

1. Berg, L., Hager M., Hassenzahl, D. (2011). Visualizing Environmental Science 3rd Ed. John Wiley & Sons.
2. Cunningham, W.P., and Cunningham, M.A. (2012). Environmental Science: A Global Concern, 12th Ed. McGraw Hill.
3. Ernst & Young Pvt Ltd. (2012) Bhutan Energy Efficiency Baseline Study. Department of Renewable Energy (DRE), Bhutan.
4. Grubler et al. (2012). Chapter 1-Energy Primer. In: Global Energy Assessment-Toward a Sustainable Future, IIASA, Vienna, Austria and Cambridge University Press, Cambridge, UK
5. Miller, G.T., and Spoolman, S.E. (2014). Environmental Science 14th Ed. Belmont: Brooks/Cole. *(Primary textbook, also available as eBook)*
6. Shepherd, R. (n.d.) What are Fossil Fuels? Retrieved from http://www.discoveringfossils.co.uk/fossilfuels.htm
7. US Environmental Protection Agency. (2005). The Quest for Less. Retrieved from http://www.epa.gov/wastes/education/quest/quest.htm
8. US Dept. of Energy. (2013). How Fossil Fuels were formed. Retrieved from http://www.fossil.energy.gov/education/energylessons/coal/gen_howformed.html
9. US National Academy of Sciences. (2008). Energy Sources and Uses. Retrieved from http://www.nap.edu/reports/energy/sources.html

Additional Readings:

1. Botkin, D.B. & Keller, E.A. (2011). Environmental Science, 8th Ed. John Wiley & Sons.
2. Enger, E.D. and Smith, B.F. (2010). Environmental Science, 12th Ed. McGraw-Hill.
3. Fossil Fuels (n.d.) http://en.wikipedia.org/wiki/Fossil_fuels
4. IEA. (2012). Key World Energy Statistics. Retrieved from http://www.iea.org/publications/freepublications/publication/name,31287,en.html
5. Marland, G., T.A. Boden, Andres, R.J. (2007). Global, Regional, and National CO2 Emissions. In Trends: A Compendium of Data on Global Change. Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, United States Department of Energy, Oak Ridge, Tenn., U.S.A. http://cdiac.esd.ornl.gov/home.html
6. Minutes of 1st National Consultation Workshop on Biogas (23rd Jan 2009). Ministry of Agriculture & Forests. http://www.moaf.gov.bt/moa/downloads/downloadFiles/MoADownload9mq7546nw.doc
7. Wright, R.T., Boorse, D.F. (2011). Environmental Science, 11th ed. New Delhi: PHI Learning Pvt Ltd.

Date last updated: May 30, 2015

Module Code and Title: **STS101 Applied Statistics**

Programme(s): BSc Environmental Management

Credit Value: 12

Module Tutor(s): Somnath Chaudhuri (Coordinator)
GP Sharma
Radhika Chhetri
Leishipem Khamrang

General objective(s) of the module:

This module will provide students with an introduction to statistics and allow them to directly begin applying statistical concepts to problems. In terms of covering the theoretical and mathematical basis, the module aims to provide a basic understanding of the concepts without extensively emphasizing the theoretical math. Rather, the module takes the approach of allowing students to directly discover statistics by applying and practicing statistics using the SPSS software platform, with some supplementation using Microsoft Excel. Lessons are geared towards reinforcing the theory with practical exercises. The module uses environmental data, problems, and cases as the content to illustrate the statistical analyses.

Learning outcomes – Upon successful completion of the module, students will be able to:

- Describe how statistics can be used for addressing research questions and analysing data.
- Define essential statistical concepts and terms.
- Recall the theoretical basis for common statistical tests and techniques.
- Apply statistical techniques for analysing data using SPSS and Excel.
- Recognize which statistical techniques are most suitable to address particular problems.
- Test hypotheses using appropriate statistical tests and techniques.
- Correctly interpret the outputs of statistical analyses, in numerical terms and through graphs.
- Identify environmental problems and data that can be analysed with statistics.

Skills to be developed:

- Students should be able to perform statistical calculations using SPSS and Excel.

Learning and teaching approaches used:

The module will be conducted over 15 teaching weeks as follows:

- 3 hrs/wk lecture & discussions.
- 2 hrs/wk practical work in computer lab.
- 3 hrs/wk outside of class, on average, for independent study and practice.

Assessment:

Semester-End Examination (SE):40%
Continuous Assessment (CA): 60%

CA Assessment	Weight	Assessment Detail
Weekly exercises (15 x 3%)	45%	Each written exercise will involve solving practice problems covered on a weekly basis. The work will require use of the lab time as well as effort outside of class.
Midterm Exam	15%	

Pre-requisite knowledge:

Subject matter:

I. Introduction to using statistics
   a. The research process; making observations, generating theories and testing them
   b. Introduction to data collection and analysis
      i. What to measure: variables, measurement error, validity and reliability
      ii. How to measure: correlational research methods, experimental research methods, randomization
      iii. Analysing data: frequency distributions (types, centre, dispersion), going beyond the data, fitting statistical models

II. Essentials of statistics
   a. Building statistical models
   b. Populations and samples
   c. Simple statistical models: mean and variance
   d. Going beyond data: standard error, confidence intervals
   e. Using statistical models to test research questions
      i. Test statistics
      ii. One- and two-tailed tests
      iii. Types I and type II errors
      iv. Effect size
      v. Statistical power

III. Basics of SPSS
   a. Overview of the SPSS environment
   b. Data editor
   c. Variable view
   d. Syntax window, outputs
   e. File management

IV. Exploring data with graphs
   a. 'Art' of presenting data properly and reading graphs accurately
   b. Chart making in SPSS
   c. Types of charts, their uses and suitability for different purposes (column and bar graphs, histograms, boxplots, line charts, scatterplots)

V. Exploring assumptions
   a. Meaning and effect of assumptions in statistics
   b. Assumption of normality
   c. Homogeneity of variance
   d. Correcting problems in data (outliers, non-normality, unequal variances)

VI. Correlation
   a. Introduction to measuring relationships and establishing correlation
   b. Types of correlative analyses and different coefficients of correlation
   c. Calculating effect size
   d. Reporting correlation coefficients
VII. Regression
   a. Introduction to regression; least squares; goodness of fit
   b. Simple regression
   c. Fitting, assessing, and interpreting a regression model
VIII. Comparing Means
   a. Concept of testing for differences between groups, samples
   b. t-test (dependent, independent)
   c. Testing between groups vs. between repeated measures
IX. ANOVA
   a. Theory, principles and uses of ANOVA
   b. Running one-way ANOVA in SPSS and interpreting the output
X. Categorical data
   a. Analysing categorical data
   b. Statistical theories and tools for categorical data (Pearson's chi-square test, Fisher's exact test, likelihood ratio, Yates' correction)
   c. Performing chi-square analysis in SPSS

Essential Readings:

1. Field, A. (2013). Discovering Statistics using IBM SPSS Statistics 4th Edition. New Delhi: Sage Publications.
2. Manly, B.F.J. (2009). Statistics for Environmental Science and Management. Boca Raton: Chapman & Hall/CRC.

Additional Readings:

1. Rumsey, D.J. (2011). Statistics for Dummies 2nd Edition. Hoboken: Wiley Publishing.
2. Rumsey, D.J. (2009). Statistics II for Dummies. Hoboken: Wiley Publishing.
3. Urdan, T.C. (2005). Statistics in Plain English 2nd Edition. New Jersey: Lawrence Erlbaum Associates, Inc.

Date last updated: May 30, 2015

Module Code and Title: **BDC201 Biodiversity Conservation and Management I**

Programme(s): BSc Environmental Management

Credit Value: 12

Module Tutor(s): Bach-Lien Ngo (Coordinator)
Deki Phuntsho Yonten
GP Sharma

General objective(s) of the module:

The main focus of the module is to introduce students to the principles, theories and concepts of biodiversity and its measurement. This module will provide combine practical knowledge on measuring and estimating biodiversity and understanding threats to biodiversity.

Learning outcomes – Upon successful completion of the module, students will be able to:

- Discuss biodiversity and its characterization.
- Explain the different status of species and how they become endangered.
- Measure and estimate species richness and relative abundance.
- Explore the benefits of biodiversity and the need to conserve it.
- Distinguish different threats to biodiversity.
- Identify the common species of flora and fauna.
- Describe the different forest types that exist and some of the characteristic species as well as their functions, uses, and threats to them.
- Explain the importance of fresh water and aquatic biodiversity.
- Explain the effect of climate on the nature, location of biomes and major terrestrial systems and human impacts on them.
- Describe the main plant and animal genetic resources in Bhutan and their in-situ and ex-situ conservation.
- Outline the management aspects of horticultural crops, vegetables and aromatic and medicinal plants.
- Explain the plant and animal quarantine acts for conservation and management of local resources.

Skills to be developed:

- Students should be able to conduct field measurements on biodiversity.
- Students should be able to collect specimens and contribute to a herbarium.

Learning and teaching approaches used:

The module will be conducted over 15 teaching weeks as follows:

- 3 hrs/wk lecture & discussions.
- 1 hr/wk basic forest measurement work, in conjunction with the GIS module this semester. The weekly field work will include identification of (and determination of the uses of) prominent plants and animals using appropriate tools and instruments in and around the College, field study for learning forest management through good silvicultural practices, and field study to identify birds available in a particular place.
- 4 hrs/wk outside of class, on average, for independent study.
- One block-day field visit to the nearby National Biodiversity Centre.
- A full block-week field trip (to Nobding and back, or equivalent areas) shared with other modules in this semester. During this time, students will have to keep a journal of their biodiversity observations and measurements.

Assessment:

Semester-End Examination (SE):40%
Continuous Assessment (CA): 60%

CA Assessment	Weight	Assessment Detail
Field Visit Report	15%	Group report (2-3 students) on block-day trip.
Practical work and journal (during block week)	25%	Journal of the biodiversity observations and measurements from block-week trip and weekly field work.
Quizzes (2 x 5%)	10%	Two written quizzes.
Midterm Exam	10%	

Pre-requisite knowledge: ECL101 Principles of Ecology

Subject Matter:

I. Fundamentals of biodiversity conservation
   a. Etymology, relevance and evolutionary significance

b. Levels and types of biodiversity: genetic, species and ecosystem
c. Biodiversity at local, national and global levels
d. Measures and documentation of biodiversity
e. Functions and values of biodiversity

II. Biodiversity measurement
a. Relative abundance: common species and rare species
b. Measuring and estimating species richness
c. Diversity indices
d. Species-area relationships
e. Biodiversity sampling methods; distance sampling

III. Loss and threats to biodiversity
a. Data and trends on global biodiversity; human impacts
b. Major threat areas, e.g. tropical rainforests, oceans
c. Major threat types, e.g. over-use and overhunting, habitat loss / degradation / fragmentation, invasive species, pollution, climate change
d. Endangered and threatened species; role as ecological smoke alarm
e. Human role in the premature extinction of species in general and case studies
f. Adjustment, adaptation and solutions

IV. Forestry and forests management
a. Identification of vegetation types and animal species within the context of ecosystems; study of common flora and fauna in and around RTC
b. Evaluating forest stand structure and composition
c. Density estimation
d. History of forestry in the world and the local and national objectives of social forestry interventions
e. Functions and types of threats to and importance of forests in general and in Bhutan in particular
f. Forest management through good silvicultural practices (rotational forestry, selective cutting and social forestry); alternatives to clear cutting

V. Aquatic biodiversity
a. Economic and ecological importance of aquatic biodiversity
b. Wetland land management in Bhutan
c. Historical development, gaps and needs of fish farming in Bhutan

VI. Plant genetic resources of Bhutan
a. Agro-biodiversity and its significance
b. Status of field crops in Bhutan (In-situ and Ex-situ)
c. Plant genetic resource management
d. Aromatic and medicinal plants conservation and management
e. Quarantine Act for plants and animals

VII. Animal genetic resources of Bhutan
a. Types of domestic animals; their importance and issues
b. Livestock development initiatives: breeds, pasture development, new technology
c. Conservation status in Bhutan (In-situ and Ex-situ)
d. New initiatives and approaches on livestock sector development and management

VIII. Biodiversity and climate
a. Effect of climate on the nature and location of biomes
b. Major terrestrial systems and human impacts on them
c. Major aquatic systems and human impacts on them

Essential Readings

1. Department of Forest and Park Services. (2013). Glimpse of Bhutan's Forest Biodiversity Captured by Foresters, Ministry of Agriculture and Forest, Royal Government of Bhutan.
2. Inskipp, C. Inskipp, T. An Introduction to Bird Watching in Bhutan. Illustrations by Craig Robson and Published by WWF Bhutan Program, Thimphu
3. Ministry of Agriculture. (2008). Plant Genetic Resources of Bhutan, Published by national Biodiversity Centre. Printed at Kuensel Corporation. Thimphu.

4. Ministry of Agriculture, (2008). Animal Genetic Resources of Bhutan, Published by national Biodiversity Centre. Printed at Kuensel Corporation. Thimphu.
5. Miller, G.T., and Spoolman, S.E. (2014). Environmental Science 14th Ed. New Delhi: Cengage Learning.
6. Ministry of Agriculture. (2000). Forest and Nature Conservation Rules of Bhutan 2000. Ministry of Agriculture. Royal Government of Bhutan.
7. Ministry of Agriculture. (2003).The Biodiversity Act of Bhutan, Royal Government of Bhutan, Bhutan.
8. Pearce, D. Moran, D. (2009). The Economic Value of Biodiversity, IUCN Earthscan, Sterling, VA, London.
9. Sodhi, N.S. and Ehrlich, P.R. (2010). Conservation Biology for All. OUP Oxford, London.
10. Wangchuk, T. Thinley, P, Tshering K., Tshering, C., Yonten, D. and Pema, B. (2004). A Field Guide to the Mammals of Bhutan, Ministry of Agriculture, Bhutan.
11. Wildlife Conservation Division. (2010). Analysis of the Contributions of Protected Areas to the Social and Economic Development of Bhutan. Case Study: Jigme Singye Wangchuck National Park, Ministry of Agriculture. Bhutan.

Additional Readings

1. Begon, M, Townsend, C.R. and Harper, JL. (2005) Ecology: From Individual to Ecosystems, 4th Edition, Wiley-Black, USA.
2. Dolder, W., Pippke U.D. (2009). Endangered Animal Species Facing Extinction, And the Threats to Their Habitats, Parragon Publishing, UK.
3. Gurung D.B. (2005). Orchids of Bhutan, DSB Books Enterprises, Thimphu, Bhutan.
4. International Centre for Integrated Mountain Development. (2010). Climate Change Vulnerability of Mountain Ecosystems in the Eastern Himalayas, ICIMOD, Kathmandu, Nepal.
5. Ives, J. D and Messerli B. (1989). The Himalyan Dilemma, Reconciling Development and Conservation, United Nations University Press, Routledge, London, ,Tokyo, New York
6. Kumar, H. D. (1999). Biodiversity & Sustainable Conservation. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi
7. Ministry of Agriculture. (2009). Pteridophytes of Bhutan, A list of Families , Genera and Species, Published by National Biodiversity Centre, Printed at Kuensel Corporation, Thimphu
8. Namgyel, T., Tenzin,K.. (2009). A photo Guide to Flowers of Bhutan, Published by WWF Bhutan, Thimphu
9. National Statistics Bureau. (2013). Bhutan's Case: Social capital, Household Welfare and Happiness, Monograph No 5. Published by NSB, Bhutan.
10. Odum, E.P. (2004). Fundamentals of Ecology (5th Edition) Cengage learning, Boston, USA and Australia.
11. Pradhan, R. (1999). Rhododendrons of Bhutan, Quality printers Pvt Ltd, Kathmandu, Nepal.
12. Riordan, T. O & Stoll-Kleeman, S.. (2002). Biodiversity, Sustainability and Human Communities Protecting Beyond the Protected. Cambridge University Press. U.K.
13. Stainton, A. (2010). Flowers of the Himalayas: A Supplement, Oxford University press, New Delhi.

Date last updated: May 30, 2015

Module Code and Title: **ENM202 Water Resources Management**

Programme(s): BSc Environmental Management

Credit Value: 12

Module Tutor(s): Jesse Montes (Coordinator)
GP Sharma

Deki Phuntsho Yonten

General objective(s) of the module:

This module covers water as one of Bhutan's principal natural resources. The module first presents learners with wide basic coverage of hydrological concepts, then goes on to provide students with a grounding in integrated water resources management principles and strategies. The module should prepare students to critically analyse the global and local water situation and be able to select appropriate approaches to water resource issues and concerns. Water resources depletion and water pollution are highlighted as key challenges.

Learning outcomes – Upon successful completion of the module, students will be able to:

- Describe the fundamental scientific concepts and properties of water and its dynamics.
- Discuss the types of natural and human-induced variations of hydrological systems.
- Given a particular sample or actual water resources system, describe its main hydrological characteristics and processes
- Explain how the major water dynamic processes are linked with aquatic ecosystems as well as with human activities such as land and water use and pollution.
- Discuss the importance of integrated watershed management.
- Debate the pros and cons of hydropower from technical, environmental, and socioeconomic points of view.
- Critically evaluate the state of water resources in Bhutan, their importance, major issues, and approaches to managing them.
- Conduct simple tests for water quality.
- Identify major types of point and non-point sources of water pollution.
- Discuss potential measures for protecting surface and groundwater sources of freshwater from depletion and pollution.
- Integrate local views into an analysis of a watershed.

Learning and teaching approaches used:

The module will be conducted over 15 teaching weeks as follows:

- 3 hrs/wk lecture & discussions.
- 1 hr/wk alternatively for presentations/discussions, and the field/practical components (measuring water quality using testing kits; data collection on water in urban and rural areas).
- 4 hrs/wk outside of class, on average, for independent study.
- One field visit to a watershed area (e.g. Wochu in Paro or Lingmetechu in Bajo) and a visit to a hydropower project as part of the block-week field trip shared with other modules in this semester.

Assessment:

Semester-End Examination (SE):40%
Continuous Assessment (CA): 60%

CA Assessment	Weight	Assessment Detail
Individual Assignment (case study)	15%	Case-study on a local or global water resources issue, approx. 1500 words plus additional data as necessary.
Presentation on case study	10%	Individual 10 min presentation with 2-5 min Q&A.
Class tests (2 x 5%)	10%	Individual written tests of 60 min duration each, covering approximately 4 weeks of subject matter.
Class Participation	5%	
Field Report	5%	Report (1000 words) on field observations from block-week and block-day trips.

Midterm Exam	15%	

Pre-requisite knowledge: ENV101 Introduction to the Environment

Subject matter:

I. Overview of water resources
   a. Earth's water resources and their renewability
   b. Science of water: water basics, properties of water
   c. Hydrologic cycle
      i. Evaporation/transpiration; condensation; precipitation; infiltration; gravitational flow
      ii. Human impacts on the cycle, including climate change
   d. Surface water and groundwater

II. Water uses
   a. Human consumption; drinking water
   b. Irrigation for agriculture
   c. Other uses
   d. Worldwide usage patterns; water scarcity and water stress
   e. Withdrawal and consumption: Off-stream and in-stream uses; Consumptive and non-consumptive uses

III. Water management
   a. Water supplies; municipal water management
   b. Surface water management
      i. Dynamics and renewability
      ii. Dams and reservoirs, their benefits and environmental impacts
      iii. Impacts of diversion and depletion of surface waters
      iv. Flooding and flood management
   c. Groundwater management
      i. Dynamics and renewability
      ii. Water tables
      iii. Depletion of groundwater
   d. Maintaining and increasing freshwater supplies
   e. Sanitation and hygiene
   f. Water conservation and sustainable water use
      i. Strategies
      ii. Water balance / allocation
      iii. Payment for eco-services related to water
   g. Water quality and water pollution
      i. Water quality properties
      ii. Point and non-point sources of pollution; major pollutants and their sources
      iii. Surface and groundwater quality and pollution
      iv. Options for reducing water pollution
   h. Watershed management: integrated approaches
      i. Establishing integrated water resources management in basins
      ii. Stakeholders, resources allocation and sharing, financing
      iii. Community-based action planning, implementation, and monitoring

IV. Hydropower
   a. Basic principles, use for electricity generation without emissions
   b. Hydropower potential
   c. Types of hydropower, their history, uses, and challenges

V. Water resources management in Bhutan
   a. Overview of Bhutan's water resources
   b. Principles and polices for water resources management in Bhutan
   c. Challenges, including climate change, and adaptation measures
   d. Transboundary issues in water resources management: Bhutan, and globally

Essential Readings:

1. Botkin, D.B. & Keller, E.A. (2011). Environmental Science, 8th Ed. John Wiley & Sons.
2. Chhopel, G.K. (2011). Water resources management in Bhutan. Presentation at Sixth Sharing & Learning Seminar on Mainstreaming Climate Change Adaptation into River Basin Planning and Development, Bangkok. Asia Pacific Adaptation Network. Retrieved from http://www.asiapacificadapt.net/sites/default/files/pdfs/seminars/6th-sharing-learning-seminar/water-resources-management-bhutan.pdf
3. Enger, E.D. and Smith, B.F. (2010). Environmental Science, 12th Ed. McGraw-Hill.
4. GWP / INBO. (2005). The Handbook for Integrated Water Resources Management in Basins. The International Network of Basin Organizations (INBO) and the Global Water Partnership (GWP). Retrieved from http://www.gwp.org/Global/ToolBox/References/A%20Handbook%20for%20Integrated%20Water%20Resources%20Management%20in%20Basins%20(INBO,%20GWP,%202009)%20ENGLISH.pdf
5. Miller, G.T., and Spoolman, S.E. (2014). Environmental Science 14th Ed. Belmont: Brooks/Cole. *(Primary textbook, also available as eBook)*
6. US Geological Survey. (2014). The USGS Water Science School. US Department of the Interior. Retrieved from http://water.usgs.gov/edu/

Additional Readings:

1. Berg, L., Hager M., Hassenzahl, D. (2011). Visualizing Environmental Science 3rd Ed. John Wiley & Sons.
2. Biswas, A.K., Varis,O. & Tortajada, C. (Eds.). (2005). Integrated Water Resources Management in South and Southeast Asia. New Delhi : Oxford University Press.
3. Cunningham, W.P., and Cunningham, M.A. (2012). Environmental Science: A Global Concern, 12th Ed. McGraw Hill.
4. GWP / INBO. (2012). The Handbook for Integrated Water Resources Management in Transboundary Basins of Rivers, Lakes, and Aquifers. The International Network of Basin Organizations (INBO) and the Global Water Partnership (GWP). Retrieved from http://www.gwp.org/Global/About%20GWP/Publications/INBO-GWP%20Transboundary%20Handbook/MGIREB-UK-2012_Web.pdf
5. MIT Mission. (2012). Clean Water. Problem: Agriculture. Retrieved from http://web.mit.edu/12.000/www/m2012/finalwebsite/problem/agriculture.shtml
6. National Environment Commission. (1998). The Middle Path, National Environment Strategy for Bhutan. Royal Government of Bhutan
7. National Environment Commission Secretariat. (2012). Bhutan Environment Outlook. National Environment Commission, RGOB. Retrieved from http://www.nec.gov.bt/nec1/wp-content/uploads/2013/01/BEO-2012-Zero-Draft-working-file_PK_2_Jan.docx
8. Rahaman, M.M. & Varis, O. (2005). Integrated water resources management: evolution, prospects and future challenges. Sustainability: Science, Practice, & Policy 1(1):15-21. Retrieved from http://sspp.proquest.com/archives/vol1iss1/0407-03.rahaman.html. Published online April 12, 2005.
9. RGoB. (2011). Water Act. NEC. http://www.nec.gov.bt/nec1/wp-content/uploads/2012/10/zero-draft-water-regulation.pdf
10. UN. (n.d.). Integrated Water Resources Management (IWRM). International Decade for Action 'Water for life'. Retrieved from http://www.un.org/waterforlifedecade/iwrm.shtml
11. USGS. (2013). Aquifers. http://ga.water.usgs.gov/edu/earthgwaquifer.html
12. World Bank. (2014). Water Resources Management. Retrieved from http://www.worldbank.org/en/topic/waterresourcesmanagement
13. World Business Council for Sustainable Development. (2009). Water Facts and Trends. http://www.unwater.org/downloads/Water_facts_and_trends.pdf
14. WWF. (n.d.) Dam Problems – Social Impacts. http://wwf.panda.org/what_we_do/footprint/water/dams_initiative/problems/social/

Date last updated: May 30, 2015

Module Code and Title: **ETH201 Environmental Ethics**

Programme(s): BSc Environmental Management

Credit Value: 12

Module Tutor(s): GP Sharma (Coordinator)
Tshering Dolkar
Leishipem Khamrang
Radhika Chhetri

General objective(s) of the module:

This module provides an overview of environmental ethics, the field of study that analyses ethical responsibilities for the natural world. The module explores the diverse responses to the concerns raised by environmental problems, analysing the ethical underpinnings of a wide variety of perspectives. Students will explore the history of contemporary philosophical and religious beliefs regarding nature. The module will be introductory, covering a wide range of perspectives, and is designed to give students an overview of major issues and players in the current debates concerning the environment. The module will help equip students with ethical perspectives on environmental management.

Learning outcomes – Upon successful completion of the module, students will be able to:

- Recall the prominent themes in philosophy and ethics.
- Identify the broad categories of ethical views towards the natural environment.
- Debate major ethical approaches in the field of environmental philosophy.
- Discuss the history of contemporary philosophical and religious beliefs concerning nature.
- Identify major approaches in religious environmental ethics.
- Describe the major players and philosophical and religious traditions represented in current debates concerning the environment.
- Analyse concrete environmental problems and cases from a variety of ethical perspectives.
- Explain the role of ecofeminism in conservation and management of the environment for socio-economic improvement and development.

Learning and teaching approaches used:

The module will be conducted over 15 teaching weeks as follows:

- 3 hrs/wk lecture & discussions.
- 1 hr/wk for tutorial, reading and analysis of articles.
- 4 hrs/wk outside of class, on average, for independent study.

Assessment:

Semester-End Examination (SE):40%
Continuous Assessment (CA): 60%

CA Assessment	Weight	Assessment Detail
Individual assignment	20%	Researched written paper of 1000 words on local beliefs and ways of thinking about the natural environment, in the context of major themes in philosophy and ethics and global worldviews.
Project work	20%	Case study in groups of 3, along with 2000 word report, on different approaches for conservation and management of environment: ecofeminism, deep ecology, animal rights, social ecology, environmental

		pragmatism, environmental aesthetics, religious approaches, etc.
Midterm exam	20%	

Pre-requisite knowledge: ENV101 Introduction to the Environment

Subject matter:

I. Introduction
   a. Role of ethics in environmental management
   b. Brief review of the field of ethics; nature and scope of environmental ethics
   c. Overview of the recent growth in environmental awareness in industrial and post-industrial nations

II. Prominent themes of philosophy and ethics
   a. Philosophical tools: facts & values, rights & duties, utility, autonomy & responsibility
   b. Cognitivism: facts & logic
   c. Anthopocentrism/Ecocentrism debate
   d. Morality: limits on behaviour
   e. Reductionism vs Holism
   f. Principles, preferences, and policies

III. Emergence of Environmental ethics
   a. Historical roots of ecological crisis
   b. Racism and environmental justice
   c. Aesthetics and value of Nature
   d. Planetary management vs. stewardship vs. environmental wisdom
   e. Western vs. Eastern philosophies on the environment
   f. Gaia hypothesis
   g. Deep Ecological Movement
   h. Natural law of tradition
      a. Telecology and virtues and contemporary perspective on utilitarianism
      b. Deontology and contemporary perspective on deontological ethics
   i. Monism, Holism, Pluralism
   j. Instrumental value, intrinsic value
   k. Ecocentrism – The Land Ethic (Aldo Leopold)
   l. Animal Rights- Sentience, sufferings, interests, respects and rights; meditations on wilderness

IV. Ecofeminism
   a. Environmental change and women
   b. Women's attitudes and the environment
   c. Gender and perception of the environment
   d. Women environmentalists, and their contributions
      i. Mei Ng
      ii. Vandana Shiva
      iii. Wangari Muta Maathai
      iv. Maria Cherkasova
      v. Rachel Carson
   e. Role of ecofeminism in conservation and management of the environment for socio-economic improvement and development

V. Environmental ethics for sustainable development
   a. Development vs. preservation
   b. Why put a value on biodiversity
   c. Individual vs. collective responsibility
   d. Cost-benefit analysis in policy-making
   e. Corporate access and uses of public resources
   f. Obligations to future generations
   g. Prominent environmental groups, their development and strategies

VI. Environmental ethics and the role of religion
    a. Buddhism and the environment in Bhutanese context
        i. Land, water, air and fire (Sachhulungmey)
    b. Hinduism and the Environment
        i. Land, water, air and fire and existence
    c. Comparison with other major global religions
    d. Environmental Philosophy Case studies from Bhutan and the region.
    e. Politics and Ethics to support Environmental management: regional and global.

Essential Readings

1. Boylan, M. (2013). Environmental Ethics, 2nd Ed. John Wiley & Sons.
2. Brundtland, G. H., 1987. Our Common Future. Report of the World Commission on Environment and Development. New York: Oxford University Press.
3. Enger, E.D. and Smith, B.F. (2010). Environmental Science, 12th Ed. McGraw-Hill.
4. Mies, M. and Shiva, V. (2010). Ecofeminism. Rawat publications.
5. Miller, G.T., and Spoolman, S.E. (2014). Environmental Science 14th Ed. New Delhi: Cengage Learning.
6. Royal Society for the Protection of Nature, 2006. Buddhism and Environment, Published with support from Royal Netherlands Embassy, India and Sustainable Development Secretariat, Thimphu
7. Varner G.E. 2002. In Nature's Interest? Animal Rights and Environmental Ethics, Oxford University Press, U.K.
8. Wright, R.T, and Boorse, D.F, 2011. Environmental Science – Towards a Sustainable Future, 11th Edition, PHI Learning Private Limited, New Delhi.

Additional Readings

1. Armstrong, Susan J., and Richard G. Botzler.1993. Environmental Ethics: New Divergence and Convergence. New York: McGraw-Hill, Inc.
2. Gottlieb, Roger S., ed. 1996.This Sacred Earth: Religion, Nature, Environment. New York: Routledge
3. Hargrove, E.1992. The Animal Rights/Environmental Ethics Debate. Albany, N.Y.: State University of New York Press, USA.
4. McAuley, D., 1996.Minding Nature: The Philosophers of Ecology. Guilford Press, New York
5. Minteer, B.A. 2009. Nature in Common- Environmental Ethics and the Contested Foundations of Environmental Policy, Retrieved from http://www.temple.edu/tempress website on 11th September 2013:
6. Pojman, L.P. and Pojman, P. (2011) Environmental Ethics, 6th Ed. Cengage Learning.
7. Saberwal, V.K. Rangarajan, M. 2009. Battle over Nature, - Science and Politics of Conservation, Published by Permanent Black, New Delhi.
8. Sessions, G. 1985. Deep Ecology: Living as if Nature Mattered, Gibbs Smith Publisher, Salt Lake.
9. Tietenberg, T. 2006. Environmental and Natural Resource Economics, 5th Ed., Published by Pearson Addison-Wiesley. Boston.
10. Withgott, J, 2009. Essential Environment: The Science Behind the Stories, 3rd Edition, Pearson Education Inc, USA, UK.

Date last updated: May 30, 2015

Module Code and Title: **GIS201 Geographic Information Sciences I**

Programme(s): BSc Environmental Management

Credit Value: 12

Module Tutor(s): Samir Patel (Coordinator)
Radhika Chhetri
Jesse Montes

General objective(s) of the module:

This module will introduce students to the fundamental concepts of Geographic Information Sciences and Technology (GIST) including Geographic Information Systems (GIS), Global Positioning Systems (GPS), cartography, remote sensing, and spatial analysis. It will also explore how geospatial technologies are used in addressing human and environmental issues. It should prepare students for more advanced topics in geospatial analysis. The module is based on GeoTech Center's model introductory courses on geospatial technologies. The module does not assume any GIS or geography background as a prerequisite.

Learning outcomes – Upon successful completion of the module, students will be able to:

- Describe the fundamental concepts and applications of Geographic Information Sciences and Technology (GIST), including the problems and challenges of representing change over space and time.
- Describe and explain the historical development of GIST and how GIST helps to solve problems of a spatial context.
- Discuss the use of web mapping tools to study and develop possible solutions to real world problems.
- Demonstrate basic proficiency in the use of geospatial software, in particular the ArcGIS suite.
- Demonstrate basic proficiency in map reading, interpretation, and design principles, including map projections and the geographic grid.
- Describe the fundamental concepts and applications of remote sensing and Global Positioning Systems (GPS).
- Demonstrate basic proficiency in the creation and acquisition of spatial data including the use of GPS.
- Solve a problem using geospatial technology from goals and data acquisition to analysis and processing to cartographic presentation and publishing.

Skills to be developed:

- Students should gain spatial and cartographic thinking skills.

Learning and teaching approaches used:

The module will be conducted over 15 teaching weeks as follows:

- 3 hrs/wk lecture & discussions.
- 3 hrs/wk practical in a computer lab.
- 2 hrs/wk outside of class, on average, for independent study, including some field work using GPS in coordination with requirements of other modules this semester.

Assessment:

Semester-End Examination (SE):30%
Continuous Assessment (CA): 70%

CA Assessment	Weight	Assessment Detail
Quizzes (4 x 5%)	20%	Short written individual quizzes of 30 min duration each, covering approximately 2 weeks of subject matter.
Presentations (2 x 10%)	20%	Individual 10 min presentation with 2-5 min Q&A.

Group Assignment	10%	GIS-based group project output report (1000 words plus data and maps).
Individual Project	20%	GIS-based individual work and output report (1000 words plus data and maps).

Pre-requisite knowledge:

Subject matter:

I. Introduction to Geospatial Information Science and Technology (GIST) and geographic concepts.
   a. Defining GIST
   b. History, data, and ethics
   c. Hardware and software
   d. Applications: social, physical, civil, behavioural, environment, and research
   e. Importance of maps for communication and decision making
   f. Scientific method as applied to spatial analysis

II. Fundamentals of Maps and Cartography
   a. Cartographic elements: colour, scale, layout, symbols
   b. Map design and interpretation
   c. Geographic grid, directions, and distance
   d. Coordinate systems
   e. Map projection
   f. Map types
   g. Resolution
   h. Classification
   i. Applications
   j. Output and presentation
   k. Geodesy

III. Survey of mapping and data acquisition technologies
   a. Current Internet-based mapping applications
   b. Global Positioning Systems (GPS)
   c. Remote sensing (including sensors, electromagnetic radiation, and remote sensing techniques)
   d. Geographic Information Systems (GIS)

IV. Data collection, processing, and analysis
   a. Aerial imagery interpretation
   b. GPS technology and field application
   c. Remote sensing and digital image analysis
   d. Collection, creation, and analysis of spatial data in a GIS
   e. Basic cartography and display of data
   f. Basic statistical analysis related to spatial data
   g. Tabular recording of field-generated data
   h. Display tools for numeric data
   i. Geoprocessing, geocoding, and modelling
   j. Uncertainty and topology
   k. Raster data models, vector data models, and digital elevation models
   l. Geospatial versus non-geospatial data collection, processing, and analysis

V. Geospatial technology: professionalism, society, and trends
   a. Virtual and augmented reality
   b. Professions that use geospatial technologies
   c. Ethics and Geospatial Data Privacy
   d. 3D geovisualization
   e. Mobile GIS and Location-Based Services
   f. Cloud-based GIS and Web GIS
   g. Big Data and Social Media

Essential Readings:

1. Chang, K. (2007). Introduction to Geographic Information Systems. New Delhi: Tata McGraw-Hill Education.
2. DiBiase, D. (continually updated). Nature of Geographic Information. Penn State: https://www.e-education.psu.edu/natureofgeoinfo/
3. Fundamentals of Remote Sensing, published by Natural Resources Canada: http://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/earthsciences/pdf/resource/tutor/fundam/pdf/fundamentals_e.pdf
4. Schmandt, M (continually updated). GIS Commons: An Introductory Textbook on Geographic Information Systems: http://giscommons.org
5. Sutton, T., Dassau, O., Sutton, M. (2009) A Gentle Introduction to GIS, Eastern Cape, South Africa: http://download.osgeo.org/qgis/doc/manual/qgis-1.0.0_a-gentle-gis-introduction_en.pdf

Additional Readings:

1. ESRI ArcNews, http://www.esri.com/news/arcnews/index.html
2. ESRI ArcUser, http://www.esri.com/news/arcuser/index.html
3. GeoTech Teaching Resources, http://www.geotechcenter.org
4. Gorr, W.L. and Kurland, K.S. (2010). GIS Tutorial 1: Basic Workbook 4th ed. Esri Press.
5. Law, W. and Collins, A. (2013). Getting to Know ArcGIS Desktop, 3rd Ed. Esri press.
6. Scally, R. (2006). GIS for Environmental Management. Esri Press.
7. Semerjian, C. and Miller, J.Z. (2014). Course Resources for GST101 – Introduction to Geospatial Technology. GeoTech Center Model Courses (GST 100 Awareness Course and GST 101 Intro to GIS Course). http://www.geotechcenter.org/model-courses.html
8. Yanow, K. (2014). Course Resources for GST100 – Exploring our World: Fundamentals of Geospatial Science. GeoTech Center Model Courses (GST 100 Awareness Course and GST 101 Intro to GIS Course). http://www.geotechcenter.org/model-courses.html

Date last updated: May 30, 2015

Module Code and Title: **BDC202 Biodiversity Conservation and Management II**

Programme(s): BSc Environmental Management

Credit Value: 12

Module Tutor(s): Deki Phuntsho Yonten (Coordinator)
Bach-Lien Ngo
Nima Wangmo
GP Sharma

General objective(s) of the module:

The module focuses on the applied aspects of the field of biodiversity. It aims to portray the importance of plant and animal genetic resources of Bhutan and the management aspects of horticultural crops, vegetables and aromatic and medicinal plants. An important aspect of biodiversity management that is emphasized is the concept of community-based natural resources management (CBNRM). The module will also introduce students to the history, concepts, principles, marketing, planning and management of ecotourism activities and development which promote cultural and environmental awareness and local economic benefits.

Learning outcomes – Upon successful completion of the module, students will be able to:

- Describe common conservation approaches.
- Explain the significance of CBNRM and its respective advantages and disadvantages from environmental, economic and social points of view.
- Identify the wild species that are threats to crops and properties, and related control measures.
- Identify the legal, social, cultural, and political institutions that affect wildlife conservation and management.
- Evaluate the efficacy of conservation efforts in Bhutan.
- Evaluate tourism development in Bhutan and propose potential suggestions and recommendations.
- Define ecotourism and identify ways in which it attempts to overcome the negative impacts of tourism.
- Explain the importance of bioprospecting, biosafety, GMO and Intellectual property rights.
- Highlight the biodiversity conservation efforts taken by various international and national organizations.

Learning and teaching approaches used:

The module will be conducted over 15 teaching weeks as follows:

- 3 hrs/wk lecture & discussions.
- 1 hr/wk basic forest measurement work (shared with the GIS module this semester), apiculture, and making herbarium specimens.
- 4 hrs/wk outside of class, on average, for independent study.
- A full block-week study tour shared with other modules in this semester, including a trip to the Royal Botanical Gardens and a visit to RNR-RDC Yusipang to understand the system of research under RNR sector in Bhutan. During this time, students will have to keep a journal of their biodiversity observations and measurements.

Assessment:

Semester-End Examination (SE):40%
Continuous Assessment (CA): 60%

CA Assessment	Weight	Assessment Detail
Field study report (from block week)	20%	Journal of the biodiversity observations and measurements from block-week field trips as well as weekly forest measurement work.
Beekeeping practical	10%	Attendance in practical work and field journal.
Individual Assignment	15%	Conservation case study in Bhutan (1500 words).
Midterm Exam	15%	

Pre-requisite knowledge: BDC201 Biodiversity Conservation and Management I

Subject matter:

I. Conservation approaches
   a. History of biodiversity conservation efforts and approaches
   b. Biodiversity mitigation hierarchy
   c. Conservation at species and population level, opportunities and techniques available for both in situ and ex situ conservation.
   d. Conserving endangered species
   e. Re-introduction of endangered species
   f. Habitat fragmentation: the need for conservation action outside protected areas; habitat restoration
   g. Management and conservation issues at the ecosystem level
      i. Definition, theory and examples of metapopulation
      ii. Protected areas as a conservation tool. Types of protected areas, the criteria for their selection, ICDPS, and management

iii. Importance of non-protected areas
iv. Ecosystem service provision and the wider landscape

II. Wildlife management in Bhutan
   a. Types of wild animals and habitats
   b. Main conflicts from ungulates, birds, elephants, boar
   c. Conservation and management efforts for avifauna (Bhutan and south Asia)

III. Community-Based Natural Resource Management (CBNRM)
   a. Definition, importance and examples
   b. Community mobilization and organization
   c. Biodiversity as an economic commodity
   d. Monitoring of the natural resource base and conflict management
   e. Case studies

IV. Emerging issues in the conservation and management of biodiversity
   a. Biosafety and genetically modified organisms (GMOs); Biosafety Bill of 2014 Bhutan
   b. Bioprospecting: definition, benefits and disadvantages
   c. Biopiracy and its effects on biodiversity
   d. Intellectual property rights
   e. Access and benefit sharing from genetic resources and traditional knowledge
   f. Patents, trademark, and copyright
   g. Brief overview of relevant organizations: World Intellectual Property Organization, International Conventions for Biodiversity, CITES, IPP in Bhutan, National Environmental Laws and Policies

V. Ecotourism and biodiversity management
   a. General concepts of tourism and its impacts
   b. Ecotourism
      i. Framework for ecotourism
      ii. Commandments of Ecotourism
      iii. Important ecotourism destinations- local, regional and international
      iv. Ecotourism certification and accreditation
      v. Ecotourism - fad and Future
      vi. Ecotourism development guidelines
      vii. Carbon footprint and offsets
      viii. Ecotourism benefits and livelihood for sustainable development in Bhutan

VI. Apiary management: brief overview as an example of practical biodiversity management
   a. Importance of bees in ecosystems; bees as environmental indicators
   b. Beekeeping introduction and intervention in Bhutan
   c. Types of honey bees in Bhutan
   d. Apiary management: Hive Management; seasonal aspects; honey flow
   e. Research and enhancement of beekeeping in Bhutan

Essential Readings:

1. Begon, M, Townsend, C.R. and Harper, J. L. (2005). Ecology: From Individual to Ecosystems, 4th Ed., Willey-Black, USA, New Zealand.
2. Chapman, J. L. (1997). Biodiversity: The Abundance of Life. Cambridge University Press.
3. Gurung, D.B. (2008). Benefits of Ecotourism to the Local Rural Communities Living Inside the Protected Areas of Bhutan, PhD Thesis, ETH, Zurich, Switzerland.
4. Matheson A. and Reid, M. (2011). Practical Beekeeping in New Zealand, 4th Ed. P.D Hasselberg, Government printer, Wellington, New Zealand. *(eBook).*
5. Maurer, F. Beekeeping Manual for Beginners, Unpublished, Baplathang, Bumthang
6. Nature Recreation and Ecotourism Development, (2012). Ecotourism Development in the Protected Areas Network of Bhutan, Published by Ministry of Agriculture and Tourism Council of Bhutan, Thimphu.
7. Ohsawa, M. (1987). Life Zone Ecology of the Bhutan Himalaya, Laboratory of Ecology, Chiba University, Japan. *(eBook).*
8. Shiva, V. (2009). Biodiversity Conservation: Whose Resource? Whose Knowledge? Indian National Trust For Art & Cultural Heritage.

9. Shiva, V. (2011). Biopiracy: The Plunder of Nature and Knowledge. Natraj Publishers, New Delhi.
10. Sodhi, N.S. (2010). Conservation Biology for All, Department of Biological Sciences, National University of Singapore, Singapore.
11. Tsering, D. (2002). Public Biodiversity Policy analysis in Bhutan, A PhD Dissertation submitted to the Institute of Technology, Zurich. Keen Publishing, Thailand.
12. Wildlife Conservation Division. (2010). Analysis of the Contributions of Protected Areas to the Social and Economic Development of Bhutan. Case Study: Bomdeling Wildlife Sanctuary, Ministry of Agriculture. Bhutan.
13. Wildlife Conservation Division, (2010). Analysis of the Contributions of Protected Areas to the Social and Economic Development of Bhutan. Case Study: Jigme Singye Wangchuck National Park, Ministry of Agriculture. Bhutan.

Additional Readings:

1. Berg, L.R. Hager, M.C. Hassenzahl, D.M. (2012). Visualizing Environmental Science, 3rd Edition, Wiley in collaboration with NG Society, USA.
2. Cunningham, W. P and Cunningham, M. A, 2004, Principles of Environmental Science: Inquiry and Application. Tata McGraw Hill, New Delhi.
3. Ives, J. D and Messerli B. (1989). The Himalayan Dilemma, Reconciling Development and Conservation, United Nations University Press, Routledge, London, Tokyo, New York.
4. Kaushik, A., Kaushik, C.P. (2009). Perspectives in Environmental studies, 3rd Edition, New Age Int Limited Publisher, New Delhi.
5. Lindberg, K. & Hawkins, D. (1993). Ecotourism: A Guide for Planners and Managers. The Ecotourism Society.
6. Lhamo, N. (2011). Health Seeking Behaviour Related to Sowa Rigpa in Bhutan, National Institute of Traditional medicine, Thimphu.
7. Miller, G.T., and Spoolman, S.E. (2014). Environmental Science 14th Ed. Cengage Learning, New Delhi:
8. Odum, E.P., 2004. Fundamentals of Ecology (5th Edition) Cengage Learning, Boston, USA and Australia.
9. Pradhan, R. (1999). Rhododendrons of Bhutan, Quality printers Pvt.t Ltd, Kathmandu, Nepal.
10. Stainton, A. (2010), Flowers of the Himalayas: A supplement, Oxford University press, New Delhi.
11. Wright, R.T, and Boorse, D.F., (2011). Environmental Science - Towards a Sustainable Future, 11th Edition, PHI Learning Private Limited, New Delhi.

Date last updated: May 30, 2015

Module Code and Title: **EEC201 Environmental Economics**

Programme(s): BSc Environmental Management

Credit Value: 12

Module Tutor(s): GP Sharma (Coordinator)
Jesse Montes
Leishipem Khamrang
Radhika Chhetri

General objective(s) of the module:

Environmental economics deals with the analysis of the rational development and use of scarce resources. This module will convey the principles underlying the efficient allocations of all resources regardless of how well markets ration their development and use. The module

examines the pervasiveness of market failures for environmental goods and the effectiveness of different techniques and policies attempting to correct these failures or to mitigate their negative consequences. This module is a systematic introduction to an economic way of thinking about the environment, which does not assume a background in economics.

Learning outcomes – Upon successful completion of the module, students will be able to:

- Explain the importance of environmental economics in the present local and global context.
- Discuss the major principles of environmental economics.
- Explain how resource use is coordinated in ideal markets and planned economies.
- Highlight the barriers to ideal signalling and incentives in real markets and real government planning.
- Describe economic tools for dealing with natural resource issues.
- Discuss the importance of trade, development, and jobs for effective implementation of environmental economic initiatives.
- Analyse the relationships between population, technology, and scarcity.
- Summarize how market mechanisms can reduce pollution.
- Discuss the methods of valuing ecosystems.
- Point out the possible reasons for coordination failures and the limitations of market signalling and incentives.
- Discuss the relationship of resource scarcity to social coordination system failures.
- Explain the economics of pollution control and management.
- Describe the economics of biodiversity loss and possible preventative measures.

Learning and teaching approaches used:

The module will be conducted over 15 teaching weeks as follows:

- 3 hrs/wk lecture & discussions.
- 1 hr/wk tutorial including debates and panel discussions.
- 4 hrs/wk outside of class, on average, for independent study including data collection for discussion in class and a small-scale group-led discussion or debate.

Assessment:

Semester-End Examination (SE):40%
Continuous Assessment (CA): 60%

CA Assessment	Weight	Assessment Detail
Group discussion/debate	15%	Group-wise debate or leading a class discussion on an emerging issue or recent event related to environmental economics.
Quizzes (3 x 5%)	15%	Three written quizzes of 30 minutes each.
Individual assignment	15%	Written assignment of 1000-1500 words on emerging topics related to a sub-theme under environmental economics.
Midterm exam	15%	

Pre-requisite knowledge: ENV101 Introduction to the Environment

Subject matter:

I. Importance and concepts of environmental economics
    a. History of environmental economics and its importance
    b. Basics concepts of economics
        i. Supply and demand
        ii. Laws of supply and demand; elasticity
        iii. Unlimited wants and competition

iv. Types of resources
v. Reasons for coordination failure
vi. Problem of setting boundaries
vii. Concept of payment for environment services, green accounting, and tax

II. Scarcity and social coordination systems
  a. Scarcity and need for social coordination
  b. Property rights and other rules and incentives
  c. Social coordination tasks
  d. Market valuation and gain from market exchange
  e. Market incentives and valuation over time
  f. Valuation in planning; incentives

III. Methods of valuing ecosystems: definitions, uses and limitations
  a. Cost-benefit analysis
  b. Cost effectiveness analysis
  c. Hedonic pricing technique
  d. Contingent valuation
  e. Travel costs
  f. Opportunity costs
  g. Multiplier effects

IV. Reasons for coordination failures: Limitation of market signalling and incentives
  a. Common pool resources
    i. Issues with property rights and incentives
    ii. Existence and scale of problems
    iii. Market signals and overharvesting
    iv. Local solutions; common property arrangements
    v. Non-rival and non-excludable goods: dependence of non-excludability on non-rivalry; decentralized production of non-rival and excludable goods
    vi. Search for market solutions
  b. High cost of markets
    i. Missing markets and externalities
    ii. Non-market feedback mechanisms
    iii. Cost of specifying property rights
    iv. A market solution for acid rain: an example
    v. Scope and limitation of markets
  c. Limitations of government signalling and incentives
    i. Cost-benefit analysis of environmental changes
    ii. Valuing the environment and decision-making over time
    iii. Monitoring changes in economic-environmental systems

V. Local environmental problems
  a. Social coordination under uncertainty
  b. Social coordination in waste management and recycling
  c. Economics of pollution control
  d. Management of common pool resources

VI. Worldwide problems and uncertainty
  a. Economics of global pollution
    i. ozone depletion
    ii. climate change
  b. Economics of biodiversity significance, loss, and preservation measures

Essential Readings:

1. Hanley, N., Shogren, F.J. and White, B. (2012). Introduction to Environmental Economics, 2nd Ed. Oxford University Press, Great Britain.
2. Tietenberg, T. (2006). Environmental and Natural Resource Economics, 5th Ed., Published by Pearson Addison-Wiesley. Boston.
3. Wills, I. (2007). Economics and the Environment: A signalling and Incentive Approach, 2nd Ed. Allen and Unwin, Australia.

4. Wright, R. T, and Boorse, D.F, (2011). Environmental Science – Towards a Sustainable Future, 11th Edition, PHI Learning Private Limited, New Delhi.

Additional Readings:

1. Common, M. and Stagl, S. (2005). Ecological Economics: An introduction. Cambridge University Press. isbn-10 0-521-01670-3
2. Curkovic, S (2012), Sustainable Development - Authoritative and Leading Edge Content for Environmental Management. InTech, Croatia. *(eBook).*
3. Haab, T. C. (editor) and Whitehead J C. (2014). Environmental and Natural Resource Economics. Greenwood.
4. Pearce, D.W. and Pearce, C. (2001). The Value of Ecosystems. Convention of Biodiversity, Montreal. http://www.cbd.int/doc/publications/cbd-ts-04.pdf
5. Quarrie, J. (1992). Earth Summit '92, The United Nations Conference on Environment and Development. Rio de Janerio., Regency Press, London.

Date last updated: May 30, 2015

Module Code and Title: **ENM203 Agriculture and Land Management**

Programme(s): BSc Environmental Management

Credit Value: 12

Module Tutor(s): Bach-Lien Ngo (Coordinator)
GP Sharma
Jesse Montes

General objective(s) of the module:

The overall objective of the module is to provide students with an overview of the importance of land and agriculture, especially in terms of satisfying human food and fibre needs, enhancing environmental quality, and maintaining the natural resource base upon which the agricultural economy depends. Further, the module deals with the current state of affairs and underlying methods and frameworks for making the most efficient use of non-renewable resources and on-farm resources that integrate, where appropriate, natural biological cycles and controls, helping to sustain the economic viability of farm operations and enhance the quality of life for farmers and society as a whole. The module will provide students with an understanding of the issues surrounding soils, agriculture, pastures, and animal husbandry.

Learning outcomes – Upon successful completion of the module, students will be able to:

- Compare and contrast industrialized and subsistence farming/agriculture.
- Describe the environmental impacts of industrialized agriculture including land degradation and habitat fragmentation.
- Recall the benefits of pesticides in diseases control and crop protection.
- Summarize the problems associated with pesticide use, e.g., ecosystem imbalance, bioaccumulation and biological magnification, and mobility in the environment.
- Describe alternative ways to control pests.
- Contrast sustainable agriculture with conventional agriculture.
- Identify the potential benefits and problems of genetic engineering.
- Discuss the changes that came about from the green revolution through to the gene revolution, particularly emphasizing promise vs. problems, and relevant policies.
- Assess the dependence of agriculture on soils
- Describe the various problems related to soil degradation.

- Review the various agricultural and animal husbandry practices that exist and their respective advantages and disadvantages from environmental, economic and social points of views.
- Compare the options that exist to make forestry, animal husbandry and agriculture more sustainable.

Skills to be developed:

- Students should gain awareness on and basic skills related to work in simple gardens for growing organic vegetables and other crops.

Learning and teaching approaches used:

The module will be conducted over 15 teaching weeks as follows:

- 4 hrs/wk lecture & discussions, group work, and presentations.
- 1 hr/wk practical each week on average, involving practice in the agricultural plot.
- 3 hrs/wk outside of class, on average, for independent study.
- One block-day field trip to the National Mushroom Centre.
- A block week for field studies, shared with the other modules in this semester. Students will need to keep a journal of their observations and work in the weekly practical work as well as the block-week field studies, and incorporate GIS measurements related to agricultural practices in Bhutan.

Assessment:

Semester-End Examination (SE):40%
Continuous Assessment (CA): 60%

CA Assessment	Weight	Assessment Detail
Individual assignment	15%	Case study on agroforestry or permaculture or climate-smart agriculture, with report of 1500 words.
Field visit presentation (from block week)	15%	Group presentation (45 min / group of 4) on observations of agriculture in Bhutan.
Practical report (from weekly exercises)	15%	10% from field observations and assessment of physical works in the agricultural plot, 5% from group field report from visit to the National Mushroom Centre.
Midterm Exam	15%	

Pre-requisite knowledge: EVS 111 Introduction to the Environment

Subject matter:

I. Population and world hunger
   a. Causes, hunger hot-spots
   b. Extent and consequences of hunger
   c. Food aid
II. Challenges in agriculture
   a. Loss of agricultural lands
   b. Global decline in domesticated plants and domestic animals
   c. Increasing crop and livestock yields impediment
   d. Impetus and development of conservation agriculture
III. Soil
   a. Components
   b. Profiles
   c. Texture
   d. Horizons
   e. Functions, factors affecting efficacy

f. Phases in the formation of soil
g. Condition of soil pollution across the globe
h. Categories, causes and mechanisms of soil degradation
i. Soil conservation methods including bioengineering benefits
j. Soil treatment, e.g. steaming
k. Types of land pollution
l. Land degradation - pollution, salinization, man-made hazards
m. Public policy and soils
n. Abatement of land/soil pollution by regulatory and physical measures
o. Introduction to soil and agriculture

IV. Agroecosystems
a. Traditional and industrial agriculture pros and cons
b. Shifting cultivation- history, advantages and disadvantages, present trend
c. Green Revolution- history , benefits and impacts
d. Livelihoods and agricultural products in the agro-ecological zones of Bhutan
e. Mushroom, horticulture (fruits & vegetables) enhancement, marketing and hurdles in Bhutan.
f. Pollination of crops through apiculture development – importance, trend and management
g. Pest control – narrow spectrum and broad spectrum of pesticides
h. Benefits of pesticides in disease control and crop protection

V. Agroforestry
a. Definition and types of agroforestry
b. Direct-use and indirect-use values of agroforestry
c. SALT (Sloping Agriculture Land Technology):
i. Definition and importance
ii. Related practices and case studies from Bhutan, Philippines, and USA
d. Agroforestry development in Bhutan; research activities for enhancement of agroforestry in Bhutan

VI. Sustainable Agriculture
a. Integrated Pest Management, importance and intervention
b. Organic farming for sustainable agribusiness
c. Climate-smart farming
d. Agroforestry - types, importance, intervention in Bhutan
e. Permaculture - definition, importance and trend
f. Genetic engineering for food production for growing population
g. Food security in the world - green banking, food distribution and trade
h. From green revolution to gene revolution - promise, problems and policies.

Essential Readings

1. Barrow, C.J. (2012). Environmental Management for Sustainable Development, 2nd Edition, Routledge, London, New York.
2. Bharucha, E. (2010). Text book for Environmental Studies for Undergraduate Course, Universities Press Hyderabad, India.
3. Brady N. C & Weil, R. P. (2001). The Nature and Properties of Soil. Pearson Education, India
4. Miller, G.T., and Spoolman, S.E. (2014). Environmental Science 14th Ed. New Delhi: Cengage Learning.
5. Ministry of Agriculture. (2008). Plant Genetic Resources of Bhutan, Published by National Biodiversity Centre, Thimphu, Bhutan.
6. Ministry of Agriculture. (2008). Animal Genetic resources of Bhutan, Published by National Biodiversity Centre, Thimphu, Bhutan
7. Rose, C. W. (2004). An Introduction to the Environmental Physics of Soil, Water and Watersheds. Cambridge University Press.
8. Wild, A. (2003). Soils, land and food: managing soils during the 21st century. Cambridge University Press, UK.

Additional Readings:

1. Acquaah,G..(2004). *Principles of Crop Production: Theory, Techniques and Technology*, Prentice Hall.
2. Begon, M, Townsend, C.R., and Harper, J. L. (2005). Ecology : From Individuals to Ecosystems, 4th Edition, Willey-Black, USA, New Zealand
3. Buck, L.E., Lassoie J.P., and Fernandes, E.C.M. (1999) Agroforestry in Sustainable Agricultural Systems. CRC Press LLC, New York.
4. Hanumantha Rao, C. H. (2006). Agriculture, Food Security, Poverty, and Environment Essays on Post-reform India. Oxford University Press India.
5. International Institute of Rural Reconstruction (IIRR). (1990). Agroforestry Technology Information Kit (ATIK). Cavite Publisher: Los Banos, Philippines.
6. Ives, J. D and Messerli, B. (1989). The Himalayan Dilemma, Reconciling Development and Conservation, United Nations University Press, Routledge, London.
7. Norris, R. F., Caswell-Chen E. P & Kogan, M. (2002). *Concepts in Integrated Pest Management*. Prentice Hall.
8. Ohsawa, M. (1987). Life Zone Ecology of the Bhutan Himalaya, Laboratory of Ecology, Chiba University, Japan. *(eBook).*
9. Roling N. G & Wagemakers, M. A. E., (1998). Facilitating Sustainable Agriculture. Cambridge University Press
10. Shiva, V. (2005). The Impoverishment of the Environment: Women and Children Last. Environmental Philosophy: From Animal Rights to Radical Ecology, 4th Ed. Pearson Education Inc. Upper Saddle River, NJ.
11. Wild, A. (1993). *Soils and the Environment.* Cambridge University Press, UK.

Date last updated: May 30, 2015

Module Code and Title: **GIS202 Geographic Information Sciences II**

Programme(s): BSc Environmental Management

Credit Value: 12

Module Tutor(s): Samir Patel (Coordinator)
Radhika Chhetri
Jesse Montes
Nima Wangmo

General objective(s) of the module:

This module follows on the general introduction to GIS in a previous semester and allows students delve deeper into problem solving and decision making using geospatial analysis techniques, applicable to a range of disciplines but with particular emphasis on environmental management. The module is based on GeoTech Center's model course on geospatial analysis.

Learning outcomes – Upon successful completion of the module, students will be able to:

- Prepare GIS data for use in analysis.
- Determine an appropriate approach to solving a problem or answering a question using geospatial tools and methods.
- Run geoprocessing tools individually.
- Implement a model to run several geoprocessing tools in sequence.
- Organize the data sets resulting from analysis.
- Apply the principles of geospatial analysis to an environmental management problem.
- Present the results of a geospatial analysis using appropriate terminology and visualizations.

Skills to be developed:

- Students should learn how to work more intimately with data: describe and demonstrate how to access different sources of data, describe and demonstrate the process of creating data, and discuss the fundamental concepts of data quality.

Learning and teaching approaches used:

The module will be conducted over 15 teaching weeks as follows:

- 3 hrs/wk lecture & discussions.
- 3 hrs/wk practical in a computer lab.
- 2 hrs/wk outside of class, on average, for independent study, including some field work using GPS in coordination with requirements of other modules this semester.

Assessment:

Semester-End Examination (SE):30%
Continuous Assessment (CA): 70%

CA Assessment	Weight	Assessment Detail
Quizzes (4% x 5)	20%	Short written individual quizzes of 30 min duration each, covering approximately 3 weeks of subject matter.
Presentations (2 x 10%)	20%	Individual 10 min presentation with 2-5 min Q&A.
Group Assignment	10%	GIS-based group project output report (1000 words plus data and maps)
Individual project	20%	GIS-based individual work and output report (1000 words plus data and maps).

Pre-requisite knowledge: GIS201 Geographic Information Sciences I

Subject matter:

I. Review of the basics of geospatial data
   a. Review the basics of geospatial data including data organization in an appropriate format such as a geodatabase; the importance and role of coordinate system definition and projection between coordinate systems; the differences between vector and raster data formats; and basic cartographic and data presentation techniques.

II. Introduction to geospatial analysis
   a. Start to think about using geospatial data to explore data relationships.
   b. Learn how to prepare a simple data set using a straightforward method such as a join.
   c. Classify quantitative data using a variety of statistical methods.
   d. Create a scatter plot of data and present results of analysis in graph and cartographic format.

III. Using Advanced Attribute and Spatial Queries for Data Exploration
   a. Given a data set, perform advanced queries to prepare the data for use in analysis; spatial and attribute selections.
   b. Use a data dictionary to decipher coded data in an attribute table.
   c. Determine how to use queries to address a question.
   d. Learn about selection by location and buffering.

IV. Vector data analysis: overlay techniques
   a. Learn vector overlay analysis tools and concepts including union, intersect and identity, and how these tools can be used to analyse multiple geospatial data sets to answer a question.
   b. Convert from coverage format to modern GIS data format.
   c. Learn about changing environment settings to enhance data organization.

V. Vector data analysis: creating a site selection model
   a. Learn proximity analysis including buffering points, lines and polygons.
   b. Learn the concept of a geospatial data model by developing flow charts.
   c. Develop a model that satisfies multiple location criteria for a given project.

VI. Vector data analysis: network analysis
   a. Prepare a vector data set for use in a network routing exercise including building topology.
   b. Use network techniques to create efficient routes including modelling of impedances.
   c. Generate service areas based on network analysis.

VII. Building an automated model
   a. Learn how to implement a multi-step model using automation tools, e.g. Model Builder in ArcGIS.
   b. Learn to set appropriate environmental settings prior to running a model.
   c. Set model parameters in order to alter model inputs.
   d. Export their model to a script and edit the script using Python.

VIII. Raster data analysis: working with topographic data
   a. Learn how to use raw elevation data to create slope, aspect and hillshade surfaces.
   b. Use elevation and derived data sets to analyse an environmental issue.
   c. Reclassify raster data and use in a map algebra-based model, including weighting techniques.
   d. Use viewshed analysis to enhance site selection.

IX. Raster data analysis: working with hydrographic data
   a. Obtain appropriate data sets and use them to do a surface hydrological analysis.
   b. Generate streams using flow direction and accumulation surfaces.
   c. Create watersheds based on topographic data.
   d. Use hydrographic data to analyse a scientific question.

X. Raster data analysis: density surfaces
   a. Interpolate data density surfaces from point data using appropriate methods.
   b. Convert between vector and raster format.
   c. Develop an approach to a given question using density techniques.

XI. Final Project
   a. Solve a problem using geospatial technology from goals and data acquisition to analysis and processing to cartographic presentation and publishing.
   b. Create own data using electronic methods.

Essential Readings:

1. Chang, K. (2007). Introduction to Geographic Information Systems. New Delhi: Tata McGraw-Hill Education.
2. DiBiase, D. (continually updated). Nature of Geographic Information. Penn State: https://www.e-education.psu.edu/natureofgeoinfo/
3. Schmandt, M (continually updated). GIS Commons: An Introductory Textbook on Geographic Information Systems: http://giscommons.org
4. Fundamentals of Remote Sensing, published by Natural Resources Canada: http://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/earthsciences/pdf/resource/tutor/fundam/pdf/fundamentals_e.pdf
5. Sutton, T., Dassau, O., Sutton, M. (2009) A Gentle Introduction to GIS, Eastern Cape, South Africa: http://download.osgeo.org/qgis/doc/manual/qgis-1.0.0_a-gentle-gis-introduction_en.pdf

Additional Readings:

1. Ballard, A. (2011). Course Resources for GST102 – Spatial Analysis. GeoTech Center Model Courses (GST 102 Spatial Analysis Course). http://www.geotechcenter.org/model-courses.html
2. Bolstad, P. (2012). GIS Fundamentals: A First Text on Geographic Information Systems, 4th ed. Eider Press.
3. ESRI ArcNews, http://www.esri.com/news/arcnews/index.html

4. ESRI ArcUser, http://www.esri.com/news/arcuser/index.html
5. Law, W. and Collins, A. (2013). Getting to Know ArcGIS Desktop, 3rd Ed. Esri press.
6. GeoTech Teaching Resources, http://www.geotechcenter.org
7. Gorr, W.L. and Kurland, K.S. (2010). GIS Tutorial 1: Basic Workbook 4th ed. Esri Press.
8. Scally, R. (2006). GIS for Environmental Management. Esri Press.

Date last updated: May 30, 2015

Module Code and Title: **ENM304 Environmental Hazards Management**

Programme(s): BSc Environmental Management

Credit Value: 12

Module Tutor(s): GP Sharma (Coordinator)
Deki Phuntsho Yonten
Nima Wangmo

General objective(s) of the module:

This module introduces students to the major causes, effects, and control measures for various types of environmental hazards, and how these impact the environment and the health and well-being of humans. An overview of biological and chemical hazards is given. Students will also have an opportunity to familiarize themselves with local and regional risk reduction measures and pollution standards and regulations. This module will also provide students with an in-depth insight and understanding of issues related to the anthropogenic greenhouse effect, climate change and global warming. Air pollution is covered in detail, while major land and water pollution issues are also briefly reviewed. The module further delves into sociological and technological hazards to the environment. Finally, the module gives an overview of natural hazards, their potential to cause environmental disasters, and options for pre-planning for them or mitigating their effects.

Learning outcomes – Upon successful completion of the module, students will be able to:

- Describe types of biological hazards and common risk reduction measures thereof.
- Describe types of chemical hazards, their various sources, and risk reduction measures thereof.
- Discuss major sources of air pollution.
- Choose appropriate control measures for important air pollutants.
- Describe environmental and health issues of various air pollutants and the role humans play in generation of these pollutants.
- Express and defend an opinion on issues related to climate change and global warming.
- Identify possible solutions for prevention, mitigation and adaptation to climate change.
- Recall local, regional and international air and water quality standards.
- Assess and monitor air quality at a basic level.
- Explain the net result of inadequately managed man-made hazards and how they typically cost the most in terms of human suffering, loss of life and long-term damage to a country's economy and productive capacity.
- Identify common natural hazards.
- Describe how human activities can increases susceptibility to natural disasters.
- Evaluate options for pre-planning for and mitigation of natural hazards.

Skills to be developed:

- Students will be able to design and carry out simple surveys.

Learning and teaching approaches used:

The module will be conducted over 15 teaching weeks as follows:

- 3 hrs/wk lecture & discussions.
- 1 hr/wk practical on incorporating pollution measurement studies. Students will practice basic air quality testing, including gathering dust records using a dust sampler machine and other testing kits. Students will also need to carry out a basic survey pertaining to hazard occurrence and preparedness, or mitigation measures.
- 4 hrs/wk of independent study.

Assessment:

Semester-End Examination (SE):40%
Continuous Assessment (CA): 60%

CA Assessment	Weight	Assessment Detail
Individual presentation	15%	Creation of brochure and sensitization plan for pre-planning and mitigation of natural hazards (e.g flood, earthquake)
Poster presentation	15%	Group (2 students) poster on air pollution and climate change causes, effects, and mitigation measures
Practical reports	10%	Analysis report from air quality testing using dust sampler
Midterm Exam	20%	

Pre-requisite knowledge: CLM101 Introduction to Climate and Weather Studies, ENM202 Water Resources Management, ENM203 Agriculture and Land Management

Subject matter:

I. Overview of environmental hazards
   a. Concept of risk, risk assessment, and risk management
   b. Types of environmental hazards
II. Biological hazards
   a. Infectious diseases: common types and examples, risk reduction thereof
   b. Non-transmissible diseases: genetic and lifestyle based, risk reduction thereof
III. Chemical hazards
   a. Types and categories (e.g. toxic, carcinogens, teratogens)
   b. Potential effects on health of humans and ecosystems
   c. Common sources, mobility, and mitigation measures
IV. Air Pollution
   a. Nature of the atmosphere: composition and function
   b. Natural and anthropogenic sources of atmospheric pollutants
   c. Significance, transport and dispersion of pollutants
   d. Local, regional & global air pollutants
   e. Historical development of temperature and climate on earth
   f. Sources and sinks of greenhouse gases
   g. Factors contributing to increasing greenhouse gases in the atmosphere
   h. Recent scientific data favouring the theory that anthropogenic activities are key responsible for the enhanced greenhouse effect
   i. Impact of global warming/the enhanced greenhouse effect
   j. Strategies for prevention, mitigation and adaptation to global climate change (including carbon budgeting and the Kyoto Protocol)
   k. Stratospheric ozone depletion
   l. Acid deposition, photochemical smog & ozone depletion
   m. Health effects of air pollution
   n. Atmospheric pollutants control measures
   o. Air quality standards & regulations (local, regional & international)

p. Indoor air pollution: health effect on human and environment

V. Review of land and water pollution
   a. Brief review of types, causes, impacts, and mitigation measures for land pollution
   b. Brief review of types, causes, impacts, and mitigation measures for water pollution

VI. Technological hazards
   a. Industries and transportation: impacts and measures
   b. Technological hazards from the information revolution; impacts on environment

VII. Sociological hazards
   a. Crime, civil disorder, impacts and measures to protect life and properties and managing environment.
   b. Impacts of sociological hazards affect economy, ecosystems and livelihood.

VIII. Natural hazards
   a. Definitions
   b. Potentially hazardous natural phenomena: atmospheric, seismic, geologic, hydrologic, volcanic, weather-related; acute vs. long-term
   c. Anthropogenic activities exposing susceptibility/vulnerabilities to natural phenomena
   d. Mitigation efforts and sustainable development to minimize effects of natural hazards
   e. Hazards management and development planning (Integrated Development Planning for Natural Hazard Management)

Essential Readings:

1. Datta, SK. (2006). Soil Conservation and Land Management, Published by International Book Distributors, Dehradun, India.
2. Department of Regional Development and Environment Executive Secretariat for Economic and Social Affairs Organization of American States. (1991). Primer on Natural Hazard Management in Integrated Regional Development Planning: Ch 1. Incorporating Natural Hazard Management into the Development and Planning Process. https://www.oas.org/dsd/publications/Unit/oea66e/ch01.htm
3. Gyelyong Tshokhang (2012). Waste Prevention and Management Regulation. Printed at Phama Printers and Publisher, Bhutan.
4. Miller, G.T., and Spoolman, S.E. (2014). Environmental Science 14th Ed. New Delhi: Cengage Learning.
5. Murnaghan, N. and Stocking, M. (2001). Handbook for the Field Assessment of Land Degradation, Earthscan Publication Ltd, London.
6. National Environment Commission (2010). Strategy for Air Quality Assessment and Management in Bhutan, Published by NEC, Thimphu.
7. Prasad, S.N. (2008). Environmental Hazards: Challenges and Management. Pointer Publishers.
8. Quarrie, J. (1992). Earth Summit '92, The United Nations Conference on Environment and Development. Rio de Janerio., Published by the Regency Press, London.

Additional Readings:

1. Barrow, C.J. (2012). Environmental Management for Sustainable Development, 2nd Edition, Routledge, London, New York.
2. Boubel, R.W., Fox, D. L & Turner, B. (1994). Fundamentals of Air Pollution. Elsevier Science & Technology. USA.
3. Carson, R. (2002). Silent Spring, 40th Anniversary edition, Houghton Mifin, Publication, Boston.
4. Cunningham, W. P. (2009). Principles of Environmental Science: Inquiry and Application, Published by Tata McGraw Hill, New Delhi
5. Gupta, A. (2002). Environment pollution: Developed Countries vs Less Developed Countries, International Book distributors, Dehradun. India.

6. Harrision, R. M (Ed.). (2001): Pollution: Causes, Effects and Control. Royal Society of Chemistry
7. Hill, M. (2004). Understanding Environmental Pollution. Cambridge University Press
8. Ives, J.D. and Messerli, B. (1989). The Himalayan Dilemma: Reconciling Development and Conservation. Routelage.
9. National Environment Commission. (2008). Bhutan National Adaptation Programme of Action. Printed by Phama Printers, Thimphu
10. National Environment Commission. (2012). Waste Prevention and Management Act of Bhutan, Gyelyong Tshokhang, Thimphu, Bhutan.
11. Shyam, S. (2006). Air Pollution and its Impacts on Plant Growth. Eastern Book Corporation.
12. Sherubtse Colllege. (1994). Bhutan and its Natural Resources, Workshop's Proceedings, printed at Ramprintograph, New Delhi.
13. Smith, K. (2013). Environmental Hazards: Assessing Risk and Reducing Disaster, 6th Ed. Routelage.
14. Viessman, W. Jr. & Hammer M.J. (2005). Water Supply and Pollution Control. Pearson Education.

Date last updated: May 30, 2015

Module Code and Title: **ENM305 Urban Environmental Management**

Programme(s): BSc Environmental Management

Credit Value: 12

Module Tutor(s): Leishipem Khamrang (Coordinator)
Radhika Chhetri
Nima Wangmo
Jesse Montes

General objective(s) of the module:

Urban environments and ecosystems encompass all of the elements of rural areas, but include large human populations and their associated built environments. This module integrates classical ecology with fundamental concepts from other fields, including engineering, architecture, anthropology, economics, and law, to address the unique ecosystems that are urban environments. Students will learn about the complexity of issues that affect daily quality of life as well as the long-term health of the environment. Students will gain an appreciation for professional careers in environmental and sustainability planning, urban planning, public policy, and community development.

Learning outcomes – Upon successful completion of the module, students will be able to:

- Define urbanization and posit why cities grow.
- Describe and interpret the merits of urban development.
- Investigate the attitude differences of people (societal behaviour) living in towns and rural areas, and postulate the underlying reasons for such differences.
- Explain the environmental impacts of urban sprawl in regions worldwide and in Bhutan.
- Analyse the importance of smart growth of cities/town for making cities liveable.
- Discuss how urbanization may pose greater risks from extreme climatic events such as storms, floods or urban heat, as well as changes in species distribution including pathogens.
- Describe the concept of green cities.
- Examine the benefits that can accrue for town/city dwellers from greening efforts.
- Explain how restoring urban ecological functions can promote city resilience while having a positive effect on human health and well-being.

- Evaluate options for reducing adverse impacts of business operations and products on air, water, land and living organisms to a level where the cost to society of further reductions are no longer offset by the benefits.
- Discuss the successes, failures, and challenges of urban environmental approaches in developing and developed countries.

Learning and teaching approaches used:

The module will be conducted over 15 teaching weeks as follows:

- 3 hrs/wk lecture & discussions.
- 1 hr/wk case studies, projects, brainstorming, guest lectures, seminars, group activities, demonstrations, and panel discussions.
- 4 hrs/wk outside of class, on average, for independent study.
- One block-day field trip around Thimphu to evaluate the status of urban planning in Bhutan's capital, or other urban area. Students will also collection information on storms, floods, urban heat, changes in species and pathogens (comparative study between towns and villages).

Assessment:

Semester-End Examination (SE):40%
Continuous Assessment (CA): 60%

CA Assessment	Weight	Assessment Detail
Individual Assignment	15%	Essay on urban challenges in Bhutan, including personal reflections and proposed strategies; 750 words.
Quizzes (2 x 5%)	10%	Two written quizzes of 30 min each.
Practical (field work)	20%	Group work (3-4 students) - comparative/evaluative study between towns and villages nearby the college with respect to status and health of urban planning, culminating in a 20-30 min presentation.
Midterm Exam	15%	

Pre-requisite knowledge: ECL101 Principles of Ecology, ENV102 Population, Development, and Environment, ENM202 Water Resources Management, ENM203 Agriculture and Land Management

Subject matter:

I. Brief historical overview of urban development
    a. Characteristic processes of urbanization
II. City/ town as a system
    a. Urban atmosphere and climate
    b. Solar energy in cities
    c. Large population
    d. Expanding cities
        i. Push and pull factor
        ii. Government policies
III. Benefits of urban development
    a. Society
    b. Ecosystems
    c. Economics
    d. Ethics
IV. Environmental impacts of urban sprawl
    a. Urban blight
    b. Cities and the rivers
    c. Economic disparity
    d. Transportation in cities and traffic congestion

e. Water in urban environment
f. Air quality
g. Housing problems
h. Insufficient sewage treatment

V. Green urban development and smart growth of cities
   a. Green cities
      i. Concepts
      ii. Key/common features: Commitment to greening, green purchasing, green construction, green energy, green landscapes and infrastructure, multi-use compact communities, accessibility and green transportation, eco-friendly waste management.
      iii. Benefits for urban dwellers
      iv. Green certifications, e.g. LEED
   b. Smart growth: urban planning and development towards green cities
      i. Planning for infrastructure development
      ii. City planning city for defence and resilience
      iii. Industries and their management in urban areas
      iv. Compact neighbourhoods
      v. Systematic Transport arrangement and enhancement; mass transits for liveable cities
      vi. Recreation facilities and aesthetics
      vii. Enhancement of Sewage treatment
      viii. Supportive zoning policies
   c. Restoring urban ecological functions
      i. Redevelopment towards green cities
      ii. Reintroduction of biodiversity, e.g. urban domestic gardens and parks
      iii. Water and waste management restructuring

VI. Organizations and networks such as Society for Urban Ecology and the Urban Climate Change Research Network (UCCRN) and others

VII. Urban challenges in the developing and developed world and some case studies.

Essential Readings:

1. Botkin, D.B. (2011). Environmental Science, Earth as a Living Planet,8th Edition, John Wiley and Sons Inc., USA.
2. Bharucha, E. (2010). Textbook for Environmental Studies for Undergraduate Courses. University Grants Commission, Bharati Vidyapeeth Institute of Environmental Education and Research, Pune, New Delhi.
3. Global Development Research Center. (2014). Urban Environmental Management Virtual Library. (http://www.gdrc.org/uem/index.html).
4. Miller, G.T., and Spoolman, S.E. (2014). Environmental Science 14th Ed. New Delhi: Cengage Learning.
5. Singh, A.L. and Fazah, S., eds. (2008). Urban Environmental Management. New Delhi: B.R. Publishing Corporation.

Additional Readings:

1. Alexandria, E. and Jones, P. (2008). Building and Environment, Temperature increase in an urban canyon due to Green walls and green roofs in diverse climate, Building and Environment, pp 480- 493.
2. Asian Development Bank. (2014). ADB GrEEEn Cities Initiative. http://www.adb.org/green-cities/
3. Berg, L.R., Hager, M.C., Hassenzahl, D.M. (2012). Visualizing Environmental Science, 3rd Edition, Wiley in Collaboration with NG Society, USA.
4. Cunningham, W. P and Cunningham, M. A. (2012). Principles of Environmental Science: Inquiry and Application. 6th Edition, Tata McGraw-Hill, USA.

5. Gaston, K.J. (2010). Urbanization. Urban Ecology (Ed. KJ Gaston) pp 1034, Cambridge University Press.
6. Hanaki, K. (Ed.). (2008). Urban Environmental Management and Technology (cSUR-UT Series: Library for Sustainable Urban Regeneration). Springer.
7. Loram, A, Warren, P.H., Gaston, K.J. (2008). Environmental Management, Urban Domestic Garden (XIV), The Characteristics of Garden in Five Cities, 42. pp 361-379.
8. Newman, P & Jennings, I. (2008). Cities as Sustainable Ecosystems, Principles and Practices, Island Press, Washington DC, USA.
9. Singh, A.L. and Fazah, S., eds. (2008). Urban Environmental Management. New Delhi: B.R. Publishing Corporation.

Date last updated: May 30, 2015

Module Code and Title: **ENM306 Environmental Impact Assessment**

Programme(s): BSc Environmental Management

Credit Value: 12

Module Tutor(s): Jesse Montes (Coordinator)
GP Sharma
Deki Phuntsho Yonten
Tshering Dolkar

General objective(s) of the module:

This module will provide an introduction to environmental planning and environmental impact assessment (EIA). Major module components include goals and approaches to environmental planning, dealing with key environmental and social issues as well as natural hazards, history and practice of EIA, tools and methodologies, and case studies. The module strongly emphasizes physical and social science aspects due to the interdisciplinary nature of the planning and EIA fields.

Learning outcomes – Upon successful completion of the module, students will be able to:

- Explain key steps in a project cycle and apply them to environmental planning.
- Describe the delicate interplay between natural and human environments.
- Describe key themes and approaches for environmental planning.
- Explain the idea of EIA – its history, principles, process, methods and best practices.
- Outline the processes for conducting EIAs.
- Discuss emerging approaches for EIA.
- Describe the legislative context for EIA in Bhutan.
- Analyse potential issues and bottlenecks that can arise with EIAs.
- Explain the role of NEC and other key stakeholders for EIA in Bhutan.
- Discuss common mechanisms involved in environmental compliance.
- Conduct a sample EIA.
- Critically evaluate an EIA.

Skills to be developed:

- Students should learn how to analyse project/development proposals for key information.

Learning and teaching approaches used:

The module will be conducted over 15 teaching weeks as follows:

- 3 hrs/wk lecture & discussions.
- 1 hr/wk guest lectures, group discussions, practice EIA analysis, and the presentation thereof.
- 4 hrs/wk outside of class, on average, for independent study.
- A block-day field trip and accompanying field report to an active development site to conduct a sample EIA.

Assessment:

Semester-End Examination (SE):40%
Continuous Assessment (CA): 60%

CA Assessment	Weight	Assessment Detail
Group Project	20%	Group (3 students) project work on NEC's eight sectoral EIA guidelines; EIA will be carried out around college campus. Written report of 2000 words (10%) and 10 min presentation (5%).
Quizzes (3 x 5%)	15%	One verbal quizzes of 5 minutes and two written of 30 min each.
Field Report	10%	Group (3 students) field visit report, 1000 words.
Midterm Exam	15%	

Pre-requisite knowledge: ENM101 Energy Resources and Materials Management, BDC202 Biodiversity Conservation and Management II, ENM202 Water Resources Management, ENM203 Agriculture and Land Management

Subject matter:

I. Environmental management
   a. Values
   b. Historical paradigms
   c. Sustainable development
II. Landscape planning
   a. Characteristics of landscapes: geology, hydrodynamics, soils, ecology, human settlement patterns and historical development
   b. Scenic and visual aspects of landscapes: nature and extent of visual impacts and qualities relating to locations and proposals
   c. Health of landscapes
   d. Integrated landscape planning goals and processes; stakeholder coordination
III. Environmental planning
   a. Approaches
   b. Interdisciplinary aspects
   c. Environmental evaluation
IV. Land-use planning
   a. Urban sprawl & growth management
   b. Land-use impacts
   c. Bioengineering & industrial ecology
V. Emerging approaches
   a. Brief review of community-based management (covered fully in BDC202)
   b. Brief review of watershed management (covered fully in ENM202)
   c. Adaptive management
      i. Key features
      ii. Use in environmental practices
      iii. Applications for specific environmental projects
   d. Ecosystem management
VI. Environmental Impact Assessment
   a. Introduction to EIA
      i. Definition, history, principles

ii. EIA procedures: screening, scoping, managing impacts, alternatives, implementation, monitoring, evaluation, modification

b. Public participation
   i. Collaborative planning
   ii. Tools for participation
   iii. Traditional ecological knowledge
   iv. Participatory rural appraisal
c. EIA methodologies
   i. Checklists & matrices
   ii. Networks
   iii. Cost-benefit analyses
d. EIA in Bhutan
   i. EA Act (2000) and Regulations (2002)
   ii. NEC
   iii. Guidelines & IEE Forms
   iv. Review of IEE applications and EIAs submitted to NEC
e. Strengths & weaknesses of EIA; case studies
f. Developments in EIA practice
   i. Strategic Environmental Assessment
   ii. Community-Based Environmental Assessment

VII. Environmental compliance
   a. Concept, definition, and scope
   b. Relationship to environmental concerns, laws, regulations, standards, permits
   c. Environmental audit: definition and purpose
   d. Indicators and monitoring protocols
   e. Types of environmental audits: compliance audits and management system audits
   f. Audit tools and technology
   g. Environmental auditing in Bhutan and region with case studies

Essential Readings:

1. Gilpin, A. (1995). Environmental Impact Assessment: Cutting Edge for the 21st Century. Cambridge University Press.
2. Glasson, J. (2005). Introduction to Environmental Impact Assessment. Spon Press UK
3. National Environment Commission. (2000). Environment Assessment Act 2000 and Regulations for the Environmental Clearance of Projects from the NEC website.
4. National Environment Commission. (1999). EIA- Background Document, Sectoral guidelines (full set). National Environment Commission. Royal Government of Bhutan.
5. Randolph, J. (2004). Environmental Land Use Planning and Management, Ch. 1-4. Washington: Island Press.

Additional Readings:

1. Conkin, P.K. (2007). The State of the Earth Environmental Challenges on the Road to 2100, University Press of Kentucky, Lexington. USA.
2. Hoban, T.M. (1996). Green Justice: The Environment and Courts, West view press, Boulder, Colorado.
3. Morris, P & Therivel, R. (2001). Methods of Environmental Impact Assessment. Spon Press.UK
4. National Environment Commission. (1999). Mining and Mineral processing: Bhutanese Environmental Assessment Sectoral Guidelines, NEC Thimphu.
5. National Environment Commission. (2004). Environmental Discharge standards 2004, NEC, Thimphu.
6. National Environment Commission. (2007). National Environmental Protection Act of Bhutan 2007. Printed at Phama Printing and Publishers.
7. National Environment Commission. (2002). Regulations for the Environmental Clearance of Projects and regulation of Strategic Environmental assessment, NEC secretariat, Thimphu.

8. National Environment Commission. (2006). Reference manual for Environmental Impact assessment Training in Bhutan, NEC Publication, Thimphu.
9. Quarrie, J. (1992). Earth Summit '92, The United Nations Conference on Environment and Development. Rio de Janiero., Published by the Regency Press, London.
10. Ramachandra, T. V & Kulkarni. V. (2006) Environmental Management. Capital Publishing Company. New Delhi
11. Spaling, H. (2003). Innovation in environmental assessment of community-based projects in sub-Saharan Africa. The Canadian Geographer (47:2), pp151-168.
12. Tetlow, M. and Hanusch, M. (2012). Strategic environmental assessment: the state of the art. Impact Assessment and Project Appraisal (30:1), pp15-
13. Wright, R. T, Boorse, D.F. (2011). Environmental Science – Towards a Sustainable Future, 11th Edition, PHI Learning Private Limited, New Delhi.

Date last updated: May 30, 2015

Module Code and Title: **RSP301 Undergraduate Research Project I**

Programme(s): BSc Environmental Management

Credit Value: 24

Module Tutor(s): Samir Patel (Coordinator)
All other environment faculty

General objective(s) of the module:

RSP301 is the first part of a two-part year-long research course taught alongside the conduct of individual student research projects. It is intended to be half instructional and half guided independent study. Within the research project, students will individually conceptualize, design, implement, and analyse research. The Undergraduate Research Project Is intended to build on and be a culmination of the skills acquired through previous modules within the programme. Students should have already gained field experience and technical skills (statistics, GIS) previously. During the project, students will gain research experience that will facilitate future employment or future research in further studies. By means of the final product, students are expected to show proficiency in both the theory and practice of research. In the first part of the research course, students will learn about what research means, research methods, how to design a research project, and write an individual research proposal along with a substantial literature review. They will also learn about data collection, allowing them to proceed with that phase of their research projects as soon as the semester ends.

Learning outcomes – Upon successful completion of the module, students will be able to:

- Describe the characteristics of research.
- Explain a generalized overall research process.
- Describe the various types and categorizations of research.
- Rationalize the selection of specific research methods to address different types of research questions.
- Identify an appropriate sub-field of research within Environmental Management to begin a research project on.
- Choose a research question and formulate an applicable hypothesis.
- Identify and choose research methods appropriate for a particular project.
- Plan a research project relevant to the chosen subject area.
- Explain the merits of different sampling strategies.
- Discuss the relative advantages and applications of quantitative vs. qualitative methods.
- Analyse published primary literature.

- Select and gather information from relevant large datasets / databases.
- Compile an annotated bibliography.
- Write a literature review on a specific topic within the chosen subject area.
- Write a research proposal.
- Present and defend a research proposal.
- Demonstrate initial research skills related to subjects studied during the earlier modules of the program.

Skills to be developed:

- Students should learn how to think through and plan an individual research project, culminating in a written research proposal.

Learning and teaching approaches used:

The module will be conducted over 15 teaching weeks as follows:

- First 7 weeks:
  - 5 hrs/wk of lecture
  - 3 hrs/wk of primary literature reading and discussions
  - 8 hrs/wk of independent study
- Next 7 weeks:
  - 3 hrs/wk of lecture
  - 3 hrs/wk of primary literature reading and discussions
  - 2 hrs/wk of small group guidance on individual project proposals
  - 8 hrs/wk of independent study
- Final week:
  - Research proposal presentations and defence

Research supervisors will be identified by the module coordinator from among the Environmental Management faculty once students have finalized their topic selections, based on a rough matching of topics with faculty specializations. Approximately four faculty members in total will handle student supervision for up to 10 projects each. These faculty will be involved in the small group guidance time at the latter half of the semester.

Assessment:

Semester-End Examination (SE):30%
Continuous Assessment (CA): 70%

CA Assessment	Weight	Assessment Detail
Annotated Bibliography	5%	Week 5. Annotated bibliography with a minimum of 5 reference sources researched.
Draft literature review	10%	Week 8. Literature review of 1500 words.
Draft research design	10%	Week 11. Research paradigms to be employed along with justifications of their applicability to the research question; objectives, outline of methods for data collection and analysis; practical plan for operationalizing the study; 2500 words.
Compiled final research proposal	25%	Week 14. A complete research proposal with all requisite sections, commonly found in a proposal (as per Zhib Tshol: RUB Research Policies); 4000 words.
Research proposal presentation and defence	10%	Week 15. Presentation of 15 min and Q&A for 10 min.

Midterm Exam	10%	

Pre-requisite knowledge: EAP102 English for Academic Purposes II, IPS101 IT and Basic Problem Solving, STS101 Applied Statistics

Subject matter:

I. Understanding research
   a. What is research?
   b. Philosophy of research
   c. Experience/reasoning vs. research
      i. Deduction: theory guides research
      ii. Induction: theory is an outcome of research
   d. Empiricism
   e. Principles of scientific inquiry; overview of scientific research
   f. Overview of the research process in the social sciences
   g. Types of research
      i. Basic vs. applied
      ii. Primary vs. secondary
      iii. Based on purpose: Exploratory, Descriptive, Correlative, Explanatory
      iv. Quantitative vs. qualitative
   h. Characteristics of research

II. Overview of the research process

III. Designing a research project
   a. Narrowing in on a project: Research topics, research problems, research purpose, research questions, hypotheses
   b. Developing the research question
      i. Raising research questions and developing testable hypotheses
      ii. Developing research objectives and specific aims
   c. Constructing an appropriate research design
   d. Sample selection: considerations of size, representativeness, randomness, level of significance obtainable, possibilities of bias
   e. Types of designs and their quantitative and qualitative tools and implementations
      i. Experimental
      ii. Cross-sectional
      iii. Longitudinal
      iv. Case studies
      v. Comparative
   f. Reliability and validity; controlling bias

IV. Quantitative methods
   a. Overview, measurement, and data management
   b. Experimental
      i. Characteristics of experiments
      ii. Types of experimental design
      iii. Experimental validity
   c. Descriptive and correlational
      i. Causation and prediction
      ii. Data collection and analysis
   d. Review of data management and analysis using SPSS

V. Qualitative methods
   a. Overview and introduction to qualitative research
   b. Measurement and data collection
   c. Designing qualitative research and sampling
   d. Broad types of qualitative methods
      i. Ethnography
      ii. Phenomenology
      iii. Case studies

iv. Textual analysis
v. Applied research

e. Qualitative research tools (e.g. interviews, focus groups, observation)

VI. Sources of previously gathered data
   a. Primary literature; common literature search techniques and journal collations
   b. Online published datasets and databases
   c. Data repositories, e.g. government archives, special library collections

VII. Literature Reviews and Research Proposals
   a. Overview; what is a research proposal and why write one
   b. Parts of a research proposal
   c. Special focus on: Purpose, features, and techniques for writing good literature reviews

VIII. Select topics in research ethics
   a. Overview of ethical considerations in research
   b. Responsible conduct of research
   c. Protection of research subjects
   d. Ethics approval and informed consent
   e. Avoiding biases, common errors in question formulation and data analysis
   f. Avoiding conflicts of interests

Essential Readings:

1. AAAS: American Association for the Advancement of Science. (n.d.). Integrity in Scientific Research – Resource Guide. http://www.aaas.org/spp/video/website.htm
2. Black, T. R. (1999). Doing quantitative research in the social sciences: An integrated approach to research design, measurement, and statistics. Thousand Oaks, CA: SAGE Publications, Inc.
3. Bromage, A. (2008). A brief note on research ethics. A page from the website 'Higher education resources', Birmingham: Higher education resources. http://highereducationresources.atspace.com/ethics.htm
4. Burge, S. (n.d.) Bias in Research. http://familymed.uthscsa.edu/facultydevelopment/elearning/biasinresearch.htm
5. Danya International, Inc. (2003). Formulating a research question. http://www.theresearchassistant.com/tutorial/2.asp
6. Isaac, W.L. (2009). Podcast on research ethics. Part I at http://www.youtube.com/watch?v=OG1ymKBLCK8 and Part II at http://www.youtube.com/watch?v=wV-1I8geHVU
7. Keifer-Boyd, K. (2006). Formulating a research problem. http://explorations.sva.psu.edu/lapland/LitRev/prob1.html
8. Kumar, R. (2006). Research Methodology, 2nd Ed. Delhi: Dorling Kindersley (Pearson).
9. NIAID: National Institute of Allergy and Infectious Diseases. (2010). Laying the groundwork for your research plan. http://www.niaid.nih.gov/researchfunding/newsletter/2010/pages/1027.aspx
10. Nuffield Council on Bioethics. (2011). Ethical Issues. http://www.nuffieldbioethics.org/animal-research/animal-research-ethical-issues
11. Office of Behavioral and Social Sciences Research, US National Institutes of Health. (n.d.). Qualitative Methods In Health Research: Opportunities and Considerations In Application and Review. http://obssr.od.nih.gov/pdf/Qualitative.pdf
12. Physioprof. (2009). Structure Of An R01: Specific Aims. http://scienceblogs.com/drugmonkey/2009/03/structure_of_an_r01_specific_a.php
13. RREE: Resources for Research Ethics Education, University of California, San Diego. (2010). http://research-ethics.net/
14. Steneck, N. (2006). ORI Introduction to the Responsible Conduct of Research. Office of Research Integrity, US Department of Human and Health Services. http://ori.dhhs.gov/education/products/RCRintro/index.html
15. Withen, P. (2002). Outline on research instruments. http://www2.uvawise.edu/pww8y/Resources/MERes/ResInstruments/00ResInstruments.html

16. Wong, P. (n.d.). How to write a research proposal. http://www.meaning.ca/archives/archive/art_how_to_write_P_Wong.htm

Additional Readings:

1. Babbie, E. (2011). The basics of social research (5th Ed.). Belmont, CA: Wadsworth.
2. Bryman, A. (2008). Social Research Methods, 3rd Ed. New York: Oxford University Press.
3. Environmental Social Sciences, Methods and Research Design. (2010). Vaccaro, I., Smith, E.A., Aswani, S. (Eds.). Cambridge University Press.
4. Flick, U., von Kardorff, E. & Steinke, I. (Eds.) (2004). A companion to qualitative research (B. Jenner, trans.). Thousand Oaks, CA: Sage.
5. Franklin, A. and Blyton, P. (2013). Researching Sustainability: A Guide to Social Science Methods, Practice and Engagement. Routelage.
6. Gorard, S. (2003). Quantitative methods in social science. New York: Continuum.
7. Gordon, J.C. (2007). Planning Research: A Concise Guide for the Environmental and Natural Resource Sciences. Yale University Press.
8. Halliwell, L. and Watts, S. (2003). Essential Environmental Science: Methods and Techniques. Routelage.
9. Johnson, B., & Christensen, L. (2004). Educational Research: Quantitative, Qualitative, & Mixed Approaches, 2nd Edition. Prentice Hall.
10. Newing, H. (2010). Conducting Research in Conservation: Social Science Methods and Practice. Routelage.
11. Pfeferrmann, D. & Rao, C.R. (Eds.) (2009). Sample surveys: Design, methods, and applications (Handbook of Statistics 29A). Amsterdam: Elsevier.
12. Singh, K. (2007). Quantitative social research methods. Thousand Oaks, CA: Sage.

Date last updated: May 30, 2015

Module Code and Title: **RSP302 Undergraduate Research Project II**

Programme(s): BSc Environmental Management

Credit Value: 12

Module Tutor(s): Samir Patel (Coordinator)
All other environment faculty

General objective(s) of the module:

RSP302 is the second part of a two-part year-long research course taught alongside the conduct of individual student research projects. It is intended to be more independent that the first part. Within the research project, students will individually conceptualize, design, implement, and analyse research. The Undergraduate Research Project Is intended to build on and be a culmination of the skills acquired through previous modules within the programme. Students should have already gained field experience and technical skills (statistics, GIS, research methods) previously. During the project, students will gain research experience that will facilitate future employment or future research in further studies. By means of the final product, students are expected to show proficiency in both the theory and practice of research. In the second part of the research course, students will be finishing their data collection, and learn more about data analysis and communicating research results. The module ends with a senior project symposium at which students are expected to present their findings to a wider audience. After incorporating final feedback, students may submit their final research reports for assessment.

Learning outcomes – Upon successful completion of the module, students will be able to:

- Collect data using appropriate methodology as given in a research proposal.
- Evaluate the quality of data collected.
- Screen data for issues with reliability, validity, and bias.
- Critically analyse data using appropriate methods.
- Transform raw data into specific, concise outputs as appropriate for a particular project, e.g. graphs, tables, diagrams, etc.
- Formulate sound discussion and conclusions based on research findings.
- Complete a research project and write a full research report.
- Deliver an oral presentation and defence on a completed research project.

Skills to be developed:

- Students should learn how to execute and complete an individual research project, including communicating their findings in a written research report as well as an oral presentation.

Learning and teaching approaches used:

The module will be conducted over 15 teaching weeks as follows:

- 2 hrs/wk lecture & discussions.
- 2 hrs/wk tutorial sessions for individual and small group guidance on individual research projects: refining data analysis, working on research write-up; this time will also be used for support and monitoring of the students by their supervisors.
- 4 hrs/wk independent research work and writing.

Assessment:

Continuous Assessment (CA): 100%

CA Assessment	Weight	Assessment Detail
Literature review write-up for final report	10%	Week 3: 1500 word review on clearly identified bodies of literature (~2-3) pertaining to the chosen topic, incorporating analysis and synthesis as well as some evaluation of outstanding knowledge gaps to set up the set independent research work within the context and history of what is already known.
Methodology write-up for final report	10%	Week 5: 500-1000 word description of the methods used to collect and analyse data; explanation about data collection instruments and their suitability; explanation on sampling or selection criteria where appropriate; explanation on technical methodology where appropriate; statement on validity and ethics.
First draft of results (data findings)	10%	Week 8: ~1000 word report of the main findings from the data collection and analysis.
First draft of full research report	10%	Week 10: Updated compilation of the above plus ~1000-1500 word evaluative analysis / discussion of the findings and a conclusion.
Final research report	40%	Week 13: ~5000 word complete research report that takes a reader through the entire research process, the context of the study, the knowledge gap addressed, the methodology, the results and their interpretation, discussion and conclusions, and an evaluation of the merits and limitations of the study along with future directions. Individual section assessment criteria: • Introduction – 5% • Literature review – 5%

		• Methodology – 5 % • Data findings – 10% • Data analysis / discussion – 10% • Conclusion – 5% Students will be provided with a full outline of the required sections and their expected contents along with grading rubrics for all components.
Research presentations	10%	15 min research presentation with 5-10 min Q&A. Weeks 14-15.
Research process	10%	Research supervisors will assign a 'process mark' for each student in discussion with the module coordinator based on: • Adherence to the work plan given in the research proposal • Meeting deadlines and milestones • Responsible conduct of the research; following research ethics • Contributing to discussions during small group guidance time / tutorials

Pre-requisite knowledge: RSP301 Undergraduate Research Project I

Subject matter:

I. Select topics in data analysis
   a. Evaluating data quality
   b. Screening data for issues with reliability, validity, and bias
   c. Analysis of quantitative data
   d. Analysis of qualitative data
   e. Guidelines and best practices on data presentation
II. Research reports
   a. Types of research reports
   b. Parts of research reports
   c. Drawing appropriate conclusions
   d. Contextualizing research
   e. Preparing research papers for publication
   f. Guidelines on communicating and presenting research
III. Select topics in research ethics
   a. Publication
   b. Peer review

Essential Readings:

1. AAAS: American Association for the Advancement of Science. (n.d.). Integrity in Scientific Research – Resource Guide. http://www.aaas.org/spp/video/website.htm
2. Black, T. R. (1999). Doing quantitative research in the social sciences: An integrated approach to research design, measurement, and statistics. Thousand Oaks, CA: SAGE Publications, Inc.
3. Bromage, A. (2008). A brief note on research ethics. A page from the website 'Higher education resources', Birmingham: Higher education resources. http://highereducationresources.atspace.com/ethics.htm
4. Burge, S. (n.d.) Bias in Research. http://familymed.uthscsa.edu/facultydevelopment/elearning/biasinresearch.htm
5. Danya International, Inc. (2003). Formulating a research question. http://www.theresearchassistant.com/tutorial/2.asp

6. Isaac, W.L. (2009). Podcast on research ethics. Part I at http://www.youtube.com/watch?v=OG1ymKBLCK8 and Part II at http://www.youtube.com/watch?v=wV-1I8geHVU
7. Keifer-Boyd, K. (2006). Formulating a research problem. http://explorations.sva.psu.edu/lapland/LitRev/prob1.html
8. Kumar, R. (2006). Research Methodology, 2nd Ed. Delhi: Dorling Kindersley (Pearson).
9. NIAID: National Institute of Allergy and Infectious Diseases. (2010). Laying the groundwork for your research plan. http://www.niaid.nih.gov/researchfunding/newsletter/2010/pages/1027.aspx
10. Nuffield Council on Bioethics. (2011). Ethical Issues. http://www.nuffieldbioethics.org/animal-research/animal-research-ethical-issues
11. Office of Behavioral and Social Sciences Research, US National Institutes of Health. (n.d.). Qualitative Methods In Health Research: Opportunities and Considerations In Application and Review. http://obssr.od.nih.gov/pdf/Qualitative.pdf
12. Physioprof. (2009). Structure Of An R01: Specific Aims. http://scienceblogs.com/drugmonkey/2009/03/structure_of_an_r01_specific_a.php
13. RREE: Resources for Research Ethics Education, University of California, San Diego. (2010). http://research-ethics.net/
14. Steneck, N. (2006). ORI Introduction to the Responsible Conduct of Research. Office of Research Integrity, US Department of Human and Health Services. http://ori.dhhs.gov/education/products/RCRintro/index.html
15. Withen, P. (2002). Outline on research instruments. http://www2.uvawise.edu/pww8y/Resources/MERes/ResInstruments/00ResInstruments.html
16. Wong, P. (n.d.). How to write a research proposal. http://www.meaning.ca/archives/archive/art_how_to_write_P_Wong.htm

Additional Readings:

1. Babbie, E. (2011). The basics of social research (5th Ed.). Belmont, CA: Wadsworth.
2. Bryman, A. (2008). Social Research Methods, 3rd Ed. New York: Oxford University Press.
3. Environmental Social Sciences, Methods and Research Design. (2010). Vaccaro, I., Smith, E.A., Aswani, S. (Eds.). Cambridge University Press.
4. Flick, U., von Kardorff, E. & Steinke, I. (Eds.) (2004). A companion to qualitative research (B. Jenner, trans.). Thousand Oaks, CA: Sage.
5. Franklin, A. and Blyton, P. (2013). Researching Sustainability: A Guide to Social Science Methods, Practice and Engagement. Routelage.
6. Gorard, S. (2003). Quantitative methods in social science. New York: Continuum.
7. Gordon, J.C. (2007). Planning Research: A Concise Guide for the Environmental and Natural Resource Sciences. Yale University Press.
8. Halliwell, L. and Watts, S. (2003). Essential Environmental Science: Methods and Techniques. Routelage.
9. Johnson, B., & Christensen, L. (2004). Educational Research: Quantitative, Qualitative, & Mixed Approaches, 2nd Edition. Prentice Hall.
10. Newing, H. (2010). Conducting Research in Conservation: Social Science Methods and Practice. Routelage.
11. Pfeferrmann, D. & Rao, C.R. (Eds.) (2009). Sample surveys: Design, methods, and applications (Handbook of Statistics 29A). Amsterdam: Elsevier.
12. Singh, K. (2007). Quantitative social research methods. Thousand Oaks, CA: Sage.

Date last updated: May 30, 2015

Module Code and Title: **ENM307 Waste Management**

Programme(s): BSc Environmental Management

Credit Value: 12

Module Tutor(s): Deki Phuntsho Yonten, (Coordinator)
GP Sharma
Tshering Dolkar
Leishipem Khamrang

General objective(s) of the module:

Waste management is a major emerging issue in Bhutan. This module will provide students with a broad overview of waste and comprehensive understanding of waste management practices in the light of environment and public health. Students will have opportunity to visit municipal organizations and waste management sites in the locality. This will help familiarize students with current waste management practices and allow them to consider best measures and alternatives in managing wastes in Bhutan. The module also emphasizes a holistic approach to waste management in terms of ethics, civic sense, and producer responsibility.

Learning outcomes – Upon successful completion of the module, students will be able to:

- Classify wastes into different categories.
- Explain the factors affecting waste decomposition.
- Describe the types, sources, properties and impacts of solid and liquid wastes.
- Describe the major environmental problems associated with different types of anthropogenic wastes.
- Explain the rationale behind and principles of the waste management hierarchy.
- Apply waste management hierarchy concepts to the management of wastes in case studies.
- Describe the roles of various systems for treatment of wastes, in particular for wastewater and freshwater.
- Discuss local, regional and international case studies on waste management.
- Critically evaluate potential solutions for waste-related problems.
- Explain the concept of cleaner production and its scope for sustainable development.
- Examine the roles of various stakeholders in a holistic waste management approach.

Learning and teaching approaches used:

The module will be conducted over 15 teaching weeks as follows:

- 3 hrs/wk lecture & discussions.
- 1 hr/wk tutorial section for student presentations and guest lectures.
- 4 hrs/wk outside of class, on average, for independent study.
- One block-day study tour to the Memelhakha landfill, Thimphu Thromde sewerage treatment facility, and Thimphu Hospital (medical wastes disposal). Students will also explore organic waste disposal from the Centenary Farmer's Market, and wastes processing at Greener Way.

Assessment:

Semester-End Examination (SE):40%
Continuous Assessment (CA): 60%

CA Assessment	Weight	Assessment Detail
Group project	20%	Project in groups of 3-4 on leaflet / pamphlet production and strategy for creating awareness on solid waste management at individual, community, and gewog levels; 20 min presentation.
Individual assignment	15%	1000-1500 word report on analysis of household waste production in Thimphu vs. rural area.
Field report	10%	Written group report (groups of 3) on field observations of both organic and inorganic waste

		management in Thimphu valley - TCC & other organizations; 1500 words.
Midterm Exam	15%	

Pre-requisite knowledge: ENM101 Energy Resources and Materials Management, ENM202 Water Resources Management, ENM203 Agriculture and Land Management, ENM304 Environmental Hazards Management, ENM305 Urban Environmental Management

Subject matter:

I. Introduction and ethical concepts related to waste management
   a. Ethical and legal responsibilities for proper waste management
   b. Review of relevant theories in environmental ethics (different worldviews and their takes on human responsibility for waste management)
   c. Review of 'Tragedy of the Commons' concept
   d. Polluter-pays principle: individual responsibility, legal enforcement thereof
   e. Extended Producer Responsibility (EPR) for waste management
   f. Challenges and opportunities in promoting individual and community-based responsible waste management

II. Basic technical concepts of waste
   a. Definitions
   b. Categories of waste
   c. Waste decomposition and conversion
   d. Factors affecting waste decomposition
   e. Wastes and public health
   f. Benefits of waste conversion
   g. Wastes as environmental hazards

III. Solid wastes
   a. Types, sources, properties and impacts
   b. Disposal and management strategies
   c. Integrated solid waste management
      i. Collection, storage and transport
      ii. Source reduction
      iii. Product recovery
      iv. Recycling
      v. Incineration
      vi. Land filling
      vii. Modern biotechnological approaches (compost & biogas)
      viii. Public policy and waste management
   d. Issues of solid waste in Bhutan -Waste Prevention and Management Act, 2009
   e. Waste Prevention and Management Regulation, 2012
   f. Environmental codes of practice for Hazardous Waste, 2002
   g. Integrated Waste Management Strategy, 2014

IV. Liquid wastes
   a. Characterization of liquid wastes
   b. Classification of Liquid wastes by
      i. Origin
      ii. Destination
      iii. Content
      iv. Treatment
      v. Value
   c. Fresh water supply treatment
   d. Water quality and important factors for treatment
   e. Wastewater treatment
      i. Physical
      ii. Chemical
      iii. Biological treatments (microbial, bioremediation, phyto-remediation)

iv. Treatment of sludge
v. Composting and irrigation

f. Case studies

V. Hazardous Wastes
   a. History
   b. Types of hazardous waste: hospital waste, electronic waste
   c. Mismanagement of hazardous waste
   d. Conventions (Basel, Rotterdam and Stockholm)
   e. Pollution prevention for a sustainable society
   f. Case studies

VI. Cleaner Production
   a. Stages of CP
   b. Advantages and disadvantages
   c. Future scenarios
   d. Case studies
   e. Stakeholders in waste management and case studies

Essential Readings:

1. Aquarius ND Ltd. (2013). Domestic Wastewater Treatment Plants. http://www.aquariusbg.com/en/Domestic-wastewater-treatment-plants/product.html
2. Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal. http://www.basel.int/
3. Berg, L., Hager M., Hassenzahl, D. (2011). Visualizing Environmental Science 3rd Ed. John Wiley & Sons. Ch.10.
4. Bloch, M. (2009). Waste Decomposition Rates. Green Living Tips. Retrieved from http://www.greenlivingtips.com/articles/311/1/Waste-decomposition-rates.html
5. Casiday, R., Noelken, R. and Frey, R. (1999). Treating the Public Water Supply. http://www.chemistry.wustl.edu/~edudev/LabTutorials/Water/PublicWaterSupply/PublicWaterSupply.html
6. Gupta, S.K. (2009). Methods in Environmental Analysis of Water Soil and Air, Agribios, Jodhpur, India.
7. Quarrie, J. (1992). Earth Summit ’92, The United Nations Conference on Environment and Development. Rio de Janerio., Published by the Regency Press, London
8. Queensland Litter Prevention Alliance. (2008). Waste Product Decomposition Time. Queensland, Australia. Retrieved from http://www.qldlitter.com/pdfs/wastea3.pdf
9. Skye, C. (2006). Conversion Technology 101. Los Angeles County Department of Public Works. Retrieved from www.herc.ucla.edu/Presentations/SCEWTF_July2006_Skye_2.0.ppt
10. Syed, S. (2006). Solid and Liquid Waste Management. Emirates Journal for Engineering Research, 11(2), 19-36. http://www.engg.uaeu.ac.ae/ejer/issues/v11/pdf_iss2_11/2.%20Syed.pdf
11. US Environmental Protection Agency (2008) Basic Information - Composting. US EPA. Retrieved from http://www.epa.gov/waste/conserve/rrr/composting/basic.htm
12. Waste Decomposition: The Main Stages of waste decomposition, or the waste degradation process. (n.d.). Retrieved on from http://www.landfill-site.com/html/waste_decomposition.html
13. World Business Council for Sustainable Development. (2009). Water Facts and Trends. http://www.unwater.org/downloads/Water_facts_and_trends.pdf

Additional Readings:

1. Australia and New Zealand Biosolids Partnership. (2009). *What are Biosolids?* http://www.biosolids.com.au/what-are-biosolids.php
2. Botkin, D.B., and Keller, E.A. (2011). Environmental Science, 8th Ed. John Wiley & Sons. Ch. 18.
3. City Water and Waste. (2012). Christchurch Wastewater Treatment Plant. http://www.ccc.govt.nz/homeliving/wastewater/treatmentplant/chchwastewatertreatmentplant/index.aspx

4. Cunningham, W. P and Cunningham, M. A. (2004). Principles of Environmental Science: Inquiry and Application. Tata McGraw Hill.
5. Hygiene and Environmental Health HEAT Module. http://labspace.open.ac.uk/mod/oucontent/view.php?id=453835&section=1.3.1
6. List of Waste Types. (n.d.). http://en.wikipedia.org/wiki/List_of_waste_types
7. Miller, G.T., and Spoolman, S.E. (2014). Environmental Science 14th Ed. New Delhi: Cengage Learning.
8. National Environmental Commission. (1998). The Middle Path: National Strategy for Bhutan. National Environmental Commission. RGOB.
9. National Environmental Commission. (2002). Environmental Code of Practice for Hazardous Wastes Management. National Environmental Commission. RGOB
10. National Environmental Commission. (2004). Environmental Discharge Standard. National Environmental Commission. RGOB.
11. National Environmental Commission. (2002). Environmental Code of Practice for Hazardous Waste Management. National Environmental Commission. RGOB
12. National Environment Commission. (2007). National Environmental Protection Act of Bhutan 2007. Printed at Phama Printing and Publishers
13. National Environment Commission. (2009). Waste Prevention and Management Act of Bhutan. NEC, Bhutan.
14. New South Wales Environmental Protection Agency. (2012). Classifying Waste http://www.environment.nsw.gov.au/waste/envguidlns/index.htm
15. Rajagopal, R.. (2005). Environmental Studies: from Crisis to Cure. Oxford University Press. UK.
16. Texas Commission on Environmental Quality. (2012). http://www.tceq.state.tx.us/permitting/waste_permits/msw_permits/MSW_generatorsliquidwaste.html
17. Viessman, W. Jr. & Hammer M.J. (2005). Water Supply and Pollution Control. Pearson Education.
18. Virgin Islands Waste Management Authority. (2011). http://www.viwma.org/Recycling/Special_Waste/Liquid_Waste.aspx
19. Willams, P. T. (2005). Waste Treatment and Disposal. John Wiley and Sons.
20. Wright, R.T., and Boorse, D.F. (2011). Environmental Science – Towards a Sustainable Future, 11th Edition, PHI Learning Private Limited, New Delhi.

Date last updated: May 30, 2015

Module Code and Title: **BES301 Bhutanese Economy and Social Capital**

Programme(s): BSc Environmental Management

Credit Value: 12

Module Tutor(s): Tshering Dolkar (Coordinator)
Leishipem Khamrang
Radhika Chhetri
GP Sharma

General objective(s) of the module:

This module will look at the role of social capital in economic development and environmental conservation. Social capital is the instantiation of norms that permit people to cooperate in groups. A growing body of research suggests that the social networks, community norms, and associational activities signified by these concepts can have important effects on social welfare, political stability, economic development, environmental conservation, and governmental performance. The preservation of the traditions is strengthened through generation of employment and economic benefits from leveraging cultural heritage. This module will introduce students to

the main aspects of Bhutanese culture, economy and demographic features in order to impart knowledge, understanding and appreciation of the Bhutanese society as well as the factors that determine the past and present day Bhutanese society and the future directions. The students will be learning that leveraging social capital is vital for environmental conservation and socio-economic development in Bhutan.

Learning outcomes – Upon successful completion of the module, students will be able to:

- Describe the main sociological concepts (society, culture, social institutions) and their historical evolution.
- Examine the application of the main sociological concepts in the Bhutanese cultural context.
- Explain the processes of social change.
- Trace the developments that have been and are taking place in Bhutan in the context of the social change processes.
- Describe economy as a social institution.
- Explore the Bhutanese economy in the context of its institutional structure and development.
- Evaluate the role of the religious institutions in Bhutan in relation to environmental conservation and economic development.
- Investigate how social capital could be an integral part for conserving various ecosystems intact for sustainable socio-economic growth in Bhutan.

Skills to be developed:

- Students will be able to conduct small-scale sociological research, further developing skills such as how to find, select, and compare relevant sources of information, and how to deal with stakeholders and working partners more effectively.

Learning and teaching approaches used:

The module will be conducted over 15 teaching weeks as follows:

- 4 hrs/wk lecture & discussions, guest lectures, presentations, group discussions and practical group exercises.
- 4 hrs/wk of self-study of the theory available and for collecting information, and preparing papers and presentations. Students will also use the independent study time for conducting small-scale research to understand how social capital is an integral part for conserving various ecosystems for sustainable socio-economic growth in Bhutan, e.g. data collection and writing on household welfare (from nearby villages).

Assessment:

Semester-End Examination (SE):40%
Continuous Assessment (CA): 60%

CA Assessment	Weight	Assessment Detail
Quizzes (3 x 5%)	15%	One verbal quiz, 10 min, worth 5 %, and two written quizzes, 30 min each, worth 5% each.
Individual project work	15%	Small-scale research to investigate how social capital could be an integral part of conserving various ecosystems for sustainable socio-economic growth in Bhutan; report of 1000-1500 words.
Poster presentation / viva	15%	Poster production using the theme “processes of social change and its implication in Bhutan” or “social capital in Bhutan”; presentation of poster at a poster session along with verbal quizzing/interview.
Midterm Exam	15%	

Pre-requisite knowledge: ENV102 Population, Development, and Environment

Subject matter:

I. Human societies
   a. Theories of the origin of society
   b. Importance of society to the individual
   c. Characteristics and functions of society and culture
   d. Factors of social changes – ideology, science and technology, environment – green revolution, trends in industrial nations, population pressures, scientific revolutions
   e. Social institutions
      i. Organizational differences in patterns of earning livelihoods
      ii. Divisions of labour: traditional versus modern
      iii. Social mobility: factors affecting social mobility
      iv. Processes of social changes
      v. Social problems, societal crimes
      vi. Means of social control: mores, morals, religion and law
      vii. Functions of religion for individuals and society
      viii. Institutions of marriage and family

II. Social capital
   a. Concept and historical evolution
   b. Household welfare model
   c. Cooperation and collective actions
   d. Self-rated happiness
   e. Poverty perception
   f. Policies and practices
   g. GNH and social capital

III. Characteristics of the population of Bhutan
   a. Population size and growth
   b. Religion and ethnicity
   c. Composition, growth and structure of labour force
   d. Literacy and health status of population
   e. Nuptiality trends and patterns
   f. Determinants of age at marriage; fertility levels, trends and differentials
   g. Trends and patterns of morbidity; major causes of morbidity; mortality levels
   h. Levels and trends of urbanization

IV. Bhutanese economy
   a. Structure prior to 1960
   b. Structural changes post-1960: Five-Year development plans; changes in the institutional structures; achievements of different sectors; social, political, and economic reforms; impacts of modernization and globalization on the society
   c. Gross National Happiness: Concept; the domains of socioeconomic development; the pillar of environmental conservation
   d. Uniqueness of the Bhutanese economy; status as a land-locked country and implications thereof, hydropower development, role of foreign aid; challenges and opportunities

V. Bhutanese Culture
   a. Values and beliefs
   b. Norms
   c. Language
   d. Symbols
   e. Technology
   f. Functions and purpose of the cultural institutions for the Bhutanese society

VI. Nexus between social capital, the economy, and environmental sustainability
   a. Case studies on the relationship between economic development, environmental conservation and social capital
   b. Contributions of social capital to Bhutanese ecosystem management and economic growth
   c. Comparative analyses of past situations with the present, and future outlooks

Essential Readings

1. Macionis, J.J. and Plummer, K. (2013). Sociology: A global introduction. 5th Ed. USA: Pearson Education.
2. Miller, G.T., and Spoolman, S.E. (2014). Environmental Science 14th Ed. New Delhi: Cengage Learning.
3. National Statistics Bureau. (2013). Bhutan's case: social capital, Household Welfare and Happiness, Monograph Series 5, Published by National Statistics Bureau, Thimphu, Bhutan.
4. Schuelka, M.J. (Ed.). (2013). Proceedings from the International conference on leveraging Cultural Diversity, Thimphu, Bhutan.
5. Woolcock, M. and Narayan, D. (2000). Social Capital: Implications for Development Theory, Research, and Policy. World Bank Research Observer, 15(2): 225-249.

Additional Readings:

1. Coleman, J.S. (1988) "Social Capital in the Creation of Human Capital," American Journal of Sociology Supplement 94 (): S95-S120.
2. Cunningham, W.P., and Cunningham, M.A. (2012). Environmental Science: A Global Concern, 12th Ed. McGraw Hill.
3. Ellickson, R.C. (1991). Order without Law: How Neighbors Settle Disputes, Cambridge, MA: Harvard University Press, pp. 137-166.
4. Enger, E.D. and Smith, B.F. (2010). Environmental Science, 12th Ed. McGraw-Hill.
5. Fukuyama, F. (2000). "Social Capital and Civil Society," IMF Working Paper WP/00/74.
6. Grootaert, C. and van Bastelaer, T. (2001). Understanding and Measuring Social Capital: A Synthesis of Findings and Recommendations. Washington, DC: World Bank SCI.
7. Knack, S. and Keefer, P. (1997). Does Social Capital Have an Economic Payoff? A Country Investigation. College Park, MD: Univ. of Maryland IRIS.
8. Royal Government of Bhutan, Office of the Census Commissioner, Thimphu. (2005). Results of Population and Housing Census of Bhutan 2005.
9. Singerman, D. (1995). Chapter 3, "Networks: the Political Lifeline of Community" in Avenues of Participation: Family, Politics, and Networks in Urban Quarters of Cairo. Princeton, NJ: Princeton University Press.

Date last updated: May 30, 2015

Module Code and Title: **ECL302 Restoration Ecology**

Programme(s): BSc Environmental Management

Credit Value: 12

Module Tutor(s): GP Sharma (Coordinator)
Bach-Lien Ngo
Samir Patel

General objective(s) of the module:

This module includes both the general theories behind ecosystem restoration, taught through lectures and group discussions, and field trips / projects designed to give students a more hands-on understanding of these general principles. The module will also explore the diverse human aspects of restoration, the various stakeholders involved in restoration, including conservation non-governmental organizations, stewardship volunteer groups, and environmental consultants. Students should come to understand that like ecosystems themselves, ecological restoration is a multifaceted field – successful restoration requires a good understanding of site-specific conditions, ecosystem processes, monitoring and management.

Learning outcomes – Upon successful completion of the module, students will be able to:

- Explain the ethics and reasons for restoring ecosystems.
- Discuss societal and ecological issues associated with ecological restoration.
- Describe the general guidelines for restoring an ecosystem.
- Incorporate a systems approach into restoration planning.
- Prepare and evaluate ecological restoration and management plans.
- Explain management approaches that can allow for mixed-use regions in or around riparian areas.
- Select appropriate approaches for forest landscape restoration.
- Recommend ways to allow ruminant domestic livestock grazing without impairing forest and grassland ecosystems.
- Identify the various ways and methods to mitigate forest fires in Bhutan.
- Explain the problems arising from invasive species in Bhutan.
- Suggest appropriate measures for controlling and eradicating invasive species.
- Describe potential restoration methods for use around built areas.

Learning and teaching approaches used:

The module will be conducted over 15 teaching weeks as follows:

- 3 hrs/wk lecture & discussions.
- 1 hr/wk case studies, projects, brainstorming, guest lectures, seminars, group activities, demonstrations, and panel discussions.
- 4 hrs/wk outside of class, on average, for independent study.
- Independent small-group field visits on group-wise topics related to: riparian restoration, invasive species, rangeland management, and wildland forest fire management.

Assessment:

Semester-End Examination (SE):40%
Continuous Assessment (CA): 60%

CA Assessment	Weight	Assessment Detail
Individual Assignment	15%	Argumentative essay of 1500 words.
Quizzes (2 x 5%)	10%	Two written quizzes of 30 min each.
Practical (field work)	20%	Group work (3-4 students) on restoration planning for selected areas, culminating in a 20-30 min presentation.
Midterm Exam	15%	

Pre-requisite knowledge: ENV101 Introduction to the Environment, ECL101 Principles of Ecology, ENM202 Water Resources Management, BDC202 Biodiversity Conservation and Management II

Subject matter:

I. Introduction
   a. Definition and concepts
   b. Ethics and reasons for restoring ecosystems; differing values
   c. Principles and guidelines for ecological restoration
   d. Key ecological concepts underlying restoration
      i. Disturbance
      ii. Succession
      iii. Fragmentation
      iv. Ecosystem functions
   e. Society for ecological restoration, international science & policy working group

II. General guidelines for ecosystem restoration

a. Assessing a site
b. Developing project goals
c. Removing sources of disturbance
d. Eradicating invasive species
e. Restorative processes/natural disturbance cycles such as flood or fire cycles
f. Restoring vegetation
g. Monitoring and maintenance

III. Riparian ecology and management
a. Importance of riparian zones; biofilter concept
b. Threats to riparian zones
c. Wetland conservation measures
d. Management and monitoring
i. Stream bank reconfiguration
ii. Livestock grazing: rotational, premature, trampling
iii. Roads construction and management
iv. Recreational impacts on riparian areas
v. Re-vegetation and timber harvesting activities
vi. Ramsar convention and other related protocols
vii. People's participation and traditional knowledge

IV. Wildland fire management in Bhutan
a. History of forest fire
b. Causes: induced and natural
c. Stages of forest fires
d. Effects of forest fires in Bhutan
e. Management and suppression of forest fires in Bhutan
i. Role of organizations, private sectors, local communities, academicians and other
ii. Sustainable land-use to prevent forest fire
iii. Fire management / suppression technologies, facilities and trainings
iv. Public polices and Nature Conservation Act

V. Forest Landscape Restoration
a. Possible scopes
b. Aims and desired outcomes
c. Tools and methods
d. Case studies

VI. Rangeland management in Bhutan
a. Ruminant livestock production system
b. Migratory habits of the herders and grazing in forests; impacts and solutions
c. Statistics for livestock numbers
d. Types of fodder species in Bhutan
e. Opportunities for improvement of fodder resources
i. National Grazing Policy
ii. Presents trends and future scenario
iii. Pros and cons of pasture land development

VII. Invasive Species Management in agriculture fields and along roads in Bhutan
a. Invasive species definition
b. Characteristics of invasive plants
c. Tools and techniques for managing invasive species: chemical, biological, cultural re-vegetation, physical

VIII. Overview of built-areas restoration
a. Erosion control measures around built areas, e.g. roads
b. Protection of settlements and agricultural areas using restoration measures

Essential Readings:

1. Allison, S.K. (2012). Ecological Restoration and Environmental Change: Renewing Damaged Ecosystems. Earthscan publications.

2. Bharucha, E. (2010). Textbook for Environmental Studies for Undergraduate Courses. University Grants Commission, Bharati Vidyapeeth Institute of Environmental Education and Research, Pune, New Delhi.
3. Ministry of Agriculture. (2001). Proceedings of the National Grazing Policy Workshop, Bumthang, August 21-24, 2001. FIDI. Royal Government of Bhutan.
4. Parkyn, S. (2004). Review of Riparian Buffer Zone Effectiveness. Ministry of Agriculture and Forestry (New Zealand), www.maf.govt.nz/publications
5. Royal Government of Bhutan, MOA/SFD FFMS. (2004). Annual forest Fire Evaluation and Compilation Report, Thimphu, Bhutan.
6. Simberloff, D. (2013). Invasive Species: What Everyone Needs to Know. Oxford University Press, USA.
7. Society for Ecological Restoration. (2004). The SER International Primer on Ecological Restoration. (http://www.ser.org/resources/resources-detail-view/ser-internationalprimer-on-ecological-restoration).

Additional Readings:

1. Botkin, D.B. (2011). Environmental Science, Earth as a Living Planet,8th Edition, John Wiley and Sons Inc., USA.
2. Hobbs, R. J., Higgs, E. S., and C. Hall. (2013). Novel Ecosystems: Intervening in the New Ecological World Order. John Wiley & Sons.
3. International Council for Science, (2002). ICSU Series on Science for Sustainable Development No. 5: Science Education and Capacity Building for Sustainable Development. Paris: ICSU
4. Kasemir, B., Jäger, J., Jaeger, C. C & Gardner, M. T. (2003), Public Participation in Sustainability Science: A Handbook. Cambridge University Press.UK. New York
5. Miller, G.T., and Spoolman, S.E. (2014). Environmental Science 14th Ed. New Delhi: Cengage Learning.
6. National Environmental Commission. (1998). The Middle Path: National Strategy for Bhutan. National Environmental Commission. RGoB.
7. Schmandt, J & Ward, C. H. (2000). Sustainable Development: The Challenge of Transition. Cambridge University Press.UK.

Date last updated: May 30, 2015

Module Code and Title: **ENM308 Frontiers in Environmental Management and Sustainable Development**

Programme(s): BSc Environmental Management

Credit Value: 12

Module Tutor(s): GP Sharma (Coordinator)
Samir Patel
Tshering Dolkar
Bach-Lien Ngo

General objective(s) of the module:

This module is primarily a seminar/discussion course in which students will read, evaluate, criticize and discuss recent key primary scientific literature in the field of environmental management for sustainable development. This module will enable students to explore how and why different parts of the world are changing and how people, plants and animals are living within their changing environment. The module will also cover newly emerging challenges and threats to the environment and illustrate to students how people are striving to manage and protect the many features of the world that we all share. The initial part of the module focuses on basic concepts of sustainable development, and the remainder is a seminar series comprising special lectures and readings geared towards environmental management aspects of sustainable development. The topics will also highlight the tensions that exist between value systems, and the practical implications for considering sustainability issues in a wide range of governmental and industrial applications. Emerging topics and seminal works in sustainable development, environmental management, and biodiversity conservation will be discussed. Students should be able to apply critical thinking skills to understand how the concept of environmental sustainability is put into action, and the scientific, political, economic, and ethical ramifications of doing so.

Learning outcomes – Upon successful completion of the module, students will be able to:

- Explain the various pillars of sustainable development, its objectives, and the options we have to make development more sustainable.
- Discuss the different opinions that exist on sustainable development including the criticism that is often expressed.
- Identify the various initiatives that have been taken globally to encourage sustainable development.
- Explore the most current ways in which people are striving to manage and protect the many features of the world.
- Debate on key environmental issues of the day.
- Identify primary literature sources that detail the research underlying news media stories on current environmental management issues.
- Critically evaluate evidence or examples presented in research reports against author(s)' claims and conclusions.
- Identify caveats in research reports and construct alternative conclusions where appropriate.
- Draw appropriate broader interdisciplinary connections and conclusions from narrowly tailored research studies.

Skills to be developed:

- Students should be able to critically read and evaluate news/popular media and primary research sources and draw out big-picture connections and conclusions.

Learning and teaching approaches used:

The module will be conducted over 15 teaching weeks as follows:

- First 3 weeks:
    - 4 hrs/wk of lecture and discussions.
    - 4 hrs/wk outside of class, on average, for independent study.
- Remaining 12 weeks:
    - 2 hrs/wk block alternating weekly either: a lecture based on emerging topics from primary literature (6 in total) or a discussion section on a select paper, to be followed up by response papers by students (6 in total).
    - 2 hrs/wk student presentations – approximately 3-4 per week, of a primary literature paper of their choice, related to recent events and discoveries.
    - 4 hrs/wk outside of class, on average, for independent study.

Assessment:

Continuous Assessment (CA): 100%

CA Assessment	Weight	Assessment Detail
Class Test 1	10%	1hr written exam covering Unit I (sustainable development concepts).
Individual response papers (6 x 10%)	60%	Critical review / response papers of 500-1000 words each.
Primary literature seminar presentation (Individual)	10%	Students will read a recent report/journal article and do a 30 min presentation individually.
Class Participation	10%	Discussion group participation and contributions.
Class Test 2	10%	1hr written exam covering Unit II (seminar series) – based on critical analysis of select topics raised throughout the series.

Pre-requisite knowledge: ETH201 Environmental Ethics, EEC201 Environmental Economics, BDC202 Biodiversity Conservation and Management II, ENM304 Environmental Hazards Management, ENM305 Urban Environmental Management, RSP301 Undergraduate Research Project I

Subject matter:

I. Sustainable development, concepts and management with particular emphasis on the environment
    a. Principles for sustainable development; basic pillars of sustainable development
        i. Economic perspective
        ii. Environmental perspective
        iii. Social perspective: energy, Industry and renewable system, social modernization - a new direction
    b. Sustainable Development: approaches and indicators
        i. Factors influencing development sustainability
        ii. Daly's rule
        iii. Indicators for sustainable development
        iv. Environmental indicators; cause-effect response logic (OECD, UNEP/UNSTAT, World Bank)
        v. Case studies on environmental indicators: national and international
    c. Review of key areas, recent issues and challenges in environmental management
        i. Land (forests, grasslands, agriculture, urban areas, etc.), atmosphere, oceans, freshwater systems
        ii. Recent trends and indicators of planetary health
II. Seminar series
    a. Students will follow up on recent news media announcements to trace underlying recent reports/journal articles or search directly from the following suggested sources (or equivalent primary literature repositories) and do individual presentations:
        i. OARE: Online Access to Research in the Environment
        ii. ARDi: Access to Research for Development and Innovation

iii. AGORA Access to Global Online Research in Agriculture
iv. HINARI: Research in Health and Biomedical Sciences
v. Reports: WWF, UNEP, CITES, IPCC, IFC, national agencies, etc.
vi. F1000 Prime
vii. ScienceDaily

b. Tutor will select recent seminal works in environmental management from among the following themes, or others that may be more emergent, and conduct discussions with students for critical analysis (representative important papers as of 2014 are indicated):
   i. Biodiversity conservation, e.g. "Assemblage time series reveal biodiversity change but not systematic loss". Dornelas M, Gotelli NJ, McGill B, Shimadzu H, Moyes F, Sievers C, Magurran AE. Science. 2014 Apr 18; 344(6181):296-9.
   ii. Pollution, e.g. "The changing paradigm of air pollution monitoring". Snyder EG, Watkins TH, Solomon PA, Thoma ED, Williams RW, Hagler GSW, Shelow D, Hindin DA, Kilaru VJ, Preuss PW. Environ Sci Technol Lett. 2013; 47(20):11369-11377.
   iii. Waste management, e.g. "Wasteaware benchmark indicators for integrated sustainable waste management in cities". Wilson DC, Rodic L, Cowing MJ, Velis CA, Whiteman AD, Scheinberg A, Vilches R, Masterson D, Stretz J, Oelz B. Waste Management. 2015; 35:329-342.
   iv. Environmental economics, e.g. "Social equity matters in payments for ecosystem services". Pascual U, Phelps J, Garmendia E, Brown K, Corbera E, Martin A, Gomez-Baggethun E, Muradian R. Bioscience. 2014 Nov; 64(11):1027-36.
   v. Agriculture and the environment, e.g. "Rising temperatures reduce global wheat production". Asseng S, et al. Nature Climate Change, 2014
   vi. Forestry and land management, e.g. "Long-Term Increase in Aboveground Carbon Stocks Following Exclusion of Grazers and Forest Establishment in an Alpine Ecosystem". Speed JDM, Martinsen V, Mysterud A, Mulder J, Holand Ø, Austrheim G. Ecosystems. 2014 Nov; 17(7):1138-50.
   vii. Impacts of urban developments, e.g. "Quantifying human impacts on rates of erosion and sediment transport at a landscape scale". L. Reusser, P. Bierman, D. Rood. Geology, 2015 Jan 7.
   viii. Sustainable natural resource management, e.g. "China's aquaculture and the world's wild fisheries". L. Cao, R. Naylor, P. Henriksson, D. Leadbitter, M. Metian, M. Troell, W. Zhang. Science, 2015; 347 (6218):133.
   ix. Environmental hazards occurrences and solutions, e.g. "The effectiveness of coral reefs for coastal hazard risk reduction and adaptation". Ferrario F, Beck MW, Storlazzi CD, Micheli F, Shepard CC, Airoldi L. Nat Commun. 2014; 5:3794.
   x. Biotechnology/bioengineering related to the environment, e.g. "Quality attributes of map packaged ready-to-eat baby carrots by using chitosan-based coatings". I. Leceta, S. Molinaro, P. Guerrero, J.P. Kerry, K. de la Caba. Postharvest Biology and Technology, 2015; 100:142.
   xi. Restoration ecology, e.g. "Recovery and resilience of tropical forests after disturbance". Cole LES, Bhagwat SA, Willis KJ. Nat Commun. 2014; 5:3906.

Essential Readings:

1. Barrow, C.J. (2012). Environmental Management for Sustainable Development, 2nd Edition, Routledge, London, New York.
2. Curkovic, S. (2012). Sustainable Development - Authoritative and Leading Edge Content for Environmental Management, Published by InTech, Croatia. *(eBook).*
3. Miller, G.T., and Spoolman, S.E. (2014). Environmental Science 14th Ed. Cengage Learningm, New Delhi.
4. Quarrie, J. (1992). Earth Summit '92, The United Nations Conference on Environment and Development. Rio de Janerio., Regency Press, London.

5. Wright, R. T, and Boorse, D.F, (2011). Environmental Science - Towards a Sustainable Future, 11th Edition, PHI Learning Private Limited, New Delhi.

Additional Readings:

1. Berg, L., Hager M., Hassenzahl, D. (2011). Visualizing Environmental Science, 3rd Ed. John Wiley & Sons.
2. International Council for Science. (2002). ICSU Series on Science for Sustainable Development No. 5: Science Education and Capacity Building for Sustainable Development. Paris: ICSU.
3. Kasemir, B., Jäger, J., Jaeger, C. C & Gardner, M. T. (2003). Public Participation in Sustainability Science: A Handbook. Cambridge University Press.UK. New York
4. National Environment Commission Secretariat. (2008). Bhutan Environment Outlook. National Environment Commission, RGOB. Retrieved from http://www.nec.gov.bt/nec1/wp-content/uploads/2012/10/Bhutan-Environment-Outlook-2008.pdf
5. National Environmental Commission. (1998). The Middle Path: National Strategy for Bhutan. National Environmental Commission. RGoB.
6. Schmandt, J & Ward, C. H. (2000). Sustainable Development: The Challenge of Transition. Cambridge University Press, UK.
7. World Business Council for Sustainable Development. (2009). Water Facts and Trends. http://www.unwater.org/downloads/Water_facts_and_trends.pdf

Date last updated: May 30, 2015

Module Code and Title: **PRD101 Personal Development**

Programme(s): BSc Environmental Management

Credit Value: 12

Module Tutor(s): Rob Marjerison (Coordinator)

General objective(s) of the module:

Students starting their degree course with a plan are much more likely to successfully complete their education and have fruitful careers. This module aims to help students succeed by discovering their personal mission, setting goals, prioritizing tasks and working well with others. The module largely follows Stephen Covey's The Seven Habits of Highly Successful People with relevant activities and discussions, providing students with a comfortable forum in which to reflect individually, practice/apply the course contents, and learn teamwork skills.

Learning outcomes – Upon successful completion of the module, students will be able to:

- Identify the fundamentals of effective interpersonal relationships.
- Recognize effective interactions between various relationships.
- Interpret cross-cultural interpersonal relationships.
- Define the connections between knowledge, skill, desire and habits.
- Prioritize short- and long-term personal goals.
- Clarify actions necessary to achieve short and long term personal goals.
- Allocate time and resources to achieve short and long term goals in a balanced manner.
- Identify, appraise and evaluate risk, risk mitigation, risk estimation.
- Systematically evaluate, appraise and improve one's personal, professional and interpersonal effectiveness.

Skills to be developed:

- Students should be able to implement individual processes for managing time, setting meaningful goals, and monitoring progress towards achieving them.

Learning and teaching approaches used:

The module will be conducted over 15 teaching weeks as follows:

- 4 hrs/wk in class in 2 x 2hr blocks comprising: review of prior topics, introduction to a new topic, practice time (~1 hr), and debrief/reflection time at the end.
- 4 hrs/wk outside of class, on average, for independent study, reading, and preparation time.

Assessment:

Continuous Assessment (CA): 100%

CA Assessment	Weight	Assessment Detail
Quizzes (4 x 5%)	20%	Short written individual quizzes of 30 min duration each, covering approximately 2 weeks of subject matter.
Short Assignments (3 x 5%)	15%	Take-home exercises equivalent to 30-min in-class quizzes, covering approximately 2 weeks of subject matter each.
Quizzes (Viva voce, 2 x 5%)	10%	Individual interviews with students assessing their level of application of class topics, particularly goal setting.
Class participation	10%	
Role plays	15%	In-class demonstrations (3x per student) in pairs or groups on interpersonal interactions.
Group multi-media project and presentation	30%	Project in groups of 3-4 on developing a video of 10 min duration on select social issues; group assessment is 10% on video and 10% on presentation; individual assessment component: 10% on reflective diary on group work and making of the video.

Pre-requisite knowledge:

Subject matter:

I. Personal development: an introduction
   a. Overview of the concept of personal development
   b. Importance and applications of personal development in personal, academic, and professional settings
   c. Paradigms and principles in personal development: commonalities in different approaches (e.g. concept of inner mastery and outer impact, self-discipline, resilience and adaptability)
   d. The Seven Habits – an overview

II. Inner mastery / Private victory
   a. Habit 1: Be Proactive
      i. Principles of Personal Vision
      ii. The Social Mirror
      iii. Between Stimulus and Response
      iv. Proactivity Defined
      v. Taking the Initiative
      vi. Act or be Acted Upon
      vii. Listening to our Language
      viii. Circle of Concern - Circle of Influence

ix. Direct, Indirect and No Control
x. Expanding the Circle of Influence
xi. The “Have’s” and the “Be’s”
xii. The Other End of the Stick
xiii. Making and Keeping Commitments

b. Habit 2: Begin with the End in Mind
i. What it Means to “Begin with the End in Mind”
ii. All Things are Created Twice
iii. By Design or Default
iv. Personal Leadership and Management
v. Re-scripting: Becoming Your Own Planner
vi. Personal Mission Statement: Long Term Goals (LTG), Personal and Professional LTG, Steps Needed to Reach LTG, Planning of Steps to Reach LTG, Measuring Progress Towards LTG
vii. At the Center of Circle of Influence
viii. Alternative Centers of Influence
ix. Identifying Your Center of Influence
x. A Principle Center
xi. Writing a Personal Mission Statement
xii. Using Your Whole Brain
xiii. Tapping the Right Brain
xiv. Expand Perspective
xv. Visualization and Affirmation
xvi. Identifying Roles and Goals
xvii. Organizational Mission Statements

c. Habit 3: Put First Things First – Personal Management
i. What is Personal Management
ii. The Power of Independent Will
iii. Four Generations of Time Management
iv. Quadrants – Important vs. Urgent
v. Managing Quadrants
vi. Controlling Quadrants
vii. Determining Quadrants
viii. Fourth Generation of Time Management Skills
ix. Time Management – Personal Management: Planning and Scheduling, Daily Schedule, Weekly/Monthly, Long Term Planning
x. Delegating to Others
xi. Delegating to Time
xii. Two kinds of Delegation: Gofer vs. Stewardship

III. Outer impact / public victory

a. Concept of public victory
i. Paradigms of Independence
ii. The Emotional Bank Account
iii. Six Major Deposits
iv. Attending to Little Things
v. Keeping Commitments
vi. Clarifying Expectations
vii. Showing Personal Integrity
viii. Apologizing Sincerely When You Make a Withdrawal
ix. The Laws of Love and the Laws of Life
x. Problems are Opportunities
xi. Habits of Interdependence
xii. Risk Taking: Types of Risk, Personal Risk, Financial Risk, Social Risk, Emotional Risk, Physical Risk, Professional/Political Risk, Risk in Business, Calculating/Estimating Risk, Mitigating Risk

b. Habit 4: Think win-win
i. Six Paradigms of Human Interaction: Win-Win, Win-Lose, Lose-Win, Lose-Lose, Win, Win-Win or No Deal

ii. Three character traits: integrity, maturity, abundance mentality
iii. Relationships
iv. Agreements
v. Win-Win Management Training
vi. Win-Win Performance Agreements
vii. Win-Win processes

c. Habit 5: Seek first to understand, then to be understood
i. Listening skills
ii. Principles of Empathic Communication
iii. Character and Communication
iv. Empathic Listening
v. Diagnose Before You Prescribe
vi. Four Autobiographical Responses: evaluate, agree or disagree, probe, advise
vii. Understanding and Perception
viii. One-on-One

d. Habit 6: Synergize
i. Principles of creative cooperation
ii. Synergistic Communication
iii. Synergy in the Classroom
iv. Synergy in the Business
v. Synergy and Communication
vi. Considering Additional Alternatives
vii. Negative Synergy
viii. Valuing Differences
ix. Force Field Analysis
x. Synergy in the Environment

IV. Conclusion

a. Habit 7: Sharpen the saw
i. Principles of Self-Renewal
ii. Four Dimensions of Self-Renewal: physical, spiritual, mental, social/emotional
iii. Scripting Others
iv. Balance in Renewal
v. Synergy in Renewal
vi. The Upward Spiral
vii. Intergenerational Living
viii. Becoming a Transition Person
ix. Project Preparation and Guidance/Coaching by Group

b. Final project preparation and presentations

Essential Readings:

1. Covey, Stephen. R. (2013). The 7 habits of highly effective people. Simon & Schuster; Anniversary Ed.
2. De Bono, Edward. (2009). Think! Before It's Too Late. Ebury Publishing.
3. De Bono, Edward. (1999). New Thinking for the New Millennium. New Millennium Entertainment.
4. Other materials and resources as assigned.

Additional Readings:

1. Allen, D. (2002). Getting Things Done. Piatkus.
2. Allen, J. (1911). Eight Pillars of Prosperity. http://james-allen.in1woord.nl/
3. Bach, R. (1970). Jonathan Livingston Seagull. Scribner.
4. Colvin, G. (2010). Talent is Overrated. Portfolio Trade; Updated edition.
5. Gilbert, E. (2010). Eat, Pray, Love. Penguin Books.
6. Hill, N. (1937). Think and Grow Rich. https://archive.org/details/Think_and_Grow_Rich
7. Isaacson, W. (2011). Steve Jobs. Simon & Schuster.

8. Kuh, G. D. (1995). The other curriculum: Out-of-class experiences associated with student learning and personal development. The Journal of Higher Education, 123-155.
9. Kuh, G. (1991). Involving Colleges: Successful Approaches to Fostering Student Learning and Development outside the Classroom. San Francisco: Jossey-Bass.
10. Marcus Aurelius. (167 BCE). The Meditations of Marcus Aurelius. http://classics.mit.edu/Antoninus/meditations.html
11. Ratey, J. (2013). Spark. Little, Brown and Company; Reprint edition.
12. Stanley, T. (2009). Stop Acting Rich. Wiley.
13. Schwartz, D. (1987). The Magic of Thinking Big. Fireside; Reprint edition.
14. Tolle, E. (2004). The Power of Now. New World Library; 1st edition.

Date last updated: May 30, 2015

Module Code and Title: **EAP101 English for Academic Purposes I**

Programme(s): BSc Environmental Management

Credit Value: 12

Module Tutor(s): Yesodha Chauhan (Coordinator)
Ivan Stacy
Vanlallawmkimi
Poonam Chhetri

General objective(s) of the module:

EAP101 is the first part of a year-long course which aims to develop abilities in reading, writing, listening, and speaking in an academic context. The course aims to provide students with the opportunity to engage with a range of topics, tasks and texts of an academic nature. During the course, students will develop their skills in understanding lectures, reading academic texts effectively, taking notes from lectures and written texts, writing academic essays, participating in seminars and discussions, giving presentations, and the language aspects of Academic English appropriate to the above. The course presents opportunities to work on multiple skills within a content-based approach and seeks to develop these skills iteratively in a systematic fashion. Each unit has a specific theme, which can be covered in approximately a week. The unit themes/contexts themselves are intended to be modular, so long as they can cumulate to the overall learning outcomes of the module, and the total number of units is maintained. Therefore, it is expected that for different disciplines to which this course is offered, different themes may be used for the various units, as long as they align with levels B1-B2 of the Common European Framework Reference for languages. The subject matter listed here is derived from The Cambridge Academic English series. Equivalent series include Cambridge Academic Encounters, Oxford EAP, Pearson Academic Connections, Pearson LEAP, any others which provide integrated skills development, or equivalent units/themes developed by individual departments.

Learning outcomes – Upon successful completion of the module, students will be able to:

- Follow and summarize extended speech and complex oral lines of argument on topics that are reasonably familiar, and when the direction of the talk is sign-posted by explicit markers.
- Take notes (or make other types of representations) when listening, sufficient to study from.
- Ask relevant questions on topics recently presented in organized classroom talks and presentations.
- Recall basic material presented in organized classroom talks to the extent of being able to correctly answer on-the-spot questions about the material.
- Distinguish between different texts for different purposes (to inform, to entertain, to argue a point, etc.) and clearly identify the purpose.

- Identify the author(s)' position on an issue in an opinion piece / argumentative written work.
- Evaluate longer potential readings for relevance to an intended purpose and choose appropriate ones, prior to reading the whole text (e.g. judge based on title, author, publisher, year of publication, table of contents).
- Synthesize main points and relevant information from academic texts in written notes.
- Summarize the key ideas in straightforward written text.
- Paraphrase from straightforward written text.
- Define common academic vocabulary words as well as subject-specific words and terms frequently encountered in first-semester subject modules.
- Report and express an opinion on different topics associated with relevant coursework and everyday life and common issues (e.g., give a 10 min. independent presentation).
- Research, plan, outline, and draft a text on assigned topics or subjects of interest incorporating proper English grammar usage and academic writing conventions.
- Define plagiarism, identify examples of plagiarized and original work, and demonstrate basic proficiency in techniques for avoiding it.

Learning and teaching approaches used:

The module will be conducted over 15 teaching weeks as follows:

- 6 hrs/wk in-class lecture, discussions, and practice in 3 x 2hr blocks. In-class time in each block is used in a workshop style with a review of prior topics and introduction to a new topic, at least one hour on practice, and debrief / reflection / assessment time at the end. Each major unit includes some assessment involving approximately 30 min of in-class time per week on average. Students are expected to use a significant portion of the total in-class time on practice with selected exercises.
- 2 hrs/wk outside of class, on average, for independent study and practice.

Assessment:

Continuous Assessment (CA): 100%

CA Assessment	Weight	Assessment Detail
Weekly exercises (10 x 2%)	20%	Workbook exercises involving approx. 30-45 min of in-class effort.
Presentation	10%	Individual 10 min presentation on a current affairs topic with 2-5 min Q&A.
Written paper including all the phases	15%	Essay of 1000 words, primarily personal in nature with reflective/responsive style.
Learning journal	15%	Semester-long journal with min. 10 entries of min. 250 words each, relating discipline-specific topics to EAP lessons.
Class tests (3 x 10%)	30%	Written tests of 60 min duration, each covering approximately 5 weeks of subject matter.
Vocabulary and grammar test	10%	Written test of 45 min duration.

Pre-requisite knowledge:

Subject matter:

I. Academic orientation
   a. Setting study goals in academic English
   b. Focusing on academic study
   c. Reading and writing in academic English
   d. Attending lectures
   e. Studying independently on an academic English course
   f. Thinking about the role of language in academic English
   g. Plagiarism and how to avoid it

II. Topic/context: Styles of learning
    a. Reading: Reading for key terms and guessing meaning in context; Grammar in context: *-ing* forms; Grammar in context: present simple in academic English; Scan reading; Reading for your course; Gist reading
    b. Listening and speaking: Asking for study help
    c. Writing: Organizing ideas; Linking words 1
    d. Grammar and vocabulary practice: Noun forms; *-ing* forms; Present simple in academic English; Sentences with *if* that talk about what is generally true; Collocations with *conclusion*
III. Topic/context: Problems in the natural world
    a. Reading: Understanding essay questions; Identifying the relevance of the text; Grammar in context: noun phrases
    b. Listening and speaking: Making sure you have understood
    c. Writing: Paragraph building; Grammar in context: present perfect
    d. Grammar and vocabulary practice: Word families; Quantifying expressions; Noun phrases; Clause structure; Present perfect and past simple
IV. Lecture Skills A
    a. Preparing for lectures: Talking about products; Vocabulary for the context
    b. Listening: Listening for gist and detail
    c. Language focus: *If* structures 1; Vocabulary: key expressions; Pronunciation: emphasising words
    d. Follow-up: Organising notes; Further listening
V. Topic/context: Indications and trends
    a. Reading: Deciding what to read for an essay; Approaches to note-taking 1; Grammar in context: past perfect
    b. Listening and speaking: Giving advice; Asking for help
    c. Writing: Planning the main paragraphs of an essay; Writing a short report; Vocabulary in context: language for describing trends
    d. Grammar and vocabulary practice: Corpus language; Past simple; Past perfect; Language to describe statistics; Words for economic graphs
VI. Topic/context: The information age
    a. Reading: Interactive reading Grammar in context: phrases of frequency Reading for the main ideas in a text; Grammar in context: prepositional phrases
    b. Listening and speaking: Outlining issues and putting forward your point of view
    c. Writing: Drafting and building arguments
    d. Grammar and vocabulary practice: Word building; Noun phrases; Phrases of frequency; Vocabulary families; Prepositional phrases; Reporting verbs
VII. Lecture Skills B
    a. Preparing for lectures: Women scientists in history; Vocabulary for the context
    b. Listening: Listening for gist and detail
    c. Language focus: Signposting language in lectures; Pronunciation; Useful phrases
    d. Follow-up: Further research; Further listening
VIII. Topic/context: On budget
    a. Reading: Reading for key information and concepts; Grammar in context: expressing different levels of certainty; Vocabulary in context: language to define terms
    b. Listening and speaking: Describing a process in a seminar presentation; Giving a presentation: describing a process
    c. Writing: Drafting and revising content
    d. Grammar and vocabulary practice: Words associated with planning; Language of possibility; Definitions; Language of presentations; Word families from the Academic Word List
IX. Topic/context: Being objective
    a. Reading: Close reading for key ideas; Analysing information in more complex texts; Grammar in context: modal expressions; Grammar in context: relative clauses
    b. Listening and speaking: Agreeing and disagreeing

c. Writing: Paraphrasing information for essays; Avoiding plagiarism; Linking words 2
d. Grammar and vocabulary practice: Verb and noun collocations; Language of agreement; Modal expressions; Relative clauses; Linking words and phrases

X. Lecture Skills C
a. Preparing for lectures: Chemical elements; Predicting information from visuals; Vocabulary for the context
b. Listening: Listening for gist and detail
c. Language focus: Language for focusing on visuals; Beginnings and endings; Intonation
d. Follow-up: Critical thinking; Further listening

XI. Topic/context: Innovation
a. Reading: Approaches to note-taking 2
b. Listening and speaking: Turn-taking in discussions
c. Writing: Paraphrasing by using synonyms; Grammar in context: comparing and contrasting
d. Grammar and vocabulary practice: *Innovation* word family; Synonyms; Comparative language; Articles; Joining ideas

XII. Topic/context: Sensing and understanding
a. Reading: Text organisation 1; Grammar in context: passive constructions; Vocabulary in context: word building
b. Listening and speaking: Signposting in seminar presentations; Giving a presentation
c. Writing: Linking words 3; Grammar in context: using the passive to manage information in texts
d. Grammar and vocabulary practice: Art and design vocabulary; Passive forms; *Perceive* word family; Signposting in seminar presentations; Linking words

XIII. Lecture Skills D
a. Preparing for lectures: Discussion on global warming; Vocabulary for the context; Predicting
b. Listening: Listening for gist and detail
c. Language focus: Referring words; Emphasising structures
d. Follow-up: Taking action; Further listening

XIV. Topic/context: IT issues
a. Reading: Text organisation 2; Grammar in context: hedging language
b. Listening and speaking: Problem–solution patterns and repair strategies
c. Writing: Generating ideas; Grammar in context: cohesive devices; In-text referencing (particular focus on APA style)
d. Grammar and vocabulary practice: Subordination; Crime vocabulary; Hedging language; Cohesion

XV. Topic/context: Culture shock
a. Reading: Text organisation 3; Grammar in context: reduced relative clauses
b. Listening and speaking: Concluding a presentation
c. Writing: Planning the overall shape of an essay; Reading for relevant information; Writing the conclusion; Creating a bibliography (APA style references list)
d. Grammar and vocabulary practice: Word building; Reduced relative clauses; Participle clauses; Compound words

XVI. Lecture Skills E
a. Preparing for lectures: Discussion; Vocabulary for the context
b. Listening: Scan listening and interactive listening
c. Language focus: Guessing the meaning of vocabulary; *If* structures 2
d. Follow-up: Discussion; Further listening

The aspects of academic writing covered in the above chronology include:

- Organizing ideas
- Paragraph building
- Planning the main paragraphs of an essay

- Writing a short report
- Drafting and building arguments
- Drafting and revising content
- Paraphrasing information for essays
- Avoiding plagiarism
- Generating ideas
- In-text referencing (particular focus on APA style)
- Planning the overall shape of an essay
- Writing the conclusion
- Creating a bibliography (APA style references list)

Essential Readings:

1. Thaine, C. and McCarthy, M. (2014). Cambridge Academic English – An integrated skills course for EAP: B1+ (Intermediate) Student's Book. Delhi: Cambridge University Press.
2. Equivalent series to the above as necessary, including Cambridge Academic Encounters, Oxford EAP, or Pearson Academic Connections, or Pearson LEAP, any others which provide integrated skills development, or equivalent units/themes developed by individual departments.
3. Additional selected short readings that are discipline-specific.

Additional Readings:

1. Thaine, C. and McCarthy, M. (2014). Cambridge Academic English – An integrated skills course for EAP: B1+ (Intermediate) Teacher's Manual. Delhi: Cambridge University Press.
2. Equivalent teacher's manuals/editions from other series to the above as necessary.

References:

1. Common European Framework of Reference for Languages: learning, teaching, assessment. (2014). European University Institute Language Centre. https://www.eui.eu/Documents/ServicesAdmin/LanguageCentre/CEF.pdf
2. Council of Europe. (n.d.). Common European Framework of Reference for Languages: Learning, Teaching, Assessment (CEFR). http://www.coe.int/t/dg4/linguistic/cadre1_en.asp
3. Council of Europe. (2001). Global Scale descriptors for CEFR levels. Council of Europe, 2001: 24. http://www.coe.int/t/dg4/education/elp/elp-reg/Source/Global_scale/globalscale.pdf
4. Hyland K. (2006). English for Academic Purposes. New York: Routelage.
5. St. Giles International. (n.d.). CEFR Level B1. http://www.stgiles-international.com/downloads/Level-B1-Learner-Outcomes.pdf
6. Using the CEFR: Principles of Good Practice (University of Cambridge, 2011) http://www.cambridgeenglish.org/images/126011-using-cefr-principles-of-good-practice.pdf

Date last updated: May 30, 2015

Module Code and Title: **EAP102 English for Academic Purposes II**

Programme(s): BSc Environmental Management

Credit Value: 12

Module Tutor(s): Ivan Stacy (Coordinator)
Yesodha Chauhan
Vanlallawmkimi
Poonam Chhetri

General objective(s) of the module:

EAP102 is the second part of a year-long course which aims to develop abilities in reading, writing, listening, and speaking in an academic context. The second part focus on helping students ensure their communication is *effective*, particularly in terms of academic writing. The course aims to provide students with the opportunity to engage with a range of topics, tasks and texts of an academic nature. During the course, students will develop their skills in understanding lectures, reading academic texts effectively, taking notes from lectures and written texts, writing academic essays, participating in seminars and discussions, giving presentations, and the language aspects of Academic English appropriate to the above. The course presents opportunities to work on multiple skills within a content-based approach and seeks to develop these skills iteratively in a systematic fashion. Each unit has a specific theme, which can be covered in approximately a week. The unit themes/contexts themselves are intended to be modular, so long as they can cumulate to the overall learning outcomes of the module, and the total number of units is maintained. Therefore, it is expected that for different disciplines to which this course is offered, different themes may be used for the various units, as long as they align with levels B1-B2 of the Common European Framework Reference for languages. The subject matter listed here is derived from The Cambridge Academic English series. Equivalent series include Cambridge Academic Encounters, Oxford EAP, Pearson Academic Connections, Pearson LEAP, any others which provide integrated skills development, or equivalent units/themes developed by individual departments.

Learning outcomes – Upon successful completion of the module, students will be able to:

- Recall the main themes of standard speech spoken at a normal rate and complex lines of argument provided the topic is reasonably familiar, with comprehension difficulty arising only from extreme background noise, inadequate discourse structure and/or excess idiomatic usage.
- Accurately summarize the essentials of most lectures, talks, and reports, including the main ideas of complex speech on both concrete and abstract topics delivered in a standard language, including technical discussions.
- Critically evaluate articles and reports concerned with contemporary issues in which the writers adopt particular stances or viewpoints.
- Explain the main themes of complex texts read with a large degree of independence, using a broad active reading vocabulary in all but low frequency words and idioms, adapting style and speed of reading to different texts and purposes, and using appropriate reference sources selectively.
- Suspect, recognize and verify the detection of plagiarized text.
- Deliver a formal oral presentation, with clear, systematically developed, detailed descriptions on a wide range of subjects related to their field of interest, expanding and supporting ideas with subsidiary points and relevant examples, and rounding off with an appropriate conclusion.
- Demonstrate basic proficiency in pronunciation with a reasonably clear, natural, pronunciation and intonation that can, with some effort, keep up with and contribute to group discussions even when speech is fast and colloquial.
- Define common academic vocabulary words as well as subject-specific words and terms frequently encountered in second-semester subject modules.
- Write original researched text using and acknowledging sources appropriately and without plagiarism, incorporating summarization, paraphrasing, quotation, and synthesis as appropriate.

Learning and teaching approaches used:

The module will be conducted over 15 teaching weeks as follows:

- 6 hrs/wk in-class lecture, discussions, and practice in 3 x 2hr blocks. In-class time in each block is used in a workshop style with a review of prior topics and introduction to a new topic, at least one hour on practice, and debrief / reflection / assessment time at the

end. Each major unit includes some assessment involving approximately 30 min of in-class time per week on average. Students are expected to use a significant portion of the total in-class time on practice with selected exercises.

- 2 hrs/wk outside of class, on average, for independent study and practice.

Assessment:

Continuous Assessment (CA): 100%

CA Assessment	Weight	Assessment Detail
Weekly exercises (10 x 2%)	20%	Workbook exercises involving approx. 30-45 min of in-class effort.
Presentation	10%	Individual 10 min presentation on a current affairs topic with 2-5 min Q&A.
Written paper including all the phases	15%	Outline including annotated bibliography, draft, and final copy of a researched paper of 1500 words incorporating at least 3 reference sources.
Learning journal	15%	Semester-long journal with min. 10 entries of min. 250 words each, relating discipline-specific topics to EAP lessons.
Class tests (3 x 10%)	30%	Written tests of 60 min duration.
Vocabulary, grammar, and pronunciation test	10%	Written test of 45 min duration + viva (5 min).

Pre-requisite knowledge: EAP101 English for Academic Purposes I

Subject matter:

I. Academic orientation
   a. Assessing one's academic skills
   b. Thinking about academic culture
   c. Thinking critically
   d. Avoiding plagiarism
   e. Recognising variation across academic subjects
   f. Focusing on academic vocabulary

II. Topic/context: Choices and implications
   a. Reading: Researching texts for essays; Skimming and scanning; Identifying the sequence of ideas; Understanding implicit meanings; Inferring the meaning of words; Vocabulary building: adjectives
   b. Listening and speaking: Introducing your presentation; Clarifying key terms
   c. Writing: Understanding how essay types are organised; Drafting the introduction to an essay; Language for writing: common knowledge
   d. Grammar and vocabulary practice: Avoiding repetition: *that (of)* and *those (of)*; Word families: linking parts of texts ; Verb-noun collocations

III. Topic/context: Risks and hazards
   a. Reading: Selecting and prioritising what you read; Thinking about what you already know; Inferring the meaning of words; Vocabulary building 1: collocations; Vocabulary building 2: cause-effect markers; Retelling what you have read
   b. Listening and speaking: Preparing slides for presentations; Choosing the right type of chart for a slide; Presenting charts; Pronunciation 1: numbers; Pronunciation 2: inserts
   c. Writing: Using claims to plan essays; Supporting claims with evidence
   d. Grammar and vocabulary practice: Complex noun phrases; Countable and uncountable nouns; Adjectives meaning *large* or *important*; Prefixes

IV. Lecture Skills A
   a. Preparing for lectures: Lecturing styles; Revising basic information
   b. Listening: Understanding lecture aims; Understanding outlines; Identifying main and secondary points; Taking notes: annotating slides 1

c. Language focus: *Repetition and rephrasing*
d. Follow-up: Taking notes: annotating slides 2; Reviewing your notes

V. Topic/context: Language and communication
   a. Reading: Predicting the content of a text; Reading for detail; Scanning for information; Understanding implicit meanings; Vocabulary building: adjectives; Thinking about ways of taking notes
   b. Listening and speaking: Making suggestions in group work; Pronunciation : stress in adjectives ending in *-ic* and *-ical*
   c. Writing: Referring to other people's work; Using in-text references (particular focus on APA style); Language for writing: reporting verbs
   d. Grammar and vocabulary practice: Impersonal *it*-clauses: saying that something is important, interesting, etc.; Word families; Nouns with related adjectives ending in *-ic* and *-ical*; Reporting verbs

VI. Topic/context: Difference and diversity
   a. Reading: Thinking about what you already know; Reading in detail; Taking notes; Vocabulary building 1: word families; Vocabulary building 2: adjective-noun collocations; Collecting information for an essay; Taking notes for essay writing
   b. Listening and speaking: Working with colleagues: generating ideas and reporting; Pronunciation: dividing speech into units
   c. Writing: Language for writing 1: the grammar of reporting verbs; Language for writing 2: comparing and contrasting; Reporting from a reading
   d. Grammar and vocabulary practice: Linking parts of a text: conjunctions and sentence connectors; Single-word verbs and multi-word verbs; Word families

VII. Lecture Skills B
   a. Preparing for lectures: Using preparation strategies; Making predictions before a lecture starts
   b. Listening: Making predictions during a lecture; Identifying topic change; Following an argument; Taking notes: using symbols and abbreviation in notes
   c. Language focus: Organising questions and topic changes
   d. Follow-up: Expanding your vocabulary

VIII. Topic/context: The world we live in
   a. Reading: Recognising plagiarism; Getting started; Identifying the main ideas in a text; Summarising what you have read; Vocabulary building: single-word verbs and multi-word verbs; Vocabulary in context: hedging adverbs
   b. Listening and speaking: Reaching a consensus in group work; Pronunciation: contrasts
   c. Writing: Using paraphrases; Including quotations in writing
   d. Grammar and vocabulary practice: Articles: *zero* article and *the*; Complex prepositions; *Person*, *people*, *peoples*

IX. Topic/context: Behaving the way we do
   a. Reading: Organising information for an essay; Skimming and scanning texts; Taking notes and explaining what you have read; Vocabulary building: collocations
   b. Listening and speaking: Referring backwards and forwards in presentations
   c. Writing: Writing conclusions in essays; Language for writing: hedging; Giving references
   d. Grammar and vocabulary practice: Avoiding repetitions: expressions with *so*; *Wh*-noun clauses; Using viewpoint adverbs to restrict what is said; Verb/adjective + preposition combinations

X. Lecture Skills C
   a. Preparing for lectures: Thinking about the purposes of lectures
   b. Listening: Understanding evaluations; Understanding lists
   c. Language focus: Noticing differences in the language of lectures and academic writing; Noticing prominent words
   d. Follow-up: Taking notes: annotating; Reconstructing your notes

XI. Topic/context: Bringing about change

a. Reading: Reading critically; Finding information and taking notes; Vocabulary in context 1: inferring the meaning of words; Vocabulary in context 2: hedges; Retelling what you have read
b. Listening and speaking: Concluding your presentation; Pronunciation: linking words in speech units
c. Writing: Using an academic style
d. Grammar and vocabulary practice: Adding information about nouns: relative clauses; *It*-clauses: expressing personal opinions impersonally; Abstract nouns + *of* + *-ing*/*to*-infinitive

XII. Topic/context: Work and equality
a. Reading: Understanding figures and tables; Scanning for information; Taking notes; Understanding the significance of references; Vocabulary in context: avoiding repetition
b. Listening and speaking: Taking part in tutorials and joining in discussions; Pronunciation: stress in compound nouns 1
c. Writing: Looking at the structure and content of reports; Language for writing 1: describing events in a time sequence; Language for writing 2: cause and effect
d. Grammar and vocabulary practice: Passive voice; Past perfect; *-ing* nouns

XIII. Lecture Skills D
a. Preparing for lectures: Building basic information
b. Listening: Understanding the relationship between parts of the lecture; Understanding descriptions of processes
c. Language focus: Understanding vague language
d. Follow-up: Listening for a lecture summary; Comparing notes

XIV. Topic/context: Controversies
a. Reading: Understanding the writer's opinion; Identifying main ideas and supporting information; Recognising general nouns; Understanding hedges; Vocabulary building 1: formal and informal verbs; Vocabulary building 2: opposites
b. Listening and speaking: Tutorials: asking for and giving more information; Pronunciation: intonation in *wh*-clefts
c. Writing: Describing information in figures and tables; Language for writing 1: referring to figures and tables; Language for writing 2: referring backwards and forwards; Writing practice
d. Grammar and vocabulary practice: Verbs followed by a noun phrase or *that*-clause; Non-finite relative clauses; Adverbials used to comment

XV. Topic/context: Health
a. Reading: Reading for evidence; Thinking about what you already know; Preparing for essay writing; Vocabulary in context: inferring the meaning of words; Understanding connections in texts: *this*/*these*; Developing hedging skills
b. Listening and speaking: Summarising what has been said; Evaluating visual aids; Pronunciation: stress in compound nouns 2
c. Writing: Contrasting information; Taking a stance : expressing disagreement; Writing practice
d. Grammar and vocabulary practice: Referring to quantities; Evaluative adjectives and adverbs; Phrases connecting sentences: *this*/*these*; Non-finite relative clauses

XVI. Lecture Skills E
a. Preparing for lectures: Overcoming problems in listening to lectures
b. Listening: Understanding specialised terms; Understanding reasons
c. Language focus: Understanding signals of incomplete information; Understanding forward and backward reference
d. Follow-up: Listening and annotating slides; Writing up your notes; Overcoming problems

The aspects of academic writing covered in the above chronology include:

- Understanding how essay types are organized

- Drafting the introduction to an essay
- Using claims to plan essays
- Supporting claims with evidence
- Referring to other people's work
- Using in-text references (particular focus on APA style)
- Reporting from a reading
- Using paraphrases
- Including quotations in writing
- Writing conclusions in essays
- Giving references
- Using an academic style
- Describing information in figures and tables
- Contrasting information
- Taking a stance: expressing disagreement

Essential Readings:

1. Hewings, M. and McCarthy, M. (2014). Cambridge Academic English – An integrated skills course for EAP: B2 (Upper Intermediate) Student's Book. Delhi: Cambridge University Press.
2. Equivalent series to the above as necessary, including Cambridge Academic Encounters, Oxford EAP, or Pearson Academic Connections, or Pearson LEAP, any others which provide integrated skills development, or equivalent units/themes developed by individual departments.
3. Additional selected short readings that are discipline-specific.

Additional Readings:

1. Hewings, M. and McCarthy, M. (2014). Cambridge Academic English – An integrated skills course for EAP: B2 (Upper Intermediate) Teacher's Manual. Delhi: Cambridge University Press.
2. Equivalent teacher's manuals/editions from other series to the above as necessary.

References:

1. Common European Framework of Reference for Languages: learning, teaching, assessment. (2014). European University Institute Language Centre. https://www.eui.eu/Documents/ServicesAdmin/LanguageCentre/CEF.pdf
2. Council of Europe. (n.d.). Common European Framework of Reference for Languages: Learning, Teaching, Assessment (CEFR). http://www.coe.int/t/dg4/linguistic/cadre1_en.asp
3. Council of Europe. (2001). Global Scale descriptors for CEFR levels. Council of Europe, 2001: 24. http://www.coe.int/t/dg4/education/elp/elp-reg/Source/Global_scale/globalscale.pdf
4. Hyland K. (2006). English for Academic Purposes. New York: Routelage.
5. St. Giles International. (n.d.). CEFR Level B2. http://www.stgiles-international.com/downloads/Level-B2-Learner-Outcomes.pdf
6. Using the CEFR: Principles of Good Practice (University of Cambridge, 2011) http://www.cambridgeenglish.org/images/126011-using-cefr-principles-of-good-practice.pdf

Date last updated: May 30, 2015

Module Code and Title: **IPS101** **IT and Basic Problem Solving**

Programme(s): BSc Environmental Management

Credit Value: 12

Module Tutor(s): Somnath Chaudhuri (Coordinator)
Tanmay Singha
Libni Thomas
Phub Namgay

General objective(s) of the module:

This module aims to develop a working facility with Office productivity tools (Microsoft Word, Excel, PowerPoint). The module will also develop skill in basic structuring of problems, applying common sense logic and reasoning to problem solving, using appropriate tools to solve problems, and presenting findings in a clear and concise manner.

Learning outcomes – Upon successful completion of the module, students will be able to:

- Demonstrate basic functional use of Word, Excel and PowerPoint, to the level appropriate for the remainder of the time in college plus an entry-level job.
- Find data relevant to a problem.
- Assess the quality and reliability of data.
- Structure common mathematical problems.
- Solve common mathematical problems on Excel and other software.
- Approximate quantitative answers.
- Judge reasonableness for computed answers.
- Structure more complex problems, including asking the relevant questions, gathering appropriate data, analysing that data, and presenting findings.

Skills to be developed:

- Students should develop basic IT/office productivity skills.
- Students should gain skill in structuring and solving problems, and assessing the reasonableness and usefulness of conclusions.

Learning and teaching approaches used:

The module will be conducted over 15 teaching weeks as follows:
- 4 hrs/wk lecture & practice in a computer lab in 2 x 2hr block periods.
- 4 hrs/wk outside of class, on average, for independent study and further practice.

Assessment:

Continuous Assessment (CA): 100%

CA Assessment	Weight	Assessment Detail
Frequent short practice exercises (6 x 5%)	30%	In-class (30 min) and take-home practice exercise incorporating small elements of Units I-III (e.g. data searches, re-write letter, short Excel problems, milestones in Unit III).
Achieving interrelated tasks throughout, Unit I	20%	Written report using Word (500 words) – 10%; Preparation of a presentation using PPT (10 slides) – 10%.
Problem solving, approximation exercises, Unit II	30%	Three written/computed in-class exercises of 10% each on problem solving.
Final Project	20%	Written report using Word (500 words) and accompanying presentation of 10 min duration using PPT (~10 slides).

Pre-requisite knowledge:

Subject matter:

I. Basics of the computer for communication and analysis
   a. Write a letter, e-mail it, file it, respond
      i. Basics of Word
      ii. Basics of Internet
      iii. File folders; search
   b. Find and assess information: Internet search (e.g. Google); Sifting through / assessing quality of information; quality of the source; Categories of information/issues with each
      i. Facts: Reliability of the source; crosschecking different sources
      ii. Data: Varies with the question being asked; different perspectives
      iii. Opinion: No single answer; varies with source and perspective; different uses in different contexts
      iv. Revise the letter, using better quality information
   c. Present the findings
      i. Written report using Word (introduction, key issues, analysis, conclusions, actions)
      ii. Presentation using Powerpoint: Powerpoint basics (clear concise slides; major points only, not reading off the slides; body language and eye contact / facing the audience

II. Solving problems using basic math on the computer
   a. Introduction to Excel: types of basic problems that can be solved
      i. Calculation of a specific answer to a narrow problem (e.g. average and weighted averages, Min/Max, Count, Present value, IRR)
      ii. Statistical overview of a dataset
   b. Students do a variety of problems, and solve on Excel: Identify different types of problems; set up problem/data on Excel; Assess the correctness of the answer
      i. Students select different types of problems they can solve with basic math of general relevance
         1. Budgeting and basic finance (money and consumer math): Account balances, savings and loan repayment calculations based on simple interest; estimating returns on investment, doubling time
         2. Percentages: % increases, decreases, commissions, discounts
         3. Weighted averages, e.g. marks calculation
         4. Quantitative trends over time
         5. Basic probability
      ii. Assess the correctness of the answer (i.e. do estimations of the answer and compare with the calculated answer as a way of finding mistakes and approximating answers)
         1. Basic “reasonableness”: identify answers which are clearly out of the possible range of answers
         2. Do rough calculations to get approximate answers
         3. Relate to the type of possible answers (e.g. for an average, the answer cannot be outside the range of numbers in the data - look at the most frequent number in the data; e.g. for a compound interest problem, do simple multiplication for the approximation).

III. More complex problem-solving
   a. Introduction to structuring a complex problem, asking the right questions, analysing the data, drawing conclusions. Examples in various subject areas:
      i. Business: Market/Customer data regarding demand for competing products
      ii. Economics: Price vs. Demand
      iii. Environment: Correlation of an environmental hazard with a health issue
      iv. Social sciences: Types of people for/against a particular issue

IV. Final Project
   a. Student identifies a more complex problem he/she wants to analyse, and then structures the basic data collection, data analysis, and conclusions

i. Identify the issues to be addressed
ii. Structure questions to highlight these issues and draw conclusions
iii. Process and limitations for obtaining survey answers (if relevant)
iv. Accuracy and compiling data
v. Structuring the data analysis in Excel
vi. Interpreting quantitative results and drawing conclusions
vii. Assessing reliability, limitations of answers

b. Student prepares a written report in Word and a presentation in Powerpoint (presentation given to student audience; other students critique the presentation)

Essential Readings:

1. Frye, C. (2014). Microsoft Excel 2013 Step by Step. Microsoft Press.
2. Simple case studies designed to teach students how to identify a problem and structure a solution.
3. Training resources on Microsoft Office, available at http://office.microsoft.com/en-us/training/

Additional Readings:

1. Swinford, E., Melton, B., and Dodge, M. (2013). Microsoft Office Professional 2013 Step by Step. Microsoft Press.
2. Weverka, P. (2013). Microsoft Office 2013: All-in-One for Dummies. Wiley India.

Date last updated: May 30, 2015

Module Code and Title: **ANS101 Analytical Skills**

Programme(s): BSc Environmental Management

Credit Value: 12

Module Tutor(s): Ugyen Thinlay (Coordinator)
Rob Marjerison
Somnath Chaudhuri

General objective(s) of the module:

This module aims to develop skills in analytical thinking, specifically the ability to assess a situation, relationship or organization based on certain criterion, along with development of professional communication skills.

Learning outcomes – Upon successful completion of the module, students will be able to:

- Discuss a general process of analysis.
- Explain, including examples, assessment and evaluation criteria.
- Apply a set of criteria in the evaluation of a situation, organization or relationship.
- Apply the power of creative thinking to spot unnoticed opportunities.
- Identify and accurately assess issues and their ramifications.
- Analyse issues, consider and prioritize solutions and make informed decisions.
- Apply problem solving tools appropriate to a given issue.
- Design creative, appropriate solutions to issues.
- Develop a positive and constructive manner in presenting issues, options and solutions.

Skills to be developed:

- Ability to present and clearly explain issues, options and solutions.
- Ability to write brief concise communiqués in professional business contexts.
- Ability to use multimedia formats to present information effectively.

Learning and teaching approaches used:

The module will be conducted over 15 teaching weeks as follows:

- 1 hr/wk lecture.
- 1 hr/wk classroom discussion.
- 0.5 hr/wk quizzes and in-class practice assignments.
- 1 hr/wk role playing activities.
- 0.5 hr/wk group presentations (project/case study).
- 4 hrs/wk outside of class, on average, for independent study.

Assessment:

Semester-End Examination (SE):20%
Continuous Assessment (CA): 80%

CA Assessment	Weight	Assessment Detail
Group Case Study/Project:	30%	Project in groups of 3-4 on a case-study style analysis.
Quizzes (3 x 5%)	15%	Short written individual quizzes of 30 min duration each, covering approximately 3 weeks of subject matter.
Assignments (2 x 5%)	10%	Short written individual take-home assignments, covering approximately 3 weeks of subject matter.
Class participation	10%	
Role plays	15%	In-class demonstrations (3x per student) in pairs or groups on interpersonal interactions.

Pre-requisite knowledge:

Subject matter:

I. Orientation and Introduction
   a. Concepts of:
      i. Analytical Skills
      ii. Logical Problem Solving
      iii. Creative Problem Solving
II. Overview of Analytical Thinking and Types of Analysis
   a. Examples – Case Study
   b. Exercises
   c. Consideration of criterion to be used in analysis/evaluation.
   d. Known evaluation criterion:
      i. Survey/Original Research
      ii. Literature Review
      iii. SWOT Analysis
      iv. PEST/STEEPLES Analysis
   e. Subjects of Analysis
      i. Relationships: Personal, Professional, Inter-organizational, Commercial/Economic
      ii. Organizations: Governmental, Corporate, Multi-National, Political, NGOs, Profit/Non-Profit
      iii. Situations: Political, Competitive, Adversarial, Commercial/Economic
III. General process of analysis
   a. Planning

i. Establishing the purpose of an analysis
ii. Identifying issues essential for a comprehensive understanding
iii. Clarifying relevant issues and ask relevant questions in relation to who/what/where/when/why/how, options, benefits and risks
iv. Deciding on an approach
v. Creating a plan for collection of necessary information

b. Analysing
i. Collecting, organizing, and evaluating data using standard tools
ii. Evaluating information and data; dealing with information gaps
iii. Generating ideas from evaluated data
iv. Determining risks; performing cost-benefit analyses
v. Evaluating ideas using established criteria; analysing strategies

c. Concluding
i. Characteristics of well-thought out and valid conclusions
ii. Transforming conclusions into recommendations
iii. Developing conclusions and recommendations into presentable formats for target audiences
iv. Presenting the analysis project with an aim to generate buy-in

IV. Analysis exercise
a. Choosing an entity, relationship or situation for group project
b. Determine the criterion to assess
c. Identify issues
d. Identify possible solutions
e. Explore alternative solutions:
i. Re-explore assessment criterion
ii. Re-examine situational assumptions
iii. “What if” scenarios
f. Analyse - identify and assess each possible solution:
i. Benefits
ii. Consequences
iii. Risks
iv. Ramifications
g. Prioritize possible solutions
h. Identify optimal solution
i. Develop implementation and contingency plans

V. Communication of analysis
a. Preparation of a suitable written document
b. Preparation of an effective presentation
c. Preparation of multimedia project
d. Presentations of the analysis

Essential Readings:

1. RTC. (2015). Coursepack for General Analytical Skills. Thimphu: Royal Thimphu College (Compiled readings and exercises from the following list of additional readings).

Additional Readings:

1. Bono, Edward de (2005). Thinking course (Rev Ed). Barnes and Nobel.
2. Bono, Edward de (2000). Six thinking hats (2nd). New Delhi: Penguin India.
3. Bono, Edward de (2009). Lateral thinking. e-Penguin.
4. Bono, Edward de (2008). Creativity workout: 62 exercises to unlock your most creative ideas. Ulysses Press.
5. Chopra, Dr. R. (). Logical, critical, analytical reasoning. Galgoba.
6. Covey, Stephen. R. (2009). The 7 habits of highly effective people. New York: Franklin Covey Co.
7. Covey, Sean. (2009). The 7 habits of highly effective teenagers. Pocket Books.
8. Davies, William. (1992). Climbing the corporate ladder. Thorsons.

9. Eiffert, Stephen. D. (1999). Cross-train your brain: a mental fitness program for maximizing creativity and achieving success. Amacom.
10. Michalko, M. (2006). Thinkertoys: A handbook of creative-thinking techniques (2nd Ed). Ten Speed Press.
11. Treffinger, D.J. (2006). Creative problem solving: An introduction (4th Ed). Prufrock Press.
12. Wujec, Tom. (n.d). The complete mental fitness book. Orient Paper.

Date last updated: May 30, 2015

Module Code and Title: **DZG101** **Dzongkha Communication**

༡ སློབ་ཚན་གྱི་མིང་	:	རྫོང་ཁ་བརྡ་སྦྱོར་ལྟེན།
༢ སློབ་ཚན་ཨང་	:	རྫོང་ཁ་༡༠༡ (DZG101)
༣ སློབ་སྦྱོང་གི་མིང་	:	གནྡུག་ལཱ་གཞི་རིམ་བྱེད་མའི་སྦྱོབ་སྦྱོང་དང་ གནྡུག་ལཱ་གཞི་རིམ་སྦྱོབ་སྦྱོང་།
༤ སློང་འཐུས་	:	༡༢
༥ སློབ་སྦྱོན་པ་	:	རྫོང་ཁའི་ལྷག་པ་ཨཁང་པ།

༦ སྒྲིང་བཤད་གི་ལས་རྟེན་ :

རྫོང་ཁ་བརྡ་སྦྱོར་ལྷན་གྱི་སློང་ཚན་འདི་མཐར་འཛུལ་ཞིན་ལས་སློབ་སྦྱོང་པ་ཚུ་གིས་རང་གི་མི་ཚེ་ཧང་ལྟ་གཡྱོག་དང་འབྲེལ་བའི་གནད་རྟེན་ག་ཅིའི་ཐད་ལས་འབད་རྩྭ་རྫོང་ཁའི་ནང་དགཔ་རྩོག་དང་ཡིག་རྟོག་གཉིས་ཆ་རའི་ནང་བརྡ་རྟོན་སྦྱོར་ལྷན་ཚུལ་དང་མཐུན་རྟེག་རྟོ་འབད་འབད་ཚུགས་ནི།

༧ སློབ་སྦྱོང་གྲུབ་འབྲས།

སློང་ཚན་འདི་ཕྱག་ཚར་བའི་ཤུལ་ལྟི་སློབ་སྦྱོང་པ་ཚུ་གིས་ :

༧.༡	རྫོང་ཁའི་སྐད་ཡིག་གི་འབྱང་རབས་དང་རྫོང་ཁ་ཕྱག་དགོ་པའི་ཁྱངས་དང་དགོས་པ་ཚུ་སྡུད་ཚུགས།
༧.༢	དུས་རྒྱུན་ལཱ་ལྷན་འཐབ་དགོ་པའི་མིང་བྱ་ཆིག་ཁྱད་ཆོག་ཆིག་ཐོག་ཐོག་གོས་ཚུ་མ་འརྩོལ་བར་ལཱ་ལྷན་འཐབ་ཚུགས།
༧.༣	དུས་རྒྱུན་ལཱ་ལྷན་འཐབ་དགོ་པའི་མིང་བྱ་ཆིག་ཁྱད་ཆོག་ཆིག་ཐོག་གོས་ཚུ་གི་ཡིག་སྣེབ་ དགཔ་འབད་འབྲི་ཚུགས།
༧.༤	ཡུལ་དུས་གནས་སངས་དང་བསྟུན་ཏེ་ཞེ་ས་དང་ཡལ་སྐད་ཚུལ་མཐུན་འབད་ལཱ་ལྷན་འཐབ་ཚུགས།
༧.༥	རྫོང་ཁའི་རྩོག་ལྟི་བེས་ཏེ་ཡོད་མི་ཚུ་ཚུལ་དང་ལྡན་རྟོ་རྟོ་འབད་ལྷག་ཚུགས།
༧.༦	རྐང་སྦྱོ་དང་བྱོ་ཟེ་དཔེ་གཏམ་གྱི་རིགས་ཚུ་ལཱ་ལྷན་འཐབ་ཚུགས།
༧.༧	འབྲེལ་སྦྲ་དང་ཅེད་སྦྲ་ལྷག་བཅས་རྒྱན་སྡུད་ཀྱི་ཆིག་ཕྲད་ཚུ་མ་འརྩོལ་བར་ལཱ་ལྷན་འཐབ་ཚུགས།
༧.༨	འབྱི་རྣྱོ་མ་ཀྱི་ཁྱད་ཆོས་ཚུ་ཚངམ་འབད་ལཱ་ལྷན་འཐབ་སྟེ་འབྱི་ཚུགས།
༧.༩	གཞུང་སྐེར་ཡིག་འགྲུལ་ཀྱི་རིགས་འབྱི་ཚུགས།
༧.༡༠	འབྱི་ཐྲོག་གི་རིགས་གཅིར་ཅ་ཚིན་རྒྱང་རྫོང་ཁའི་ནང་དཀའ་ངལ་མེད་པར་བཀང་ཚུགས།
༧.༡༡	ལྷིང་འཛེན་དང་རྒྱབ་རྟེན་ཀྱི་ཐྲོ་ཐྲོས་འབབ་ལྷན་ཐྲོ་འབད་བགོད་ཚུགས།

༨ རིགས་རྒལ་ཡར་རྒྱས་ : རྫོང་ཁའི་སྐད་ཡིག་གི་རིགས་རྒལ་བཞི།

ཁ གནས་ཚད་ :

༡༠ སྨོན་སྤྲོན་འབད་ཐངས :

སྤྱོང་ཚན་འདི་གི་རྩྭ་ལྷ་ཡོངས་བསྡོམས་ཆུ་རྒྱུས་ ༡༢༠ཐྲོག་དགོས་ཤེན་རྩུལ་རྒྱན་སྤྱོད་ཚང་ནང་སྤྱོན་སྤྲོན་གྱི་རྩྭ་ལྷ་ཆུང་ཆུང་ ༤༠དགོས་ཤེན། དེ་ཡང་ བདུན་ཕྲག་རེ་ལྷ་ཆུ་རྒྱུས་ ༤ རེ་འབད་བདུན་ཕྲག་ ༡༤ གི་རིང་ལྷ་སྨོན་སྤྲོན་འབད་དགོས་ཤེན།དེ་གི་ཕྱག་མ་ཆུ་རྒྱུས་ ༤༥ སྨོན་ཚང་ནང་འབད་ཞེན་ཤར་རིང་ཆུང་གི་ཐྲོག་ལས་ཕྱག་ནི་ དང་ལས་འགུལ་འཛིའི་ཆུ་གི་རྩྭ་ལྷ་ལ་གཡོག་འཐབ་དགོས་ཤེན།དུས་རྒྱུན་སྨོན་ཚང་ནང་ལྷ་སྨོན་སྤྲོན་འབད་བའི་སྐབས་ལྷ་ཐྲོག་ཆུ་རྒྱུས་ དམ་བགོ་ཆུབ་མི་དང་འཁེལ་ཏེ་ ལག་ལྷན་འཐབ་དགོ

སྨོན་སྤྲོན་	ཆུ་རྒྱུས་ ༢༠
སྨོང་ལྷ	ཆུ་རྒྱུས་ ༣༠
སྤྱན་ཞུ་	ཆུ་རྒྱུས་ ༧༠

༡༡ དཔེ་ཁིབ : སྤྱོང་ཚན་འདི་གི་རྩྭ་ལྷ་སངས་ཆུགས་དཔེ་ཁིབ་དང་དུས་ཆུན་དཔེ་ཁིབ་ གཉིས་ཆ་ར་ལག་ལྷན་འཐབ་སྟེ་དཔེ་ཁིབ་འབད་དགོས་ཤེན།

ཀ	དུས་ཆུན་དཔེ་ཁིབ།	སྐུགས་ ༥༠%
	ལས་འགུལ་	༢༠%
	སྤྱོབ་ཁང་སྤྱན་ཞུ་	༧༥%
	སྤྱོབ་ཁང་གི་སྤྱོང་ལྷ་	༧༥%
ཁ	སངས་ཆུགས་དཔེ་ཁིབ།	༥༠%
	ཚེས་ཆུགས།	༥༠%
	ཡྱོངས་བསྡོམས་	སྐུགས་ ༡༠༠%

༡༢ སྡོད་ཚང་ཤེས་ཡྱོན་ :

༡༣ ཤད་རྟོག་

རྩོན་ཚན་ཀ་པ།	སྐད་ཡིག་གིངོ་སྤྱོད།	(ཆུ་རྒྱུས་ ༣)
༡	རྩོང་ཁའི་སྐད་ཡིག་གི་འབྲུང་རབས།	
༢	རྩོང་ཁ་ལྷབ་དགོ་པའི་དགོས་པ།	
རྩོན་ཚན་ཁ་པ།	མིང་ཚིག་རྩོད་པའི་རྣམ་གཞག	(ཆུ་རྒྱུས་ ༢༥)
༡	མིང་	
༢	བྱ་ཚིག	
༣	ཁྱད་ཚིག	
༤	ཚིག་གྲོགས།	
༥	རྩོང་ཁ་དག་གཤིས་འགྲོ་ལྟེ་གནས།	
༦	སྐྱན་རྩྭ་མང་ཉེ་གཏམ་དང་བྱོ་ཟེ་རྩང་རྩྭ།	

๗ རྩོང་ཁ་ཉག་རྒྱང་གི་མིང་ཚིག་ལགས་ལྱན་འཐབ་ཐངས།

๘ མིང་ཚིག་དང་བྱ་ཚིག་ཁྲད་ཚིག་ཚུ་ཁྱོན་འབབ་ལྱན་ལགས་ལྱན་འཐབ་ཐངས།

སྐྱོན་ཚན་གསལ། རྩོང་ཁའི་དགག་གཞིས་དང་འཞིལ་ཏེ་ལྷག་ཐངས། (ཤུ་རྩོད་๙)

๑ ཚིག་མཚམས་བཅད་དེ་ལྷག་ཐངས།

๒ རྗེས་འཇུག་གི་སྒྲ་ཅི་བྱ་བཏོན་དང་མ་དགོ་པའི་རིགས་ཚུ་ཁད་པར་ཕྱེ་སྟེ་ལྷག་ཐངས།

๓ རྗེས་འཇུག་མེད་རྒྱང་ཡོད་པ་བཟུམ་ལྷག་ཐངས།

སྐྱོན་ཚན་ང་པ། ཡི་གུའི་སྟོང་གཅིག (ཤུ་རྩོད་๔)

๑ འབྲེལ་སྒྲ་

๒ ཕྱེད་སྒྲ

๓ ལྷག་བཅས།

๙ རྒྱུན་སྤྱད།

སྐྱོན་ཚན་ཅ་པ། ཡིག་འགྱུལ། (ཤུ་རྩོད་๒๐)

๑ ཡིག་རྒྱང་འབྲི་ཐངས།

๒ མཐོན་ཁུ་འབྲི་ཐངས།

๓ གཏུང་ཡིག་འབྲི་ཐངས།

๙ ཁུ་ཡིག་དང་ཁུ་ཚིག /བཤེར་ཡིག་འབྲི་ཐངས།

๕ གན་ཡིག་འབྲི་ཐངས།

๖ སྐྱན་ཁུ་འབྲི་ཐངས།

๗ ཐོས་ཆོད་འབྲི་ཐངས།

๘ ཁྲབ་བསྒྲགས་ཀྱི་རིགས་འབྲི་ཐངས།

๑ འབྲི་སྟོགས་གི་རིགས་བཀང་ཐངས།

๑๐ འབྲི་ཇུ་ོམ་འབྲི་ཐངས།

๑๑ ཚ་གཤད་ལགས་ལྱན་འཐབ་ཐངས།

๑๒ ལྷིང་འདེན་དང་རྒྱབ་རྟེན་ཀྱིད་པ་ཐོད་ཐངས།

๓ ལྷག་དགོ་པའི་དཔེ་ཐོ།

๓ སྟོང་ཚན་འདི་སང་བ་ལྱགས་ཐོན་འབད་ཞིའི་རྩོན་ལྷི་ཏོག་ལྷི་བགོད་དེ་ཡོད་ཅིའི་དཔེ་དེ་ཨུ་རུ་ལྷག་དགོ

ཀུན་བཟང་རྡོ་རྗེ། (๒๐๑๑) ཐོ་ཞེ་ལྷའི་པི་ཁང་། ཐིམ་ཕུ།རྩོང་ཁ་གོང་ལྷན་ཆོས་གྲྭ།

ཀུན་བཟང་རྡོ་རྗེ། (๒๐๑๑) ཇང་སྟོའི་ཀི་དེབ་ཐོ་རིག་མེ་ཏོག ཐིམ་ཕུ།རྩོང་ཁ་གོང་ལྷན་ཆོས་གྲྭ།

ཀུན་བཟང་འཕེན་ལས། (๒๐๐๗) ཡིག་བསྒྱུར་རྣམ་གཞག་གི་དེབ་ཐིམ་ཕུ།ཀེ་ཚེམ་ཀྱི།

སྐལ་བཟང་ཆོས་འཕེལ་དང་ཆ་རྩོལ་གས་ཚུ། (๒๐๑๓) ཉེ་ འབྲེལ་མིང་ཚིག་རབ་འབྲེད།ཐིམ་ཕུ།ཚེས་ཀྱི་གཟེབ་པ་ལྷེས།

རྣམ་རྒྱལ་དབང་ཕྱུག (๒๐๐๗) རྩོང་ཁའི་ཚ་ལྷན་སྐྱན་ཞུ་དང་ཡིག་རིགས་འབྲི་ཐངས།ཐིམ་ཕུ།

རྩོང་གོང་ལྷན་རྩོགས། (๒๐๑๑) ཁལ་སྐད་ཞེ་སའི་རྣམ་གཞགས་སྐར་མའི་ཁྲོད་ཟེར། ཐིམ་ཕུ། རྩོང་ཁ་གོང་ལྷན་རྩོགས།

རྩོང་གོང་ལྷན་རྩོགས། (๒๐๑๙) འབྲུག་གི་ཡིག་བསྒྱུར་རྣམ་གཞག ཐིམ་ཕུ། རྩོང་ཁ་གོང་ལྷན་རྩོགས།

རྩོང་ཁ་གོང་འཕེལ་ལྷན་ཚྭོགས། (༢༠༠ཉ) རྩོང་ཁའི་བརྡ་གཞུང་གསར་པ་ཐིམ་ཡུ།རྩོང་ཁ་གོང་འཕེལ་ལྷན་ཚྭོགས།

བསམ་གྲྭབ་ཆེ་རིང་། (༢༠༠ཇ) ཡ་རབས་ལམ་དུ་འདེན་པའི་ཐལ་སྐད་དང་ཞེ་སའི་དེབ་ཆུང་། (ཁ་གསལ་མེད)

ཁ་ ངྭོག་ལྷི་བགོད་མི་དཔེ་དེབ་ཚུ་ཁ་སྐོང་གི་གནས་ཚུལ་ངྭོབ་ནི་ངྭོན་ལྷི་ལྷགཁ་དགོཔ་ཨིན།

ཀུན་ལུགས་རྒྱལ་མཚན། (༢༠༠ཆ) རྩོང་ཁའི་རྗོད་སྒྲུག་རྩོ།

སྐལ་བཟང་དབང་ཕྱུག (༢༠༠ཅ) རྩོང་ཁ་བཏ་ངྭོན་རྒྱུན་འཛེལ།བསམ་རྩེ།

བྱམས་པ་ཆོས་རྒྱལ། (༡༩༩༩) སུམ་རྩུ་པའི་རྣམ་ཝཁདཔ།ཐིམ་ཡུ།རྩོང་ཁ་གོང་འཕེལ་ལྷན་ཚྭོགས།

རྩོང་ཁ་གོང་འཕེལ་ལྷན་ཚྭོགས། (༡༩༩༠) ཆོག་ངྭོན་ཀུན་གསལ་མེ་ལྷོང་། ཐིམ་ཡུ།རྩོང་ཁ་གོང་འཕེལ་ལྷན་ཚྭོགས།

རྩོང་ཁ་གོང་འཕེལ་ལྷན་ཚྭོགས། (༡༩༩ཉ) འབྲི་རྩྭོམ་ཕྱོགས་དེབ་ཐིམ་ཡུ།རྩོང་ཁ་གོང་འཕེལ་ལྷན་ཚྭོགས།

རྩོང་ཁ་གོང་འཕེལ་ལྷན་ཚྭོགས། (༡༩༩༠) རྩོང་ཁ་ངོ་གསལ་ལམ་བཟང་།ཐིམ་ཡུ།རྩོང་ཁ་གོང་འཕེལ་ལྷན་ཚྭོགས།

རིན་ཆེན་མཁའ་འགྲོ། (༡༩༩ང) རྩོང་ཁ་དབྱིན་སྐད་ཆོག་མཚྭོད།

བསྟོད་ནམས་བསན་འཛིན། (༢༠༠ང) ངྭོ་འགོམ་བཏུ་གཉིས་ཀྱི་ཝཁདཔ། ཐིམ་ཡུ། ཀ་ཚེམ་ཀྱི་ལས་སྟེ།

ཀ། བསྒྲུབ་ཞིབ་འབད་བའི་ཆོས་གྲངས་ : ༢༦/༠༢/༢༠༡ཅ།

Module Code and Title: **DFL101 Introductory Dzongkha as a Foreign Language**

Programme(s): Foreign students of all programmes

Credit Value: 12

Module Tutor(s): Karma Gyeltshen (Module Coordinator)

General objective(s) of the module:

This module is for learners who are non-Bhutanese and have had little or no prior exposure to Dzongkha. It is expected to be conducted at a level commensurate with introductory courses in foreign languages typically offered at the University level worldwide. The focus is on functional skills in the use of the language. At this level, learners will primarily use official Dzongkha Romanization for any reading/writing instead of the Dzongkha script, but will nevertheless learn the fundamentals of the Dzongkha script and alphabet. Content is intended to be relevant to the day-to-day lives of the learners. Learners would not be expected to gain fluency or deal proficiently in unfamiliar situations, but will learn how to get by in day-to-day familiar situations with Dzongkha-speaking friends, classmates, colleagues, and some official situations with a basic vocabulary and level of understanding. Learners would be expected to gain an appreciation for the cognitive aspects of the Dzongkha language, i.e., the vocabulary and diction that are specific to Bhutan (not directly translatable), and which reflect the underlying life and culture of Bhutan.

Learning outcomes – Upon successful completion of the module, students will be able to:

1. Recite and correctly use frequently used spoken words, expressions and questions in familiar contexts in conversation.
2. Speak in a slow but clear manner on a variety of topics in academic, social and work-related contexts.
3. Participate in simple oral communication in a variety of contexts.
4. Indicate the gist of a Dzongkha speech by a native speaker speaking slowly and clearly, and from overheard conversations.

5. Distinguish between and use appropriate alternative expressions for familiar (informal) vs. formal contexts.
6. Construct limited meaning from reading materials (in Romanized Dzongkha) on learned topics.
7. Recognize letters of the Dzongkha alphabet, numbers and some simple words.
8. Recognize a limited range of simple spoken isolated words, phrases and questions in Dzongkha script.
9. Demonstrate ability to copy letters of the alphabet, numbers and isolated words and phrases in Dzongkha script.
10. Write Romanized Dzongkha personal information and previously learned simple sentences and messages.
11. Produce correct sentences in a short loosely organized paragraph in Romanized Dzongkha.
12. Determine the meaning of new words and phrases with the help of a native speaker.
13. Recognize new words using visual clues in simplified reading material with the help of a native speaker.

Learning and teaching approaches used:

The module will be conducted over 15 teaching weeks as follows:

- 3 hrs/wk lecture (introduction of new topics), practice, and in-class assessments.
- 1.5 hr/wk language lab (tutorial section) for additional practice.
- 3.5 hrs/wk outside of class, on average, for independent study and practice.

Assessment:

Semester-End Examination (SE):30% (25 written / 5 viva)
Continuous Assessment (CA): 70%

CA Assessment	Weight	Assessment Detail
Written exercises (10 x 3%)	30%	20-min written in-class quizzes (5x) or take-home work (5x).
Oral exercises (2 x 5%)	10%	5-min viva once in the first half and once in the last half of the semester.
Presentation	10%	5-min presentation on oneself and description of a recent outing (may be done with pre-written notes).
Midterm exam	20%	Written test of 60 min.

Pre-requisite knowledge:

Subject matter:

I. Welcome Unit
   a. Learning Objectives: Introduce themselves and others; Say hello and good-bye; Recognize Dzongkha script
   b. Vocabulary: Introduction and greetings; Classroom items and people (teacher, students)
   c. Speaking and Listening: Introductions; Greetings
II. New encounters
   a. Learning Objectives: Ask for and say names; Spell own names, recognize simple Dzongkha signage; Talk about where people are from and; What they do; Discuss people's names and jobs
   b. Vocabulary: Names and titles; Interesting jobs; Addressing people; Terms for respect
   c. Speaking and Listening: Class introductions and greetings; Keep talking: Name circle; Class name list; Guessing game about famous people; Keep talking: "Find the differences" activity about; jobs and cities; Quiz about well-known people
III. People and places

a. Learning Objectives: Ask for and say people's nationalities; Ask for and give phone numbers and email addresses; Identify family members and give their ages; Give information about family and friends
b. Vocabulary: Nationalities; Family members; Numbers 0-101, higher denominations
c. Speaking and Listening: True and false information about people; Keep talking: Interviews with new identities; Class survey for new contact information; Information exchange about family members; Keep talking: Family trees; Presentation about friends

IV. What's that?
a. Learning Objectives: Ask about and identify everyday items; Ask what something is called in Dzongkha; Talk about clothes and possessions; Describe favourite possessions
b. Vocabulary: Everyday items; Clothes and colours
c. Speaking and Listening: Questions and answers about personal items; Keep talking: Things in the closet; Memory game about everyday items; Personal items and their owners; Keep talking: "Find the differences" activity about clothing colours; Presentation of favourite things

V. Daily life
a. Learning Objectives: Describe how people get around; Ask for and tell the time; Ask and answer questions about routines; Describe the things they do on weekends; Describe a traditional Bhutanese house
b. Vocabulary: Ways of getting around; Days of the week and routines; Parts of a house
c. Speaking and Listening: Survey about getting to school and work; Keep talking: Transportation facts; Interview about the times of specific events; Interview about routines; Keep talking: "Find someone who" activity about routines; Home furnishing activity

VI. Free time and shopping
a. Learning Objectives: Talk about their shopping habits; Accept and decline help; Ask and answer questions about leisure activities; Discuss how they use technology; Purchase common items and negotiate if necessary
b. Vocabulary: Shopping activities; Leisure activities and places; Numbers and monetary units, simple negotiation
c. Speaking and Listening: Comparison of shopping habits; Keep talking: Interview about online habits; Role play of a shopping situation; Interview about leisure activities; Keep talking: Interviews about fun activities

VII. Work and Play
a. Learning Objectives: Identify and talk about jobs; Ask for someone on the telephone; Have someone wait; Describe their talents and abilities; Talk about study and work programs
b. Vocabulary: Jobs; Abilities
c. Speaking and Listening: "Find someone who" activity about jobs; Keep talking: Memory game about jobs; Role play of a phone call; Interview about abilities; Keep talking: Board game about abilities; Discussion about study and work programs

VIII. Food
a. Learning Objectives: Say what meals they eat; Say what they like and dislike; Talk about their eating habits; Talk about their favourite food; Buy food (ask for specific items and their prices)
b. Vocabulary: Food; Grocery shopping
c. Speaking and Listening: Survey about meals; Keep talking: Recipes; Information exchange about food preferences; Comparison of eating habits; Keep talking: Discussion about eating habits; Interview about favourite food

IX. In the neighbourhood
a. Learning Objectives: Give the locations of neighbourhood places; Ask for and give directions; Talk about interesting places in their towns; Give a presentation on a city attraction
b. Vocabulary: Places in the neighbourhood; Places to visit
c. Speaking and Listening: Information exchange with maps; Keep talking: Information gap activity with neighbourhood maps; Role play about directions; Interview about

places in town; Keep talking: Description of a lhakhang; Presentation about a city attraction

X. Around Bhutan
    a. Learning Objectives: Indicate Dzongkhags of Bhutan; List key historical figures and events; Describe rural village life, and simple traditions
    b. Vocabulary: Places around Bhutan; Historical figures and events; Rural life, including agricultural terms, crops, livestock, tools, and practices
    c. Speaking and Listening: Information exchange with maps; Keep talking: History of key places and events in Bhutan; Role play about directions; Interview about rural life; Keep talking: Description of a village; Drawing and labelling map of Bhutan
XI. Art and culture
    a. Learning Objectives: Recognize and list the 13 traditional arts; Recognize and name common religious iconography: Describe what is happening at a tsechu
    b. Vocabulary: Zorig Chusom; Handicrafts; Tsechu and religious arts and practices; Common deities
    c. Speaking and Listening: Discuss plans for tsechu; Keep talking: describe what is happening at a tsechu; Memory game about traditional arts and crafts; Guessing game on common deities in artwork
XII. What are you doing?
    a. Learning Objectives: Describe what people are doing right now; Ask if someone can talk now; Explain why they can't talk on the telephone; Describe what people are doing these days; Discuss what people are doing
    b. Vocabulary: Actions and prepositions; Activities
    c. Speaking and Listening: Guessing game about people's actions; Keep talking: Interpretations of actions; Role play of a phone call; "Find someone who" activity about things people are doing these days; Keep talking: Guessing game about who's doing what; Speculations about someone's activities
XIII. Past experiences
    a. Learning Objectives: Say what they did last weekend; Show that they're listening; Express surprise; Talk about routine events in the past; Talk about past activities
    b. Vocabulary: Weekend activities; Things to do
    c. Speaking and Listening: Information exchange about last weekend; Keep talking: Picture story; Role play of surprising conversations; Interview about routine events in the past; Keep talking: Memories; "Find someone who" activity about past activities
XIV. Getting away
    a. Learning Objectives: Describe where they were in the past; React to news; Talk about their last vacation; Describe a vacation
    b. Vocabulary: Adjectives; Vacation activities
    c. Speaking and Listening: Interview about where you were; Keep talking: Interview about school trips; Class exchange of personal news; Information exchange about vacations; Keep talking: Speculations about a vacation; Presentation of postcards
XV. Occasions
    a. Learning Objectives: Talk about their plans for specific dates; Accept or decline an invitation; Discuss and agree on plans; Describe birthday traditions in their cultures; Talk about religious and other holidays
    b. Vocabulary: Months and dates; Party checklist; Religious holidays
    c. Speaking and Listening: Information exchange about special days; Keep talking: Weekend plans; Class invitations; Discussion of plans for three scenarios; Keep talking: Plan for a picnic; Discussion about typical plans for a religious holiday

Essential Readings:

1. RTC. (2014). Coursepack for Introductory Dzongkha as a Foreign Language. Royal Thimphu College.

Additional Readings:

1. Dzongkha Development Commission. (1990). Dzongkha Rabsel Lamsang. Thimphu: Royal Government of Bhutan, Dzongkha Development Commission.
2. Van Driem, G. (1991). Guide to Official Dzongkha Romanization. Thimphu: Royal Government of Bhutan, Dzongkha Development Commission.
3. Dzongkha Development Commission. (1997). Samples for Geographical Names of Bhutan in Dzongkha and Roman Dzongkha with Brief Guidelines. Thimphu: Royal Government of Bhutan, Dzongkha Development Commission.

Date last updated: May 30, 2015

Bridge Course in Biology

Rationale

This short course on basic biology will be taught for students from Commerce and Arts backgrounds that are admitted to the BSc programme in Environmental Management but have not taken biology at the higher-secondary school level. The students will be learning the basics of biology for the purpose of facilitating a better grasp of subject matter related to life sciences that will appear in the BSc Environmental Management modules.

Teaching, Learning and Assessment

The course will be taught for a duration of three weeks just before the start of the first semester. (3 hrs/day x 5 days/wk x 3 wks = 45 hours). The classes will be conducted in class for the tutor to introduce new topics and in a computer lab wherein students will be learning independently using electronic learning resources, with guidance from the tutor. The tutor will be teaching 25% of the total time and be guiding and facilitating students in the computer lab for self-learning for 75% of the time. Students will be assessed with three one-hour test, one at the end of each week of the course, worth 30%, 30%, and 40%. The pass mark overall is 40%.

Course contents

1. Matter and energy basics
2. Organization of life
    a. Cells and cell divisions
    b. Genes and heredity
    c. Tissues in plants and animals
3. Diversity of life
    a. Evolution
    b. Microorganisms
    c. Plants
    d. Animals
        i. Wild - invertebrates and vertebrates; arthropods, fish, amphibians, reptiles, birds, mammals
        ii. Domestic - bovine, caprine, equine, canine, avian and swine, in brief
4. Plant physiology and processes
    a. Physiology of non-flowering and flowering plans
    b. Photosynthesis and respiration
    c. Propagation
    d. Plant development
5. Animal physiology and processes
    a. Animal development and classifications
    b. Key physiological processes in animals
6. Overview of human biology
    a. Basic human physiology
    b. Health and hygiene
    c. Immunology; Environmental causes of disease; bacteria, virus, parasites

Reading materials

Students will be provided with a coursepack compiled from basic biology texts.

Bridge Course in Mathematics

Rationale

This short course on basic mathematics will be taught for students from Commerce and Arts backgrounds that are admitted to the BSc programme in Environmental Management but have not taken mathematics at the higher-secondary school level. The course will provide basic quantitative skills for the purpose of facilitating a better grasp of quantitative subject matter that will appear in the BSc Environmental Management modules, e.g. statistics, GIS, and research.

Teaching, Learning and Assessment

The course will be taught for a duration of three weeks just before the start of the first semester. (3 hrs/day x 5 days/wk x 3 wks = 45 hours). The classes will be conducted in class for the tutor to introduce new topics and in a computer lab wherein students will be learning independently using electronic learning resources, with guidance from the subject teacher. The tutor will be directly teaching 50% of the total time and be guiding and facilitating student practice/exercise time for the remaining 50%. Students will be assessed with three one-hour test, one at the end of each week of the course, worth 30%, 30%, and 40%. The pass mark overall is 40%.

Course contents

1. Measurements and conversions (British, SI, and, Bhutanese systems)
    a. Linear, square, and cubic measures
    b. Weight measures
    c. Temperature (F, C, Kelvin)
    d. Currency conversions ($, Nu. Pound, etc.)
2. Accuracy, precision and estimation
    a. Error, accuracy, precision
    b. Types of errors
    c. Calculation of absolute error, relative error and percentage error
    d. Combination of errors; rules for sum and difference; rules for product and quotient
    e. Scientific notation
    f. Significant figures; rules for counting the number of significant figures
    g. Rounding
3. Area and volume calculations
    a. Flat objects / land: perimeter, and area: rectangular, triangular, circular; other polygons
    b. Volumetric objects: height, surface area and volume
4. Basic trigonometry
    a. Introduction to trigonometry
    b. Trigonometric identities
    c. Heights and distance measurement using clinometers
5. Probability
    a. Introduction to probability
    b. Calculating probabilities of events
    c. Combinations and permutations
6. Working with data
    a. Measures of dispersion: mean, median and mode
    b. Standard deviation and variance
    c. Percentages, fractions, and decimals in datasets; frequency distributions
    d. Metrics for trends: growth rate, doubling rate/time, increases and decreases
    e. Data presentation and interpretation in various types of graphs

Reading materials

Students will be provided with a coursepack compiled from relevant exercise workbooks.