Programme Handbook

Bachelor of Science
in
Environmental Management

Offered by

ROYAL THIMPHU COLLEGE

In affiliation with

Royal University of Bhutan

Effective July 2021 **Updated March 2025**

This programme handbook should be read in conjunction with the RTC Student Handbook.

Acknowledgements:

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1 Programme Specification

1.1 Basic Information on the Programme

College:	Royal Thimphu College
Title of award:	Bachelor of Science in Environmental Management
Duration and mode of study:	Four years, full-time
Awarding/accrediting body:	Royal University of Bhutan
Date of initial approval:	January 26, 2015 (32nd AB)
Date of last review:	4-8 August 2020 [Endorsed by 14th USRC meeting, 14-15 December 2020]

1.2 Aims and Learning Outcomes of the Programme

1.2.1 Aims of the Programme

The BSc in Environmental Management (EM) programme aims to provide theoretical knowledge and practical skills in the field of environmental management that every individual, including policy makers and planners, will need in order to help create and maintain sustainable societies in Bhutan and beyond. Some of the critical issues policy makers and planners and also concerned citizens in general required to address include: management of scarce natural resources, pollution and waste management, climate change, and population growth. These aspects constitute the core subject matters of the present programme. While the hardcore environmental discipline inclines more toward scientific investigation, this programme takes a holistic approach including socio-political approach to address environmental issues. In this way, this programme stands slightly different from the environmental programmes offered in other university colleges in the country.

EM students will gain a core foundation in natural sciences and social sciences disciplines approaches to environmental issues and work individually or collectively towards the conservation of natural resources, protection of habitats, and solutions of current problems in the field of environmental management. The programme will instil students with the notion that integrative and interdisciplinary approaches are vital for environmental management and sustainable socio-economic development. It will also provide necessary knowledge and skills to address the current environmental challenges at their individual capacity irrespective of their positions.

The programme graduates will be able to conduct and coordinate cross-disciplinary communication to integrate ideas from various fields of study engaging multiple stakeholders. As environmental managers are at the centre of global efforts to minimise human impacts on the environment and use resources sustainably, the programme graduates will expose to various initiatives and strategies including policy measures taken at different levels by different institutions, organisations and nations. They will be able to internalise environmental values and participate actively as concerned citizens in building of sustainable societies.

1.2.2 Learning Outcomes of the Programme

Graduates of this programme are expected to acquire not only a grounding within the field of environmental management (subject specific skills) but will also gain competency in the following skill areas: critical thinking skills, application skills and transferable skills. Specific learning outcomes based on these four different skill sets are the foundation of this programme, along with appropriately aligned teaching, learning and assessment tools.

Subject Specific Skills: This skill-set refers to **knowledge and understanding (KU)** of the field of environmental management.

KU1. Discuss the fundamental concepts of environmental management, principles and theories.

KU2. Explain the relevance of the discipline in the contemporary discourse of environmental issues.

KU3. Develop strong analytical skills needed to identify problems, develop a program to address the problem, and communicate the results scientifically.

KU4. Analyse climate-change related issues such as its causes, impacts, mitigation and adaptation of climate change tools and technologies.

KU5. Develop a broad interdisciplinary framework for approaching complex environmental issues facing our world at multiple scales.

Critical Thinking Skills (CS):

CS1. Think beyond common conventional scientific frameworks for understanding environmental crises and consider alternative ethical, social and cultural perspectives to address these issues.

CS2. Propose, design, and conduct relevant research projects in natural settings.

CS3. Effectively communicate well-reasoned positions on environmental and other issues.

CS4. Critically analyse the nexus between development process and environmental degradation.

CS5. Solve problems using critical and analytical thinking skills.

Application skills (AS): refers to the ability to use environmental knowledge and practices within the real-world settings.

AS1. Conduct basic field studies in natural settings.

AS2. Apply the tools and recognize the capabilities of GIS applications for environmental management.

AS3. Evaluate means by which impacts of climate change on human well-being and the natural world can be reduced.

AS4. Evaluate the underlying environmental policy frameworks and implementation in Bhutan.

AS5. Perform impact assessment studies for new developmental activities.

AS6. Explore strategies implemented worldwide to manage pollution and issues related to the anthropogenic greenhouse effect, climate change and global warming.

AS7. Practice conservation activities appropriate to different settings (e.g., with forests and wildlife).

Transferable Skills (TS): Transferable skills will be integrated within modules whenever appropriate. Students will have the opportunity to practice and receive feedback on these skills both formally, through the use of assessments, and informally, through on-going interactions with tutors within the scope of everyday classroom activities.

TS1. Become reflective, independent and life-long learners.

TS2. Demonstrate effective time-management and personal goal setting.

TS3. Work collaboratively and effectively within a team.

TS4. Undertake self-evaluation and preparation for employment.

TS5. Use ICT thoughtfully and effectively.

TS6. Adapt to, assimilate, and use new information and tools as part of a continuous learning process.

1.3 Career-related Opportunities

A degree in Environmental Management prepares graduates for careers in a variety of positions in the private and public sectors. The programme prepares graduates with the theoretical knowledge and practical skills to work in environmental planning and management field. Individuals who are already working in one of these fields may be able to advance their careers, with the increased knowledge and specialization, in the fields like geospatial technologies, natural resource conservation, alternative energy, environmental engineering, and atmospheric sciences. Some of the specific employment opportunities would be:

- Government Service: The graduates can either sit for BCSE general category and enter into management cadre or sit for technical cadre and be employed in agencies like National Environment Commission, Department of Forest and Park Services, Department of Geology and Mining, National Centre for Hydrology and Meteorology, policy and planning institutions, statistical organisations, research institutions, schools, training institutes, and colleges.

- NGOs and international organisations in Bhutan like RSPN, UN, WWF, BES, BTFEC. etc.
- Private companies and major mining industries, tourism sector, private consultancy firms.

1.4 Programme Structure

Yr	Sem	Modules				
1	I	ENV101 Introduction to the Environment	ECL101 Principles of Ecology	ENV102 Population, Development and Environment	IPS101 IT and Basic Problem Solving	EAP101 Intermediate English for Academic Purposes
	II	CLM101 Climate Change	STS101 Introduction to Statistics	ENM101 Energy Resources Management	AFD102 Biological Anthropology	EAP102 Upper-Intermediate English for Academic Purposes
2	III	BDC201 Fundamentals of Biodiversity	ETH201 Environmental Ethics	ENM202 Water Resources Management	GSE101 Analytical Skills	DZG101 Dzongkha Comm.
	IV	BDC202 Biodiversity Conservation and Management	ENM203 Soil Conservation for Sustainable Agriculture	BDC203 Introduction to Plant Taxonomy	GIS201 Fundamentals of Geographic Information Sciences	CET101 Introductory Microeconomics
3	V	BDC304 Forest Management	ENM204 Watershed Management	ENM305 Ecotourism	GIS302 Spatial Analysis in Geographic Information Sciences	AEC201 Environmental Economics
	VI	ENM306 Urban Environmental Management	Elective: BES301 Bhutanese Society, Culture and Economy / LAN202 Basic Journalism	UGR301 Research Methodology	ENM307 Environmental Pollution Management	DEV201 Development Problems & Policies
4	VII	ENM408 Waste Management	ENM409 Environmental Impact Assessment	ENM410 Environmental Conflict Management	Elective: ENV403 Environmental Humanities / ENV404 Cultural and Human Geography	UGR404 Undergraduate Research Project
	VIII	ENM411 Natural Hazards and Disaster Management	ENM412 Frontiers in Sustainable Development	ENM413 Environmental Management Systems and Auditing	ECL402 Restoration Ecology	

Elective modules:

BES301 Bhutanese Society, Culture and Economy / Elective: LAN202 Basic Journalism

ENV403 Environmental Humanities / ENV404 Cultural and Human Geography

All modules shown are 12-credit modules except UGR404 Undergraduate Research Project worth 24 credits, cumulating to 480 credits achieved over four years of full-time study. Each semester requires approximately 15-16 weeks of teaching-learning incorporating 40 hrs of student effort per week, and approximately 2 weeks of examinations. Modules shaded in grey are crosscutting skills modules offered across programmes.

The programme structure is designed in a progressive manner with five modules offered in each semester. The first-year modules provide foundations in all the essential natural sciences and related disciplines. From the second year onward, the modules offered are more focused on specialised environmental topics. In the fourth year of the programme, the focus is more on research-based independent learning by students.

1.4.1 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, ENM203, BDC203, BDC304, ENM204, ENM305, AEC201, ENM306, ENM307, ENV403-ENV404, ENM408, ENM409, ENM410, ENM411, ECL402, ENM412, ENM413	25/40 = 62.5
Technical and research skills development related to environment	STS101, GIS201, GIS302, UGR301, UGR404 (x2),	6/40 = 15
Core competencies	EAP101, EAP102, IPS101, DZG101, GSE101	5/40 = 12.5
Breadth Subjects	AFD102, CET101, DEV201, BES301-LAN202	4/40 = 10
	Total	**100.00**
2 Elective modules Combination	BES301-LAN202, ENV403-ENV404	-
Borrowed modules	IPS101, AFD102, GSE101, DZG101, CET101, AEC201, LAN202, UGR301, DEV201, UGR404	

There are two elective module combinations in this programme, viz, (1) BES301-LAN202 and (2) ENM403-NM404. Elective modules will be offered as per the demand of the students; the whole cohort will do only one module preferred by the majority of the students. For instance, in a situation where 30 students opt for BES301 and 10 students opt for LAN202, only the BES301 module will be offered. The modules offered for electives as an option, despite varying in theme, are of equivalent weightage in terms of providing knowledge and developing skills to the field environmental management. It will provide students an opportunity to select and study subject areas introduced earlier in greater depth and to learn certain specialised kinds of reporting.

Environmental Studies (ENV) modules encompass more broad and general topics, while Environmental Management (ENM) modules cover management aspects in specific areas. ECL modules are Ecology focused, and CLM modules are Climate studies focused. BDC modules encompass biodiversity management modules. Statistics follows the STS code, Geographic Information Sciences modules are coded GIS, and UGR modules encompass a 36-credit total research training and independent research component. Other modules follow the coding of programmes from which they are borrowed.

1.5 Learning and Teaching Approach

All the modules in this programme will be delivered within an outlined approach of contact (face-to-face) teaching and independent study with equivalent credit hours. The contact teaching approach comprises of (1) lecture, which can include methods like, but not limited to, oral and power-point presentations intended to present and convey critical information, history, background, theories, and equations, guest lectures, reading and discussion of text and journal articles, field trips, and (2) tutorials designed to provide space to engage students more actively with the module content and enhance formative assessment. This includes regular one-on-one interactions, for project assignments, with an assigned research project advisor, guided and independent research.

The independent study includes (1) written or other types of assignments, reflection papers and review exercise, which can help reinforce concepts learnt in class, motivate students to explore beyond the classroom teaching, improve students' performance and provide feedback to the teacher about the depth of students' assimilation, (2) Practical exercises to facilitate and help structure a lesson and improve students engagement, enhance knowledge retention, and provide hands-on-experience, and (3) Forum discussions for improvement of communication skills and enhance student

collaboration/engagement by sharing challenges, clarifying assumptions, examining, arguing and critiquing thoughts, and self-assessing the level of their learning.

1. The average in-class instruction time for a 12-credit module is thus expected to be 4 hrs/wk for 15 weeks. These contact hours will be used for lectures, group discussions, guest speakers, student presentations, demonstrations, tutorials, and in-class assessments such as class tests. All aforementioned approaches, including tutorials, require the attendance of the entire class together for the scheduled hours. Different modules will also incorporate varying levels of practical components within these times.
2. 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.
3. In terms of promoting student involvement in their own learning, field visits - from daylong trip to block week field trips, and project assignment will constitute essential components of the learning process. The main objective of conducting field trips for students is to reinforce experiential and contextual learning. It will enhance classroom learning by making real world connections and exposing them to different ground realities.
4. The college network infrastructure including Information and Communication Technology (ICT) and Virtual Learning Environment (VLE) will be used to improve teaching and learning experience of both the lecturers and students by enabling them to communicate, create, disseminate, store, and manage information cognitively.
5. 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) that are assessed.
6. 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.
7. Students will learn techniques for, and carry out, small empirical 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.
8. Students will use industry standard materials, tools and implements for practicals and field studies for development of skills necessary to handle latest instruments and for improved quality of results.
9. 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) either by visiting these centres or inviting guest lecturers to augment knowledge and skills. It can make learning experience more interactive and enhance the provision of bringing into classroom learning new perspectives, while it provides important specific subjects that are often omitted from a regular class.

1.6 Placements / Work-based Learning

N/A

1.7 Assessment Approach

1. 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. Details of assessments are provided in each module descriptor.

2. SE is intended to be a type of summative assessment. The exams will focus on comprehensively assessing all the modules' learning outcomes as best as possible. 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).
3. Most modules incorporate testing as part of CA, including typically a mid-semester (midterm) exam. These are intended to promote continuous learning and be formative in nature, allowing both students and tutors to monitor progress. A midterm examination is generally intended to be half a final examination in scope, depth, and duration.
4. CA components will also include, variously, Written Assignments, Case Analyses, Field Visit Reports, Lab/Practical Exercises and Reports, Presentations, Debates and Class Discussions, Projects, and Tests.
5. Group work should be marked including criteria based on a cohesive group effort as well as individual effort put in by group members.

1.8 Regulations

1.8.1 Entry 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*

** 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 developed as part of this programme (DFL101: Introductory Dzongkha as a Foreign Language).*

1.8.2 Assessment and Progression Requirements

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, 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 two modules in a semester (i.e., students must pass at least three modules in a semester), or they are considered semester failures, in which case they may repeat the failed semester, if they wish to, in the following year with the junior cohort. To pass a module, students must obtain a minimum mark of 50% overall and at least 40% in both the Total Continuous Assessment (CA) and Semester-End (SE) Examination components.

Any module failure must be cleared through reassessment or module repeat as set out in Section D1 of the Wheel of Academic Law of the RUB. A student may not register for more than two repeat modules in addition to the modules prescribed for the semester. An appropriate assessment will be

tasked by the Programme Board of Examiners (PBoE) to the student upon failing a module, to be completed prior to the start of the next semester. Upon passing a failed module by reassessment, a student will be awarded a pass mark of 50%. A student may repeat a failed module any number of times within the normal registration period for completing an award, wherein he/she must meet all assessment requirements of the module, both CA and SE; the marks earned in a successful repeat are retained and not capped at 50%.

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 ratio of 10:20:30:40 (1st year: 2nd year: 3rd year: 4th year).

The Programme Board of Examiners (PBoE) is responsible for the overall assessment of students, for making a decision on the progression of students at each stage of the programme, and for making a decision on the award to be granted to the learners on completion of the programme (see below, section on “Programme Management”).

1.9 Programme Management, Quality Assurance and Enhancement

The roles of the Programme Leader (PL), the Programme Committee, the Head of Subject/Department, the Head of the College, and the College Academic Committee are as defined in the RUB Wheel of Academic Law Section F6. Briefly:

The **RTC Academic Committee (CAC)** is chaired by the Dean of Academic Affairs. Members of the committee include the President, 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 CAC 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 CAC. The CAC 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 run by a **Programme Committee** responsible for the effective conduct, organisation, and development of the programme. The committee comprises all tutors of the core (host) department as well as a **Programme Leader** 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.

Module tutors submit their reflective module reports to the PL at the end of each semester. The PL, in consultation with the module tutors and with input from an **external examiner (EE)**, compiles an **annual programme monitoring report (APMR)** at the end of each academic year in the University’s standard format, to be endorsed by the CAC and submitted to the University. The EE appointed by the University is invited each academic year to assess the programme operation by considering student performance, quality of teaching learning materials and assessments, resources, and quality of the staff. The report submitted by the EE forms a part of the APMR and is crucial for enhancement and quality assurance of the programme.

The authority for matters regarding assessment and progression is delegated to the **Programme Board of Examiners (PBoE).** The board includes a Chair from outside the programme’s management, the Programme Leader, each tutor 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 PBoE is accountable to the CAC.

In line with section D8 of the Wheel of Academic Law, **Moderation of Assessments**, all assessments that constitute 20% or more of the total assessment weighting for a module are reviewed and moderated.

Additional quality assurance mechanisms within the College:

- *Tutor performance management and enhancement* – Tutor performance is monitored regularly and evaluated at the end of each semester. Each semester, programme leaders sit in on and complete observations of tutor in-class performance (quality of the teaching), and out-of-class performance (quality of the conduct of general tutor duties, student advising). Where issues affecting teaching-learning are identified, these may trigger specific action plans for the concerned tutor to pursue to improve in targeted areas. Each tutor 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 tutors, incorporating guest presentations, teaching development workshops, and peer strategy sharing. These are held approximately every two weeks within a semester. Recent topics included: Classroom management, student advising, facilitating guided study halls, diverse classrooms, using peer coaching and think-pair-share to enhance teaching-learning, critical thinking and creativity, coaching skills workshop for programme leaders, and professionalism in the classroom.

  Tutors new to teaching are asked to join additional teaching-learning workshops that work to enhance core teaching skills among its members through activities such as peer and supervisor observations (required at least twice per semester for new tutors, and once per semester for all tutors) and teacher training programmes. The College also sends early career tutors to the Samtse College of Education to participate in its Post-graduate Certificate 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 (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 tutors monitor the success and effectiveness of the delivery of the programme and make future improvements. All tutors are required to conduct their own feedback collection mid-semester as well.

- *Peer review* – 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 halfway 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.

- *Module repeats* – If a student has failed a module (but not the whole semester) and has also failed in the reassessment 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-year students will have faculty advisors support and advice on their studies as well as personal aspects related to the college environment. 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 throughout each semester as necessary.

2 Module Descriptors

Module Code and Title: **ENV101 Introduction to the Environment**
Programme: BSc in Environmental Management
Credit: 12
Module Tutor: Tshewang Dorji (Coordinator), Kinley Dorji

General objective: This module introduces students to the basic principles of the environment and encourages them to think about social science and natural resource aspects of environmental management. The module will also explore different environmental worldviews to provide students a holistic understanding of the environment and environmental issues.

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

1. Define the focus, scope and limitations of environmental science.
2. Describe the historical development of environmental problems such as pollution, land degradation, biodiversity loss and climate change.
3. Relate the different environmental worldviews and how they lead to different approaches to environmental management.
4. Classify the various kinds of natural resources.
5. Discuss the challenges associated with managing natural resources.
6. Identify the key environmental issues in Bhutan.
7. Analyse environmental information from various news sources and present some recent developments related to the environment.
8. Describe the historical development of environmental conservation globally.
9. Discuss the importance of integrated approaches to sustainable environmental management.

Learning and Teaching Approach:

Type	Approach	Hours per week	Total credit hours
Contact	Lectures	3	67.5
	Discussions and presentations	1	
	Field visit	0.5	
Independent study	Written assignments and project	1.5	52.5
	Reading and review of class materials	2	
Total			120

Assessment Approach:

A. Individual written assignment and presentation: 20%

Students will individually undertake one written assignment (500 to 750 words) and a presentation (8 minutes). The students will be assigned to read current events from different news media and evaluate the information from the sources, and present some recent developments related to the environment.

Written assignment 10%

4% Synthesis of the information (includes critical review and the explanation of key concepts from the module, and produce evidence-based arguments)
3% Organization of idea (coherence and flow of idea)
3% Language and references

Presentation 10%

4% Analysis of the issues (critical review of the issue)
3% Delivery of the content
2% Visual aids
1% Body language

B. Field visit and report: 10%

The students will undertake a short field visit to an environmental site or agency. The field site can be either the Thimphu city water treatment plant, Memelakha landfill or Bjemina industrial estate. The students will interview the field officials and note down the field observations. After

the field visit students in groups of 4 will produce a field report based on their interactions with the site officials and field observations. Students will be provided with a grading rubric that will help guide the writing of the field report. Reports are expected to be 300-500 words in length.

4% Summary of the field visit that includes problem identification (includes problem analysis, accuracy and completeness of the report)
3% Quality of analysis (includes explanation of a key concept or process from the module, and generate authentic approaches to the problems identified)
3% Language and references

C. Class Tests: 10%

Students will undertake class tests two times during the semester; once before mid-term and once after mid-term (5% each). The written tests will be conducted within the class for a duration of 40-50 min and cover 5-6 weeks of material.

D. Midterm Examination: 20%

Students will take a written exam of 1.5-hr duration covering topics up to the mid-point of the semester. The exam will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

E. Semester-End Examination: 40%

Students will take a written exam of 2.5-hr duration encompassing all the subject matter covered in the semester. This assessment is comprehensive and summative in nature, and will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

Overview of assessment approaches and weighting

Areas of assignments	**Quantity**	**Weighting**
A. Individual written assignment and presentation	1	20%
B. Field visit and report	1	10%
C. Class tests	2	10%
D. Midterm Examination	1	20%
Total Continuous Assessment (CA)		**60%**
Semester-end Examination (SE)		**40%**

Pre-requisites: None

Subject matter:

Unit I: Introduction to Environmental Management

1.1. The scope, focus and limitations of environmental management
  1.1.1. Ecological aspects, environmental issues, environment conservation and natural resources (land, water and air) management.
1.2. Common environmental issues and concerns
1.3. Pollution (Air, water and soil)
  1.3.1 Environmental data for air, water and soil - Equipments, quality standards, current status and mitigation measures
  1.3.2 Emerging environmental technologies (solar, wind, hydro, and geothermal power).
1.4. Climate change
1.5. Forest degradation
1.6. Species extinction

Unit II: Historical context of humans and the natural environment - Major societies in human history

2.1. Description and origin of the societies (Hunter-gatherer, Pastoral-horticultural, Agrarian, Industrial, Post-industrial)
2.2. Revolutions/transitions between the societies (Neolithic/domestication revolution, Agricultural revolution, Industrial revolution, Information revolution); others such as “Green” revolution
2.3. Ways in which each of these societies have affected the environment

2.3.1 Anthropogenic impact to the environment (basics of human population growth, resource consumption, and carrying capacity)

2.4. Major environmental disasters

2.4.1 Ecological footprints and sustainability indicators.

Unit III: Stages of conservation history and environmentalism

3.1. History of environmentalism in the West (Costa Rica and USA), internationally (globally and in the region, e.g., India), and locally (Bhutan); environmental problems, their consequences, and societal reactions

3.2. Most important contributors to the development of environmentalism and their specific contributions

Unit IV: Environmental conservation

4.1. Motives for environmental conservation

4.1.1. Ethical/Cultural arguments

4.1.2. Ecological arguments

4.1.3. Economic arguments

4.2. Philosophical approaches to conservation

4.2.1. Environmental ethics (anthropocentrism, biocentrism, ecocentrism)

4.2.2. Environmental worldviews (individual-centered vs. Earth-centered; management, stewardship, environmental wisdom)

4.2.3. Environmental attitudes/approaches (development, preservation, conservation, sustainable development)

4.3. Environmental organizations

4.3.1. Global (World Wildlife Fund, United Nations Environment Programme etc.)

4.3.2. Regional (International Centre for Integrated Mountain Development, The South Asia Co-operative Environment Programme)

4.3.3. Local (National Environment Commission, Royal Society for Protection of Nature, Department of Forest and Park Services, National Centre for Hydrology and Metrology)

4.4. Fundamental principles for environmental conservation and sustainable development (general principles, internationally-agreed principles, major global initiatives)

4.5. Challenges to environmental conservation

Unit V: Overview of natural resources

5.1. Introduction to natural resources

5.1.1. Classification of natural resources

5.1.2. Overview of Bhutan's natural resources

5.1.3. Benefits and challenges of using natural resources

5.1.4. Consumption and depletion of natural resources

5.1.5. Protection and management of natural resources

5.2. Overview of major types of natural resources

5.2.1. Energy resources (wind and solar energy)

5.2.2. Water/Hydrogeological resources

5.2.3. Minerals/Geological resources

5.2.4. Atmospheric resources

5.2.5. Biodiversity/Biological resources

5.3. Introduction to natural resources management

5.3.1. Natural resource economics

5.3.2. Ownership regimes; rights and use; tragedy of the commons

5.3.3. Management approaches

5.3.4. Natural resources conflicts and conflict management

Unit VI: Current and emerging environmental issues in Bhutan

6.1. Environmental issues in Bhutan

6.1.1. Road construction and adverse impacts: landscape scrapping, soil erosion and landslide, wildlife habitat fragmentation and sedimentation of water channels. Eco-friendly Road Construction (EFRC) - success story of Bhutan's 'Greed Road' project

6.1.2. Mining and quarrying (extraction of mineral resources and its social and environmental ramifications)
6.1.3. Glacial Lake Outburst Flood (GLOF): risks, vulnerabilities and adaptation measures in Punakha-Wangdue and Chamkhar valleys
6.1.4. Waste: solid waste management issue in urban centres in Bhutan. Potential risks associated with the 'overfilled Memelakha landfill site' in Thimphu

6.2. Environmental policies in Bhutan: Goals, guiding principles, and policy statement
6.2.1. Climate Change Policy of Bhutan 2020 (Draft)
6.2.2. National Environment Strategy 2020
6.2.3. National Environment Protection Act 2007
6.2.4. Environmental Assessment Act 2000
6.2.5. National Forest Policy of Bhutan 2011
6.2.6. Mineral Development policy 2017

List of practical work:

a. One field visit to an environmental site or agency, of half-day to full-day duration. The field site can be either Thimphu city water treatment plant, Memelakha landfill or Bjemina industrial estate. Students will interview the field officials and note down the field observations.

Reading Lists:

Essential Reading

Enger, E.D., & Smith, B.F. (2016). *Environmental science* (14th ed.). New York, NY: McGraw-Hill.

Miller, G.T., & Spoolman, S.E. (2018). *Environmental science* (16th ed.). New Delhi, India: Cengage Learning.

National Environment Commission. (2016). *Bhutan state of the environment report 2016.* Thimphu, Bhutan: National Environment Commission.

Nolan, P., & Lenski, H. (2011). *Human societies: An introduction to macrosociology* (11th ed.). London: Paradigm.

Ministry of Agriculture and Forests. (2011). *National forest policy of Bhutan 2011*. Thimphu, Bhutan: Ministry of Agriculture and Forests.

Ministry of Economic Affairs. (2017). *Mineral development policy 2017*. Thimphu, Bhutan: Ministry of Economic Affairs.

Additional Reading

Berg, L., Hager M., & Hassenzahl, D. (2016). *Visualizing environmental science* (5th ed.). Hoboken, NJ: John Wiley & Sons.

Cunningham, W.P., & Cunningham, M.A. (2014). *Environmental science: A global concern* (13th ed.). New York, NY: McGraw Hill.

National Biodiversity Centre. (2014). *National biodiversity strategies and action plan.* Thimphu, Bhutan: National Biodiversity Centre.

National Environment Commission. (2020). *Acts, policy & strategy*. National Environment Commission. http://www.nec.gov.bt/necs/acts-policy-strategy/

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.

Date: March 2025

Module Code and Title: **ECL101 Principles of Ecology**
Programme: BSc in Environmental Management
Credit: 12
Module Tutor: Bikram Sharma (Coordinator), Kinley Dorji

General objective: The module will introduce students to the basic concepts and principles of ecology to explore how nature works and how its various parts interact. It will familiarise students to the basic concepts, principles, related laws of energy dynamics and material flow, and ideas of ecology, many of which form the backbone of environmental issues and are thus necessary for their proper understanding.

Learning Outcomes – On completion of the module, students will be able to:

1. Describe the importance of ecological principles and concepts.
2. Discuss the scientific principles governing matter and energy.
3. Describe the different levels of hierarchical organizations used in ecology.
4. Discuss how matter and energy flow through ecosystems.
5. Explain how single species populations grow and are regulated.
6. Describe ecological interactions among different species.
7. Analyse the major forces structuring ecological communities.
8. Discuss biogeochemical cycles and its human impacts.
9. Investigate ecological interactions within a nearby forest ecosystem.

Learning and Teaching Approach:

Type	Approach	Hours per week	Total credit hours
Contact	Lectures	3	60
	Discussion and Presentation	1	
Independent study	Written assignment	3	60
	Field study	1	
Total			120

Assessment Approach:

A. Class Test: 5%

A class test of 50 minutes duration will be conducted covering approximately the first 2 weeks of subject matter or equivalent to content coverage of a single unit. It will be a blend of objective type questions, fill in the blanks, and short answer type questions.

B. Individual written assignment: 15%

Students will choose either a flora or fauna species of their own choice and write an individual assignment (750-1000 words) describing its ecological interactions and relationships with different species based on their own practical field observations. The assignment will be uploaded to the VLE platform wherein all students can access and learn from their colleagues' findings. This assessment will be held before the midterm.

6% Content (appropriateness of material, scientific and literary accuracy of the text and diagrams, evidence of field observations)

6% Quality of analysis and reflection (includes well stated and original analysis, thoughtfulness of reflection, uses relevant and adequate support for all claims made)

3% Mechanics (Language, organisation and referencing)

C. Group Field Report and Presentation: 25%

From a day-long field trip from Dochula to Lobesa (cool temperate to warm temperate zone) students in group of five will write a group report (750-1000 words) describing and analysing different levels of hierarchical organizations used in ecology with a prime focus on different types of ecosystem, relationships and interactions. Topics will be allocated to each group such as forest ecosystem, grassland ecosystem, soil ecosystem, and lotic/lentic aquatic ecosystem. This assessment will be held after the midterm.

Part A: Report: 15%

6% Description of their subject and its context/ summary of the visit (accuracy and completeness)

6% Quality of analysis (includes an explanation of a key concept or process from the module, and well-supported argument for how their subject illustrates the concept or process)

3% Mechanics (Language, organization and referencing)

Part B: Presentation: 10%

Each group will make a presentation of 15 minutes to share their observations.

7% Content and analysis

3% Presentation (Organization, Delivery, visual aids)

D. Midterm Examination: 15%

E. Students will take a written exam of 1.5-hr duration covering topics up to the mid-point of the semester. The exam will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

F. Semester-End Examination: 40%

Students will take a written exam of 2.5-hr duration encompassing all the subject matter covered in the semester. This assessment is comprehensive and summative in nature, and will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

Areas of assignments	Quantity	Weighting
A. Class Test	1	5%
B. Individual Written Assignment	1	15%
C. Group Field Report & Presentation	1	25%
D. Midterm Examination	1	15%
Total Continuous Assessment (CA)		**60%**
Semester-End Examination (SE)		**40%**

Pre-requisites: None

Subject matter:

Unit I: Introduction to ecology

1.1. Ecology and its aim and scope
- 1.1.1. Hierarchical levels of organization: populations, communities, ecosystems, landscapes, biomes, biosphere
- 1.1.2. Abiotic and biotic components of ecosystems

1.2. Matter: a brief review
- 1.2.1. Atoms; elements; molecules; compounds
- 1.2.2. Law of conservation of matter
- 1.2.3. Ions; pH; organic molecules
- 1.2.4. Living matter – cells
- 1.2.5. Matter in the four spheres of Earth's environment
- 1.2.6. Phases of matter
- 1.2.7. Matter interactions – air, water, minerals
- 1.2.8. Quality and usefulness of different kinds of matter

1.3. Energy: a brief review
- 1.3.1. Matter vs energy
- 1.3.2. Kinetic and potential energy
- 1.3.3. Energy conversions; Laws of thermodynamics
- 1.3.4. Energy changes in living organisms

Unit II: Ecological principles

2.1. Environmental factors; conditions and resources
2.2. Optimum, zones of stress, limits of tolerance
2.3. Law of limiting factors; environmental indicators
2.4. Habitat and niche
2.5. Competitive exclusion and resource partitioning

Unit III: Populations and communities

3.1. Dynamics of natural populations
- 3.1.1. Dynamics and growth; population growth curves
- 3.1.2. Biotic potential vs. environmental resistance

3.2. Community interactions
- 3.2.1. Competition; Predation; Symbiotic relationships (parasitism, mutualism, commensalism)
- 3.2.2. Keystone species
- 3.2.3. Introduced species and invasive species

Unit IV: Energy flow and disturbances in ecosystems

4.1. Transfer of energy through ecosystems
4.2. Characteristics of ecosystems; trophic levels

4.3. Flow of energy through food webs
    4.3.1. Energy flow and efficiency
    4.3.2. Biomass pyramids; biomagnification/bioaccumulation
4.4. Ecosystem responses to disturbance
    4.4.1. Ecological succession
    4.4.2. Disturbance and resilience

Unit V: Biogeochemical cycles: key characteristics, relationship between biogeochemical cycles and ecology, matter transfers and energy flows in the cycles, human impacts on the cycles

5.1. Geologic (tectonic) cycle
5.2. Hydrologic (water) cycle
5.3. Carbon cycle
5.4. Phosphate cycle
5.5. Nitrogen cycle
5.6. Sulfur cycle
5.7. Interaction between cycles

List of practical work:

a. A day-long field trip from Dochula to Lobesa (cool temperate to warm temperate zones) to observe and learn about various ecosystems, and to observe biodiversity in various types of forests.

b. Field studies: 1 hour/week outdoor field study such as investigating ecological interactions within the forest ecosystem above the RTC campus.

Reading List:

Essential Reading

Miller, G.T., & Spoolman, S.E. (2018). *Environmental science* (6th ed). New Delhi, India: Cengage Learning.

Odum, E., Barrick, M., & Barrett, G.W. (2005). *Fundamentals of ecology* (5th ed.). Belmont, CA: Brooks/Cole.

Ohsawa, M. (Ed.). (1991). *Life zone ecology of the Bhutan Himalaya II*. Chiba, Japan: Chiba University.

Netflix (2020, April 17). *Our planet: Fresh water* [Video]. https://www.youtube.com/watch?v=R2DU85qLfJQQ

Additional Reading

Cunningham, W.P., & Cunningham, M.A. (2014). *Environmental science: A global concern* (13th ed.). New York, NY: McGraw Hill.

Enger, E.D. & Smith, B.F. (2016). *Environmental science* (14th ed.) New York, NY: McGraw-Hill.

National Biodiversity Centre. (2014). *National biodiversity strategies and action plan of Bhutan*. Thimphu, Bhutan: Ministry of Agriculture and Forests.

Sodhi, N.S., & Ehrlich, P.R. (2010). *Conservation biology for all*. London, UK: Oxford University press.

Wright, R.T. & Boorse, D.F. (2017). *Environmental science* (13th ed.). New Delhi, India: PHI Learning Pvt Ltd.

National Environment Commission. (2016). *Bhutan state of the environment report 2016*. Thimphu, Bhutan: National Environment Commission.

Date: June 2021

Module Code and Title: **ENV102 Population, Development and Environment**
Programme: BSc in Environmental Management
Credit Value: 12
Module Tutor(s): Leishipem Khamrang (Coordinator), Tshewang Dorji, Jamyang Pelmo

General objective:

The module introduces students to the important concepts, ideas and theories of human population-environment relations. The module also deals with how societal intellectual, spiritual and moral growth are linked to the environment. Linkage between man-environment is also discussed through a gender lens. Further the module deals with the repercussions of population growth and human activities on the environment thus preparing students with necessary theoretical background in order to understand pressing social and ecological issues.

Learning Outcomes – On completion of the module, students will be able to:

1. Describe major demographic theories related to population structure and dynamics, fertility, mortality, and migration.
2. Discuss the interconnectedness amongst populations, development and the natural environment.
3. Explain environmental influences on societal growth.
4. Apply the basic measures of population growth.
5. Contrast major theories on the population-resources relationship.
6. Describe gender dimensions of environmental issues.
7. Analyse contemporary development processes and their environmental implications.
8. Discuss contemporary population growth patterns and resource utilization.
9. Identify global environmental issues linked to resource crises.

Learning and Teaching Approach:

Type	Approach	Hours per week	Total credit hours
Contact	Lectures	3	60
	Discussions and presentations	1	
Independent study	Written assignments	1	60
	Reading and review of class materials	3	
Total			120

Assessment Approach:

A. Response Paper (Individual): 10%

Students will write a response paper on contemporary socio-economic and environmental issues in 500-750 words. Students will choose a topic and submit it to the tutor for approval in advance.

4% Quality of analysis (originality, thoughtfulness of reflection, use of relevant and adequate support for all claims made, ties analysis to relevant module concepts)
3% Articulation, accuracy, and completeness
3% Mechanics (Language and referencing)

B. Class test: 10%

Students will write one class test either before or after the midterm of 50 minutes duration.

C. Forum discussion (10%)

To foster learning through discussion and debate, one forum discussion will be conducted. Tutor will frame a case/topic/statement reflecting on contemporary population, development, and environmental related issues. Each student will participate in the conversation/discussion by writing a comment in favour or against the case. Assessment will be done based on the following criteria:

5% Quality of analysis (originality, thoughtfulness of reflection, use of relevant and adequate support for all claims made)
3% Language and mechanics

2% Articulation, accuracy, frequency of participation, and completeness

D. Presentation of country profile (Individual): 15%

Towards the end of the semester, students will undertake exercises on analysis of 'census data' or 'annual dzongkhag statistics' (or similar data not limited to Bhutan) and make presentations. Each individual will get 10 -12 minutes for the presentation. Students will get different topics assigned by the tutor.

8% Content analysis and discussion (accuracy, completeness, argument and justification)
4% Delivery (Language, flow, presentation skills and visual aids)
3% Concluding remarks and Q & A

E. Midterm Examination: 15%

Students will take a written exam of 1.5-hr duration covering topics up to the mid-point of the semester. The exam will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

F. Semester-End Examination: 40%

Students will take a written exam of 2.5-hr duration encompassing all the subject matter covered in the semester. This assessment is comprehensive and summative in nature, and will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

Overview of assessment approaches and weighting

Areas of assignment	Quantity	Weighting
A. Response Paper (Individual)	1	10%
B. Class test	1	10%
C. Forum discussions via VLE	1	10%
D. Presentation on country profile	1	15%
E. Midterm Examination	1	15%
Total Continuous Assessment (CA)		**60%**
Semester-End Examination (SE)		**40%**

Pre-requisites: None

Subject matter:

Unit I: Introduction

1.1. Overview of the population, development and environment nexus
1.2. Natural environment's influences on societal growth: physical sustenance, intellectual growth, moral and spiritual growth
1.3. Population dynamics, characteristics and distribution
    1.3.1. Fertility, mortality and migration
    1.3.2. Basic measures of population growth
    1.3.3. Population composition, structure and characteristics
    1.3.4. World population growth, trends, patterns and distribution
    1.3.5. Determinants of spatial distribution and density of population

Unit II: Theories on population and natural resources

2.1. Ancient, medieval and modern views on population and resources
2.2. Optimistic and pessimistic views
2.3. Neo-Malthusian
2.4. Theory of surplus population
2.5. Theories of demographic transition

Unit III: Gender, development and environment

3.1. Defining gender, gender equality and equity
3.2. Gender dimensions of development
    3.2.1. Women in development

3.2.2. Empowering women, gender equality and smart economics
3.2.3. Gender and sustainable livelihoods
3.2.4. Integrated approaches to gender equality and decent work
3.2.5. Gender mainstreaming

3.3. Gender and biodiversity
3.3.1. Gender-based differences in human interactions with environments
3.3.2. Gendered nature of ecosystem services
3.3.3. The influence of ecofeminism
3.3.4. Feminist political ecology
3.3.5. Alternative formulations of women–environment relationships

3.4. Gender and climate change
3.5. Gender and land degradation
3.6. Gender and natural disaster

Unit IV: Development and environmental challenges

4.1. Development questions and environmental issues in developing countries
4.2. Globalization competitiveness and environment
4.3. Natural capital degradation
4.4. Ecological scarcity and poverty
4.5. Agriculture and climate change
4.6. Migration and the environment
4.7. Urbanization and the environment

Unit V: Population growth and exploitation of resources

5.1. Impact of growing population on resources
5.2. Resource exploitation and uses - demand for and supply of resources
5.2.1. Forest resources: Use and over-exploitation
5.2.2. Water resources: Use and over-utilization of surface and ground water
5.2.3. Mineral resources: Use and exploitation
5.2.4. Food resources: food security; overgrazing, effects of modern agriculture, fertilizer-pesticide problems
5.2.5. Energy resources: Growing energy needs, energy crisis, use of alternate energy sources
5.2.6. Land resources: Land as a resource, man induced land degradation, soil erosion and desertification
5.2.7. Environmental sink resources and their overutilization, e.g., environmental pollution

5.3. Population growth and global warming
5.4. Ecological balance of population and resources

Reading List:

Essential Reading

Barbier, E.B. (2019*). Natural resources and economic development* (2nd ed.). New York, NY: Cambridge University Press.

Gould, W.T.S. (2015*). Population and development* (2nd ed.). Abingdon, England: Routledge.

Hedberg, T. (2020). *The environmental impact of overpopulation: The ethics of procreation*. Abingdon, England: Routledge.

Weeks, J.R. (2012). *Population: An introduction to concept and issues* (10th ed.). Belmont, CA: Wadsworth Cengage Learning.

Additional Reading

Adam, W.M. (2008). *Green development: Environment and sustainability in a developing world.* Abingdon, England: Routledge

Bandarage, A. (2013). *Sustainability and well-being: The middle path to environment, society, and the economy*. London, England: Palgrave Macmillan.

Bhende, A.A., & Kanitkar, T. (2008). *Principles of population studies* (19th ed.). Mumbai, India: Himalayan Publishing House.

Castree, N. (2014). *Making sense of nature*. Abingdon, UK: Routledge.

Gritzner, C.F. (2010). *Environment and natural resources (Global connections)*. New York, NY: Chelsea House Pub.

Kumar, P., & Reddy, B.S. (2007*). Ecology and human well-being.* New Delhi, India: Sage.

Miller, G.T., & Spoolman, S.E. (2018). *Environmental science* (16th ed.). Boston, MA: Cengage Learning.

Mosley, P. (2017). *Fiscal policy and the natural resources curse: How to escape from the poverty trap.* Abingdon, UK: Routledge.

Peacock, K. W. (2008). *Natural resources and sustainable development*. New York, NY: Facts on File, Inc.

Poulopoulos, S.G., & Inglezakis, V.J. (Eds.). (2016). *Environment and development: Basic principles, human activities, and environmental implications*. Amsterdam, Netherlands: Elsevier.

Robinson, H. (1981). *Population and resources*. London, England: Macmillan Education.

Sharma, R.K. (2004). *Demography and population problems*. New Delhi, India: Atlantic.

Date: March 2025

Module Code and Title: **IPS101 IT and Basic Problem Solving**
Programme: BSc in Environmental Management
Credit: 12
Module Tutor: Suchibrota Dutta

General objective: This module aims to develop a working facility with Office productivity tools (e.g., Microsoft Word, Excel, and PowerPoint) including online tools such as Google suite and Google docs. 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 – On completion of the module, students will be able to:

1. Create typed documents using word processing software with proper formatting, style, spacing, and pagination.
2. Create slide presentations that include text, graphics, and transitions applying good design practices
3. Effectively present information through slideshows.
4. Organize tabular data in spreadsheet software.
5. Generate basic charts (line graphs, bar graphs, pie charts, scatter plots) appropriate for different kinds of data in spreadsheet software.
6. Find data relevant to a problem.
7. Assess the quality and reliability of data.
8. Structure common mathematical problems.
9. Solve common mathematical problems on spreadsheet software using formulas.
10. Approximate quantitative answers.
11. Judge reasonableness for computed answers.
12. Structure more complex problems, including asking the relevant questions, gathering appropriate data, analysing that data, and presenting findings.

Learning and Teaching Approach:

Type	Approach	Hours per week	Total credit hours
Contact	Lecture	2	60
	Practical exercises	2	
Independent study	Practical assignments and practice	3	60
	Reading and review of class materials	1	
Total			120

Assessment Approach:

A. Written class test (theory): 10%

Students will take a written class test of 50 min duration covering approximately 2 weeks of subject matter on basic aspects of computer usage and internet usage for accessing information.

3% Introduction to computers (types of computers, types of digital communications, input and output devices, memory and storage, etc.)

4% Introduction to Windows (Launching software; Navigating, managing, and creating files and folders, shortcut keys), and basic internet concepts

3% Basic online tools - Google sheets, google docs, google drive, etc.

B. Practical class tests: 40%

Students will undertake 4 x 1 hr in-class practical tests incorporating small elements of Units I-III (e.g., data searches, re-write letter, short Excel problems, presenting findings), each worth 10% and focusing on different tools (1 test with Word, 2 tests with Excel, 1 test with Powerpoint).

C. Practical assignments: 20%

Students will do 1 word processing (10%) and 1 spreadsheet (10%) assignment achieving interrelated tasks throughout Units I-III.

Written report using Word (500 words) – 10%

1% Cover Page

2% Content: Reliability, effectiveness, and accuracy of the content

6% Document guidelines incorporation: Instructions for completing the assignment are followed along with incorporating all required elements, such as formatting, style, spacing, etc.

1% Conclusion and References

Preparation of a calculation spreadsheet using Excel – 10%

1% Data Entry

5% Identifying and solving the problem using appropriate formulas. Summarizing the data and exploring more complex data with Pivot Tables/charts, etc.

3% Using functions for decision-making and validating data, and visually presenting the output

1% Organization/ Formatting

D. Midterm examination: 15%

Students will take a written exam of 1.5-hr duration covering topics up to the mid-point of the semester. The exam will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

E. Project: 15%

Each student will identify a more complex problem he/she wants to analyse, and then follow a standard workflow: Identify the issues to be addressed; Structure questions to highlight these issues and draw conclusions; Determine the process and limitations for obtaining survey answers (if relevant); Compile data while ensuring accuracy; Structure the data analysis in Excel; Interpret quantitative results and draw conclusions; Assess the reliability and limitations of results.

Students will then prepare a written report in Word/Google docs (400-600 words) incorporating spreadsheet tables and charts, and presentation of 10 min duration using Powerpoint or Google slides (~10 slides).

6% Documentation Format
Cover Page and Introduction – 1%
Problem analysis – 2%
Structure of document and formatting – 3%

4% Presentation
Slides include text, graphics, and transitions applying good design practices - 2%
Effective delivery of content – 2%

5% Spreadsheet work
Solution – An appropriate response to a challenge or a problem - 2%
Computation and Execution – Aspects of the student's solution are accurate without logical errors – 2%
Techniques – Students select a variety of appropriate techniques and tools to analyse and generalize the problem, using formulas, graphs, data validation, grouping, etc. - 1%

Overview of assessment approaches and weighting

Areas of assignments	Quantity	Weighting
A. Written class test (theory)	1	10%
B. Practical class tests	4	40%
C. Practical assignments	2	20%
D. Midterm examination	1	15%
E. Final project	1	15%
Total Continuous Assessment (CA)		**100%**

Pre-requisites: None

Subject matter:

Unit I: Basics of IT for communication and information

1.1. Computer basics: types of computers, types of digital communications, input and output devices, memory and storage

1.2. Introduction to the Windows operating system environment: launching software; navigating, managing, and creating files and folders, common shortcut keys

1.3. Computer tools for written communications
- 1.3.1. Basics of word processing (Word and Google docs)
- 1.3.2. Basics of Internet
- 1.3.3. File folders; search
- 1.3.4. Basics of using online tools and applications for productivity, e.g., Google suite (using e-mail, storing files, google docs)

1.4. Finding and assessing information: Internet search (e.g., Google); Sifting through / assessing quality of information; quality of the source; Categories of information/issues with each
- 1.4.1. Facts: Reliability of the source; crosschecking different sources
- 1.4.2. Data: Varies with the question being asked; different perspectives
- 1.4.3. Opinion: No single answer; varies with source and perspective; different uses in different contexts

1.5. Presenting findings
- 1.5.1. Written reports using Word or Google docs (introduction, key issues, analysis, conclusions, actions)
- 1.5.2. Presentation using Powerpoint or similar online tools: Powerpoint basics (clear concise slides; text indicating major points only, effective use of graphics)

Unit II: Organizing data and solving problems using spreadsheets

2.1. Introduction to Excel: types of basic problems that can be solved
- 2.1.1. Calculation of a specific answer to a narrow problem (e.g., average and weighted averages, Min/Max, Count, Present value, IRR)
- 2.1.2. Statistical overview of a dataset

2.2. Basic workflow for problem solving: Identifying different types of problems; setting up problem/data on Excel; Assessing the correctness of results
- 2.2.1. Sample types of problems that can be solved with basic math of general relevance
  - 2.2.1.1. 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
  - 2.2.1.2. Percentages: % increases, decreases, commissions, discounts
  - 2.2.1.3. Weighted averages, e.g., marks calculation
  - 2.2.1.4. Quantitative trends over time
  - 2.2.1.5. Basic probability
- 2.2.2. Assessing the correctness of the answer (i.e., comparing quick estimations with calculated answers as a way of finding mistakes and approximating answers)
  - 2.2.2.1. Basic “reasonableness”: identifying answers which are clearly out of the possible range of answers
  - 2.2.2.2. Doing rough calculations to get approximate answers
  - 2.2.2.3. Relating calculated values to the type of possible answers (e.g., for an average, checking that the answer is within the range of numbers in the data).

Unit III: More complex problem-solving

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

List of practical work:

a. Basics of computing in the digital age:
   - i. Brief demonstration of key elements of desktop computers; Navigating the Windows operating system environment
   - ii. Browsing the internet; use of internet office productivity tools and e-mail

b. Word Processing:
   - i. Document/File Formatting: Table of Content, Table of Figure, Page No., Cover Page, Referencing/Citation, and Table of reference
   - ii. Mail Merge: Create letters for multiple recipients with the same content of file
   - iii. Organogram: using Smart art feature

c. Spreadsheets:
   - i. Simple Bill Creation: Fill series, introduction of formula, currency conversation, and graph/chart
   - ii. Salary calculation and payslip generation (using mail merge): concept of allowances and deduction, individual TA and Leave calculation
   - iii. Result/Mark sheet (using mail merge) Preparation: total marks, % of marks, weightage wise calculation, Pass/Fail determination by If formula, conditional formatting to highlight data

iv. Attendance Calculation: introduction of count, counta, countif formula, calculate attend class, missed class, % of attendance and Allowed/ Debarred by using IF formula
v. Count/Sum product: sumif/sumifs countif/countifs
vi. Data Validation: Restrict users to enter wrong data.
vii. Lookup, Vlookup, Hlookup
viii. Pivot Table, Pivot Chart, Slicer, Filter
ix. Consolidated data from different sheet and file

d. Presentation software:
i. Basics of placing elements on slides.
ii. Explore some creative and less standard ways of creating an interactive presentation.
iii. Slide transition, Text Animation
iv. Action Button, Smart art, Custom animation, Handout
v. Slide masters

Reading List:

Essential Reading

Frye, C. (2014). *Microsoft Excel 2013 Step by Step*. Microsoft Press.
Training resources on Microsoft Office, available at http://office.microsoft.com/en-us/training/
Training resources on Google G Suite, available at https://gsuite.google.com/training/

Additional Reading

Swinford, E., Melton, B., & Dodge, M. (2013). *Microsoft Office Professional 2013 step by step*. Sebastapol, CA: Microsoft Press.
Weverka, P. (2013). *Microsoft Office 2013: All-in-one for dummies*. Delhi: Wiley India.

Date: June 2021

Module Code and Title: **EAP101 Intermediate English for Academic Purposes**
Programme: BA in English Studies
Credit Value: 12
Module Tutor: Dechen Pelden (Coordinator), Sangay C. Wangchuk, Mohan Rai, Palden Wangmo and Ruma Tamang.

General objective: EAP101 is the first part of a two-semester series that aims to develop abilities in reading, writing, listening, and speaking in an academic context to support students' learning through their degree studies. This module includes topics that are relevant to students' specific subject areas, which will help students apply the skills learned in context of their respective fields of study.

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

Reading Skills

1. Closely read key terms and guess meanings in context, key information, ideas and concepts.
2. Skim and scan relevant sources for essays.
3. Analyse information in more complex texts.
4. Parse essay questions to give answers.

Writing Skills

1. Outline an essay.
2. Organize ideas by using linkers, and signposts.
3. Draft and build arguments.
4. Paraphrase written texts.
5. Create a bibliography.

Listening and Speaking Skills

1. Listen for gist and details through scan listening and interactive listening.
2. Interview subjects to write short reports.
3. Express one's point of view in a discussion.
4. Describe the process narrated in a pre-recorded audio clip.
5. Participate in a panel discussion.

Grammar and Vocabulary

1. Explain targeted grammatical structures in both spoken and written forms.
2. Apply targeted grammatical structures appropriately in both written and oral production.
3. Self-correct while using targeted grammatical structures.

Learning and Teaching Approach:

Type	Approach	Hours per Week	Total Credit Hours
Contact	Lecture, discussions, and practice (2 x 2 hr). 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.	4	60
Independent study	Writing assignments and Learning Journal VLE discussions	4	60
	Reading and review of class materials		
Total			120

Assessment Approach:

A. Note-Taking Exercise 5%

Each student has to maintain class notes containing series of exercises from both within and outside the class. It will be assessed before the mid-semester.

'Note-Taking Exercise' will be assessed using the following rubric:
Relevance and Completeness: 10 marks
Coherence and Organisation: 10 marks
Language and clarity: 10 marks

B. VLE Discussion 10%

Students will participate in two VLE discussions on topics assigned by the tutor. It will be conducted one before mid-semester and one after mid semester.

Each task will be assessed on 5%, and will be based on the following rubric:
Quality of Discussion: 12 marks
Interaction with peers: 4 marks
Language and Grammar: 4 marks

C. Learning Journal: 20%

Students will have to maintain a journal incorporating two entries of 250-350 words each related to discipline-specific topics. Each of the two entries will be submitted as first and final drafts. The first will be assessed for a total weightage of 7%, and the second 13%.

The entries will be assessed as per the Learning Journal rubric based on the following rubric:
Critical Thinking: 10 marks
Personal Reflection: 10 marks
Language and Grammar: 10 marks

D. Panel Discussion: 20%

Each student will speak for 5-7 minutes in a panel discussion. Students will be assigned topics related to their discipline, or an evidence-based subject of their interest. This assessment will be divided into two components: one pre-discussion meeting and the final panel discussion. In the pre-discussion meeting, students will meet the tutor to update on the progress, confer on the direction of the presentation, and set goals if applicable.

The pre-discussion meeting will be evaluated on 3% and the final panel discussion will on 17%.

The pre-discussion rubric will be based on the following rubric:
Completion of task: 5 marks
Planning and preparedness: 10 marks

The final panel discussion will be based on the following rubric:
Relevance of argument: 30 marks
Coherence and logical flow of ideas: 30 marks
Language and grammar: 30 marks
Respect for the other panellists' views: 10 marks

E. Written assignment: 20%

The student will write a 750 – 1000-word reflective academic essay on the topics assigned by the tutor. This is not expected to be an extensively researched essay. The assignment will be written in two drafts: the first draft will be worth 5%; and the final draft will be worth 10% with 5% on the improvement on the first draft.

Both drafts will be evaluated using the following criteria:
Depth of reflection: 35 marks
Critical thinking: 25 marks
Use of sources: 20 marks
Language and grammar: 20 marks

Improvement on feedback will be evaluated using the following rubric:
Marginal improvement: 0 – 49 marks
Satisfactory improvement: 50 – 59 marks
Significant and appropriate improvement: 60 – 74 marks
Significant improvement beyond feedback given: 75 – 100 marks

F. Class Tests: 25%

Three class tests (5%+10%+10%) of 60 minutes will be held within class hours, each covering approximately 3-4 weeks of subject matter. These tests should be based on the four skills.

Overview of assessment approaches and weighting

Areas of assignments	Quantity	Weighting
A. Note-Taking Exercise	1	5%
B. VLE Discussion	2	10%
C. Learning journal	2	20%
D. Presentation	1	20%
E. Written assignment	1	20%
F. Class tests	3	25%
Total Continuous Assessment (CA)		**100%**

Pre-requisites: None

Subject matter:

Unit I: Academic orientation

1.1. Setting study goals in academic English
1.2. Focusing on academic study
1.3. Reading and writing in academic English
1.4. Attending lectures

1.5. Studying independently on an academic English course
1.6. Thinking about the role of language in academic English
1.7. Plagiarism and how to avoid it

Unit II: Topic/context: Problems in the natural world

2.1. Reading: Understanding essay questions; Identifying the relevance of the text; Grammar in context: noun phrases
2.2. Listening and speaking: Making sure you have understood
2.3. Writing: Paragraph building; Grammar in context: present perfect
2.4. Grammar and vocabulary practice: Word families; Quantifying expressions; Noun phrases; Clause structure; Present perfect and past simple

Unit III: Lecture Skills I

(Lecture Skills A and B)

3.1. Preparing for lectures: Talking about products; Vocabulary for the context
3.2. Preparing for lectures: Chemical elements; predicting information from visuals; vocabulary for the context.
3.3. Listening: Listening for gist and detail
3.4. Language focus: If structures 1; Vocabulary: key expressions; Pronunciation: emphasising words
3.5. Follow-up: Organising notes; Further listening

Unit IV: Topic/context: Indications and trends

4.1. Reading: Deciding what to read for an essay; Approaches to note-taking 1; Grammar in context: past perfect
4.2. Listening and speaking: Giving advice; Asking for help
4.3. Writing: Planning the main paragraphs of an essay; Writing a short report; Vocabulary in context: language for describing trends
4.4. Grammar and vocabulary practice: Corpus language; Past simple; Past perfect; Language to describe statistics; Words for economic graphs

Unit V: Topic/context: The information age

5.1. Reading: Interactive reading Grammar in context: phrases of frequency Reading for the main ideas in a text; Grammar in context: prepositional phrases
5.2. Listening and speaking: Outlining issues and putting forward your point of view
5.3. Writing: Drafting and building arguments
5.4. Grammar and vocabulary practice: Word building; Noun phrases; Phrases of frequency; Vocabulary families; Prepositional phrases; Reporting verbs

Unit VI: Topic/context: On budget

6.1. Reading: Reading for key information and concepts; Grammar in context: expressing different levels of certainty; Vocabulary in context: language to define terms
6.2. Listening and speaking: Describing a process in a seminar presentation; Giving a presentation: describing a process
6.3. Writing: Drafting and revising content
6.4. Grammar and vocabulary practice: Words associated with planning; Language of possibility; Definitions; Language of presentations; Word families from the Academic Word List

Unit VII: Topic/context: Being objective

7.1. Reading: Close reading for key ideas; Analysing information in more complex texts; Grammar in context: modal expressions; Grammar in context: relative clauses
7.2. Listening and speaking: Agreeing and disagreeing
7.3. Writing: Paraphrasing information for essays; Avoiding plagiarism; Linking words 2
7.4. Grammar and vocabulary practice: Verb and noun collocations; Language of agreement; Modal expressions; Relative clauses; Linking words and phrases

Unit VIII: Topic/context: Sensing and understanding

8.1. Reading: Text organisation 1; Grammar in context: passive constructions; Vocabulary in context: word building
8.2. Listening and speaking: Signposting in seminar presentations; Giving a presentation
8.3. Writing: Linking words 3; Grammar in context: using the passive to manage information in texts
8.4. Grammar and vocabulary practice: Art and design vocabulary; Passive forms; Perceive word family; Signposting in seminar presentations; Linking words

Unit IX: IT issues

9.1. Reading: Text organisation 2; Grammar in context: hedging language
9.2. Listening and speaking: Problem–solution patterns and repair strategies
9.3. Writing: Generating ideas; Grammar in context: cohesive devices; In-text referencing (particular focus on APA)
9.4. Grammar and vocabulary practice: Subordination; Crime vocabulary; Hedging language; Cohesion

Unit X: Topic/context: Culture shock

10.1. Reading: Text organisation 3; Grammar in context: reduced relative clauses
10.2. Listening and speaking: Concluding a presentation
10.3. Writing: Planning the overall shape of an essay; Reading for relevant information; Writing the conclusion; Creating a bibliography (APA style references list – basic rules and format for end-text references for different types of sources)
10.4. Grammar and vocabulary practice: Word building; Reduced relative clauses; Participle clauses; Compound words

Unit XI Lecture Skills II

(Lecture Skills C)

11.1. Preparing for lectures: Thinking about the purposes of lectures
11.2. Listening: Understanding evaluations; Understanding lists
11.3. Language focus: Noticing differences in the language of lectures and academic writing; Noticing prominent words
11.4. Follow-up: Taking notes: annotating; Reconstructing your notes

(Lecture Skills D)

11.5. Preparing for lectures: Building basic information
11.6. Listening: Understanding the relationship between parts of the lecture; Understanding descriptions of processes
11.7. Language focus: Understanding vague language
11.8. Follow-up: Listening for a lecture summary; Comparing notes

(Lecture Skills E)

11.9. Preparing for lectures: Overcoming problems in listening to lectures
11.10. Listening: Understanding specialised terms; Understanding reasons
11.11. Language focus: Understanding signals of incomplete information; Understanding forward and backward reference
11.12. Follow-up: Listening and annotating slides; Writing up your notes; Overcoming problems

Reading List:

Essential reading

Paterson, K. & Wedge, R. (2013*). Oxford grammar for EAP*. Oxford University Press.
Thaine, C. & McCarthy, M. (2014). *Cambridge academic English – An integrated skills course for EAP: B1+ (Intermediate) student's book*. Cambridge University Press.

Additional reading

Hacker, D. (2021). *Writer's reference* (10th ed.). Bedford/St. Martin's.
Hyland, K. (2006). *English for academic purposes*. Routledge.

Date: June 2022

Module Code and Title: **CLM101 Climate Change**
Programme: BSc in Environmental Management
Credit Value: 12
Module Tutor(s): Kinley Dorji (Coordinator), Bikram Sharma, GP Sharma

General objective: This module introduces students to the fundamentals of weather and climate to enhance their understanding of the Earth's changing climate and its underlying causes. Students will learn about the impacts of climate change on various facets of livelihoods like food security and public health, along with potential mitigation and adaptation measures applicable for managing climate change.

Learning Outcomes – On completion of the module, students will be able to:

1. Describe the elements of weather and climate.
2. Analyse various weather variables for scientific purposes.
3. Identify possible factors affecting the climate.
4. Discuss climate change and its possible causes.
5. Explain the relationship between human activities and climate change.
6. Analyse the impacts of climate change on human well-being and the natural world.
7. Explain the principles of climate change vulnerability assessment.
8. Discuss the applications of dendrochronology in climate science studies.

Learning and Teaching Approach:

Type	Approach	Hours per week	Total credit hours
Contact	Lectures	3	75
	Discussions and in-class exercises	1	
	Field practical work	1	
Independent study	Written assignments	1	45
	Reading and review of class materials	2	
Total			120

Assessment Approach:

A. In-class group exercises (written): 10%

Students will undertake two in-class written exercises (5% each) in small groups of 3-4 focusing on answering questions based on readings. Students will be given an entire class period (50 min) to complete the exercises. These questions should require students to deliver clear and accurate summaries and identify main arguments as well as how these arguments have been supported. The written submissions will be marked on the correctness of the answers.

B. In-class group exercises (discussion): 10%

Students will undertake two in-class discussion exercises (5% each) in small groups of 3-4 focusing on addressing given discussion topics. The groups will be given different case studies among the following broad areas: 1. Global Climate Models, 2. Global Climate Change, Impacts of Climate Change on the natural world and human wellbeing, and 4. Measurement of Climate Change. The groups will share their case analyses using PowerPoint Presentation of about 10 minutes with the class. This exercise, with immediate guidance from the tutor, should enable students to learn about techniques to identify, analyse, interpret and discuss the different case studies.

2% Summary of main ideas of the overall broad topic area and cohesive discussion on the specific questions posed by the tutor within the broad topic (group score)
3% Content and delivery of individual discussion points (individually scored)

C. Meteorological data collection and analysis: 15%

Part 1: Students will be asked in turn to take care and keep a daily record of readings from the college meteorological station using a spreadsheet thrice a day (800 – 1300 – 1800 hours). Numerous instruments will be read including the Campbell Sunshine Recorder, Evaporation Pan, Anemometer, Wind Vane, Barometer, Hygrometer, Maximum/Minimum Thermometer, Dry and Wet Bulb Thermometer, Soil Thermometer and Rain Gauge for a record of at least three months. This assessment focuses on giving a hands-on-practice to collect data from various instruments measuring various weather variables. From the collected data, the various aspects of the weather will be displayed in class, for a day, a week and a month. Individuals will be assessed on:

2% Correct and timely collection
2% Correct and timely display in the classroom
4% Maintenance of spreadsheet

Part 2: The class will be divided into groups of four students. Each group will be given overall data (of three months) collected from one of the aforementioned instruments measuring an aspect (variable) of weather. Students will perform some statistical analyses like mean, standard deviation, correlation and regression to gain better insight into characterizing the cumulative weather phenomena. After the analyses, within a week, students will produce a report of 500-750 words towards the end of the semester along with all appropriate tables and graphs.

3% Content
3% Analysis
1% Language and Grammar

D. Written assignment: 10%

The students will be (individually) asked to write a review paper of 750-1000 words. They will be given a collection of scientific documentary films from which to draw on about climate change. The review will be based on one selected documentary. This exercise will keep the students abreast of recent development in the field of climate change.

4% Review of the article (all the major points/main ideas of the article selected and discussed with supporting details)
3% Organization and Writing (articulate and good build of arguments, well organised, good flow and coherence)
3% Mechanics (Language and referencing)

E. Midterm Examination: 15%

Students will take a written exam of 1.5-hr duration covering topics up to the mid-point of the semester. The exam will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

F. Semester-End Examination: 40%

Students will take a written exam of 2.5-hr duration encompassing all the subject matter covered in the semester. This assessment is comprehensive and summative in nature, and will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

Overview of assessment approaches and weighting

Areas of assignments	**Quantity**	**Weighting**
A. In-class group exercises (written)	2	10%
B. In-class group exercises (discussion)	2	10%
C. Meteorological data collection and analysis	1	15%
D. Written Assignment	1	10%
E. Midterm Examination	1	15%
Total Continuous Assessment (CA)		**60%**
Semester-end Examination (SE)		**40%**

Pre-requisites: None

Subject Matter:

Unit I: Fundamentals of weather and climate

1.1. Definition of weather and climate
1.2. Climatology and meteorology: Definition, Scope, History
1.3. Observation of weather variables (Definition, recording, calculation, interpretation)
    1.3.1. Temperature
    1.3.2. Humidity
    1.3.3. Pressure
    1.3.4. Precipitation
    1.3.5. Cloud cover
    1.3.6. Sunshine
    1.3.7. Wind speed
    1.3.8. Wind direction
    1.3.9. Evaporation
1.4. Weather Phenomena (Definition and its relationship to weather at microscale, mesoscale, and macro-scale of an area)
    1.4.1. Fog and Frost
    1.4.2. Fronts and storms, Jet streams, Cyclones, Tornadoes and Hurricanes
    1.4.3. Cold and Heat Waves
    1.4.4. Thunderstorm: Supercell, Derecho, and Squall Line.
    1.4.5. Winter storm: Blizzard and Ice storm

Unit II: Natural factors affecting climate

2.1. Constitution of the atmosphere
    2.1.1. Structure of atmosphere
    2.1.2. The chemical composition of the atmosphere
    2.1.3. The vertical profile of temperature, pressure and density
2.2. Solar Radiation
    2.2.1. Distribution of radiant energy from the Sun
    2.2.2. Effects of the atmosphere
    2.2.3. Average radiation budgets
    2.2.4. Surface-energy budgets
2.3. Atmospheric circulation
    2.3.1. Isobaric heating and cooling
    2.3.2. Adiabatic reference processes
    2.3.3. Convective stability
    2.3.4. Scales of atmospheric motion: microscale, mesoscale and synoptic
    2.3.5. The general circulation
2.4. Ocean Currents
    2.4.1. Cold and warm currents
    2.4.2. Geostrophic flow
    2.4.3. Thermal winds
2.5. Latitude, Elevation, and Relief

Unit III: Causes of climate changes

3.1. Defining climate change
3.2. Causes and factors contributing to climate change: natural and anthropogenic
3.3. Past, current, and future concentrations of greenhouse gases (GHG)
3.4. Major sectors and human activities contributing globally to GHG emissions
3.5. Detection and Attribution of Global Temperature Changes
    3.5.1. Atmosphere and Surface: Temperature, Water Cycle, Atmospheric Circulation and Patterns of Variability.
    3.5.2. Changes in Ocean Properties: Temperature, Salinity, Sea Level, Oxygen and Ocean Acidity.
    3.5.3. Cryosphere: Sea Ice, Ice Sheets, Ice Shelves and Glaciers, Snow Cover.
    3.5.4. Extremes: Attribution of Changes in Frequency/Occurrence and Intensity of Extremes.

3.6. Emerging strategies for addressing climate change
3.7. Basic concepts in climate change adaptation and mitigation: approaches in Bhutan

Unit IV: Impacts of climate change on people and the environment

4.1. Climate Change and Food Security
  4.1.1. Effects on agriculture and food security
  4.1.2. Women vulnerabilities in relation to agriculture and food security
  4.1.3. Adaptation actions to reduce the negative impacts
  4.1.4. Reduction of emissions from agriculture land use
  4.1.5. Agricultural systems to improve food security
4.2. Climate Change and Human Health
  4.2.1. Diseases exacerbation - local, regional, and global
  4.2.2. Vulnerable populations health affection
  4.2.3. Adaptations on health issues, risks, and problems

Unit V: Responses to climate change

5.1. Principle and practices of Climate Change Vulnerability Assessment
  5.1.1. Resilience and vulnerability
  5.1.2. Elements and principles
  5.1.3. Gender sensitive vulnerability assessment framework
  5.1.4. Vulnerability assessment results and adaptation strategies
  5.1.5. Uncertainties associated with projected climate change impacts
5.2. Climate Change and ecosystem Services
  5.2.1. Framework of ecosystem services assessment and response
  5.2.2. Emerging ecosystem markets for carbon and watershed services
  5.2.3. Role of ecosystem-based adaptation and mitigation solution
5.3. Global frameworks for responding to climate change: Paris agreement, Resilient development

Unit VI: Dendroscience as a tool to understand and measure climate change

6.1. Introduction to tree biomass growth
6.2. Physical and biological basis of tree rings
6.3. Wood anatomy, structure, and function
  6.3.1. Tree growth & woody tissue
  6.3.2. Composition & structure of wood cells
  6.3.3. Softwood structure
  6.3.4. Hardwood structure
6.4. Weather, climate and tree growth
6.5. Growth Stresses and Strains in Trees
6.6. Mechanistic model of tree-ring growth

List of practical work:

a. Students will visit the college meteorological station in turns and record the daily readings from instruments measuring different elements of the weather (using Campbell Sunshine Recorder, Evaporation Pan, Anemometer, Wind Vane, Barometer, Hygrometer, Maximum/Minimum Thermometer, Dry and Wet Bulb Thermometer, Soil Thermometer and Rain Gauge).

Reading List:

Essential Reading

Creasman, P. P. (2011). Basic principles and methods of dendrochronological specimen curation. *Tree-Ring Research, 67*(2), 103-115.

DiMento, J. F. C., & Doughman, P. (Eds.) (2007). *Climate change: What it means for us, our children, and our grandchildren.* Cambridge, MA: The MIT Press.

McIlveen, J. F. R. (2010). *Fundamentals of weather and climate* (2nd ed.). Berlin, Germany: Springer – Science + Business Media.

Ugyen Wangchuck Institute for Conservation and Environmental Research. (2017). *Dendrochronology manual*. Bumthang, Bhutan: UWICER Press.

Northern Light Production (2021, January 10). *Climate emergency: Feedback loops* [Video]. https://feedbackloopsclimate.com/

Additional Reading

Intergovernmental Panel on Climate Change (2018). *Special report: Global warming of 1.5°C.* Geneva: Intergovernmental Panel on Climate Change.

Intergovernmental Panel on Climate Change (2018). *Climate change and land.* Geneva: Intergovernmental Panel on Climate Change.

Intergovernmental Panel on Climate Change (2014). *Climate change 2014: Synthesis report: climate change 2014.* Geneva: Intergovernmental Panel on Climate Change.

Intergovernmental Panel on Climate Change (2014). *AR5 Climate Change 2014: Impacts, Adaptation and Vulnerability.* Geneva: Intergovernmental Panel on Climate Change.

Houghton, J. (2015). *Global warming: The complete briefing* (5th ed.). New York, NY: Cambridge University Press.

Krusic, P.J., Cook, E.R., Dukpa, D., Putnam, A.E., Rupper, S., & Schaefer, J. (2015). Six hundred thirty-eight years of summer temperature variability over the Bhutanese Himalaya. *Geophysical Research Letters, 42*, 2988 – 2994. DOI: 10.1002/2015GL063566

Lovejoy, T.E., Hannah, L., & Wilson, E.O. (Eds.). (2019). *Biodiversity and climate change: Transforming the biosphere*. London, England: Yale UnivEn410ersity Press.

Press, S., & Rennenboog, R. (2018). *Principles of climatology*. Hackensack, NJ: Salem Press.

Schweingruber, F. H. (1989). *Tree rings: Basics and applications of dendrochronology.* Amsterdam, Netherlands: Kluwer Academic Publishers.

Date: June 2021

Module Code and Title: **STS101 Introduction to Statistics**
Programme: BSc in Environmental Management
Credit Value: 12
Module Tutor(s): Leishipem Khamrang (Coordinator), Kinley Dorji

General objective: This module aims to provide students with the basic statistical concepts and its relevance to environmental studies. Practical learning using empirical data and the real-word data is a major emphasis of the module. The module will thus not only expose students to the availability and the uses of quantitative information related to environmental issues but also help them better learn the current state of the environment.

Learning Outcomes – On completion of the module, students will be able to:

1. Describe the relevance of statistics in environmental studies.
2. Define essential statistical concepts and terms.
3. Choose appropriate statistical tests and techniques for analysis of data.
4. Organize and present quantitative data using appropriate statistical techniques.
5. Apply statistical techniques for analysing data using spreadsheet and statistical software.
6. Test hypotheses using appropriate statistical tests and techniques and draw correct inferences.
7. Interpret the outputs of statistical analysis, in numerical terms and through graphs.
8. Analyse environmental related data such as rainfall, temperature and water quality.

Learning and Teaching Approach:

Type	Approach	Hours per week	Total credit hours
Contact	Lectures	3	75
	Practical work in computer Lab	2	
Independent study	Written assignments	1	45
	Review of class exercise	2	
Total			120

Assessment Approach:

A. Class test (Practical): 15%

Students will undertake two class tests (lab tests) – one before the midterm (7.5%) and one after the midterm (7.5%). These lab tests will cover proficiency of using statistical software for generation of outputs, interpretation of the outputs – contingency tables and graphs.

B. Written assignment (Analysis of statistical report): 10%

To assess statistical proficiency, students will individually analyse different statistical reports such as, Bhutan Living Standards Survey, Labour Force Survey, GNH Survey report, Poverty Analysis Report, Bhutan (PAR) etc. They will discuss the statistical tools and techniques employed in the reports and make inferences based on the results presented in the reports. The report analysis will be 500-600 words in length. The report analysis will be evaluated on:

3% Exposition on the techniques, tools and methods employed in the reports
5% Interpretation: accuracy, completeness and robustness
2% Language, flow and articulation

C. Written assignment (application of statistical techniques): 20%

Students will individually submit a project on quantitative data analysis using primary data or secondary data. Students will decide a topic and identify suitable statistical tools and technique(s) for the data analysis. The project will be 750-1000 words in length. This assignment consists of two parts: presentation (10%) and project report (10%). Duration of the presentation will be 10 minutes.

Presentation

4% Content analysis and discussion (accuracy, completeness, argument and justification)
4% Delivery (Language, flow, presentation skills and visual aids)
2% Time management and concluding remarks.

Project report

4% Accuracy and completeness
4% Quality of analysis: contents analysis and discussion of the findings
2% Mechanics (Language, organization and referencing

D. Midterm Examination: 15%

Students will take a written exam of 1.5-hr duration covering topics up to the mid-point of the semester. The exam will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

E. Semester-End Examination: 40%

Students will take a written exam of 2.5-hr duration encompassing all the subject matter covered in the semester. This assessment is comprehensive and summative in nature, and will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

Overview of assessment approaches and weighting

Areas of assignment	Quantity	Weighting
A. Class test (Practical)	2	15%
B. Written assignment (analysis of statistics report)	1	10%
C. Written assignment (application of statistical techniques)	1	20%
D. Midterm Exam	1	15%
Total Continuous Assessment (CA)		**60%**
Semester-End Examination (SE)		**40%**

Pre-requisites: None

Subject Matter:

Unit I: Introduction to using statistics

1.1. The research process; making observations, generating theories and testing them
1.2. Introduction to data collection and analysis
    1.2.1. Populations and samples
    1.2.2. What to measure: variables, measurement error, validity and reliability
    1.2.3. How to measure: correlational research methods, experimental research methods, randomization

Unit II: Basics of SPSS

2.1. Overview of the SPSS environment
2.2. Data editor
2.3. Variable view
2.4. Syntax window, outputs
2.5. File management

Unit III: Exploring data with graphs

3.1. Art of presenting data properly and reading graphs accurately
3.2. Chart making in SPSS
3.3. Types of charts, their uses and suitability for different purposes (column and bar graphs, histograms, boxplots, line charts, scatterplots)

Unit IV: Descriptive Statistics

4.1. Measures of central tendency and dispersion
    4.1.1. Mean, median, mode, quartile, deciles and percentiles
    4.1.2. Range and coefficient of range
    4.1.3. Mean deviation, variance, standard deviation and coefficient of variance
4.2. Analysing data: frequency distribution (types, centre, dispersion)

Unit V. Inferential statistics: Correlation

5.1. Karl Pearson's Correlation Co-efficient
5.2. Spearman's Rank Correlation
5.3. Kendall's Rank Correlation
5.4. Testing the significance of correlation coefficient
5.5. Fitting statistical model

Unit VI: Inferential statistics: Tests of hypotheses

6.1. Basics concept of hypothesis
6.2. Critical regions, critical values, p-values and decision rule
6.3. Confidence intervals
6.4. Using statistical models to test research questions
    6.4.1. Test statistics
    6.4.2. Null hypothesis and alternative hypothesis
    6.4.3. One- and two-tailed tests
    6.4.4. Types I and type II errors
    6.4.5. Effect size
    6.4.6. Statistical power
6.5. Applications of t-test
6.6. Applications of chi-squared test

List of practical works:

a. Data presentation – group and ungrouped data, frequency tables
b. Analysis of weather variable data and vegetation data (tree height, DBH, Biomass)

c. Correlation exercises (correlation coefficient and t-test) using data related to social infrastructure and level of living, access to irrigation and agriculture production, application of fertilizers and agriculture production
d. Measures of central tendency and dispersion exercises using socio-economic data, such as, literacy rate, urbanization, households' access to safe drinking water, happiness index, labour force participation rate etc.
e. Hypothesis testing exercises: t-test and chi-squared test

Reading List:

Essential Reading

Field, A. (2013). *Discovering statistics using IBM SPSS statistics* (4th ed.) New Delhi, India: Sage Publications.

Gupta, S.C. (2018*). Fundamentals of statistics* (7th ed.). Mumbai, India: Himalaya Publishing House.

Manly, B.F.J. (2009). *Statistics for environmental science and management.* London, England: Chapman & Hall.

Additional Reading

Rumsey, D.J. (2011). *Statistics for dummies (*2nd ed.). Hoboken, NJ: Wiley Publishing.

Rumsey, D.J. (2009). *Statistics II for dummies*. Hoboken, NJ: Wiley Publishing.

Urdan, T.C. (2017). *Statistics in plain English* (4th ed.). New Jersey: Lawrence Erlbaum Associates, Inc.

Twonend, J. (2002). *Practical statistics for environmental and biological scientists.* West Sussex, UK: John Wiley and Sons.

Kothari, C. R. & Garg, G. (2019). *Research methodology: Methods and techniques* (4th ed.) New Delhi, India: New Age International Publishers.

Date: June 2021

Module Code and Title: **ENM101 Energy Resources Management**
Programme: BSc in Environmental Management
Credit: 12
Module Tutor: Tshewang Dorji (Coordinator), Bikram Sharma

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

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

1. Identify the various kinds of energy resources.
2. Describe the global and local trends in energy extraction and usage.
3. Explain the methods of energy conservation.
4. Identify alternative renewable energy resources such as solar, wind, geothermal, hydrogen power and hydropower for non-renewable energy.
5. Appraise the pros and cons of using fossil fuels.
6. Discuss the challenges and prospects of energy production from nuclear reactors.
7. Evaluate Bhutan's hydropower potential and challenges.
8. Assess Bhutan's potential to harness renewable energy resources such as solar and wind.
9. Explain the current trend of electrical and thermal energy consumption in Bhutan.

Learning and Teaching Approach:

Type	Approach	Hours per week	Total credit hours
Contact	Lectures	3	75
	Discussions and presentation	2	
Independent study	Written assignments	1	45
	Reading and review of class materials	2	
Total			120

Assessment Approach:

A. Field Practical 10% and Written Assignment 10%
Students, in group, will visit an institution, site, or organization involved in energy resources management. The field visit sites may include i) energy production unit, or ii) energy resources management unit, or iii) energy trade unit, or iv) energy conservation innovation labs. Based on their field visit and field activities (which will include field site profiling, studying about the principles and structure of management, its implication to the overall energy management system in Bhutan, and interviews), students will individually undertake one written assignment (750-1000 words) and a presentation (7 min). Their report will be very contextual (to Bhutan and region) but framed within the broad themes like, but not limited to, recent global energy trends, global and regional fossil fuel consumption patterns, nuclear energy, and environmental impacts of fossil fuels and methods of energy conversion, conservation and efficiency.

Written Assignment 10%

- 4% Synthesis of the information (includes accuracy of information, quality analysis of the data, explanation of a key concept or process from the module and evidence-based-arguments supporting their assertion)
- 3% Analytical thinking (includes authentic discussions on the best practices of energy conservation, propose alternatives options and remedial measures to reduce environmental impacts)
- 3% Language and reference

Presentation 10%

- 5% Analysis of issues (accurate data, proper illustration of the key findings substantiated with well-support arguments and realistic examples)
- 3% Delivery of the content (clarity of words and organization of ideas)
- 2% Visual aids and body language

B. Class Test: 10%

Students will undertake two class tests during the semester; once before mid-term and once after mid-term (5% each). The written tests will be conducted within the class for a duration of 40-50 min and cover 5-6 weeks of material.

C. Forum Discussion via VLE: 10%

Discussion 1; before mid-term (5%): energy production from nuclear reactors contemporary issues, benefits and challenges
Discussion 2; after mid-term (5%): Bhutan's hydropower potentials, challenges and issues in the context of climate change

The VLE forum discussions will be hosted over one day each, spread out over the semester. Students will be given readings on issues related to the upcoming discussion topic to be read, then reflected upon/discussed together in the VLE forum. Each student will have to participate with appropriate discussion points in the VLE forums in line to the flow of discussions therein. Students may make multiple posts as appropriate totalling to 450-600 words for each discussion. The contributions will be cumulatively assessed once a particular discussion concludes. 5% of the VLE discussion will be assessed before midterm, and the remaining 5% post midterm.

- 3% Quality of analysis (originality, thoughtfulness of reflection, use of relevant and adequate support for all claims made, ties analysis to relevant module concepts)
- 2% Articulation, accuracy, and completeness

D. Midterm Examination: 20%

Students will take a written exam of 1.5-hr duration covering topics up to the mid-point of the semester. The exam will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

E. Semester-End Examination: 40%

Students will take a written exam of 2.5-hr duration encompassing all the subject matter covered in the semester. This assessment is comprehensive and summative in nature, and will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

Overview of assessment approaches and weighting

Areas of assignments	**Quantity**	**Weighting**
A. Field Practical 10% and Written Assignment 10%	1	20%
B. Class test	1	10%
C. Forum discussion via VLE	2	10%
D. Midterm Examination	1	20%
Total Continuous Assessment (CA)		**60%**
Semester-end Examination (SE)		**40%**

Pre-requisites: ENV101 Introduction to the Environment

Subject matter:

Unit I: Introduction to energy sources and uses

1.1. Definition and types of energy
1.2. Brief history of energy use
1.3. Energy conversions
1.4. Primary and secondary sources of energy
1.5. Energy flow and energy efficiency; matching sources to uses

Unit II Fossil fuels

2.1. Origin and formation of fossil fuels
  2.1.1. The three kings: coal, oil, natural gas
  2.1.2. Others: oil shale, oil sand, etc.
2.2. Extraction and processing of fossil fuels
  2.2.1. Coal (surface and subsurface mining, different types of coal)
  2.2.2. Crude oil (extraction, refining)
  2.2.3. Natural gas
2.3. Use, pros and cons, and impacts of fossil fuels
  2.3.1. General environmental effects of using non-renewable resources
  2.3.2. Coal (mining, transporting and converting, burning)
  2.3.3. Oil (recovery: land and marine, refining, delivery and use)
  2.3.4. Natural gas
  2.3.5. Others: oil shale, oil sand, etc.

Unit III: Nuclear energy

3.1. Nuclear power in perspective, use for electricity generation
3.2. Hazards of nuclear power, safety
3.3. Waste disposal, nuclear fuel cycle
3.4. Pros and cons of nuclear power
3.5. Status and future of nuclear power

Unit IV: Renewable energy resources

4.1. Origin of all energy from the Sun
4.2. Types of solar energy and uses
  4.2.1. Passive solar systems and active solar systems
  4.2.2. Solar-generated electricity
  4.2.3. Photovoltaics
4.3 Wind power
  4.3.1 Wind turbines in Bhutan (key challenges)
  4.3.2 Adverse environmental impacts (visually unappealing landscape, noise pollution, hazards to birds species),
4.4 Hydropower
  4.4.1 Basic working principles of hydro power plant
  4.4.2 Three types of hydropower facilities: impoundment, diversion, and pumped storage

4.4.3 Advantages (dams for flood control, agriculture irrigation and recreational activities)

4.4.4 Disadvantages (impedes fish migration, disturbs water ecosystem, dam wreak havoc downstream community, displacement of people)

4.5 Tidal and wave power

4.5.1 Tidal barrage and hydroelectric turbines

4.5.2 Wave energy converters

4.5.3 Environmental impacts

4.6 Geothermal energy

4.6.1 Technology for geothermal energy

4.6.2 Environmental impacts

4.7 Biomass energy: Biofuels and biogas

4.7.1 Vegetable oils

4.8.2 Biodiesel

4.8.3 Bioethanol

4.8 Hydrogen power

4.8.1 Solar-hydrogen

4.8.2 Hydrogen fuel cells

4.8.3 Advantages and disadvantages of fuel cells

4.9 Environmental impacts of solar, wind and hydropower in Bhutan.

Unit V: Energy efficiency and conservation

5.1. Concept of energy efficiency, laws of thermodynamics, net energy

5.2. Efficiency of various energy sources and conversion processes

5.3. Energy waste; major sources of energy waste; reducing energy waste

5.4. Methods of energy conservation and efficiency

5.4.1. Adjust your day-to-day behaviours (turning off lights or appliances when not in use or drive less, walk more and carpooling)

5.4.2. Use energy efficient electrical appliances (LED bulbs, smart thermostats, hybrid car or electric car)

5.4.3. Insulation and ventilation in buildings

5.4.4. Cogeneration (combined heat and power, CHP)

5.5. Conservation and efficiency; benefits and challenges thereof

Unit VI: Global energy trends

6.1. World total primary energy supply and use

6.1.1 World status of coal, oil, natural gas, nuclear, hydro and other minor sources

6.1.2 Concept of peak oil, permanent depletion of fossil fuels

6.1.3 Global electricity generation

6.2. Energy trends in Bhutan

6.2.1 Total energy consumption

6.2.2 Electrical energy

6.2.2.1 Electricity consumption per-capita in rural and urban

6.2.2.2 Electrical energy consumption in industry, agriculture and buildings

6.2.3 Thermal energy (Coal, petrol, diesel, kerosene, firewood, LPG)

6.2.3.1 Thermal energy consumption per-capita in rural and urban

6.2.3.2 Thermal energy consumption in industry, transport, agriculture and buildings

6.2.4 Economics of energy use in Bhutan

Reading List:

Essential Readings:

Casper, J. (2007). *Energy: Powering the past, present, and future.* New York, Chelsea House Publishing

Ernst & Young Pvt Ltd. (2012). *Bhutan energy efficiency baseline study.* Thimphu, Bhutan: Department of Renewable Energy (DRE).

Ngô, C. & Natowitz, J. (2009). *Our energy future: Resources, alternatives, and the environment*. Torondo, Canada: John Wiley & Sons.

Reisser, W., & Reisser, C. (2018). *Energy resources: From science to society.* London, England: Oxford University Press.

Miller, G.T., & Spoolman, S.E. (2018). *Environmental science* (16th ed.). New Delhi, India: Cengage Learning.

Additional Readings:

Botkin, D.B. (2014). *Environmental science, earth as a living planet* (9th ed.). United State of America: John Wiley and Sons Inc.,

Cunningham, W.P., & Cunningham, M.A. (2014). *Environmental science: A global concern* (13th ed.). New York, NY: McGraw Hill.

Enger, E.D., & Smith, B.F. (2016). *Environmental science* (14th ed). New York, NY: McGraw-Hill.

International Energy Agency. (2020). *Key world energy statistics.* Retrieved from https://www.iea.org/reports/key-world-energy-statistics-2020

National Environment Commission. (2016). *Bhutan state of the environment report 2016.* Thimphu, Bhutan.

Wright, R.T., & Boorse, D.F. (2017). *Environmental science* (13th ed.). New Delhi: PHI Learning Pvt Ltd.

Date: March 2025

Module Code and Title: **AFD102 Biological Anthropology**
Programme: BA in Anthropology
Credit: 12
Module Tutor: Dolma C. Roder (Coordinator), Jelle J P Wouters

General objective: In this module students will learn the principles of evolutionary theory and apply them to improving their own understanding of human development, biology and behaviour. While this module does take a scientific perspective, it does not assume students will have a background in science, and the topics are taught with the context of Anthropology and human evolution in mind, rather than from a pure genetics and evolutionary theory perspective.

Learning outcomes – On completion of this module, students will be able to:

1. Define biological anthropology.
2. Summarize the key concepts used by biological anthropologists
3. Explain the basics of genetic inheritance.
4. Explain the key components of modern evolutionary theory.
5. Develop a hypothesis related to biological anthropology.
6. Identify human ancestors using physical traits.
7. Summarize the history of human evolution.
8. Explain the biological relationship between humans and their evolutionary relatives.
9. Assess what biological variation can and cannot demonstrate about human diversity.

Learning and Teaching Approach:

Approach	Hours per week	Total credit hours
Lectures & discussions	3	45
In-class exercises	1	15
Independent study	4	60
Total		120

Assessment Approach:

A. In-class exercises: 15%

The tutor will conduct 5 lab exercises in class during the semester. These in class exercises led by the tutor will help students to apply the scientific method to understanding topics in biological anthropology. For each exercise, students will individually complete a worksheet that guides them through developing a hypothesis, collecting data, describing their findings, and answering questions about the meaning of their findings. Exercises may last a whole class period or extend over multiple classes. The worksheets will be out of 15 marks and will have

their marks averaged to compute the final mark for this assessment. Worksheets will have the following allocation of points:

2% Clear and testable hypothesis

4% Accurate collection and clear record keeping of their data

4% Clear and accurate presentation and description of their findings including appropriate use of graphs and tables

5% Answering worksheet questions to test what the findings mean

B. Report on recent finding in biological anthropology: 10%

Using a reputable journalistic or popular science periodical, students will individually write a 300-400 word report about a recent finding relevant to biological anthropology or evolution. Students will be expected to summarize the subject of the finding. Students will also be expected to use concepts and knowledge learned in class to explain the significance of the finding. The tutor will provide a list of approved periodicals. Essays will be evaluated on:

1% Quality of the source used
5% Accuracy and completeness of summary
3% Insightful use of class material to explain the significance of the finding
1% Language, organization and referencing

C. Class Tests: 10%

Students will undertake a class test twice during the semester; once before mid-term and once after mid-term (5% each). The written tests will be conducted within the class for a duration of 40-50 min and cover 2-4 weeks of material.

D. Class participation and preparedness: 5%

Students will be expected to participate substantially in class discussions, with contributions reflecting adequate preparation for topics under discussion. 2.5% of class participation and preparedness will be assessed before midterm, and the remaining 2.5% post midterm.

E. Midterm Examination: 10%

Students will take a written exam of 1.5-hr duration covering topics up to the mid-point of the semester.

Areas of assignments	Quantity	Weighting
A. In class exercises	5	15%
B. Report on recent finding	1	10%
C. Class Tests	2	10%
D. Class participation and preparedness	Ongoing	5%
E. Midterm Examination	1	10%
Total Continuous Assessment (CA)		**50%**
Semester-End Examination (SE)		**50%**

Pre-requisites: None

Subject matter:

Unit I: The Basics of Science and Biological Anthropology

1.1. Overview of biological anthropology
- 1.1.1. What biological anthropologists study
- 1.1.2. Key subfields of biological anthropology today
- 1.1.3. Types of evidence used by biological anthropologists
- 1.1.4. Why biological anthropology matters

1.2. Basic definitions of science and the scientific method
- 1.2.1. Definition of science
- 1.2.2. Definition and examples of scientific theory
- 1.2.3. Examples of how theories become hypotheses in biological anthropology
- 1.2.4. Examples of how biological anthropologists use evidence to test hypotheses

Unit II: Key Concepts for the Study of Biological Anthropology

2.1. Introduction to evolution

2.1.1. Precursors to and influences on early evolutionary theory
2.1.2. Charles Darwin, Alfred Wallace and early theories of evolution
2.1.3. Definition and examples of natural selection
2.1.4. Problems with early evolutionary theory
2.1.5. Definition of the Modern Synthesis in evolutionary theory

2.2. The basics of genetic inheritance
2.2.1. Definition of gene and genotype
2.2.1.1. Explanation of what DNA is
2.2.1.2. Explanation of the relationship between DNA and genes
2.2.2. How genes are passed on
2.2.2.1. Mitosis and Meiosis
2.2.2.2. A brief overview of reproduction
2.2.3. Definition of phenotype
2.2.4. Explanation of the relationship between genotype and phenotype

2.3. An example of genetic inheritance: Basic Mendelian inheritance

2.4. The basic mechanisms of evolution
2.4.1. Explanation and examples of natural selection
2.4.2. Explanation and examples of mutation
2.4.3. Explanation and examples of migration
2.4.4. Explanation and examples of genetic drift
2.4.5. Explanation and examples of sexual selection
2.4.6. Explanation and examples of artificial selection

2.5. The basics of biological classification
2.5.1. Definition of species
2.5.2. Examples and definitions of taxonomy, phylogeny, cladistics, and other key concepts in classification
2.5.3. Classification based on morphological and molecular evidence
2.5.4. Explanation of Binomial nomenclature
2.5.5. Examples of how biological anthropologists classify species

2.6. Conceptual overview of population genetics and Hardy-Weinberg equilibrium

2.7. Common misconceptions about how evolution works

Unit III: Primates

3.1. Key characteristics of primates
3.1.1. Similarities to other mammals

3.2. Important classes of primates
3.2.1. Defining characteristics of Prosimians
3.2.2. Defining characteristics of Anthropoids

3.3. Defining characteristics Hominoids: The basics of primate behaviour
3.3.1. Examples of reproduction and reproductive behaviours
3.3.2. Examples of primate parenting and life stages among primates
3.3.3. Examples of primate family and group structures
3.3.4. Explaining primate altruism and aggression
3.3.5. Explanation of culture and communication strategies among primates

3.4. Primates and their environment
3.4.1. Examples of Primates as predators
3.4.2. Examples Primates as prey
3.4.3. Primate-plant interactions
3.4.4. Primate parasites and disease
3.4.5. The effects of environmental change on Primates

3.5. Reasons why biological anthropologists study primates

3.6. Explanation of the relationship between primates and humans

Unit IV: Early Hominin Evolution

4.1. Overview of early Hominins
- 4.1.1. Characteristics of early hominins
- 4.1.2. Explanation of the similarities and differences between hominins, primates, and modern humans
- 4.1.3. Changing terminology and classifications in biological anthropology

4.2. Bipedalism
- 4.2.1. The evolutionary development of bipedalism
- 4.2.2. The mechanics of bipedalism
- 4.2.3. The relationship between bipedalism and the body

4.3. Overview of the origin of early *Hominins*
- 4.3.1. Timeline and characteristic anatomy from Pre-australopiths to late Australopiths
- 4.3.2. Examples of key fossil findings showing the evolution of early *Hominins*

4.4. Key debates in Hominin evolution
- 4.4.1. Overview of unanswered questions in early hominin evolution
- 4.4.2. Debates about the way characteristics developed
- 4.4.3. Debates about the classification of early hominins and early *Homo*

Unit V: Development and Dispersal of Genus Homo

5.1. A brief history of how the evolutionary development of the genus *Homo*
- 5.1.1. *Homo habilis* classification and characteristics
- 5.1.2. *Homo erectus* classification and characteristics
- 5.1.3. Classification and characteristic of *Homo heidelbergensis* and later species of *Homo*
- 5.1.4. The geographic dispersal of *Homo* including key fossil findings from around the globe

5.2. The development of new technologies
- 5.2.1. Evidence of how and when humans harnessed the use of fire
- 5.2.2. Advent of stone tool use in early *Homo*
- 5.2.3. Early *Homo* improvements in tool making

5.3. Overview of social organization amongst early *Homo*
- 5.3.1. Hunting and gathering, scavenging, and other possible subsistence patterns
- 5.3.2. Language and symbolic behaviour
- 5.3.3. Burials and questions about prehistoric religion

Unit VI: *Homo Sapiens*

6.1. Overview of the characteristics of *Homo sapiens*
- 6.1.1. Classification and characteristics
- 6.1.2. Evolutionary increase in brain and skull size

6.2. The origins and spread of *Homo sapiens*
- 6.2.1. Regional continuity and multiple origin hypotheses
- 6.2.2. Single origin and replacement hypothesis
- 6.2.3. Partial replacement hypothesis
- 6.2.4. Current consensus on origins of *Homo sapiens*

6.3. The problem of Neanderthals
- 6.3.1. Classification and characteristics of Neanderthals
- 6.3.2. Debates about the relationship between Neanderthals and modern humans

6.4. Shifts in social organization and technology
- 6.4.1. *Homo sapiens* technological innovations
- 6.4.2. Paleolithic art

6.4.3. Animal domestication and the advent of agriculture

6.5. Human adaptations today

6.5.1. Debates about continuing evolution

6.5.2. Human physiological adaptations to environment and diet

Unit VII: Biological Anthropology and Culture

7.1. The biological basis of culture

7.2. The strengths and weaknesses of using evolutionary psychology to explain human behaviour

7.2.1. Explanation of evolutionary psychology

7.2.2. How scholars have applied evolutionary psychology (e.g., religion, gender)

7.3. Biological anthropology and the concept of race

Reading List:

Essential Reading

Lewis, B., Jurmain, R., & Kilgore, L. (2008). *Understanding humans: An introduction to physical anthropology and archaeology* (10th ed.). Boston, MA: Cengage Learning.

Lewis, S.K. & Garmon, L. (Producers), Lewis, S.K., Espar, D., & Reid, A. (Directors). (2009). *Darwin's dangerous idea* [Motion Picture]. Boston: WGBH Boston Video.

University of California Museum of Paleontology. (2004). *Understanding evolution.* Retrieved from http://evolution.berkeley.edu/

WGBH/NOVA Science Unit and Clear Blue Sky Productions. (2001). *Evolution* [Website]. Retrieved from http://www.pbs.org/wgbh/evolution/

Additional Reading

Beall, C. M. (2014). Adaptation to high altitude: phenotypes and genotypes. *Annual Review of Anthropology*, *43*, 251-272.

Flammer, L., Beard, J., Nelson, C.E., & Nickels, M. (1998). *Evolution lessons* ENSIWEB. Evolution/Nature of Science Institutes. Retrieved from www.indiana.edu/~ensiweb/

Fuentes, A. (2012). *Race, monogamy, and other lies they told you: Busting myths about human nature*. Berkeley: University of California Press.

Hawks, J. (June 24, 2014). Laboratory session with *Homo erectus*. Retrieved from https://youtu.be/lTZM9vtIUn0.

Gould, S. J. (1980). *The panda's thumb: More reflections in natural history*. New York: WW Norton & company.

Hens, S. M. (2014). *Method and practice in biological anthropology: A workbook and laboratory manual for introductory courses*. London: Pearson.

Lewin, R. (2009*). Human evolution: An illustrated introduction*. Malden, MA: John Wiley & Sons.

National Academy of Sciences (US) Working Group on Teaching Evolution. (1998). *Teaching about evolution and the nature of science*. Washington, DC: National Academy Press.

Sapolsky, R. M. (2007). *A primate's memoir: A neuroscientist's unconventional life among the baboons*. New York: Simon and Schuster.

Date: March, 2018

Module Code and Title: **EAP102 Upper-Intermediate English for Academic Purposes**
Programme: BA in English Studies
Credit Value: 12
Module Tutor: Dechen Pelden (coordinator), Sangay C. Wangchuk, Palden Wangmo, Mohan Rai and Ruma Tamang

General objective: EAP102 is the second part of a two-semester series that aims to develop abilities in reading, writing, listening, and speaking in an academic context to support students' learning through their degree studies. The second part builds on the skills learned in EAP101 and focuses on further helping students to improve their proficiency in English Language and communication.

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

Reading skills

1. Research texts for essays and apply skimming and scanning while doing so.
2. Identify the progression of ideas in a text.
3. Predict the content of a text and infer the meanings of words.
4. Read for detail, collect information for an essay and take notes for essay-writing and summarise what they have read.
5. Recognize and verify the detection of plagiarized text.

Writing skills

1. Write using discipline-specific language.
2. Defend claims by using evidence, paraphrase information and use quotations in their writing.
3. Identify language for academic writing.
4. Examine the structure and content of reports.
5. Take a stance and express disagreement.
6. Write text using and citing sources appropriately, incorporating summarization, paraphrasing, quotation, and synthesis as appropriate.

Listening and Speaking skills

1. Make and respond to suggestions in a group work.
2. Collaborate with peers to generate ideas.
3. Participate in tutorials and discussions to ask for and give information.
4. Deliver a well-structured formal oral presentation.

Grammar and Vocabulary

1. Explain targeted grammatical structures in both spoken and written forms.
2. Apply targeted grammatical structures appropriately in both written and oral production.
3. Self-correct while using targeted grammatical structures.

Learning and Teaching Approach:

Type	Approach	Hours per Week	Total Credit Hours
Contact	Lecture, discussions, and practice (2 x 2 hr). 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.	4	60
Independent study	Writing assignments, Learning journal, VLE discussions	2	30
	Reading and review of class materials	2	30
Total			120

Assessment Approach:

A. Note-Taking Exercise 5%

Each student has to maintain class notes containing series of exercises from both within and outside the class. It will be assessed before the mid-semester.

'Note-Taking Exercise' will be assessed using the following rubric:
Relevance and Completeness: 10 marks
Coherence and Organisation: 10 marks
Language and clarity: 10 marks

B. VLE Discussion 10%

Students will participate in two VLE discussions (5%+5%) on topics assigned by the tutor. It will be conducted one before mid-semester and one after mid semester for 5% each.

The task will be assessed based on the following rubric:
Quality of Discussion: 12 marks
Interaction with peers: 4 marks
Language and Grammar: 4 marks

C. Essay Writing Portfolio: 20%

Students will write a persuasive essay and an argumentative essay of 350-500 words each. These essays will be on discipline-specific topics, each submitted as first and final drafts. The two first drafts will be assessed out of 3% each and the final submission will be out of 7% each.

The first draft of the persuasive essay will be assessed on the following rubric:
Quality of persuasion: 60 marks
Organisation and Structure: 20 marks
Language and Grammar: 20 marks

The first draft of the argumentative essay will be assessed on the following rubric:
Quality of arguments: 60 marks
Organisation and Structure: 20 marks
Language and Grammar: 20 marks

The final drafts for both the (persuasive & argumentative) essays will be assessed on the following rubric:
Quality of persuasion/ arguments: 50 marks
Organisation and Structure: 15 marks
Language and Grammar: 20 marks
Improvement made on the first draft: 15 marks

D. Presentation: 20%

Each student will make a 7–10-minute presentation. with clear, systematically developed, detailed descriptions on a subject of their interest, expanding and supporting ideas with subsidiary points and relevant examples, and rounding off with an appropriate conclusion The student can choose one presentation topic of their interest.

The presentations will be assessed based on the following criteria:
Content: 15 marks
Structure: 25 marks
Use of sources and citation: 10 marks
Use of visual aids: 5 marks
Language: 15 marks
Delivery: 25 marks
Time Management: 5 marks

E. Written assignment: 25%

Students will write a 1000-1250 word researched assignment in an academic style, incorporating at least 3 reference sources. The assignment will consist of an outline with an annotated bibliography, followed by the first and final drafts of the essay. The annotated bibliography will be worth 5%. The first draft will be worth 5%; improvement on the first draft will be 5%; and the final draft will be worth 10%.

The annotated bibliography will be assessed based on the following rubric:
Quality and reliability of sources: 15 marks
Quality of summary and evaluation: 20 marks
Citation: 5 marks
Language: 10 marks

The first and final drafts of the essay will be assessed using the following criteria:

Depth of reflection: 25 marks
Critical thinking: 25 marks
Use of sources: 20 marks
Language and Grammar: 20 marks
Use of annotated bibliography: 10 marks

Improvement on feedback will be evaluated using the following rubric:
Marginal improvement: 0 – 49 marks
Satisfactory improvement: 50 – 59 marks
Significant and appropriate improvement: 60 – 74 marks
Significant improvement beyond feedback given: 75 – 100 marks

F. Class Tests: 20%

Two class tests (10%+10%) of 45-50 minutes will be held within class hours, each covering approximately 3-4 weeks of subject matter. These tests should be based on the four skills. These will be marked out of 10 each.

Overview of assessment approaches and weighting

Areas of assignments	Quantity	Weighting
A. Note-Taking Exercise	1	5%
B. VLE Discussion	2	10%
C. Essay Writing	2	20%
D. Written assignment	1	25%
E. Presentation	1	20%
F. Class tests	2	20%
Total Continuous Assessment (CA)		**100%**

Pre-requisites: EAP101 Intermediate English for Academic Purposes

Subject matter:

Unit I: Academic orientation

1.1. Assessing one's academic skills
1.2. Thinking about academic culture
1.3. Thinking critically
1.4. Avoiding plagiarism
1.5. Recognising variation across academic subjects
1.6. Focusing on academic vocabulary

Unit II: Topic/context: Choices and implications

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

Unit III: Topic/context: Language and communication

3.1. 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
3.2. Listening and speaking: Making suggestions in group work; Pronunciation: stress in adjectives ending in -ic and -ical
3.3. Writing: Referring to other people's work; Using in-text references (particular focus on APA style); Language for writing: reporting verbs

3.4. 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

Unit IV: Lecture Skills I

(Lecture Skills A)

4.1. Preparing for lectures: Lecturing styles; Revising basic information
4.2. Listening: Understanding lecture aims; Understanding outlines; Identifying main and secondary points; Taking notes: annotating slides 1
4.3. Language focus: Repetition and rephrasing
4.4. Follow-up: Taking notes: annotating slides 2; Reviewing your notes

(Lecture Skills B)

4.5. Preparing for lectures: Using preparation strategies; Making predictions before a lecture starts
4.6. Listening: Making predictions during a lecture; Identifying topic change; Following an argument
4.7. Taking notes: using symbols and abbreviation in notes
4.8. Language focus: Organising questions and topic changes
4.9. Follow-up: Expanding your vocabulary

Unit V: Topic/context: Difference and diversity

5.1. 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
5.2. Listening and speaking: Working with colleagues: generating ideas and reporting; Pronunciation: dividing speech into units
5.3. Writing: Language for writing 1: the grammar of reporting verbs; Language for writing 2: comparing and contrasting; Reporting from a reading
5.4. Grammar and vocabulary practice: Linking parts of a text: conjunctions and sentence connectors; Single-word verbs and multi-word verbs; Word families

Unit VI: Topic/context: The world we live in

6.1. 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
6.2. Listening and speaking: Reaching a consensus in group work; Pronunciation: contrasts
6.3. Writing: Using paraphrases; Including quotations in writing
6.4. Grammar and vocabulary practice: Articles: zero article and the; Complex prepositions; Person, people, peoples

Unit VII: Topic/context: Bringing about change

7.1. 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
7.2. Listening and speaking: Concluding your presentation; Pronunciation: linking words in speech units
7.3. Writing: Using an academic style
7.4. Grammar and vocabulary practice: Adding information about nouns: relative clauses; It-clauses: expressing personal opinions impersonally; Abstract nouns + of + -ing/to-infinitive

Unit VIII: Topic/context: Work and equality

8.1. Reading: Understanding figures and tables; Scanning for information; Taking notes; Understanding the significance of references; Vocabulary in context: avoiding repetition
8.2. Listening and speaking: Taking part in tutorials and joining in discussions; Pronunciation: stress in compound nouns 1

8.3. 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
8.4. Grammar and vocabulary practice: Passive voice; Past perfect; -ing nouns

Unit IX: Topic/context: Controversies

9.1. 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
9.2. Listening and speaking: Tutorials: asking for and giving more information; Pronunciation: intonation in wh-clefts
9.3. 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
9.4. Grammar and vocabulary practice: Verbs followed by a noun phrase or that-clause; Non-finite relative clauses; Adverbials used to comment

Unit X: Topic/context: Health

10.1. 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
10.2. Listening and speaking: Summarising what has been said; Evaluating visual aids; Pronunciation: stress in compound nouns 2
10.3. Writing: Contrasting information; Taking a stance: expressing disagreement; Writing practice
10.4. Grammar and vocabulary practice: Referring to quantities; Evaluative adjectives and adverbs; Phrases connecting sentences: this/these; Non-finite relative clauses

Unit XI: Lecture Skills II

(Lecture Skills C)

11.1. Preparing for lectures: Thinking about the purposes of lectures
11.2. Listening: Understanding evaluations; Understanding lists
11.3. Language focus: Noticing differences in the language of lectures and academic writing; Noticing prominent words
11.4. Follow-up: Taking notes: annotating; Reconstructing your notes

(Lecture Skills D)

11.5. Preparing for lectures: Building basic information
11.6. Listening: Understanding the relationship between parts of the lecture; Understanding descriptions of processes
11.7. Language focus: Understanding vague language
11.8. Follow-up: Listening for a lecture summary; Comparing notes

(Lecture Skills E)

11.9. Preparing for lectures: Overcoming problems in listening to lectures
11.10. Listening: Understanding specialised terms; Understanding reasons
11.11. Language focus: Understanding signals of incomplete information; Understanding forward and backward reference
11.12. Follow-up: Listening and annotating slides; Writing up your notes; Overcoming problems

Reading List:

Essential reading

Hewings, M. and McCarthy, M. (2014). *Cambridge academic English – An integrated skills course for EAP: B2 (Upper Intermediate) Student's Book*. Cambridge University Press.

Paterson, K. and Wedge, R. (2013). *Oxford grammar for EAP*. Oxford University Press.

Additional reading

Hacker, D. (2021). *A writer's reference* (10th ed.). Bedford/St. Martin's.

Hyland, K. (2006). *English for academic purposes*. Routledge.

Date: June 2022

Module Code and Title: **BDC201 Fundamentals of Biodiversity**
Programme: BSc in Environmental Management
Credit: 12
Module Tutor: Kinley Dorji (Coordinator) and Tshewang Dorji

General objective: This module introduces students to the principles, theories and concepts of biodiversity and its measurement. It aims to provide practical knowledge and skills to measure and estimate biodiversity for better understanding of its health to manage against various threats.

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

1. Discuss biodiversity and its characterization.
2. Describe a general method of laying transect for biodiversity measurement.
3. Measure biodiversity for community analysis.
4. Explain the status of different species and how they have become endangered.
5. Explore the benefits of biodiversity and the need to conserve it.
6. Explain the importance of aquatic biodiversity.
7. Describe the main plant and animal genetic resources in Bhutan.
8. Discuss the status of in-situ and ex-situ plant and animal genetic diversity of Bhutan
9. Explain the plant and animal quarantine policies for conservation and management of local resources.

Learning and teaching approach:

Type	Approach	Hours per week	Total credit hours
Contact	Lectures	3	75
	Discussions	1	
	Field practical work	1	
Independent study	Written assignments	1	45
	Reading and review of class materials	2	
Total			120

Assessment Approach:

A. Individual written assignment: 15%

Students will do one individual written assignment of 750-1000 words. They will be assigned a topic each, which can include but not limited to topics like *benefits of biodiversity, different types of biodiversity, threats to biodiversity, different status of species, human impacts on biodiversity*. The assessment will be graded based on the following rubric.

Part A: Draft: 5%
2% Content (originality, approach, result/discussion, scholarship)
1% Focus (relevance, organization, conclusion)
2% Language (style, mechanics)

Part B: Final submission: 10%

2% Depending on how many comments from the draft are incorporated for the final submission, the tutor can award them negative marking.
3% Synthesis of the information (includes an explanation of a key concept or process from the module, and well-supported argument for how their subject illustrates the concept or process taught in the class)
3% Analytical thinking (discuss the best practices of biodiversity conservation and propose remedial measures to reduce threats to different biodiversity, discuss different conservation techniques)
2% Mechanics (Language and referencing)

B. Field visit and report: 10%

Students will individually write a report on a field trip made to the nearby National Biodiversity Centre or Lam Pelri. In the report, students must pick one aspect of the biodiversity conservation techniques such as *in-situ conservation and ex-situ conservation* (plant species in the Botanical garden, seed bank, germplasm, herbarium specimen). Reports are expected to be 300-500 words in length.

3% Overall environmental issues and its context/ summary of the visit (accuracy and completeness)

4% Quality of analysis (includes an explanation of a key concept or process from the module, and well-supported argument for how their subject explains the concept taught in the class)

3% Mechanics (Language and referencing)

C. Class Test: 10%

Students will undertake a class test of 5% during the semester. The written tests will be conducted within the class for a duration of 40-50 min and cover 2-3 months of material.

D. Weekly Field Studies Journal: 10%

The students will individually undertake weekly field studies in the RTC campus. In the field, students must conduct biodiversity analysis, vegetation measurement and bird count, among others. In the report, students must show four major vegetation and biodiversity measurements and analysis from their field observations. Students will be provided with a grading rubric that will help to guide the writing of the field report. Reports are expected to be 1000 - 1200 words in length.

Field report must capture the following biodiversity analysis:

5% Biomass calculation (reliability of data, materials and tools used)
4% Vegetation transects (use of line intercept methods and materials and tools used)
3% Floristic diversity (species richness, species evenness, relative abundance)
3% Bird count (species richness, species evenness, relative abundance)

E. Midterm Examination: 15%

Students will take a written exam of 1.5-hr duration covering topics up to the mid-point of the semester. The exam will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

F. Semester-End Examination: 40%

Students will take a written exam of 2.5-hr duration encompassing all the subject matter covered in the semester. This assessment is comprehensive and summative in nature, and will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

Overview of assessment approaches and weighting

Areas of assignment	Quantity	Weighting
A. Individual written assignment	1	15%
B. Field-visit and report	1	10%
C. Class Test	1	5%
D. Weekly field studies journal	1	15%
E. Midterm Examination	1	15
Total Continuous Assessment (CA)		**60%**
Semester-End Examination (SE)		**40%**

Pre-requisites: ECL101 Principles of Ecology

Subject Matter:

Unit I: Fundamentals of biodiversity

1.1. Etymology, relevance and evolutionary significance
1.2. Levels and types of biodiversity: genetic, species and ecosystem

1.3. Biodiversity at local, national, regional and global levels
1.4. Measures and documentation of biodiversity: scope and significance
1.5. Functions and values of biodiversity: in ecosystem function, ecosystem integrity, and increasing productivities - provisioning, regulating, cultural and supporting

Unit II: Biodiversity measurement

2.1. Transect for biodiversity measurement: Scope, process, and advantages and disadvantages.
  2.1.1. Line intercept transects
  2.1.2. Belt transects
  2.1.3. Line transect
  2.1.4. Point intercept transects
  2.1.5. Strip transects
  2.1.6. Point transect/point count
2.2. General methods of sampling/counting: Definition, process, and advantages and disadvantages.
  2.2.1. Total counts
  2.2.2. Timed searches
  2.2.3. Quadrats
  2.2.4. Distance sampling
2.3. Biodiversity measurement: Definition and calculation.
  2.3.1. Alpha diversity
  2.3.2. Beta diversity
  2.3.3. Gamma diversity
2.4. Relative abundance: common species and rare species
2.5. Measuring and estimating species richness: Definition and calculation
  2.5.1. Measure of the number of species
  2.5.2. Menhinick's index
  2.5.3. Margalef's index
2.6. Diversity indices: Definition and calculation
  2.6.1. Shannon-Wiener Index
  2.6.2. Simpson (1949) index of Dominance
2.7. Important Value Index (IVI): Definition and calculation
  2.7.1. Relative Frequency
  2.7.2. Relative Density
  2.7.3. Relative Dominance
2.8. Species-area relationships
2.9. Species discovery curve

Unit lll: Aquatic biodiversity

3.1. Population trends, habitat use, foraging behaviour, trophic dynamics and community ecology of the following
  3.1.1. Aquatic bird diversity
  3.1.2. Fish diversity of Bhutan
  3.1.3. Aquatic plants
3.2. Importance of aquatic biodiversity – Ecological, Economic and Socio-cultural

Unit IV: Plant genetic diversity of Bhutan

4.1. Agro-biodiversity and its significance
4.2. Status of field crops in Bhutan (In-situ and Ex-situ)
4.3. Plant genetic diversity management
4.4. Aromatic and medicinal plants conservation and management

Unit V: Animal genetic diversity of Bhutan

5.1. Types of domestic animals; their importance and issues
5.2. Livestock development initiatives: breeds, pasture development, new technology
5.3. Conservation status in Bhutan (In-situ and Ex-situ)

5.4. New initiatives and approaches on livestock sector development and management

5.5. Quarantine policies for plants and animals - Overview, main purposes and significance

5.5.1. Plant Quarantine Rules of Bhutan 2003

5.5.2. Plant Quarantine Rules and Regulations of Bhutan 2018

5.5.3. Livestock_Act of Bhutan 2001

5.5.4. Livestock Rules and Regulations of Bhutan 2017

Unit VI: Loss and threats to biodiversity

A.1. Data and trends on global biodiversity; human impacts

A.2. Major threat areas, e.g., tropical rainforests, oceans

A.3. Major threat types, e.g., over-use and overhunting, habitat loss/degradation/fragmentation, invasive species, pollution, climate change

A.4. Endangered and threatened species; role as indicator species

A.5. Human role in the premature extinction of species in general and case studies

A.6. Adjustment, adaptation and solutions

List of practical work:

a. **A day-long field trip**: A day-long field trip to the nearby National Biodiversity Centre or to Royal Botanical Garden, Lam Pelri, will be conducted.

i. Identify/document common flora and fauna

ii. Identify/document bird species, types and abundance

iii. Study the vegetation types

b. **Weekly field studies:** Students will conduct weekly field studies around the RTC campus.

i. Identify/document common flora and fauna of the place of visit

ii. Identify/document bird species, vegetation types and abundance

iii. Conduct detail vegetation analysis and measurement (forest types, species abundance, species richness and species evenness)

Reading List:

Essential Reading

Department of Forest and Park Services. (2015). *National forest inventory report: Stocktaking of nation's forest resources*. Thimphu, Bhutan: Ministry of Agriculture and Forest.

Lovejoy, T.E., Hannah, L., & Wilson, E.O. (Eds.). (2019). *Biodiversity and climate change: Transforming the biosphere.* London, UK: Yale University Press.

Maclaurin, J., & Sterelny, K. (2008). *What is biodiversity?* Chicago, IL: University of Chicago Press.

Magurran, A. E., & McGill, B.J. (2010). *Biological diversity: Frontiers in measurement and assessment.* London, UK: Oxford University Press

Ministry of Agriculture. (2008). *Plant genetic resources of Bhutan*, Thimphu, Bhutan: Kuensel.

Ministry of Agriculture. (2008). *Animal genetic resources of Bhutan*, Thimphu: Kuensel.

Psihoyos, L. (2015, December 12). *Racing extinction* [Video file]. Retrieved from https://www.youtube.com/watch?v=sUpccvUa0C4

Wangchuk, T., Thinley, P., Tshering, K., Tshering, C., Yonten, D., & Pema, B. (2004). *A field guide to the mammals of Bhutan*. Thimphu, Bhutan: Ministry of Agriculture.

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*. Thimphu, Bhutan: Ministry of Agriculture.

Additional Reading

Dolder, W., & Pippke U.D. (2009). *Endangered animal species facing extinction: And the threats to their habitats*, Bath, UK: Parragon Books.

Gurung D.B. (2005). *Orchids of Bhutan. Thimphu, Bhutan:* DSB Books.

International Centre for Integrated Mountain Development (ICIMOD). (2019). *The Hindu Kush Himalaya assessment: Mountains, climate change, sustainably and people*. Kathmandu, Nepal: Author.

Inskipp, C., Grimmett, R., Inskipp, T., & Sherub. (2019), *Birds of Bhutan and the Eastern Himalayas.* Lake Dallas, TX: Helm.

Ives, J. D., & Messerli B. (1989). *The Himalayan dilemma, reconciling development and conservation.* London, UK: Routledge.

Ministry of Agriculture. (2009). *Pteridophytes of Bhutan, a list of families, genera and species*. Thimphu, Bhutan: National Biodiversity Centre.

Namgyel, T., & Tenzin, K. (2009). *A photo guide to flowers of Bhutan*. Thimphu, Bhutan: World Wild Fund for Nature.

Pearce, D. & Moran, D. (2009). *The economic value of biodiversity*. London, United Kingdom: IUCN Earthscan.

Pradhan, R. (1999). *Rhododendrons of Bhutan*. Kathmandu, Nepal: Quality Printers.

Date: June 2021

Module Code and Title: **ETH201 Environmental Ethics**
Programme: BSc in Environmental Management
Credit Value: 12
Module Tutor(s): Jamyang Pelmo (Coordinator), Tshewang Dorji

General objective: This module introduces students to philosophical and religious beliefs regarding nature. It focuses on the importance of ethical responsibility with regards to environmental conservation and discusses how culture, society and corporations influence individuals and their relationship to the environment. The module explores diverse responses to the concerns raised by environmental problems, analysing the ethical underpinnings of a wide variety of perspectives.

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

1. Describe different environmental movements.
2. Discuss different environmental ethics (land ethics, deep ecology, ecofeminism, animal rights)
3. Explain the role and contribution of these ecological movements for environmental conservation and management.
4. Relate different religious beliefs and practices in environment conservation.
5. Discuss the importance of ethics in environmental management.
6. Examine the role of corporate social responsibility in ethical decisions with regards to the environment.
7. Discuss the importance of societal responsibilities towards environment.
8. Analyse the contemporary issues in the field of environmental ethics.

Learning and teaching approach:

Type	Approach	Hours per week	Total credit hours
Contact	Lectures	3	60
	Discussions and debate	1	
Independent study	Written assignments	2	60
	Reading and review of class materials	2	
Total			120

Assessment Approach:

A. Class Test: 5%

Students will take a test for a duration of 40-50 mins, in which they will have to explain text passages and apply key concepts of the module such as utilitarianism, virtue ethics, and deontology to real-life situations. The test aims at preparing students in analysing ethical views and formulating arguments.

B. Group report and discussion/debate: 20%

Two group works will be conducted: before and after midterm. These assessments are intended to help students confront and discuss their views, develop arguments and effectively communicate their ideas.

Group work before midterm:

Students will work in groups of 4. Each group will be assigned a specific religion (or folk religion). Students will research the assigned religion and examine its relationship with nature. One class will be allocated for group work during which the tutor will provide guidance. Individual contributions will be assessed through a Google document. The report will help students discuss issues in groups and interact with others. After submission of the group report of 1000-1250 words, groups will discuss for 20 minutes about the influence of religion and its contribution to environmental conservation. Each discussion will include two groups to allow a comparison between different religious approaches. Individual performance will be assessed during the discussion.

5% group report (content and structure)
2% individual contribution to the report (follow-up, relevance of the contribution)
3% individual performance (arguments, clarity and confidence in the topic)

Group work after midterm:

Students will work in groups of 4. Each group will be assigned with a topic in the field of applied ethics (GMOs, animal experimentation, globalisation, etc). Students will prepare a critical analysis of this particular issue including benefits, practical examples, ethical considerations and alternatives. Two classes will be allocated for group work and discussion in which students will submit group worksheets and write their arguments and analysis. Students will debate for 30 minutes. Each debate will include two groups. Individual performance will be assessed during the discussion.

4% group worksheets (arguments, analysis of the ethical issues)
3% individual preparation (confidence, participation during the debate)
3% individual performance during the debate (arguments, clarity, debate skills)

C. Individual critical essay: 15%

Students will choose a particular case study such as pollution from one industry, workers' conditions in farm industries, industrial slaughterhouse, etc, and examine ethical considerations in this particular context. Students will write a critical essay and demonstrate their ability to formulate arguments, analyse ethical aspects and provide a critical review on environmental management.

5% draft content and identification of ethical issues
5% evidence provided and validity of the arguments
3% critical review on environmental management
2% writing and grammar

D. Midterm Examination: 20%

Students will take a written exam of 1.5-hr duration covering topics up to the mid-point of the semester. The exam will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

E. Semester-End Examination: 40%

Students will take a written exam of 2.5-hr duration encompassing all the subject matter covered in the semester. This assessment is comprehensive and summative in nature, and will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

Overview of assessment approaches and weighting

Areas of assignments		Quantity	Weighting
A.	Class test	1	5%
B.	Group report and discussion/ debate	2	20%
C.	Individual critical essay	1	15%
D.	Midterm Examination	1	20%
Total Continuous Assessment (CA)			60%
Semester-End Examination (SE)			40%

Pre-requisites: ENV101 Introduction to the Environment

Subject matter:

Unit I: Introduction to environmental ethics

1.1. Definitions and concepts: Environmental ethics and key philosophical concepts

1.2. Major environmental pioneers in the field of environmental ethics and their contribution

- 1.2.1. Ralph Waldo Emerson (Transcendental Conservation Ethic)
- 1.2.2. Henry David Thoreau (Wilderness Preservation Movement)
- 1.2.3. John Muir (Biocentrism)

1.3. Past and contemporary approaches of environmental ethics

- 1.3.1. Biocentrism approach to environmental ethics
- 1.3.2. Eco-centrism and anthropocentricism approach

1.4. Anthropocentrism/eco-centrism debate

- 1.4.1. Religious dimension of anthropocentrism and eco-centrism
- 1.4.2. Metaphysical dilemma
- 1.4.3. Theocentric metaphysics

Unit II: Environmental ethics and movements

2.1. Land ethics
2.2. Deep ecology
2.3. Gaia hypothesis
2.4. Social ecology
2.5. Ecofeminism
2.6. Animal rights
2.7. Environmental movements:

- 2.7.1. History of environmental movement
- 2.7.2. Goals and objectives of environmental movement
- 2.7.3. Major environmental movements: Chipko movement, Silent valley movement, Green peace movement, Appiko movement, Global youth movement

Unit III: Religion and the environment

3.1. Brief overview of religion

3.2. Different religious perspectives on environment

- 3.2.1. Buddhism
- 3.2.2. Hinduism
- 3.2.3. Christianity
- 3.2.4. Judaism
- 3.2.5. Islam
- 3.2.6. Animism
- 3.2.7. Shamanism

3.3. Debate on religion's role and contribution in environmental conservation

Unit IV: Social Corporate Responsibility (CSR) and environmental justice

4.1. Concept of environmental justice
4.2. Role of corporations in environmental conservation and CSR
4.3. Environmental racism and its forms

4.4. Cases studies: Environmental racism, gender dimension of environmental injustice, marginalized community and environmental injustice

Unit V: Environmental ethics and sustainable development

5.1. Current issues in environmental ethics: GMOs, localisation, decentralisation, etc.
5.2. Environmental ethics and environmental politics
  5.2.1. Understanding global environmental politics
  5.2.2. Mainstream theories
  5.2.3. Actors and institutions in global environmental politics
  5.2.4. Global north-south divide and environmental politics
5.3. Application: environmental ethics for environmental management

Reading List:

Essential Reading

Boylan, M. (2014). *Environmental ethics (*2nd ed.). Hoboken, NJ: John Wiley & Sons.

Lee, Y.F., & So, A,Y. (Eds.). (1999). *Asia's environmental movements: Comparative perspective*. Armonk: New York: M. E. Sharpe, Inc.

Mies, M., & Shiva, V. (2010). *Ecofeminism.* Jaipur, India: Rawat publications.

Robin, A. (2018). *Environmental ethics: A very short introduction*. London, UK: Oxford University Press.

Royal Society for the Protection of Nature. (2006). *Buddhism and environment.* Thimphu, Bhutan: RSPN.

Varner, G.E. (2002). *In nature's interest? Animal rights and environmental ethics.* London, UK: Oxford University Press.

Additional Readings

Armstrong, S. J., & Botzler, R.G. (1993). *Environmental ethics: New divergence and convergence.* New York, NY: McGraw-Hill, Inc.

Arne, K., & P, Gerard. (1999). *Environmental movements in Asia*. London, UK: Rutledge.

Brundtland, G. H. (1987). *Our common future.* Report of the world commission on environment and development. New York, NY: Oxford University Press.

Gottlieb, R. S. (Ed). (1996). *This sacred earth: Religion, nature and environment.* New York, NY: Routledge.

Guha, R. (2000). *The unquiet woods: Ecological change and peasant resistance in the Himalaya*. University of California Press.

Hargrove, E. (1992). *The animal rights/environmental ethics debate.* Albany, NY: State University of New York Press

McAuley, D. (1996). *Minding nature: The philosophers of ecology*. New York, NY: Guilford Press.

Minteer, B.A. (2009). *Nature in common-environmental ethics and the contested foundations of environmental policy*. Philadelphia, PA: Temple University Press.

Date: June 2021

Module Code and Title: **ENM202 Water Resources Management**
Programme: BSc in Environmental Management
Credit: 12
Module Tutor(s): Jamyang Pelmo (Coordinator), Tshewang Dorji

General objective: The module covers the basic hydrological concepts, then goes on to provide a grounding in integrated water resources management principles and strategies. The module prepares students to critically analyse global and local water situations and enables them to critique approaches to water resource issues and concerns. Water resources depletion and water pollution are also highlighted as key challenges.

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

1. Enumerate the types of natural and human-induced variations of hydrological systems.
2. Identify some of the pertinent water resources issues
3. Explain the principles and practices of water resource management.
4. Critically evaluate issues related to use and governances of water resources.

5. Discuss the wide global variability in water availability and use
6. Access the state of water resources in Bhutan
7. Discuss the major issues of water resources management in Bhutan
8. Discuss the approaches to manage the issues.

Learning and Teaching Approach:

Type	Approach	Hours per week	Total credit hours
Contact	Lectures	3	75
	Discussions and presentation	1	
Independent study	Written assignments	2	45
	Reading and review of class materials	2	
Total			120

Assessment Approach:

A. Individual Written Assignment: 15%

Students are required to write an essay discussing a local or global water resources issue. They are required to substantiate their arguments with theoretical arguments discussed during class lectures, as well as add to these through research. The assignment will be 750-1000 words in length.

3% Proposal outlining the selected topic and proposed argument

5% Quality of content and argument (includes well stated and original analysis, use of relevant and adequate support for all claims made, ties analysis to relevant module concepts)

4% Quality of application in practical context

3% Mechanics (Language and referencing)

B. Group Poster presentation: 10%

Students will work in small groups to present (poster presentation) for 15-20 minutes on water conflict. Students will collect information about a particular topic. The presentation will introduce the audience to the context of rising concerns on water conflicts and present their effects and mitigation measures.

4% Content (quality of overall information, all claims relevant and well-supported)

3% Quality of team work and time management

3% Delivery (volume, pace, efforts to engage audience) and language use

C. Class Test: 10%

Students will undertake two class tests of 5% during the semester. The written tests will be conducted within the class for a duration of 40-50 min and cover 2-3 months of material.

D. Individual Report: 10%

Students will write an individual field report on water resources management for a selected site. A one-day field trip will be conducted for this exercise, appropriate site will be identified by the tutor. This report is expected to be both descriptive and reflective and must demonstrate the application of relevant key module concepts such as water resources management, water resources issues and the mitigation adopted in the region. In the report, students must focus on field observations of water usage for different purposes. They will discuss and analyse policies related to water management. The field visit allows students to critically assess the multiple uses of water at a large-scale balancing energy generation with ecological flows, irrigation needs, and downstream community interests. It also provides exposure to governance and policy dimensions, including transboundary water sharing and sustainability concerns. This practical experience will support students in writing both reflective reports; highlighting personal learning, challenges, and ethical considerations and applied reports, focusing on the real use of water resources in hydropower and its integration into Bhutan's development model. Such experiential learning fosters analytical thinking, professional skills, and an appreciation of the complexities in managing water resources sustainably.

Students will be provided with a grading rubric that will help to guide the writing of the field report. The report is expected to be 650-750 words in length.

2% Description of the site (accuracy and completeness)

5% Quality of analysis (includes well stated and original analysis, uses relevant module concepts and adequate support for all claims made)
3% Mechanics (Language and referencing)

E. Midterm Examination: 15%

Students will take a written exam of 1.5-hr duration covering topics up to the mid-point of the semester. The exam will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

F. Semester-End Examination: 40%

Students will take a written exam of 2.5-hr duration encompassing all the subject matter covered in the semester. This assessment is comprehensive and summative in nature, and will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

Overview of assessment approaches and weighting

Areas of assignments	Quantity	Weighting
A. Individual Written Assignment	1	15%
B. Group Poster Presentation	1	10%
C. Class Test	2	10%
D. Individual Report	1	10%
E. Midterm Examination	1	15%
Total Continuous Assessment (CA)		**60%**
Semester-End Examination (SE)		**40%**

Pre-requisites: ENV101 Introduction to the Environment

Subject matter:

Unit I: Overview of water resources

1.1. Global water distribution
  1.1.1. Water availability (Surface water, groundwater and stored water resources)
1.2. Hydrologic cycle
  1.2.1. Evaporation/transpiration; condensation; precipitation; infiltration; gravitational flow
  1.2.2. Human impacts on the cycle, including climate change

Unit II: Water uses

2.1. Type of water use (Commercial, civic, industrial, domestic, agriculture and other uses)
2.2. Overall global usage patterns
2.3. Consumptive and non-consumptive uses
2.4. Diversions, impoundments, ground-water depletion, urbanization, and levees
2.5. Water Harvesting ways and means: Rainwater, catchment harvesting, harvesting structures, soil moisture conservation, check dam, artificial recharge, farm ponds, percolation tanks
2.6. Water Resource Issues
  2.6.1. Water scarcity
  2.6.2. Water stress
  2.6.3. Water waste

Unit III: Water resources management

3.1. Water footprint
3.2. Peak water (peak renewable, peak non-renewable, and peak ecological water)
3.3. Surface water management
  3.3.1. Dams and reservoirs, their benefits and environmental impacts
  3.3.2. Impacts of diversion and depletion of surface waters
  3.3.3. Flooding and flood management
3.4. Groundwater management
  3.4.1. Water tables
  3.4.2. Depletion of groundwater
3.5. Maintaining and increasing freshwater supplies
3.6. Hydropower as a clean energy

3.7. Hydropower potential and challenges

Unit IV: Governance of water resources

4.1. Internal water, territorial water, and international water
4.2. Conflicts over water use
4.3. Integrated River Basin Management (IRBM)
4.4. Water management hierarchy – Bhutan and Global
4.5. Water resource law – Bhutan and Global Hydropower

Unit V: Water resources management in Bhutan

5.1. Overview of Bhutan's water resources
5.2. Principles and policies for water resources management in Bhutan
5.3. Challenges, including climate change, and adaptation measures
5.4. Trans boundary river-basin management with India
5.5. Payment for eco-services related to water

Reading List:

Essential Reading

Dinar, S. (2008). *International water treaties: Negotiation and cooperation along transboundary rivers*. London, UK: Routledge.

Elhance, A. P. (1999). *Hydropolitics in the third world: Conflict and cooperation in international river basins*. Washington, WA: US Institute of Peace Press.

Enger, E.D., & Smith, B.F. (2016). *Environmental science, (*14th ed). New York, NY: McGraw-Hill.

Soncini-Sessa, R., Weber, E. & Castelletti, A. (2007*). Integrated and participatory water resources management – theory*. Amsterdam, Netherlands: Elsevier Science.

Stephenson, D. (2003). *Water resources management*. Lisse, Netherlands: A. A. Balkema Publishers.

Additional Reading

Biswas, A.K., Varis, O., & Tortajada, C. (Eds.). (2005*). Integrated water resources management in South and Southeast Asia.* Oxford, UK: Oxford University Press.

Chhopel, G.K. (2011). Water resources management in Bhutan. Retrieved from http://www.asiapacificadapt.net/sites/default/files/pdfs/seminars/6th-sharing-learning-seminar/water-resources-management-bhutan.pdf.

Cunningham, W.P., & Cunningham, M.A. (2014). *Environmental science: A global concern, (*13th ed). New York, NY: McGraw Hill.

Dorji, K. (2016). *A review on water resources and water resource management in* Dehradun, India: Forest Research Institute University Press. https://biodiversity.bt/document/show/199?instanceId=199&domainObj=document

MIT Mission. (2012). *Clean water. Problem: Agriculture*. Retrieved from http://web.mit.edu/12.000/www/m2012/finalwebsite/problem/agriculture.shtml

National Environment Commission. (2016). *Bhutan state of the environment report 2016*. Thimphu, Bhutan.

Rahaman, M.M., & Varis, O. (2005). Integrated water resources management: evolution, prospects and future challenges. *Sustainability: Science, Practice, & Policy* 1(1):15-21.

Tariq, M.A.U.R., Wangchuk, K. & Muttil, N. A. (2021). Critical review of water resources and their management in Bhutan. *Hydrology* 8 (31), pp 1 -24.

UN. (n.d.). Integrated Water Resources Management (IWRM). *International Decade for Action 'Water for life'.* Retrieved from http://www.un.org/waterforlifedecade/iwrm.shtml

US Geological Survey. (2014). *The USGS Water Science School*. US Department of the Interior. Retrieved from http://water.usgs.gov/edu/

World Bank. (2014). *Water Resources Management*. Retrieved from http://www.worldbank.org/en/topic/waterresourcesmanagement

Date: August 2025

Module Code and Title: **GSE101 Analytical Skills**
Programme: University-wide module
Credit: 12
Module Tutor(s): Tshewang Dorji

General objective: This module aims at developing critical and analytical thinking skills of students to enhance their creativity and ability to think laterally that will aid problem solving and decision-making abilities. With these essential analytical thinking and problem-solving skills students gain an edge in a competitive world.

Learning outcomes - On completion of the module, students will be able to:

- articulate thinking paradigms;
- explain creativity and barriers to creative thinking;
- apply creative thinking skills to spot unnoticed opportunities;
- describe problem solving process;
- apply appropriate problem-solving tools to a given issue;
- evaluate issues to make informed decisions;
- generate creative solutions by using appropriate methods.

Teaching and learning approaches

Approach	Hours per week	Total Credit Hours
Lectures	1	15
Group and Panel Discussions, Presentations, Case Study	1	15
Role Plays/Demonstrations, Mock sessions, Audio visuals	2	30
Independent Study, Reflection, Written Assignments, Project Work , Individual Reading	4	60
Total		**120**

Assessment approach

A. Written Assignment: 20%

Students will be required to complete one written assignment on the contemporary issue of a subject. The required data and contextual information will be provided to students. Students will be required to read, analyse and interpret the data and contextual information, and communicate the result to the intended audience. Wherever there is a need, students should substantiate the existing data with their own data collection. The length of the assignment should be anywhere between 1000 and 1500 words.

Criteria:

4% - Originality and creativity
2% - Clarity of the points and opinions
4% - Reliability of data and accuracy of data interpretation
8% - Analysis of the issue
2% - Overall effectiveness of writing style

B. Class Participation: 10%

Students will participate in class discussions, contributing their ideas and opinions about the methods and tools being taught in the module.

Criteria:

2% - frequency of participation in class

3% - quality of comments –involving critical thinking and analysis of information and reasoning

5% - contribution in a group discussion in class –understanding of group dynamics and processes

C. Case Analysis and Presentation: 30%

Students will solve one case study in a group which will be assessed in two components. The case can be related to any field of knowledge such as engineering, climate change, biotechnology, sustainable development, procurement, production, marketing, strategic management, human resource and current economic and social development.

- **Written**

  Criteria:

  5% identifying the problem

  10% choosing the right approach for the analysis and solving the problem

  5% drawing the correct conclusion with a recommendation

- **Presentation**

  Criteria:

  2% Creativity in delivery of the presentations;

  2% Visual appeal

  2% Confidence

  4% Content analysis

D. Panel Discussion: 20%

A group of students will be required to discuss a topical issue such as climate change, green procurement, disruptive innovation, and big data moderated by a peer.

Criteria:

5% - Preparedness on the topic
5% - Relevance of the argument
5% - Respect for other panelists' views
5% - Coherent and logical flow of ideas

E. Debate: 20%

Students in groups of four or five will debate on a given topic against another group.

Criteria:

5% - Language Proficiency
5% - Intelligence, ability and competence
5% - Logical thinking and reasoning
5% - Ability to use appropriate information

Overview of the assessment approaches and weighting

Areas of Assignments	Quantity	Weighting
A. Written Assignment	1	20%
B. Class Participation	NA (non-definite/should participate in the class discussion at least 5 times)	10%
C. Case Analysis & Presentation	1 + 1	30%
D. Panel Discussion	1	20%
E. Debate	1	20%
TOTAL		**100%**

Pre-requisite: None

Subject matter

UNIT I: Thinking process & Reflection

1.1. Introduction to the Thinking Process & Reflection
1.2. Concept of mind mapping
1.3. Metacognition and thinking about thinking
1.4. Thinking Paradigms: Lateral and Vertical thinking
  1.4.1. Whole brain (system 1 and system 2)
  1.4.2. Analytical
  1.4.3. Critical

1.4.4. Creative
1.4.5. Logical
1.4.6. Scientific
1.4.7. Statistical
1.4.8. Systems
1.4.9. Visual
1.4.10. Ethical

UNIT II: Overview of analytical thinking skills

2.1. Concept of analytical skills
2.2. Competencies of analytical thinking
2.3. Benefits of analytical thinking
2.4. Analytical thinking process
2.5. Tools and techniques for analytical skills
2.6. Application of analytical thinking
2.7. Validity and strength in arguments

UNIT III: Creative Thinking

3.1. Definition of creativity
3.2. Creative thinking – Self-Assessment
3.3. Characteristics of a creative person
3.4. Barriers to creativity and overcoming the barriers
3.5. Ways to enhance creative thinking (e.g., brainstorming)
3.6. Methods of creativity

UNIT IV: Problem solving process

4.1. Understanding problem analysis
4.2. Conventional problem-solving process
    4.2.1. Present the problems
    4.2.2. Ask solutions
    4.2.3. Shoot down ideas
    4.2.4. Make consensus
4.3. Creative problem-solving process
    4.3.1. Problem definition
    4.3.2. Problem analysis
    4.3.3. Generating possible solutions
        4.3.3.1. Brainstorming process and rules
        4.3.3.2. Fishbone Analysis
        4.3.3.3. Mind mapping
    4.3.4. Analysing the solutions
    4.3.5. Selecting the best solution
    4.3.6. Implementing the best solution
    4.3.7. Planning the next course of action
4.4. Questioning techniques

UNIT V: Decision making process

5.1. Introduction to Decision making process
5.2. Six Thinking Hats
5.3. SWOT Analysis
5.4. Decision Tree analysis/what-if analysis
5.5. Pareto chart
5.6. Logical Framework Analysis

Reading List

Essential Reading

Bano, E. d. (2000). *Six Thinking Hats* (2nd ed.). New Delhi, India: Penguin India.

Michalko, M. (2006). *Thinkertoys: A handbook of creative-thinking techniques* (2nd ed.). Ten Speed Press.

Puccio, G.J., Mance, M. & Switalski, L.B. (2017). *Creativity Rising Creative Thinking and Creative Problem Solving in the 21st Century.* ICSC Press, International Center for Creativity, US

Treffinger, D. J. (2006). *Creative Problem Solving: An introduction* (4th ed.). Prufrock.

Additional Reading

Bano, E. d. (2008). *Creativity workout: 62 exercises to unlock your most creative ideas.* Ulysses Press.

Bano, E. d. (2009). *Lateral Thinking.* e-Penguin.

Bono, E. d. (2005). *Thinking course (Revised Edition).* Bernes and Nobel

Chopra, R. (n.d.). *Logical Critical Analytical Reasoning.* Galgoba Publications Pvt Ltd.

Eiffert, S. D. (1999). *Cross-train your brain: a mental fitness program for maximizing creativity and achieving success.* Amacom.

Kahneman, D. (2015). *Thinking fast and slow.* New York: Farrar, Straus and Giroux.

Scott, J. W. (2016). *Critical Thinking: Proven strategies for improving your decision-making skills, retaining information longer and analyzing situations with simple logic ---- Logical thinking and critical thinking skills.* New Familiar Publishing.

Date: January, 2018

སྦྱོང་ཚན་གྱི་མིང་དང་སྦྱོང་ཚན་ཨང་	**DZG101 རྩོང་ཁ་བརྡ་དོན་སྦྱོང་ལེན།**
ལས་རིམ་	གཅུག་ལག་སློབ་སྟེ་ཡོངས་ཁྱབ།
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སྤྱིར་བཏང་ལས་དོན།

སྦྱོང་ཚན་འདི་གི་དམིགས་ཡུལ་གཙོ་བོ་ར་ སློབ་སྦྱོང་པ་ཚུ་གིས་ རང་གི་མི་ཚེ་ནང་ ལྟ་གཡོག་དང་འབྲེལ་བའི་གནད་དོན་ གཅིའི་ཐད་ལས་འབད་རྒྱུད་ རྩོང་ཁའི་ཐོག་ལུ་ བརྡ་དོན་སྦྱོང་ལེན་ ཚུལ་དང་མཐུན་ཏོག་ཏོ་སྦེ་ འབད་ཚུགས་ནིའི་དོན་ལུ་ཨིན། དེ་མ་ཚད་ སྦྱོང་ཚན་འདི་གིས་ རྩོང་ཁའི་ཐོག་ལུ་ ཤེས་ཡོན་འཛི་རྩལ་གྱི་ལམ་ལུགས་དང་འཁྲིལ་ཏེ་ བྱེ་ཚུགས་ནི་ལུ་ཡང་ དམིགས་གཏད་བཀྲེད་པ་ཨིན།

སློབ་སྦྱོང་གླག་འཐས།

སྦྱོང་ཚན་འདི་མཇུག་བསྡུཔ་དུ་ སློབ་ཕྲུག་ཚུ་གིས་

1. རྩོང་ཁའི་སྐད་ཡིག་གི་འབྱུང་རབས་དང་ རྩོང་ཁ་ལྷབ་དགོ་པའི་ཁྱད་དང་དགོས་པ་ སྤྲད་ཚུགས།
2. གློག་རིག་ནང་ལུ་ རྩོང་ཁའི་མཇུག་སྟོན་ རྟག་ཚུགས།
3. འབྲེལ་སྦྲ་དང་ཉེད་སྦྲ་ ལྷག་བཅས་ ཚིག་གློགས་ འབྲེལ་ཚིག་ ཚག་ཤད་ཚུ་ དབྱེ་དཔྱད་འབད་དེ་ མ་འཛོལ་བར་ ལག་ལེན་འཐབ་ཚུགས།

- ཡུལ་ དུས་ གནས་སྟངས་དང་བསྟུན་ཏེ་ རྩོང་ཁའི་ཐོག་ལུ་ ཉན་སྒྲབ་འབད་ཚུགས།
- རྩོང་ཁའི་ཐོག་ལུ་བྱེས་ཏེ་ཡོད་མི་ཚུ་ ངག་གཤེས་དང་མཐུན་སྒེ་ལྟག་ཚུགས།
- གནས་སྟངས་དང་འཁེལ་བའི་དཔྱེ་གཏམ་ ལག་ལེན་འཐབ་ཚུགས།
- རྩོད་ཚོག་དང་དོན་མཚམས་ ཚུལ་མཐུན་སྒེ་བྱེ་ཚུགས།
- གཞུང་སྐེར་གྱི་ཡིག་རིགས་བྱེ་ཚུགས།
- རྩོང་ཁའི་ནང་ཡོད་པའི་འབྲེ་གཤེགས་གི་རིགས་གཅིག་ཅར་ཞིན་རྟུང་ བཀང་ཚུགས།
- ཡིག་རིགས་ཚུ་ ལུགས་མཐུན་དང་ལུགས་ཡངས་གཉིས་ཆ་རའི་ཐོག་ལུ་བྱེ་ཚུགས།
- ལུང་འཛིན་དང་རྒྱབ་རྟེན་གྱི་ཐོ་ འོས་འབབ་ལྟན་ཏོག་ཏོ་སྒེ་ ལག་ལེན་འཐབ་ཚུགས།

སློབ་སྟོན་ཐབས་ལམ།

དཔྱེ་བ།	ཐབས་ལམ།	བདུན་ཕྲག་གཅིག་ནང་ཆུ་ཚོད།	སྤྱོང་འཐུས་ཆུ་ཚོད།
དངོས་འཛིལ།	གསལ་བཤད།	༣	༦༠
	སྤྱོང་ལྟ།	༡	
	སྤྱན་ལུ།	༡	
རང་སྤྱོང།	ལས་འགུལ་བྱེ་ནི།	༣	༦༠
	དཔེ་མཛོད། ལྟག་དེབ་ལྟག་ནི།	༣	
སྤྱོང་ཚན་འདི་གི་དོན་ལུ་ ཡོངས་བསྟོམས་ ཆུ་ཚོད་			༡༢༠

དཔྱེ་ཁིབ་ཐབས་ལམ།

སྤྱོང་ཚན་འདི་གི་དོན་ལུ་ དུས་རྒྱུན་དཔྱེ་ཁིབ་དང་སྤྱངས་རྒྱུགས་དཔྱེ་ཁིབ་ གཉིས་ཆ་རའི་ཐོག་ལས་ དཔྱེ་ཁིབ་འབད་དགོས་ཨིན།

ཀ ལས་འགུལ་དང་པ། ཉན་ཞིའི་རིག་རྩལ་དཔྱེ་ཁིབ། (སྐུགས་ ༡༠%)

སློབ་སྟོན་པ་གིས་འོས་འབབ་ལྟན་པའི་དོན་ཚན་ (སྒྲ་བཟུང་ཡོད་མི་ཅིག) གདམ་ཁ་རྒྱབ་སྟེ་ རང་རྒྱང་གི་ཐོག་ལས་ ཁུ་སིམ་སིམ་སྒེ་ཉན་བཏུག དོ་རྟུང་ ཚར་ཅིག་ཉན་ཅིག་དང་གཅིག་ཁར་ཟིན་བྱིས་བཏང་བཏུག་ཁིན་ལས་ ཉན་མི་འདི་ ཚོག་ཐབ་འབད་དེ་ བྱེ་བཏུག དེ་གི་དམིགས་ཡུལ་གཙོ་བོ་ ཉན་ཏེ་ཏ་གོ་ནི་དང་ ཉན་ཏེ་བྱེ་ཚུགས་མི་ཚུགས་དཔྱེ་ཁིབ་འབད་ནིའི་དོན་ལུ་ཨིན།

སྐུགས་ཀྱི་ཚད་གཞི།

- གོ་དོན་ལེན་ཏེ་ དང་ཚོག་ནང་བཤད་པ་རྒྱབ་ཐངས། ༡༠%
- སྟེབ་སྤྱོར། ༩%
  - ཉན་ཏེ་བྱིས་མི་དེ་གི་དཔྱེ་དཔྱད་སྤྱན་ལུ། ༣%

- དང་གི་ཉན་ནིའི་རིག་རྩལ་ཡར་རྒྱས་ཀྱི་སྒོས་འཚར། ३%

དན་གསོ། དབྱེ་དཔྱད་སྐན་ཞུ་དང་ སྒོས་འཚར་ བསྟོམས་ཏེ་ ཤོག་ལེབ་གཅིག་བྱེ་དགོ།

ཁ ལས་འགྱལ་གཉིས་པ། སྨན་ནིའི་རིག་རྩལ་དབྱེ་ཞིབ། (སྐྱགས་ ३०%)

སློབ་སྟོན་པ་གིས་ སྤྱིར་བཏང་མི་སྟེའི་ནང་ རྩོང་ཁ་བརྡ་དོན་སྤྲོད་ལེན་ནང་ལུ་ དཀའ་དལ་གཅིག་ཅི་ར་འབྱུང་དོ་ཡོད་པ་ཞིན་ན་གདམ་ཁ་རྐྱབ་ཞིནམ་ལས་ འཐུས་མི་ ५ ཅེ་འབད་མིའི་སྟེ་ཚན་ནང་སྤྲེ་ སློབ་ཁང་ནང་ལུ་ སྐར་མ་ ७५ འི་རིང་ལུ་ སྤྱན་ཞུ་འབད་བཅུག་དགོ འཐུས་མི་རེ་གིས་ སྐར་མ་ ३ ཅེ་གསལ་བཤད་འབད་དགོ། དེ་གི་དམིགས་ཡུལ་གཙོ་བོ་ སྨན་ནིའི་རིག་རྩལ་གྱི་དབྱེ་ཞིབ་འབད་ནིའི་དོན་ལུ་ཞིན། **སྐྱགས་ཀྱི་ཚད་གཞི།**

- དོན་ཚན་དང་འབྲེལ་བ། ९%
- སྐད་ཡིག་སྦྱོར་བ། ३%
- གསལ་བཤད་འབད་ཐབས
  - ཐོག་ཆགས་ཚིག་ཉེད་པ། ३%
  - རྩོད་སྤྲ་དག་པ། ३%
  - སྐད་ཀྱི་སེང་ཐབ། २%
  - གཟུགས་ཀྱི་རྣམ་འགྱུར། १%
  - བློ་སྤྲོངས། २%
- ཉན་མི་ཚུ་འབྲེལ་གཏུགས་འབད་ཐབས། २%

ག ལས་འགྱལ་གསུམ་པ། ལྷག་ནི་དང་བྱི་ནིའི་རིག་རྩལ་དབྱེ་ཞིབ། (སྐྱགས་ ३०%)

ཚོག་འབྲུ་ १५००-२००० གི་བར་ན་ཡོད་པའི་རྩོམ་བྱིས་ཅིག་ སློབ་དཔོན་དང་སློབ་ཁྲག་མཉམ་རུབ་ཀྱི་ཐོག་ལས་ གདམ་ཁ་རྒྱབ་ཞིནམ་ལས་ དང་རྒྱང་གི་ཐོག་ལས་ དབྱེ་དཔྱད་སྐན་ཞུ་བྱེ་ནི། དེ་གི་དམིགས་གཏུད་འདི་ སློབ་ཁྲག་ཚུ་གིས་ ལྷག་སྟེ་གོ་དོན་ལེན་ཏེ་ བཅུད་དོན་ཁ་ཡོ་ནི་དང་ དབྱེ་དཔྱད་འབད་ཐབས་ཀྱི་རིག་རྩལ་ཐོབ་སྟེ་ ཡིག་ཐོག་ལུ་ བཀོད་ཚུགས་ནིའི་དོན་ལུ་དང་ ལུང་འདེན་དང་རྒྱབ་རྟེན་ལག་ལེན་འཐབ་ཐབས་ཚུ་ དབྱེ་ཞིབ་འབད་ནིའི་ཞིན། སློབ་ཁྲག་རེ་གིས་ རྩོམ་བྱིས་ཀྱི་བཅུད་དོན་རེ་དང་ དབྱེ་དཔྱད་སྐན་ཞུ་རེ་བྱི་དགོཔ་ཞིན། དབྱེ་དཔྱད་སྐན་ཞུ་འདི་ ཚོག་འབྲུ་ ३००० ཀྱི་ནང་འཁོད་བྱི་དགོཔ་ཞིན།

སྐྱགས་ཀྱི་ཚད་གཞི།

- རྩོམ་བྱིས་ཀྱི་བཅུད་དོན་གཙོ་བོ་ཚུ་ མ་འཛིལ་བར་ བཀོད་ཐབས། ५%
- དཔྱད་པ་གི་ཐོག་ལས་ དབྱེ་དཔྱད་འབད་ཐབས། ७%
- གནད་དོན་ཚུ་གོ་རིམ་སྤྱིག་ཐབས། ३%

- འོས་འབབ་དང་འཚེལ་བ་ཡོད་པའི་མིང་ཚོགས་ལག་ལེན་འཐབ་ཐངས། ༣%
- ལུགས་མཐུན་དང་འཁྲིལ་ཏེ་འབྲི་ཐངས། ༩%
- སྟེབ་སྦྱོར་དག་པ། ༢%
- ཚོགས་སྡུར་ཚུལ་མཐུན་ལག་ལེན་འཐབ་ཐངས། ༢%
- ལུང་འདེན་དང་རྒྱབ་རྟེན་ལག་ལེན་འཐབ་ཐངས། ༣%
- འབྲི་བཀོད། ༢%

ང་ སློབ་དུས་ཆོས་རྒྱུགས། (སྐུགས་ ༡༠%)

ལས་རིམ་འདི་ནང་བཅའ་མར་གཏོགས་མི་ཚུ་གིས་ སློབ་དུས་མཇུག་བསྡུམ་དུ་ དུས་ཡུན་ཆུ་ཚོད་ ༡ རིའི་ལྟ་ སྐུགས་ ༡༠ འི་འབྲི་རྒྱུགས་ཕྱལ་དགོཔ་ཨིན།

ངན་གསོ། འབྲི་རྒྱུགས་ཀྱི་སྐུགས་དང་དུས་ཡུན་ཆུ་ཚོད་ཚུ་ རང་སོའི་མཐོ་རིམ་སློབ་གྲྭའི་ལམ་ལུགས་དང་ འཁྲིལ་ཏེ་ལེན་ཞིནམ་ལས་ སྐུགས་བརྒྱ་ཆ་ ༡༠ ནང་ལུ་ ཕབ་དགོཔ་ཨིན།

དབྱེ་ཞིབ་ཐབས་ལམ་དང་ལྡིད་ཚད་ཀྱི་བཀོད་རིས།

ཐབས་ལམ།	དབྱེ་ཞིབ་ཀྱི་དབྱེ་བ།	གྲངས་ཁ།	སྐུགས་ཀྱི་བརྒྱ་ཆ།
དུས་རྒྱུན་དབྱེ་ཞིབ།	ཀ ཉན་ནིའི་རིགས་རྩལ་དབྱེ་ཞིབ།	༡	༡༠%
	ཁ སྒྲབ་ནིའི་རིགས་རྩལ་དབྱེ་ཞིབ།	༡	༡༠%
	ག ལྷག་ནི་ཐེ་ནིའི་རིགས་རྩལ་དབྱེ་ཞིབ།	༡	༡༠%
སློབ་དུས་ཆོས་རྒྱུགས།	ང འབྲི་རྒྱུགས།	༡	༡༠%
		སྐུགས་བསྡོམས་	**༡༠༠**

སྟོན་ཚད། མེད།

ཁང་དོག

ལས་ཚན་དངས། སྐད་ཡིག་གི་ངོ་སྤྲོད།

- ༡.༡ རྩོང་ཁའི་སྐད་ཡིག་གི་འབྱུང་རབས།
- ༡.༢ སྐྱིར་བཏང་ རྩོང་ཁ་ལྷབ་དགོ་པའི་དགོས་པ།
- ༡.༣ དཔེགས་བསལ་ མཐོ་རིམ་སློབ་གྲྭ་ནང་ལུ་ རྩོང་ཁའི་སྤྱོང་ཚན་འདི་ ལྷབ་དགོ་པའི་དགོས་པ།

ལས་ཚན་གཉིས་པ། བརྡ་དོན་འཕྲུལ་རིག

- ༢.༡ གློག་རིག་ནང་ རྩོང་ཁ་བཙུགས་ཐངས།

๑.๑ སྒོག་རིག་ནང་ལུ་ རྩོང་ཁ་འཛིན་ཐངས།

ལས་ཚན་གསུམ་པ། ཡི་གུའི་སྒྲོར་བ།

๓.๑ ཚོག་གྲོགས།
๓.๒ འབྲེལ་ཚོག་ལག་ལེན་འཐབ་ཐངས།
๓.๓ འབྲེལ་སྒྲ་
๓.๔ བྱེད་སྒྲ
๓.๕ ལྷག་བཅས།
๓.๖ ཚག་ཤད་ལག་ལེན་འཐབ་ཐངས།

ལས་ཚན་བཞི་པ། རྩོང་ཁའི་ངག་གཤིས་དང་འཁྲིལ་ཏེ་སྒྲུབ་ཐངས།

๔.๑ ཁ་བཟང་
๔.๒ ཞལ་སྐད་ཞེ་ས།
๔.๓ མིང་ཚིག་དང་བྱ་ཚིག་ཁྲུལ་ཚིག་ཚུ་འོས་འབབ་ལྟནམ་སྦེ་ལག་ལེན་འཐབ་ཐངས།
๔.๔ དཔྱེ་གཏམ།
๔.๕ རྩོང་ཁ་ཉག་རྒྱང་གི་མིང་ཚིག་ལག་ལེན་འཐབ་ཐངས།

ལས་ཚན་ལྔ་པ། རྩོང་ཁའི་ངག་གཤིས་དང་འཁྲིལ་ཏེ་ལྷག་ཐངས།

๕.๑ ཚོག་མཚམས་བཅད་དེ་ལྷག་ཐངས།
๕.๒ མགོ་འདོ་གས་དབྱངས་གསུམ་ཞུགས་པའི་རྩོད་སྒྲ།
๕.๓ རྩེས་འཇུག་གི་སྒྲ་ཧིལ་བྱ་བཏོན་དགོས་དང་མ་དགོ་པའི་རིགས་ཚུ་ ཁྱད་པར་ཅེ་སྟེ་ ལྷག་ཐངས།
๕.๔ རྩེས་འཇུག་མེད་རྒྱང་ཡོད་པ་བཟུམ་ལྷག་ཐངས།
๕.๕ མིང་མཐའ་མེད་རྒྱང་ཡོད་པ་བཟུམ་ལྷག་ཐངས།

ལས་ཚན་དྲུག་པ། བྱི་ནིའི་རིག་རྩལ།

๖.๑ རྩོད་ཚིག་འབྱི་ཐངས།
๖.๒ དོན་མཚམས་འབྱི་ཐངས།
๖.๓ སྐྱན་ཞུ་འབྱི་ཐངས།
๖.๔ འབྱི་ཤོག་གི་རིགས་བཀང་ཐངས།
๖.๕ གྲོས་ཆོད་འབྱི་ཐངས།

ལས་ཚན་བདུན་པ། ཡིག་འགྱུལ།

๗.๑ ཡིག་རྒྱང་འབྱི་ཐངས།

༧.༡ མགོན་ཞུ་འབྱེ་ཐངས།

༧.༢ གཏང་ཡིག་འབྱེ་ཐངས།

༧.༣ ཞུ་ཡིག་དང་ཞུ་ཚོག་/བཤེར་ཡིག་ འབྱེ་ཐངས།

༧.༤ གན་ཡིག་འབྱེ་ཐངས།

༧.༥ ཁྲབ་བསྒྲགས་ཀྱི་རིགས་འབྱེ་ཐངས།

ལས་ཚན་བརྒྱད་པ། ཤེས་ཡོན་འབྱེ་རྩལ།

༨.༡ ལུགས་མཐུན་དང་ལུགས་ཡངས་ཀྱི་འབྱེ་ཐངས།

༨.༢ ལུང་འདེན་ ལག་ལེན་འཐབ་ཐངས།

༨.༢.༡ ཐད་ཀར་ལུང་འདེན།

༨.༢.༢ ཚོག་སྐྱོར་ལུང་འདེན།

༨.༣ རྒྱབ་རྟེན་ཞི་བཀོད་འབད་ཐངས།

༨.༣.༡ དལ་དེབ་ཀྱི་རིགས་ཞི་བཀོད་འབད་ཐངས།

༨.༣.༢ གནས་དེབ་ཀྱི་རིགས་ཞི་བཀོད་འབད་ཐངས།

ལྷག་དགོ་པའི་དཔེ་ཞི།

དེས་པར་དུ་ལྷག་དགོ་པའི་དཔེ་ཞི།

ཀུན་བཟང་རྡོ་རྗེ། (༢༠༡༢) *རྩོང་ཁའི་རྩོད་སྐྱ་དག་རྒྱུན་དག་པའི་ཐུས་ཚུ།* ཞིམ་ཤུ། རྩོང་ཁ་གོང་ལྷན་ཚོགས།
ཀུན་བཟང་རྡོ་རྗེ། (༢༠༡༥) *དཔེ་གཏམ་དོན་ཀྱི་རྒྱུན་ཚ།* ཞིམ་ཤུ། རྩོང་ཁ་གོང་འཕེལ་ལྷན་ཚོགས།
རྩོང་ཁ་གོང་འཕེལ་ལྷན་ཚོགས། (༢༠༡༣) *རྩོང་ཁའི་བརྡ་གཞུང་སྐོང་བའི་སྐྱོན་ཚ།* ཞིམ་ཤུ། རྩོང་ཁ་གོང་འཕེལ་ལྷན་ཚོགས།
རྩོང་ཁ་གོང་འཕེལ་ལྷན་ཚོགས། (༢༠༡༩) *འབྲུག་གི་ཡིག་བསྒྱུར་རྩལ་གཞུག།* ཞིམ་ཤུ། རྩོང་ཁ་གོང་འཕེལ་ལྷན་ཚོགས།
གཙུག་ལག་སློབ་སྡེའི་སློབ་སྡོང་ཕྲེ་བ། (༢༠༡༨) ལུང་འདེན་དང་ རྒྱབ་རྟེན་འབད་ཐངས། ཞིམ་ཤུ་ འབྲུག་རྒྱལ་འཛིན་
གཙུག་ལག་སློབ་སྡེ།

ཁ་སྐོང་ལྷག་དགོ་པའི་དཔེ་ཞི།

སྐལ་བཟང་དབང་ཕྱུག (༢༠༠༢) *རྩོང་ཁ་བརྡ་དོན་རྒྱུན་འཛིན།* བསམ་རྩེ།
རྩོང་གོང་འཕེལ་ལྷན་ཚོགས། (༢༠༡༡) *ཤལ་སྐད་དང་ཞེ་སའི་རྣམ་གཞག་སྐད་ཚའི་འོད་ཟེར།* ཞིམ་ཤུ། རྩོང་ཁ་གོང་འཕེལ་ལྷན་ཚོགས།

སྤྱི་ཚེས། ༢༢/༡༢/༢༠༡༨ །

Module Code and Title: **BDC202 Biodiversity Conservation and Management**
Programme: BSc in Environmental Management
Credit: 12
Module Tutor(s): Bikram Sharma (Coordinator), Tshewang Dorji, Kinley Dorji

General objective: This module aims to teach important aspects of biodiversity conservation and management starting with pertinent threats to biodiversity. The module discusses frameworks and practical approaches to conserving biodiversity, sustainable utilization and equitable benefit-sharing.

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

1. Discuss the impacts of different threats to biodiversity.
2. Describe common conservation approaches.
3. Explain the significance of ecosystem-based approaches in biodiversity conservation and management in the face of climate change.
4. Describe the importance of biosecurity and use of integrated approaches to manage it.
5. Discuss the ethical and ownership issues surrounding the use of genetic resources.
6. Discuss frameworks available to ensure sustainable and equitable access and benefit sharing of biological resources.
7. Evaluate the conservation approaches implemented in Bhutan.
8. Explain the significance of various national and international policies and conventions on biodiversity conservation and management.

Learning and teaching approach:

Type	Approach	Hours per week	Total credit hours
Contact	Lectures	3	75
	Discussions	1	
	Field practical work	1	
Independent study	Written assignments	1	45
	Reading and review of class materials	2	
Total			120

Assessment Approach:

A. Individual Written assignment: 15%

The tutor will provide approximately 10 recently published research articles about biodiversity conservation and management from Bhutan and abroad related to themes like biodiversity management practices, regimes, issues, stories of success and failure, factors, gaps, and opportunities. Students will individually write a review paper of 1000-1250 words selecting one common theme that runs through at least 3 of the articles and synthesizing the article's findings on that theme.

Part A: Draft: 5%

2% Content (originality, approach, result/discussion, scholarship)
1% Focus (relevance, organization, conclusion)
2% Language (style, mechanics)

Part B: Final submission: 10%

2% Depending on how many comments from the draft are incorporated for the final submission, the tutor can award them negative marking.
3% Synthesis of the information (includes an explanation of a key concept or process from the module, and well-supported argument for how their subject illustrates the concept or process taught in the class)
3% Analytical thinking (discuss the best practices of biodiversity conservation and propose remedial measures to reduce threats to different biodiversity, discuss different conservation techniques)
2% Mechanics (Language and referencing)

B. Forum discussions via VLE: 15%

Discussion 1 (5%): conservation challenges and threats

Discussion 2 (5%): use of various biological resources, traditional knowledge systems, and benefit sharing
Discussion 3 (5%): policy and legal frameworks for biodiversity conservation and management

The VLE forum discussions will be hosted over one day each, spread out over the semester. Students will be given readings on issues related to the upcoming discussion topic to be read, then reflected upon/discussed together in the VLE forum. Each student will have to participate with appropriate discussion points in the VLE forums in line to the flow of discussions therein. Students may make multiple posts as appropriate totalling to approximately 300-500 words for each discussion. The contributions will be cumulatively assessed once a particular discussion concludes.

3% Quality of analysis (originality, thoughtfulness of reflection, use of relevant and adequate support for all claims made, ties analysis to relevant module concepts)
2% Articulation, accuracy, and completeness

C. Block-week field-visit report:15%

A week-long field visit to Wangdue Phodrang and Punakha will be undertaken this semester. In the field, students will observe, interact and discuss with the people involved (community people, government officials, and private firms) in the conservation and management of biodiversity through management of protected area, community forest, wetland and habitat of Black Necked Cranes. Students are expected to employ an *inquiry-based learning approach* to develop technical competency of observing, collecting, interpreting, recording and evaluating various types of information.

Students in groups of four will produce a block-week field visit report (1250-1500) consisting of reports for individual visits reported by individual students. The group report must also have an overall organisation and structure as given in the criteria. The reports must capture an adequate description of management practices (for protected area, community forest, wetland and habitat of Black Necked Crane) explaining the concepts of biodiversity conservation and management, theories of species level/ecosystem level conservation, principles of stakeholder participation in resources access, use and management, and overall management plan including key challenges and limitations.

Group assessment on common portions of the report (5%)

1% Organisation and structure (Introduction, methodology, discussion, and conclusion)
3% Quality of content across the Introduction (Clarity and focus, significance and proposition), Methodology (Accuracy/reliability - measurement instrument, collection, analyses, and context), Overall discussion (Interpretation and description, argument, and proposed perspectives)
1% Mechanics (language, correct use of figures and tables, citation and referencing)

Individual assessment on report portions related to individual areas visited (10%)

4% Synthesis of the information (well-supported argument for how their subject illustrates the concept or process taught in the class)
3% Analytical thinking (critically discuss the opportunities, limitations and best practices of biodiversity conservation with the adequate logical background supports)
3% Mechanics (Language and vocabulary usage)

D. Midterm Examination: 15%

Students will take a written exam of 1.5-hr duration covering topics up to the mid-point of the semester. The exam will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

E. Semester-End Examination: 40%

Students will take a written exam of 2.5-hr duration encompassing all the subject matter covered in the semester. This assessment is comprehensive and summative in nature, and will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

Overview of assessment approaches and weighting

Areas of assignment	Quantity	Weighting
A. Individual written assignment	1	15%
B. Forum discussions via VLE	3	15%
C. Block-week field-visit report	1	15%
D. Midterm Examination	1	15%
Total Continuous Assessment (CA)		**60%**
Semester-End Examination (SE)		**40%**

Pre-requisites: BDC201 Fundamentals of Biodiversity

Subject matter:

Unit I: Biodiversity conservation issues

1.1. Habitat loss
- 1.1.1. Definition and descriptions of habitat reduction and habitat fragmentation
- 1.1.2. Causes of habitat loss (terrestrial and marine)
- 1.1.3. Effects of habitat loss: Initial exclusion, Isolation, Insular/Island biogeography, Edge effect

1.2. Climate change effects: Reproduction timing, Migration timing, Length of growing seasons for plants, Geographic distribution, Population size, Invasive plant, Extinction, Disturbance regime and ecosystem change

1.3. Overexploitation/Unsustainable use
- 1.3.1. Resource-use conflicts (scarcity, abundance and inequality)
- 1.3.2. Forest resources, marine resources, water resources etc.
- 1.3.3. Cascading effect
- 1.3.4. International wildlife trade

1.4. Invasive alien species: Endemic areas, Stages of the biological invasions, Ingression, Cases of worst invasive alien species globally and locally

1.5. Environmental pollution impacts on biodiversity: Acid deposition, Toxic discharges, Biological contamination, Nutrient build up, Plastics

Unit II: Conservation approaches

2.1. History of biodiversity conservation efforts and approaches

2.2. Biodiversity mitigation hierarchy

2.3. Conservation at species and population level, opportunities and techniques available for both in situ and ex situ conservation.

2.4. Conserving endangered species

2.5. Re-introduction of endangered species

2.6. Management and conservation issues at the ecosystem level
- 2.6.1. Definition, theory and examples of metapopulations
- 2.6.2. Protected areas as a conservation tool. Types of protected areas, the criteria for their selection, ICDPS, and management
- 2.6.3. Importance of non-protected areas
- 2.6.4. Ecosystem service provision and the wider landscape

2.7. Maintaining the flow of biodiversity
- 2.7.1. Land use and development regulation
- 2.7.2. Habitat corridors and passageways
- 2.7.3. Biological dispersal zones
- 2.7.4. Habitat restoration

2.8. Adaptive management to reduce impacts of Climate Change
- 2.8.1. Ecosystem based approach (Principles, key elements and benefits)
- 2.8.2. Adaptation principles (Practical action, ecological resilience and accommodating change)
- 2.8.3. Integrate action across partners and sector
- 2.8.4. Develop knowledge and strategic planning

Unit III: Biosecurity

3.1. Biosecurity
- 3.1.1. Concept
- 3.1.2. Related Concepts (Biorisk, Biohazard, Biosafety, Biocontainment, Biosecurity, Biodefense, Bioweapons, Bioterrorism)
- 3.1.3. History
- 3.1.4. Factor influencing it
- 3.1.5. Need and benefits

3.2. Components of biosecurity
- 3.2.1. Plant, animal (specifically human) life and health security
- 3.2.2. Environmental protection
- 3.2.3. Food safety
- 3.2.4. Environmental protection

3.3. Integrated approach to biosecurity
- 3.3.1. Stakeholder analysis
- 3.3.2. Biodiversity linkage
- 3.3.3. Risk Analysis
- 3.3.4. Primary drivers for change

Unit IV Access and Benefit Sharing

4.1. Definition and importance

4.2. Use of genetic resources
- 4.2.1. Bioprospecting (definition, benefits and disadvantages)
- 4.2.2. Genetically Modified Organism (history, scope, future prospect and ethicality)

4.3. Use of traditional knowledge

4.4. Stakeholders

4.5. Key agreements
- 4.5.1. Prior informed consent (PIC)
- 4.5.2. Mutually agreed terms (MAT)

4.6. Rights & responsibilities
- 4.6.1. Patents, trademark, and copyright

4.7. Legal Framework for Access and Benefit Sharing
- 4.7.1. Intellectual property rights (World Intellectual Property Organization)
- 4.7.2. The Bonn Guidelines
- 4.7.3. The Nagoya Protocol
- 4.7.4. National implementation (Bhutan)

4.8. Key Opportunities

4.9. Key Challenges

Unit V: Policies and conventions on biodiversity and its management

5.1. Relevant Laws in Bhutan: Aims/agendas and significance on biodiversity conservation and management.
- 5.1.1. National Environmental Act, 2007
- 5.1.2. Biodiversity Act, 2003
- 5.1.3. Biosafety Bill of Bhutan, 2014

5.2. Relevant International biodiversity conventions; Overview, main purposes and significance on biodiversity conservation and management:
- 5.2.1. Convention on wetlands of international importance (Ramsar)
- 5.2.2. Convention on International trade in endangered species (CITES)
- 5.2.3. Convention on the conservation of migratory species of wild animals
- 5.2.4. International treaty on plant genetic resources for food and agriculture
- 5.2.5. Convention on biological diversity
- 5.2.6. World heritage convention
- 5.2.7. International plant protection convention
- 5.2.8. International whaling commission

List of practical work:

A block-week field visit will be organized to Wangdue Phodrang and Punakha, shared with other modules in this semester (Site visits to Lamperi National Botanical Park, community forest in Punakha, Phobjikha wetland area):

a. Study insitu and exsitu conservation of critical plant species.
b. Study the details of community forest management practices.
c. Study the details of wetland ecosystem diversity and wetland management methods.

Reading List:

Essential Reading

Gordh, G., & McKirdy, S. (Eds.). (2014). *The handbook of plant biosecurity: Principles and practices for the identification, containment and control of organisms that threaten agriculture and the environment globally*. London: Springer.

Lovejoy, T.E, Hannah, L, and Wilson, E.O. (eds.). (2019). *Biodiversity and climate change: Transforming the biosphere*. Yale University Press.

Shiva, V. (2021). *Biodiversity conservation: Whose resource? Whose knowledge?* New Delhi: Indian National Trust for Art & Cultural Heritage.

Shiva, V. (2016). *Biopiracy: The plunder of nature and knowledge*. New Delhi: Natraj Publishers.

United Nations Conference on Trade and Development (2014). *The Convention on biological diversity and the Nagoya Protocol: Intellectual property implications: A handbook on the interface between global access and benefit sharing rules and intellectual property.* New York: United Nations Publications (electronic copy).

Additional Reading

Ives, J. D and Messerli B. (1989). *The himalayan dilemma, reconciling development and conservation.* London, Tokyo, New York: Routledge.

Lhamo, N. (2011). *Health seeking behaviour related to sowa rigpa in Bhutan.* Thimphu: National Institute of Traditional Medicine.

National Environment Commission. (2016). *Bhutan state of the environment report 2016*. Thimphu: National Environment Commission.

Ohsawa, M. (1987). *Life zone ecology of the Bhutan Himalaya.* Japan: Chiba University.

Pradhan, R. (1999). *Rhododendrons of Bhutan*. Kathmandu: Quality printers Pvt. Ltd.

Tsering, D. (2002). *Public biodiversity policy analysis in Bhutan* (PhD Dissertation submitted to the Institute of Technology, Zurich.) Thailand: Keen Publishing.

Wildlife Conservation Division. (2010). *Analysis of the contributions of protected areas to the social and economic development of Bhutan - a case study in Bomdeling Wildlife Sanctuary*. Thimphu: Ministry of Agriculture.

Wildlife Conservation Division, (2010). *Analysis of the contributions of protected areas to the social and economic development of Bhutan - case study in Jigme Singye Wangchuck National Park*. Thimphu: Ministry of Agriculture.

Date: June 2021

Module Code and Title: **ENM203 Soil Conservation for Sustainable Agriculture**
Programme: BSc in Environmental Management
Credit: 12
Module Tutor: Tshewang Dorji (Coordinator), GP Sharma

General objective: This module provides students an overview of the basics of soil and the importance of soil conservation and management. Students will be oriented to the environmental challenges to agriculture, and sustainable agricultural approaches to enhancing crop production, protecting agricultural land, improving environmental quality, and maintaining the natural resource base upon which the agricultural economy depends.

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

1. Explain key concepts, principles and dimensions of sustainable agriculture.
2. Conduct different types of soil conservation techniques for sustainable agriculture.
3. Contrast sustainable agriculture with conventional agriculture in terms of economic and environmental impacts.
4. Identify the key challenges and potential of sustainable agriculture in Bhutan.
5. Evaluate the suitability of Sloping Agricultural Land Technology (SALT) techniques for sustainable land management in Bhutan.
6. Discuss the significance of agroforestry in organic farming in Bhutan.
7. Conduct field experiments to study the cropping techniques.
8. Describe the various problems related to soil degradation and remedial measures exist thereof.

Learning and teaching approach:

Type	Approach	Hours per week	Total credit hours
Contact	Lectures	3	75
	Discussions	1	
	Field practical work	1	
Independent study	Written assignments	1	45
	Reading and review of class materials	2	
Total			120

Assessment Approach:

A. Individual Written Report: 15%

Students will produce a written report (750-1000 words) on a topic from among a range including soil profile, soil pollution, crop rotation, genetic engineering, land degradation, conservation agriculture, agroforestry, food security, farm cooperatives and agribusiness. Students will review the related secondary literature and consult relevant local stakeholders (farmers, Ministry of Agriculture, policy makers, vegetable vendors) that may be involved.

4% Accuracy and completeness of the report
4% Synthesis of the information (includes critical review and the explanation of a key concept and principles from the module, and produce evidence-based arguments)
4% Analytical thinking (critical analysis on the issue, generates valuable alternatives or corrective measures to improve the existing practices)
3% Language and references

B. Field Practical Work: 15%

The students in groups of 3 will work in the RTC garden and produce a group report at the end of the semester. The students will undertake two specific tasks: soil analysis and field experiments. Students will prepare soil samples and conduct laboratory soil analysis with the help of National Soil Service Centre in Simtokha (NSSC). Students will interpret the result and discuss the significance of it. The students will also conduct field experiments to study some cropping techniques and compile a report which will capture the details of field experiments (including the field observation, results and discussion). The report is expected to be 750-1000 words in length.

4% Accuracy and precision of the field experiments conducted in the field (appropriate methods/process/techniques used for the experiment)
4% Accuracy and completeness of the report
4% Quality of analysis (includes an explanation of a key concept or process from the module, and generate proper results using graphs and charts)
3% Language and references

C. Block-week field-visit report:15%

In the block-week field visit, students in groups of 4 will conduct field observations, household interviews, and focus group discussions on 4 different subtopics as they see fit (responsibility with the individual group members), such as land management, animal husbandry, farm

irrigation, and agroforestry, organic farming, land use change and human wildlife conflict. The group will produce a block-week field-visit report (1000-1250 words), clearly identifying their individual contributions, to be marked in common and individually as follows:

Group assessment on common portions of the report (5%)

1% Organisation and structure (Introduction, methodology, discussion, and conclusion)
3% Quality of content across the Introduction (Clarity and focus, significance and proposition), Methodology (Accuracy/reliability - measurement instrument, collection, analyses, and context), Overall discussion (Interpretation and description, argument, and proposed perspectives)
1% Mechanics (language, correct use of figure and tables, citation and referencing)

Individual assessment on subtopics each individual was responsible for (10%)

3% Accuracy and completeness of the report
3% Validity and reliability of information
3% Quality of analysis (critics and insightful discussion on issues, relates key concepts, examples, theories, principles and process from the module, and generate evidence-based arguments)
1% Language and references

D. Midterm Examination: 15%

Students will take a written exam of 1.5-hr duration covering topics up to the mid-point of the semester. The exam will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

E. Semester-End Examination: 40%

Students will take a written exam of 2.5-hr duration encompassing all the subject matter covered in the semester. This assessment is comprehensive and summative in nature, and will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

Overview of assessment approaches and weighting

Areas of assignments	**Quantity**	**Weighting**
A. Individual written report	1	15%
B. Field Practical Work	1	15%
C. Block-week field-visit report	1	15%
D. Midterm Examination	1	15%
Total Continuous Assessment (CA)		**60%**
Semester-end Examination (SE)		**40%**

Pre-requisites: ENV101 Introduction to the Environment

Subject matter:

Unit l: Soil

1.1. Importance of soil
1.2. Different soil components
1.3. Soil characterization including soil texture and its importance (texture triangle)
1.4. Soil profiles and significance of each layer of soil
1.5. Horizons: physical, chemical and biological characteristics
1.6. Functions of soil including essential nutrients for plant growth
1.7. Cation exchange capacity
1.8. Phases in the formation of soil
1.9. Condition of soil degradation and/or pollution across the globe
1.10. Categories, causes and mechanisms of soil degradation - pollution, acidification, salinization, man-made hazards
1.11. Abatement of soil degradation by regulatory and physical measures
1.12. Soil conservation methods including bioengineering benefits
1.13. Soil treatment techniques, e.g., steaming

Unit II: Challenges to agriculture and adaptation strategies

2.1. Loss of agricultural land: poor agricultural practices, overgrazing, deforestation, commercialization and overexploitation of vegetation
2.2. Climate change challenges to agriculture: windstorms, erratic rainfall, pest and diseases
2.3. Water scarcity and inadequate irrigation
2.4. Increasing crop and livestock yields impediment
2.5. Global decline in domesticated plants and domestic animals
2.6. Labour shortage - negative impacts of rural to urban migration
2.7. Human-wildlife conflicts (main contributors to human-wildlife conflicts)
2.8. Case studies on successful and unsuccessful practices to adapt to the challenges
2.9. Conservation agriculture (Impetus, development, concept, techniques)
2.10. Climate-smart agriculture (concept, techniques and global status)
2.11. Sustainable agriculture knowledge and techniques
2.12. Challenges to sustainable agriculture (including societal and cultural practices/habits)

Unit III: Agroforestry for organic production

3.1. Definition and types of Agroforestry practices (Alley cropping, silvopasture, riparian buffers, wind breaks and forest farming)
3.2. Direct-use and indirect use values of Agroforestry
3.3. Sloping Agricultural Land Technology (SALT) in sustainable land management practices in Bhutan
3.4. Importance of SALT in organic farming in Bhutan
3.5. Case of SALT in farmland management in hilly areas of Philippines
3.6. Agroforestry development in Bhutan
3.7. Agroforestry case studies (successes and failures) from Bhutan, region, and the world
3.8. Key challenges of agroforestry systems

Unit IV: Soil improvement and amendments, biofertilizers

4.1. Organic manure / farmyard manure: biogas slurry, sewage and sludge
4.2. Cover crop (mulching)
4.3. Green manuring
4.4. Recycling of organic residues
4.5. Composting and its processes (three phases): heating phase, cooling phase, and maturing phase
4.6. Vermicomposting
4.7. Biofertilizers: Rhizobium, Azotbector, Azospirllum and Cyanobacteria
4.8. Mineral fertilizers: mineralization and immobilization processes
4.9. Biological intensive nutrient management

Unit V: Techniques of Sustainable Agriculture

5.1. Agronomy for resource conservation
    5.1.1. Social forestry and soil conservation
    5.1.2. Grassland management and soil conservation
    5.1.3. Horticulture development for soil conservation
5.2. Permaculture
    5.2.1. Definition, principles
    5.2.2. Importance and ecological benefits
    5.2.3. Trend
5.3. Integrated Pest Management, importance and intervention
5.4. Sustainable crop production and soil conservation
    5.4.1. Precision agriculture: concept and practice
    5.4.2. Soilless farming: vertical farming-hydroponics, aquaponics and aeroponics
    5.4.3. Crops substitutions while maintaining equivalent nutritional value
5.5. Climate-smart farming
    5.5.1. Role of institutions for CSA management

5.5.2. Resource conserving technologies
5.5.3. Crops Genetic Modification - promise, problems and policies
5.5.4. Food security - green banking, food distribution and trade

Unit VI: Social and economic sustainability of agriculture

6.1. Livelihood
6.2. Enhancing economic viability
6.3. Sustaining productivity
6.4. Maximizing benefits

List of practical work:

a. A block-week field visit to Punakha and Wangdue Phodrang shared with other modules in this semester: Students will make field observations, interact with farmers and conduct field surveys.
b. Ongoing weekly practical work in the RTC garden for soil analysis and field experiments: (1) Prepare soil samples and conduct laboratory soil analysis with the help of National Soil Service Centre in Simtokha (NSSC); (2) Conduct field experiments to study cropping techniques; (3) Demonstrate composting and vermicomposting techniques

Reading List:

Essential Reading

Weil, R. R., & Brady, C. N. (2017). *The nature and properties of soils* (17th ed). New Delhi, India: Pearson Education.

Miller, G.T., & Spoolman, S.E. (2018). *Environmental science* (16th ed). New Delhi, India: Cengage Learning.

Rose, C. W. (2004). *An introduction to the environmental physics of soil, water and watersheds*. Cambridge, UK: Cambridge University Press.

Wild, A. (2003). *Soils, land and food: Managing soils during the 21st century*. Cambridge, UK: Cambridge University Press.

Additional Reading

Acquaah, G. (2005). *Principles of crop production: Theory, techniques and technology*. Hoboken, NJ: Prentice Hall.

Begon, M., Townsend, C.R., & Harper, J. L. (2005). *Ecology: From individuals to ecosystems* (*4th ed.).* Hoboken, NJ: Willey Blackwell

Buck, L.E., Lassoie J.P., & Fernandes, E.C.M. (1999) *Agroforestry in sustainable agricultural systems.* New York, NY: CRC Press LLC.

Hanumantha Rao, C. H. (2006). *Agriculture, food security, poverty, and environment essays on post-reform India*. Oxford, UK: Oxford University Press.

International Institute of Rural Reconstruction (IIRR). (1990). *Agroforestry technology information kit* (ATIK). Los Banos, Philippines: Cavite Publisher.

National Environment Commission. (2016). *Bhutan State of the Environment Report 2016*. Thimphu, Bhutan: NEC.

Neuhoff, D., Tashi, S., Rahmann, G., & Denich, M. (2014). Organic agriculture in Bhutan: potential and challenges. *Organic Agriculture.* 4, 209-221.DOI: 10.1007/s13165-014-0075-1

Norris, R. F., Caswell-Chen E. P., & Kogan, M. (2002). *Concepts in integrated pest management*. Hoboken, NJ: Prentice Hall.

Wild, A. (1993). *Soils and the environment.* London, UK: Cambridge University Press.

Date: March 2025

Module Code and Title: **BDC203 Introduction to Plant Taxonomy**
Programme: BSc in Environmental Management
Credit: 12
Module Tutor: Kinley Dorji (Coordinator), Tshewang Dorji

General objective: This module presents the current principles of taxonomy, which includes the importance of taxonomy and systematics, characteristics, different approaches to biological classification, and concepts of categories. It aims to provide necessary knowledge and skills of plant specimen collection, identification and documentation for ecological studies.

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

1. Define plant taxonomy and systematics
2. Explain the importance of plant taxonomy
3. Discuss the evolution of taxonomic system of classification
4. Describe different taxonomic system/structure of classification
5. Identify plants based on its taxonomic description
6. Explain the principles of taxonomic nomenclature
7. Appraise the economic use of some common plant species in Bhutan
8. Prepare herbarium for ecological studies
9. Describe some of the common plant species of Bhutan.

Learning and teaching approach:

Type	Approach	Hours per week	Total credit hours
Contact	Lectures	3	75
	Discussions	1	
	Field practical work	1	
Independent study	Written assignments	1	45
	Reading and review of class materials	2	
Total			120

Assessment Approach:

A. Practical assessment (individual): 10%

i. Study the modifications of leaf (5%)

The students will be taken around the RTC campus and made to collect specimens of some common plant species and do the following activities to study the differences between spines and stem spines, tendrils and stem tendrils, and learn the significance attributed to insectivorous habit.

✓ Identify the plant to species level

✓ Observe the external morphology of each specimen.

✓ Draw diagrams to bring out the differences in each modification

1% Correct identification

3% Mophological diagram

1% Fucntions

ii. Study and identify different types of inflorescences (5%)

Student will be taken around the RTC campus and made to collect specimens of some common plant species and do the following activities:

✓ Collect inflorescences of locally available plants.

✓ Identify it.

✓ Characterise the inflorescences - racemose/cymose, raceme/cyme, and axillary/terminal.

✓ Draw labeled diagram of inflorescence – epigynous/perigynous/hypogynous.

1% Correct identification

3% Mophological diagram

1% Fucntions

B. Forum discussions via VLE: 10%

Discussion 1 (5%): topics related to types of taxonomic data and their efficacy in taxonomic hierarchy

Discussion 2 (5%): topics related to principles, characteristics and practices of plant nomenclature, botanical names and phylocode

The VLE forum discussions will be hosted over one day each, spread out over the semester. Students will be given readings on issues related to the upcoming discussion topic to be read, then reflected upon/discussed together in the VLE forum. Each student will have to participate with appropriate discussion points in the VLE forums in line to the flow of discussions therein. Students may make multiple posts as appropriate totalling to approximately 300-500 words for each discussion. The contributions will be cumulatively assessed once a particular discussion concludes.

3% Quality of analysis (originality, thoughtfulness of reflection, use of relevant and adequate support for all claims made, ties analysis to relevant module concepts)

2% Articulation, accuracy, and completeness

C. Block-week field-visit report: 15%

Prior to this field trip, students will be taught how to collect plant specimens, identify them, prepare them for the herbarium, and document them. During the field trip, individual students will collect six specimens of different plant species from different locations of Paro and Haa and prepare a herbarium. They will study the habitat and use(s) of the collected species to describe them and present their findings in class.

3% Adequacy of plant sample (six specimens)

5% Correct maintenance of Herbarium (pressing, drying, and mounting)

5% Correct description (Identification, nomenclature, taxonomic descriptions and uses)

2% Presentation (preparedness, delivery, content/organization, creativity)

D. Class Test: 10%

Students will take two written class tests: one before midterm and one after the midterm (5% each) of 45-min duration covering 3-5 weeks of material.

E. Midterm Examination: 15%

Students will take a written exam of 1.5-hr duration covering topics up to the mid-point of the semester. The exam will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

F. Semester-End Examination: 40%

Students will take a written exam of 2.5-hr duration encompassing all the subject matter covered in the semester. This assessment is comprehensive and summative in nature, and will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

Overview of assessment approaches and weighting

Areas of assignments	**Quantity**	**Weighting**
A. Practical assessment (individual)	2	10%
B. Forum discussions via VLE	2	10%
C. Class Test	2	10%
C. Block-week field-visit report	1	15%
D. Midterm Examination	1	15%
Total Continuous Assessment (CA)		**60%**
Semester-end Examination (SE)		**40%**

Pre-requisites: None

Subject matter:

Unit I: Introduction

1.1. Biological Classification: concept and levels
1.2. Taxonomy and Systematics
    1.2.1. Systematics and the Systematist
    1.2.2. Aims of Plant Systematics and Plant Taxonomy
1.3. Hierarchical Categories of Taxonomy
1.4. Basic Components of Taxonomy (Classification, Identification, Description, and Nomenclature)
1.5. Importance of Plant Taxonomy
1.6. Taxonomy in the Digital Age (e.g., AI-based plant ID apps, global databases like GBIF, biodiversity database Bhutan).

Unit II: History of Plant Taxonomy

2.1. Pre-Linnaean System
2.2. Pre-Darwinian System
2.3. Angiosperm Phylogeny Group (APG)
2.4. APG IV (current systems of classifications).
2.5. Briefly discuss Bhutanese contributions (e.g., local herbariums, traditional classification systems like "Menjong Sorig", Drunaghu" in the Bhutanese context)

Unit III: The Taxonomic System of Classification

3.1. Definition
3.2. Types of taxonomic system of classification (Artificial, Natural and Phyletic, Phenetic, and Cladistic Approach)
3.3. The Importance and Universality of Classification
3.4. Taxonomic Structure
    3.4.1. The Species, Subspecies, Variety, and Form
    3.4.2. The Genus, Family and Higher Categories
3.5. Phylogeny
    3.5.1. Definition, scope and application of phylogeny.
    3.5.2. Evidence for specific phylogeny
    3.5.3. Phylogenetics
    3.5.4. Phylogenetic tree
3.6. Type of Specimens: Holotype, Lectotype, Neotype, Epitypes, Syntypes, Paratypes, Isotypes, and Topotypes

Unit IV: Types of taxonomic data: Characteristics and their efficacy in taxonomic hierarchy

4.1. Morphology
4.2. Anatomy
4.3. Embryology
4.4. Palynology
4.5. Phytochemistry
4.6. Cytology and Cytogenetics
4.7. Molecular Biology
4.8. Genetics and Population Genetics
4.9. Reproductive Biology
4.10. Ecology

Unit V: Plant descriptions and identification

5.1. Plant Parts (root, stem, leaf, inflorescence, placentation, and fruit)
5.2. Floral Formula and Floral Diagram
5.3. Characters often Considered before Plant Identification
5.4. Identification with Keys
5.5. Some Unconventional Identification Methods
5.6. Artificial Keys for the Identification of some common Families of Angiosperm

5.7. Some selected families of Dicotyledons and monocotyledons from Bhutan: their identifying characteristics, significance, and distribution
    5.7.1 Cupressaceae, Moraceae, Quercaceae, Pinaceae, and Bombacaceae
    5.7.2 Musaceae, Orchidaceae, Amaryllidaceae, Liliaceae, Gramineae

5.8. Plant Identification including field-based smartphone tools (e.g., iNaturalist, PlantNet) alongside traditional keys. Field equipment - Add smartphone macro lenses for high-resolution plant imaging.

Unit VI: Plant Nomenclature, Botanical Names and Phylocode

6.1. Fundamentals of Plant Nomenclature
    6.1.1. Common Names, Scientific Names, and Binomial Nomenclature
    6.1.2. International Code of Botanical Nomenclature (ICBN)
    6.1.3. Some Important Rules of Nomenclature

6.2. Botanical Names: Common Prefixes and Suffixes used in Specific Epithets

6.3. Phylocode: A New System of Nomenclature
    6.3.1. Principles of the Phylocode
    6.3.2. Registration Database of Phylocode
    6.3.3. History and future of Phylocode

Unit VII: Economic Botany

7.1. Medicinal plants of Bhutan: prevalence, use and significance (economic and social).
7.2. Plant based psychoactive drugs: significance in medical field
7.3. Grains and forage grasses: Use in agriculture, and its economic significance
7.4. Wood and non-wood forest products: economic significance.
7.5. Various plant species for production of fibers, dyes, inks and tannins: classification, origin and use.
7.6. Plant species used in cosmetics: identification, use and threats.

List of practical work:

a. Study the leaf modification and inflorescence of various plant species in RTC campus.
b. Students will participate in a block-week field visit to Paro and Haa, shared with other modules in this semester. During this field trip, students will observe various plants in different agro-ecological zones, and collect specimins for documentation using photograph and herbarium preparation for the study of taxonomic classification.
c. Herbarium preparation techniques and practice: pressing, drying, mounting, and labelling.
d. Field equipment and its usage: Plant press, knife, cutter/secateurs, digger, altimeter/(GPS), old newspapers/blotters, corrugated sheets, straps/string cords, polythene bags, tags, marker/pen/pencil, and herbarium bag.

Reading List:

Essential Reading

Angiosperm Phylogeny Group (1998). An ordinal classification for the families of flowering plants. *Annals of Missouri Botanical Garden,* 85, pp. 531-553.

Angiosperm Phylogeny Group II. (2003). An update of the angiosperm phylogeny group classification for the orders and families of flowering plants. *Botanical Journal of the Linnean Society,* 141, pp. 399-436.

Angiosperm Phylogeny Group III. (2009). An update of the angiosperm phylogeny group classification for the orders and families of flowering plants: APG III. *Botanical Journal of the Linnean Society,* 161, pp. 105-121.

Angiosperm Phylogeny Group IV. (2016). An update of the angiosperm phylogeny group classification for the orders and families of flowering plants: APG IV. *Botanical Journal of the Linnean Society,* 181, pp. 1-20.

Byng, J.W., Chase, M.W., Christenhusz, M.J.M., Fay, M.F., Judd, W.S., Mabberley, D.J., Sennikov, A.N., Soltis, D.E., Soltis, P.S., & Stevens, P.F. (2016). An update of the angiosperm phylogeny group classification for the orders and families of flowering plants: APG IV. *Botanical Journal of the Linnean Society,* 181, pp. 1-20.

Grierson, A. J. C., Schafer-Verwimp, A., Long, D. G., Noltie, H. J., Pearce, N. R., & Cribb, P. J. (2002). *Flora of Bhutan* (9 volume set). Edinburgh: Royal Botanical Gardens of Edinburgh.

Kochhar, S.L. (2016) *Economic botany: A comprehensive study* (5th ed.).Cambridge, UK: Cambridge University Press.

Lawrence, A., & Hawthorne, W. (2008). *Plant identification: Creating user-friendly field guides for biodiversity management.* Abingdon: Routledge and CPC Press.

Simpson, M. G. (2006). *Plant systematics.* Amsterdam: Elsevier Academic Press.

Stuessy, T. F. (2009). *Plant taxonomy.* New York: Columbia University Press.

Additional Reading

Besse, P. (Ed). (2014). *Molecular plant taxonomy: Methods and protocols*. New Jersey: Humana Press.

Davis, P. H., & Cullen, J. (1989). *The identification of flowering plant families: Including a key to those cultivated in north temperate regions* (3rd ed.). Cambridge: Cambridge University Press.

Krug, I. (2008). *Guidelines for identification and collection of medicinal plants in Bhutan*. Thimphu: Ministry of Agriculture and Forest.

Namgyel, T., &Tenzin, K. (2009). *A photo guide to flowers of Bhutan*. Thimphu: WWF Bhutan.

Pandey, B. P. (2001). *Plant anatomy*. New Delhi: S Chand & Co.

Sharma, O. P. (2009). *Plant taxonomy* (2nd ed.). New Delhi: Tata McGraw-Hill Education Private Limited.

Singh, G. (2018). *Plant systematics: Theory and practice* (3rd ed.). India: CBS Publishers & Distributors Pvt Ltd.

Swain, T. (Ed.). (2012). *Chemical plant taxonomy*. Cambridge: Academic Press

Bhutan Biodiversity Portal for constant update about the floral and faunal biodiversity of Bhutan. https://biodiversity.bt/

Date: March 2025

Module Code and Title:	**GIS201 Fundamentals of Geographic Information Sciences**
Programme:	BSc in Environmental Management
Credit:	12
Module Tutor(s):	Samir Patel (Coordinator), Kinley Dorji, Jamyang Pelmo, Tshewang Dorji

General objective: 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.

Learning Outcomes – On completion of the module, students will be able to:

1. 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.
2. Describe and explain the historical development of GIST and how GIST helps to solve problems of a spatial context.
3. Discuss the use of web mapping tools to study and develop possible solutions to real world problems.
4. Generate maps applying fundamental map design principles using geospatial software.
5. Read and interpret maps.
6. Describe the fundamental concepts and applications of remote sensing and Global Positioning Systems (GPS).
7. Create and acquire spatial data using GPS.

Learning and Teaching Approach:

Type	Approach	Hours per week	Total credit hours
Contact	Lectures	3	75
	Computer lab and field practical work	2	
Independent study	Assignments and projects	1	45
	Reading and review of class materials	2	
Total			120

Assessment Approach:

A. Class Tests: 15%

Students will undertake 3 theory-based class tests covering three to four weeks of teaching. Two will be conducted before midterm and two after midterm. The written tests will be conducted with maximum 40 marks within the class for a duration of 50 minutes.

B. Individual Presentation: 10%

Students will individually be assigned a different existing web GIS to interpret. Each student must explore the GIS in-depth, note its implementation and how effectively it applies the GIS concepts discussed throughout the module. The student must then: Record and submit a simple video demonstrating the use of the GIS highlighting its purpose, usage, and for each map shown in the GIS: the layers / base maps / features / attributes etc. Explain and evaluate GIS mapping concepts implemented by the GIS and any map design principles. An effective video should be 10-15 minutes long, but may go up a maximum of 20 minutes if necessary.

3% Exploring the GIS and its purpose
4% Discussing and evaluating the cartography / data display
4% Showcasing, explaining, and evaluating GIS concepts

C. Block-week field-visit report: 20%

Students will be taken for a block week field trip to Wangdue Phodrang and Punakha. Since the students will be assigned different tasks from other modules too, they will be asked to incorporate their knowledge of GPS use in the tasks assigned. Students will navigate with a GPS unit, collect data within a GPS unit, import GPS data into the GIS software, enter data into a database and make maps of field data.

Before the block week, the tutor will explain GPS usage. Students will individually collect data (geo coordinates of the locations and the waypoints) using the provided GPS. Students will be, as taught, asked to generate a basic map using these data. The output, a report of 500 words, will be assessed out of 20% based on the following rubric.

5% Completeness
5% Map element
5% Visual presentation
5% Report (introduction, methods, results and discussion)

D. Group project: 15%

A group of four will work together to select GIS data to make one large-scale and one small-scale map. For the large-scale map, this must include original GPS and/or digitized map data. Each of GIS must have at least three data layers (any combination of vector features and rasters) which effectively communicate themes such as land use, pollution, settlement patterns, population distribution, biodiversity distribution, hazards, water management. The project should include:

- Own GPS and/or digitized map data in at least one of the GIS's.
- Own attributes for at least one feature class in one of GIS's.
- Joined non-location table data to a feature class that has location information (like geocoding) for at least one of GIS's.

The two maps must be exported as high-quality images submitted along with the folders containing the map files (*.mxd) and all the data layers used. Students must present the GIS (in a report of 500 words accompanied by a live presentation) demonstrating the different GIS

layers for each of the large-scale and small-scale GIS. Explain its purpose, layers, base maps, features, attributes etc. Explain the GIS mapping concepts implemented by the GIS and any map design principles applied to make effective maps.

4% Final exported maps (effective cartographic representation)
5% GIS construction (organization of layers, thematic cohesiveness)
6% Report (introduction, methods, results and discussion)

E. Semester-End Examination: 40%

Students will take a written exam of 2.5-hr duration encompassing all the subject matter covered in the semester. This assessment is comprehensive and summative in nature, and will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

Overview of assessment approaches and weighting

Areas of assignments	**Quantity**	**Weighting**
A. Class Tests	3	15%
B. Individual Presentation	1	10%
C. Block-week field-visit report	1	20%
D. Group project	1	15%
Total Continuous Assessment (CA)		**60%**
Semester-end Examination (SE)		**40%**

Pre-requisites: None

Subject Matter:

Unit I: Introduction to GIS concepts

1.1. Defining GIS
1.2. History, data, and ethics
1.3. Hardware and software
1.4. Applications: social, physical, civil, behavioural, environment, and research
1.5. Importance of maps for communication and decision making
1.6. Scientific method as applied to spatial analysis

Unit II: Fundamentals of Maps and Cartography

2.1. Cartographic elements: colour, scale, layout, symbols
2.2. Data types (Raster and vector data)
2.3. Map design and interpretation
2.4. Geographic grid, directions, and distance
2.5. Coordinate systems
2.6. Map projection
2.7. Map types
2.8. Resolution
2.9. Classification
2.10. Applications
2.11. Output and presentation
2.12. Geodesy

Unit III: Survey of mapping and data acquisition technologies

3.1. Current Internet-based mapping applications
3.2. Global Positioning Systems (GPS)
3.3. Remote sensing (including sensors, electromagnetic radiation, and remote sensing techniques)
3.4. Geographic Information Systems (GIS)

Unit IV: Data collection, processing, and analysis

4.1. Aerial imagery interpretation
4.2. GPS technology and field application

4.3. Remote sensing and digital image analysis
4.4. Collection, creation, and analysis of spatial data in a GIS
4.5. Basic cartography and display of data
4.6. Basic statistical analysis related to spatial data
4.7. Tabular recording of field-generated data
4.8. Display tools for numeric data (quantitative map types: choropleth, proportional/graduated symbol, dot density)
4.9. Concepts of Geoprocessing, geocoding, and modelling
4.10. Uncertainty and topology
4.11. Raster data models, vector data models, and digital elevation models
4.12. Geospatial versus non-geospatial data collection, processing, and analysis

Unit V: Geospatial technology: professionalism, society, and trends

5.1. Virtual and augmented reality
5.2. Professions that use geospatial technologies
5.3. Ethics and Geospatial Data Privacy
5.4. 3D geovisualization
5.5. Mobile GIS and Location-Based Services
5.6. Cloud-based GIS and Web GIS
5.7. Big Data and Social Media

List of Practical Work:

a. Exploring existing web GIS apps
b. Basics of using GIS software: managing map/project files and underlying GIS data files (shapefile, geodatabase)
c. Generating basic GIS data through digitizing on top of geoimagery to point, line, and polygon vector features
d. Adding attributes to vector data features
e. Use of handheld GPS units and mobile smartphone GPS apps to capture GPS coordinates and tracks
f. Importing GPS data into a GIS
g. Field collection of location data and non-location attributes
h. Obtaining and importing publicly available GIS data
i. Generating quantitative map displays: choropleth, proportional/graduated symbol, dot density maps
j. Adding map elements to a layout in GIS software and exporting a map
k. Basic geoprocessing: clipping and buffering
l. Basic geocoding of named location data to geolocated features

Reading List:

Essential Reading

Campbell, J. B. & Wynne, R. H. (2011) *Introduction to remote sensing* (5th ed.). New York, NY: Guilford Press.

Chang, K. (2019). *Introduction to Geographic Information Systems* (9th ed.). New York, NY: McGraw-Hill Higher Education.

Additional Reading

A Gentle Introduction to GIS, https://docs.qgis.org/testing/en/docs/gentle_gis_introduction/

DiBiase, D. (continually updated). *Nature of Geographic Information*. Penn State: https://www.e-education.psu.edu/natureofgeoinfo/

GeoTech Teaching Resources, http://www.geotechcenter.org

Kurland, K. S. & Gorr, W. L. (2016). *GIS Tutorial 1: Basic Workbook* (10.3 ed.). Redlands, CA: Esri Press.

Law, M., & Collins, A. (2018). *Getting to Know ArcGIS Desktop* (5th ed.). Redlands, CA: Esri Press.

LearnGIS. (n.d.). LearnGIS Textbook. https://learngis.org/textbook/introduction-gis-table-contents

Scally, R. (2006). *GIS for environmental management.* Redlands, CA: Esri Press.

Schmandt, M. (continually updated). *GIS Commons: An introductory textbook on Geographic Information Systems*: http://giscommons.org

Semerjian, C., & 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

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.pdfESRI ArcNews, http://www.esri.com/news/arcnews/index.html

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: March 2025

Module Code and Title: **CET101 Introductory Microeconomics**
Programme: BA in Development Economics (borrowed)
Credit Value: 12
Module Tutor: Sanjeev Mehta

General objective: This module is designed to expose students to principles of microeconomic theory. The emphasis will be on helping them to 'think like economists'. This module will introduce undergraduate students to the principles of economic thinking, basic concepts of microeconomics and how rational choices/decisions are made by different economic agents.

Learning outcomes – On completion of this module, learners should be able to:

1. Identify underlying assumptions of economic models.
2. Explain the importance of standard assumptions in the microeconomic models.
3. Find solutions to basic microeconomic problems using graphical approaches.
4. Analyse the role of market mechanisms.
5. Explain the consequences of government interference in price mechanisms.
6. Explain consumer responses to particular stimuli using indifference curve analysis.
7. Determine the behaviour of firms under different market structures.

Learning and Teaching Approach: This module will be taught by means of lectures, tutorials, workshops and self-directed study. Lectures will aim at explanation of various concepts and theories. Lectures will be complemented by tutorials for self-exploration and problem solving in smaller groups. In a series of workshops, students will be divided into smaller groups of 5-6 to work on problem statements to collectively find solutions.

Approach	Hours per week	Total credit hours
Lectures	3	45
Tutorials and workshops	1	15
Independent study	4	60
Total		120

Assessment Approach:

A. Individual Assignment: 20%

Evaluate basic assumptions (both explicit and implicit) related to human choices, and explain deviations from rational behaviour. The assignment should have a maximum limit of 300 words.

4% Identify key assumptions
6% Logical analysis of their relevance
6% Explain deviation from the rationalist behaviour
2% Language
2% Academic structure of assignment

B. Class Tests: 20%

Four small written tests will be conducted (worth 5% each) that will comprise 30 min duration and cover 2-3 weeks of material. The tests will have a maximum of 5 questions (covering conceptual understanding, and problem-solving elements).

C. Classroom experiment: 10%

In groups of 4, students will complete a task based on optimising decisions made by households/firms.

1% Identification of data needed
3% Analytical Methods
2% Identification of assumptions
4% Result analysis

D. Midterm Examination: 5%

Students will take a written exam of 1.5-hr duration covering topics up to the mid-point of the semester.

Areas of assignments	Quantity	Weighting
A. Individual Assignment	1	20%
B. Class Tests	4	20%
C. Classroom experiment	1	10%
D. Midterm Examination	1	15%
Total Continuous Assessment (CA)		**65%**
Semester-End Examination (SE)		**35%**

Pre-requisites: None

Subject matter:

Focus should only be towards graphical approaches/simple mathematical approaches for solution generation, avoiding the use of calculus.

Unit I: Exploring the core subject matter of Economics

1.1. The scope and method of economics; scarcity and choice
1.2. Questions of what, how and for whom to produce
1.3. The basic competitive model; prices, property rights and profits
1.4. Incentives and information
1.5. Rationing; opportunity sets; economic systems
1.6. Reading and working with graphs
1.7. Supply and Demand
1.8. How Markets Work, Markets and Welfare
1.9. Individual demand and supply schedules and the derivation of market demand and supply
1.10. Shifts in demand and supply curves; role prices in resource allocation
1.11. Concept of elasticity- price, income, cross and elasticity of substitution and their applications; consumer and producer surplus; taxes and their efficiency costs

Unit II: Household decisions

2.1. Preferences and their representation with indifference curves
2.2. Budget constraint
2.3. Consumer's optimum choice
2.4. Income and substitution effects using Hicks and Slutsky approaches
2.5. labour supply and savings decisions

Unit III: Behaviour of Firms

3.1. Cost and Revenue Concepts
3.2. Perfect Market Structure
3.3. Behaviour of profit maximizing firms and the production process (use only graphical approach for solution).
3.4. Short-run costs and output decisions

3.5. Costs and output in the long run

Unit IV: Imperfect Market Structure

4.1. Monopoly and anti-trust policy; discriminating monopoly

4.2. Government policies towards competition

4.3. Imperfect competition: monopolistic competition, oligopoly and duopoly;(discuss only the main features of these market)

Unit V: Market for Inputs

5.1. Labour and land markets

5.2. Concept of derived demand

5.3. Input productivity and marginal revenue product and input demand curves

5.4. Competitive input markets and public policy

Reading List:

Essential Reading

Case, K.E., & Fair, R.C. (2007). *Principles of economics* (12th ed.). New Delhi, India: Pearson Education.

Pindyck, R., Rubinfeld D., & Mehta. P. (2009). *Microeconomics* (7th ed). New Delhi, India: Pearson Education.

Additional Reading

Browning, E.J., & Zupan, M.A. (2011). *Microeconomics theory and applications*. Hoboken, NJ: John Wiley & Sons.

Mankiw, N.G. (2007). *Economics: Principles and applications*. Cengage Learning India Private Limited.

Stiglitz, J.E., & Walsh C.E. (2007). *Economics.* New York: W.W. Norton & Company, Inc.

Date: January, 2016

Module Code and Title: **BDC304 Forest Management**
Programme: BSc in Environmental Management
Credit: 12
Module Tutor(s): Kinley Dorji (Coordinator), Bikram Sharma, GP Sharma

General objective: This module introduces students to forest management planning and silviculture practices for sustainable development, with a primary emphasis on the theories and practices to achieve desired conservation objectives. The students will also learn about the history, principles, classification, status, and scope of forest management practices in Bhutan.

Learning Outcomes – On completion of the module, students will be able to:

1. Classify different kinds of forest resources.
2. Describe the characteristics of different forest types.
3. Discuss the history, principles, status, and scope of forest management.
4. Explain different silviculture practices to manage the forest resources.
5. Explain different strategies for forest regeneration – natural, artificial and assisted.
6. Appraise the method of forest resources potential assessment.
7. Explain key concepts about forest management practices.
8. Critically analyse guidelines of forest management planning in general and Bhutan in particular.
9. Critique an implemented Forest Management Plan.

Learning and teaching approach:

Type	Approach	Hours per week	Total credit hours
Contact	Lectures	3	60
	Discussions	1	
Independent study	Written assignments	2	60
	Reading and review of class materials	2	
Total			120

Assessment Approach:

A. In-class exercises: 10%

Students will undertake four in-class exercises either in small groups or individually. Students will be given the entire class period (50 min) in which to complete the exercises. Doing these activities in-class (rather than as overnight homework) will allow the tutor to provide immediate and meaningful feedback on the process and not just the final result. The marks of each exercise (each graded out of 20), will be averaged to compute the final mark for this assessment. These in-class activities should include (but are not limited to):

- Answering questions based on readings. These questions should guide students towards writing clear and accurate summaries and identifying main arguments as well as how these arguments have been supported.
- Discussing different case studies provided to the groups under the topics 1. Principles of forest management, 2. Steps of forest management planning, 3. Planning and managing guidelines, and 4. Laws and policies related to forest management. This exercise, with the immediate guidance from the tutor, should enable students to learn about techniques to identify, analyse, interpret and discuss different case studies.

2.5% Summary of main idea
2.5% Discussion questions
2.5% Delivery
2.5% Participation of all team members

B. Written assignment and presentation: 20%

Part A: Before giving this assessment, the tutor will teach the students how to do policy analysis in detail. The students will then, individually critically analyse and review any of the forest policies and regulations of Bhutan in about 750 – 1000 words. This will enable students to analyse/investigate systematically, the implementation and impact of existing forest policies. It will be conducted after the midterm exam.

2% Introduction of Problem (Thorough description of the problem – History, key terms, stakeholders and future prospect)

3% Policy Environment (Review of the current policy - with all the relevant legislative, judicial, and regulatory factors. Discuss the assumptions and effectiveness of the current policy with ambiguities, conflicts, problems, and contradictions)

3% Policy Recommendations (Three or more recommendations to the current policy are presented with cost-benefit analysis)

2% Strength of analysis (Assertions supported with verifiable support without bias in the analysis)

2% Organisation and flow

2% Mechanics (Language and referencing)

Part B: A short oral presentation of 3 minutes each will be done to the class to share their critical review. It will be assessed based on the following rubric:

2% Verbal skills (Enthusiasm and elocution)

2% Nonverbal skills (eye contact, body language and poise)

2% Content (Subject knowledge, organization and mechanics)

C. Block-week field-visit report: 15%

A week-long field visit to Haa and Paro will be undertaken this semester. In the field, they will visit various community forests and study the forest management plan of each. Each student from the group of six will study each aspect of 1. Forest resources, 2. Management plan, 3. Governance, 4. Community regulation, 5. Benefit flow and equity, 6. Strategic approaches to resources management for the future of the community forest and produce a comprehensive block-week field visit report (1250-1500) consisting of reports for individual aspects reported by individual students. The group report must also have an overall organisation and structure as given in the criteria. The reports must capture an adequate description of forest management plans and practices explaining the concepts and theories covered in the class.

Group assessment on common portions of the report (5%)

1% Organisation and structure (Introduction, methodology, discussion, and conclusion)

3% Quality of content across the Introduction (Clarity and focus, significance and proposition), Methodology (Accuracy/reliability - measurement instrument, collection, analyses, and context), Overall discussion (Interpretation and description, argument, and proposed perspectives)

1% Mechanics (language, correct use of figure and tables, citation and referencing)

Individual assessment on report portions related to individual areas visited (10%)

4% Syntheses of the information (well-supported argument for how their subject illustrates the concept or process taught in the class)

3% Analytical thinking (critically discuss the opportunities, limitations and best practices of forest resources management with the adequate logical background supports)

3% Mechanics (Language and vocabulary usage)

D. Midterm Examination: 15%

Students will take a written exam of 1.5-hr duration covering topics up to the mid-point of the semester. The exam will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

E. Semester-End Examination: 40%

Students will take a written exam of 2.5-hr duration encompassing all the subject matter covered in the semester. This assessment is comprehensive and summative in nature, and will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions. Students will be required to sit for a written midterm examination of 1.5 hr duration proving their theoretical grasp of the concepts, as well as their ability to apply the concepts using practical examples.

Overview of assessment approaches and weighting

Areas of assignment	Quantity	Weighting
A. In-class exercises	4	10%
B. Written assignment and presentation	1	20%
C. Block-week field-visit report	1	15%
D. Midterm Examination	1	15%
Total Continuous Assessment (CA)		**60%**
Semester-End Examination (SE)		**40%**

Pre-requisites: BDC202 Biodiversity Conservation and Management

Subject Matter:

Unit I: Brief overview of forest resources

1.1. Land use

1.2. Forest cover

1.2.1. Definition

1.2.2. Forest types (UNEP-WCMC and WWF system)

1.2.3. Classifications (age, regeneration, species composition, ownership and growing stock)

1.2.4. Change in forest cover globally and Bhutan

1.3. History, status and classification of forest types in Bhutan
1.4. Forest biomass, carbon stock and growing stock
1.5. Forest Resources Potential Assessment
    1.5.1. Identification of Potential Forest Production Area
    1.5.2. Delineation of Potential Forest Production Units
    1.5.3. Estimation of Growing Stock.
    1.5.4. Estimation of Growing Stock of some important species
    1.5.5. Cost Benefit Analysis

Unit II: Introduction to forest management

2.1. Define forest management
2.2. Objective, principles and scope of Forest Management
2.3. Forest management regime
    2.3.1. Nationalization of forest
    2.3.2. Establishment of protected area
    2.3.3. Social Forestry Programme
    2.3.4. Community forest
    2.3.5. Private forest
2.4. Management and administrative units

Unit III: General Silvicultural principles and practices

3.1. Soil and water Management Practices and Conservation Forestry
3.2. Defining silviculture/stand terms and processes important to tree growth
3.3. Identifying functional components of silvicultural systems
3.4. Principles of silviculture
3.5. Classification of silviculture System

Unit IV: Forest Management Planning

4.1. The forest management planning process
    4.1.1. The basic elements of planning
    4.1.2. Two time horizons of planning
    4.1.3. Legislation for management planning
    4.1.4. Balance between production, social and environmental objectives
    4.1.5. The participation of all interest groups in planning
4.2. Management structure and format of Forest management plan
    4.2.1. Discuss about management structure
    4.2.2. Goal and Objectives
    4.2.3. Management Proposals
    4.2.4. Records of Forest History
4.3. Guidelines for forest management planning
4.4. Harvest planning
    4.4.1. Strategic harvest planning
    4.4.2. Tactical harvest planning

Unit V: Forest policy context in Bhutan: Overview, main purposes and significance on forest management

5.1. Bhutan Forest Act 1969
5.2. National Forest Policy 1974 and revised in 2011
5.3. Notification for Wildlife Sanctuaries 1974
5.4. Nationalization of logging 1979
5.5. Master plan for forest development 1990
5.6. Forest and Nature Conservation Act 1995
5.7. Free Market Ban on export of logs 2000
5.8. Forest and Nature Conservation Rules 2003 and revised in 2006

Unit VI: Forest regeneration

6.1. Natural regeneration

6.1.1. From seed (clear felling, shelter wood, and selection system)

6.1.2. From coppice (seedling and stool coppice)

6.1.3. Assisting natural regeneration

6.2. Artificial regeneration

6.2.1. Species choice and patterns of mixture

6.2.2. Nursery Management

6.2.3. Seedling Production and Quality

6.2.4. Assisted natural regeneration of forests

List of practical work:

a. Students will be taken for a block week field trip to Haa and Paro. They will carry out several field activities from all the modules they study during the semester. All the module tutors teaching the class will escort the field trip.

Reading List:

Essential Reading

Bettinger, P., Boston, K., Siry, J. & Grebner, D. L. (2017). *Forest management and planning* (2nd ed.). Cambridge, UK: Academic Press.

Bravo-Oviedo, A., Pretzsch, H. & Río, M. D. (2018*). Dynamics, silviculture and management of mixed forests: Managing forest ecosystems,* Volume 31. Cham, Germany: Springer.

Food and Agriculture Organization of the United Nations (2005). *State of the world's forests.* Rome, Italy: Author.

Gadow, K. V., Pukkala, T. & Tome, M. (Eds.). (2000). *Sustainable forest management.* Dordrecht, Netherlands: Academic.

Ghosh, S.K & Singh, R (2015). *Social forestry and forest management book*. New Delhi, India: Global Vision.

Nema, S. (2016). *Forestry science: Fundamentals and terms*. New Delhi, India: New India.

Prakash, R. (2006). *Forest management*. New Delhi, India: Global Vision.

Social Forestry and Extension Division (2016). *Forestry field manual for Bhutan: Silviculture and other forestry operations.* Thimphu, Bhutan: Author.

Additional Reading

National Environment Commission. (2016). Bhutan state of the environment report 2016. Thimphu, Bhutan: Author.

Armitage, I. (1998). *Guidelines for the management of tropical forests: The production of wood*. Rome, Italy: Food and Agriculture Organization of the United Nations.

Alder, D. (1980). *Forest volume estimation and yield prediction, volume 2: Yield prediction.* Rome, Italy: Food and Agriculture Organization of the United Nations.

Food and Agriculture Organization of the United Nations. (2018). *Global forest resources assessment: Guidelines and specifications.* Rome, Italy: Food and Agriculture Organization of the United Nations.

Department of Forest and Park Services. (2021, March 2). *Publications and Guidelines*. Retrieved from http://www.dofps.gov.bt/?page_id=116

Mayers, J., Morrison, E., Rolington, L., Studd, K. & Turrall, S. (2013). *Improving governance of forest tenure: A practical guide. Governance of tenure technical guide no. 2.* Rome, Italy: International Institute for Environment and Development and Food and Agriculture of the United Nations.

Wangdi, T., Lhendup, P. & Wangdi, N. (2013). *An analysis of forestry policy, acts and rules of Bhutan to mainstream climate change adaptation.* Retrieved from http://www.asiapacificadapt.net/resource/analysis-forestry-policy-acts-and-rules-bhutan-mainstream-climate-change-adaptation

Date: June 2021

Module Code and Title: **ENM204 Watershed Management**
Programme: BSc in Environmental Management
Credit: 12
Module Tutor: Jamyang Pelmo (Coordinator), Tshewang Dorji

General objective: The objective of this module is to provide an overview of the watershed management and planning process. This module introduces students to various aspects of water resources development like watershed structure and function, issues like erosion and land use change and management. It aims to provide knowledge and develop necessary skills of watershed management planning focusing on methods and tools used to develop and implement sustainable management plans.

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

1. Explain the proponents of watershed hydrology.
2. Discuss the principles of watershed management.
3. Explain methods used for estimating soil lost to erosion.
4. Discuss impacts of land use pattern change in watershed function
5. Describe the significance of stakeholder collaboration in watershed management
6. Conduct stakeholder analysis for one watershed management project
7. Discuss some indigenous practices of water conservation in Bhutan
8. Describe the process of watershed management planning
9. Evaluate an implemented watershed management plan
10. Review some of the best practices in watershed management

Learning and teaching approach:

Type	Approach	Hours per week	Total credit hours
Contact	Lectures	3	75
	In class exercise and discussion	1	
	Field practical work	1	
Independent study	Written assignments	1	45
	Reading and review of class materials	2	
Total			120

Assessment Approach:

A. Reflective essays: 15%

Each student will complete two reflective articles (one before midterm and one post-midterm) of 500 – 750 words each, about topics of their choice covered in the class lectures. This assessment will enable students to critically reflect on a topic and discuss their response (interpretation, description and thinking) in light of gaining better understanding or insights. The reflection should assess the lessons covered in the class, contextualize it by critically analysing its importance in overall the topic (module), and respond by reflecting their experiences, opinions, interpretation and analysis of the lesson. One reflective essay will be assessed before midterm and one post-midterm. Each will be marked as follows and the two grades will be averaged:

4% Depth of reflection (Writing demonstrates an in-depth reflection on the selected topic, including supporting details and examples)

4% Required components (describe, feel, evaluate, analyse, conclude and action)

3% Quality of Information (related information, supporting details and/or examples)

2% Structure & Organization (clear, concise, coherent and well organized)

2% Mechanics

B. Evaluative report and presentation: 15%

Part A: Students in groups of five will evaluate a watershed management plan. Based on their knowledge of management planning, they will construct an assessment framework/evaluation template of an already implemented watershed management plan. The tutor will provide different watershed management plans to each group and ask them to evaluate the effectiveness, feasibility and sustainability of the process and various strategies adopted in

different components of the management plan. They will write an evaluation report of about 1000 – 1200 words:

2% Introduction to watershed management plan (technical features)

3% Evaluation methodology (explain the parameters used in framework and methods of evaluation)

3% Result and discussion

2% Mechanics (Language and referencing)

Part B: A short oral presentation of 15 minutes each will be done to the class:

1.5% Verbal skills (Enthusiasm and elocution)

1.5% Nonverbal skills (eye contact, body language and poise)

2% Content (Subject knowledge, organization and mechanics)

C. Block-week field-visit report: 15%

A full block-week field trip to Wangdue Phodrang and Punakha will be undertaken this semester. In the field, they will visit various watersheds and study the management of each. Each student from the group of five will conduct a study of each aspect of stakeholder collaboration - 1. Conduct stakeholder analysis, 2. Design structure for stakeholder participative roles, 3. Describe conflict resolution strategies, 4. Evaluate methods used in each phase of stakeholder collaboration, and 5. Cultural values surrounding watershed conservation and traditional/indigenous practices adopted - and produce a comprehensive block-week field visit report (1250-1500) consisting of reports for individual aspects reported by individual students. The group report must also have an overall organisation and structure as given in the criteria. The reports must capture an adequate description of stakeholder collaboration under watershed management planning explaining the concepts and theories covered in the class.

Group assessment on common portions of the report (5%)

1% Organisation and structure (Introduction, methodology, discussion, and conclusion)

3% Quality of content across the Introduction (Clarity and focus, significance and proposition), Methodology (Accuracy/reliability - measurement instrument, collection, analyses, and context), Overall discussion (Interpretation and description, argument, and proposed perspectives)

1% Mechanics (language, correct use of figure and tables, citation and referencing)

Individual assessment on report portions related to individual areas visited (10%)

4% Synthesis of the information (well-supported argument for how their subject illustrates the concept or process taught in the class)

3% Analytical thinking (critically discuss the issues, opportunities, limitations and best practices of stakeholder collaboration with the adequate logical background supports)

3% Mechanics (Language and vocabulary usage)

D. Midterm Examination: 15%

Students will take a written exam of 1.5-hr duration covering topics up to the mid-point of the semester. The exam will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

E. Semester-End Examination: 40%

Students will take a written exam of 2.5-hr duration encompassing all the subject matter covered in the semester. This assessment is comprehensive and summative in nature, and will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions. Students will be required to sit for a written midterm examination of 1.5 hr duration proving their theoretical grasp of the concepts, as well as their ability to apply the concepts using practical examples.

Overview of assessment approaches and weighting

Areas of assignment	Quantity	Weighting
A. Reflective essays	2	15%
B. Evaluative report and presentation	2	15%
C. Block-week field-visit report	1	15%
D. Midterm Examination	1	15%
Total Continuous Assessment (CA)		**60%**
Semester-End Examination (SE)		**40%**

Pre-requisites: ENM202 Water Resources Management

Subject matter:

Unit I: Watershed Hydrology

1.1. Concept of watershed

1.2. Underlying Principles and Processes:

- 1.2.1. Water Budget Components and Water Flow
- 1.2.2. Surface Flow
- 1.2.3. Flow Measurement and Analysis
- 1.2.4. Stream Classification and Water Quality
- 1.2.5. Water Quality and Impacts

1.3. Concept of watershed management and sustainability

1.4. Historical look at watershed management

Unit II: Soil Erosion Assessment

2.1. Introduction to soil erosion

2.2. Estimation of soil loss

- 2.2.1. Revised Universal Soil Loss Equation (RUSLE)
- 2.2.2. Rainfall-runoff erosivity
- 2.2.3. Soil erodibility
- 2.2.4. Slope Length and gradient
- 2.2.5. Vegetation/Crop Cover
- 2.2.6. Management/supporting practice
- 2.2.7. Physical Protection (engineering measures)

2.3. Soil erosion and loss of productivity

- 2.3.1. Topsoil Loss on Productivity
- 2.3.2. Soil Depth Reduction on Productivity

Unit III: Land Use and Its Role in Watershed Management

3.1. Characteristics of Watershed (size, shape, physiography, slope, climate, land use, vegetation, geology, soils, socio-economics characteristics, basic data on watersheds)

3.2. Land use types (wetland, grassland, vegetation, built-up area, and cropland)

3.3. Farming Practices (crop cultivation and use of forest resources such as fodder, timber)

3.4. Livestock grazing area and systems and areas (reforestation and afforestation)

3.5. Habitat preferences.

Unit IV: Stakeholder collaborations

4.1. Scope and significance of stakeholder collaboration

4.2. Stakeholder collaboration goals

4.3. Stakeholder analysis

- 4.3.1. Stakeholder identification (community, local leader etc.)
- 4.3.2. Investigating relationships between stakeholders
- 4.3.3. Establishing their attributes or characteristic (resources and skills)
- 4.3.4. Identify participation/involvement incentives
- 4.3.5. Identify outreach activities to build awareness and gain partners

4.4. Structure for stakeholder Participative Roles (inform, consult, collaborate/partner, and empower)
4.5. Conflict Resolution
4.6. Methods used in stakeholder collaboration
    4.6.1. Situation Assessment
    4.6.2. Surveys, interviews, and focus groups
    4.6.3. Participatory Rural Appraisal
    4.6.4. Stakeholder matrix, the onion map, the stakeholder salience model, the Force Field Analysis (FFA)
    4.6.5. Actor-linkage matrices and social network analysis
    4.6.6. Q-methodology (bottom-up approach) and Stakeholder Mapping (top-down approach
    4.6.7. Modern tools for watershed survey (multi-data, mapping, modelling)
4.7. Traditional and indigenous practices of water conservation

Unit V: Watershed Planning Process

5.1. Build Partnerships (Identifying driving forces, issues and relevant stakeholders, and collaboration with existing programs)
5.2. Characterize Your Watershed (Scoping, gathering data, identifying gaps, watershed modelling)
5.3. Finalize Goals and Identify Solutions (setting goal and objectives, setting Indicators and targets, identifying critical areas and selecting Management Strategies)
5.4. Design Implementation Program and Assemble and Watershed Plan (setting trajectories and schedules, developing monitoring strategies, creating an evaluation framework)
5.5. Implement the Watershed Plan (implementing management strategies, developing work plans, and conducting monitoring and outreach activities)
5.6. Measure Progress and Make Adjustments (reviewing and evaluating the progress, sharing results, and making adjustments)

Unit VI: Watershed Management Plan

6.1. Management Plan
    6.1.1. Size and selection
    6.1.2. Resource survey
    6.1.3. Community organization
    6.1.4. Land capability classification
    6.1.5. Watershed development plan
    6.1.6. Special problem area
    6.1.7. Integration of different approaches
    6.1.8. Governance
    6.1.9. Socio-economic impact
    6.1.10. Self Help and User Groups
    6.1.11. Watershed fund
6.2. Capacity building
6.3. Monitoring and Evaluation
6.4. Sustenance and follow up
6.5. Integration of social and natural resources management strategies
6.6. Project report

Unit VII: Watershed management in Bhutan

7.1. Law and guiding principles watershed Management
7.2. Examples of multifaceted collaborative watershed management and restoration in Bhutan
7.3. Sample watershed management plan
7.4. Case studies and best practices (such as Lingmethechu Watershed, Radhi Watershed and Yakpugang Watershed Management)

List of practical work:

a. A block-week field trip: A full block-week field trip (Wangdue Phodrang and Punakha) shared with other modules in this semester. The students will study the watershed management practices adopted in the study sites.

Reading List:

Essential Reading

Megdal, S. B., Eden, S., & Shamir, E. (Eds.). (2017). *Water governance, stakeholder engagement, and sustainable water resources management*. Basel, Switzerland: MDPI.

Das, M. M., & Saikia, M. D. (2012). *Watershed management*. New Delhi, India: PHI Public Private Limited.

Heathcote, I. W. (2009). *Integrated watershed management: Principles and practice* (2nd ed.). Hoboken, NJ: Wiley.

Mizunuma, M. (2014, June 28). *Satoyama: Japan's secret water garden* [Video file]. Retrieved from https://www.bbc.co.uk/programmes/b00792dg

Murthy, J.V.S. (2017). *Watershed management* (2nd ed.). New Delhi, India: New Age Publishers.

United States Environmental Protection Agency *(2008). Handbook for developing watershed plans to restore and protect our waters.* Washington, WA: *United States* Environmental Protection Agency.

Watershed Management Division, (2015). *Payment for ecosystem services framework for Bhutan* (SNV). Thimphu, Bhutan: Ministry of Agriculture and Forests.

Additional Reading

Dhyani, S.K., Sharda, V.N., & Juyal, G.P. (2007). *Training manual soil conservation and watershed management: Conservation forestry and watershed management, Volume III*. Dehradun, India: Central Soil & water Conservation research & Training Institute.

The International Network of Basin Organizations and the Global Water Partnership. (2005). *The handbook for integrated water resources management in basins.* Mölnlycke, Sweden: Elanders.

Mohan, S.C., Samra, J.S., Srivastava A.K., & Sharda, V.N. (2007). *Training manual soil conservation and watershed management: Soil, agronomy and socio-economic aspects, Volume I*. Dehradun, India: Central Soil & water Conservation research & Training Institute.

National Soil Services Centre. (2012). *Bhutan catalogue of soil and water conservation approaches and technologies: Best practices and guidelines from Bhutan for sustainable land management on steep to very steep slopes*. Thimphu, Bhutan: Kuensel.

National Environmental Commission. (2016). *National integrated water resources management*. Thimphu, Bhutan: Author.

Ugyen Wangchuck Institute for Conservation and Environmental research. (2018). *Climate change vulnerability assessment in Kurichu watershed: A case of Gangzur and Khengkhar*. Thimphu, Bhutan: Tshangpa Printing Press.

Watershed Management Division. (2018). *Integrated watershed management plan for Wangdigang- Dechugang, Zhemgang*. Thimphu, Bhutan: Ministry of Agriculture and Forests.

Watershed Management Division. (2015). *Project completion reporting for Blue Moon Funded Support to integrating payment for environmental services and REDD + in Bhutan*. Thimphu, Bhutan: Ministry of Agriculture and Forests.

Watershed Management Division. (2017). *Watershed management plan; Chamkhar chhu sub-basin*. Thimphu, Bhutan: Ministry of Agriculture and Forests.

Watershed Management Division, (2015), *Corruption risk assessment for REDD+ in Bhutan*. Thimphu, Bhutan: Department of Forests and Park services.

Date: June 2021

Module Code and Title: **ENM305 Ecotourism**
Programme: BSc in Environmental Management
Credit: 12
Module Tutor(s): Tshewang Dorji (Coordinator), Kinley Dorji

General objective: This module will introduce students to the concepts and principles of ecotourism, its role in the broader tourism sector, and its economic, socio-cultural and environmental impacts at different scales. The module will familiarize students with the general impacts of ecotourism and emerging trends and practices of ecotourism around the world. It also provides new insights into integrated ecotourism planning and development strategy which underscores efficient resources allocation, stakeholder participation and equitable benefit sharing. This module intends to prepare students to critically analyse and understand this whole gamut of ecotourism so that they can develop sustainable ecotourism ventures in Bhutan.

Learning Outcomes – On completion of the module, students will be able to:

1. Discuss the principles of ecotourism.
2. Discuss the impacts of ecotourism on the global economy and environment.
3. Evaluate the social impacts of global tourism/ecotourism, including acculturation, religious tolerance, and political awareness.
4. Evaluate the role of international initiatives, organizations and stakeholders in ecotourism.
5. Discuss the emerging trends of ecotourism practices in the region and in the world.
6. Outline the historical trajectory of ecotourism within Bhutan.
7. Explain the integrated systems model for ecotourism planning.
8. Identify resources, products, best management practices, and opportunities in the ecotourism sector.
9. Analyse different cultural and historical perspectives on ecotourism.
10. Discuss the typical range of ecotourism policies employed by various governments globally.
11. Explain the certification systems for ecotourism.
12. Discuss the basic framework of efficient resource allocation for ecotourism planning.

Learning and Teaching Approach:

Type	Approach	Hours per week	Total credit hours
Contact	Lectures	3	75
	Discussions	1	
	Field practical work	1	
Independent study	Written assignments	1	45
	Reading and review of class materials	2	
Total			120

Assessment Approach:

A. Individual Reflection Paper: 10%

Students will individually produce a reflection paper based on the assigned readings. Reading materials will include a wide range of themes such as sustainable ecotourism, socio-cultural impacts of tourism/ecotourism, historical development of ecotourism or some recent survey reports on ecotourism in Bhutan/or in the regions. Students will review the information and produce a critical reflection (750 words) on their readings.

4% Accuracy and completeness of the work
4% Critical analysis of the issue and insightful use of class lessons to explain the significance of the findings
2% Language, organization and referencing

B. Block-week field-visit report: 15%

Students, in groups of 4, will undertake case study on ecotourism. Students will visit the study site during the Block Week period, read relevant secondary literature and consult support agencies (i.e., tour operators, hotels, restaurants, and homestays) that may be involved. The group report should be of 1250-1500 words and contain a common overall structure along with

identified individual portions related to different cases or stakeholders from which data was collected.

Group assessment on common portions of the report (5%)

1% Organisation and structure (Introduction, methodology, discussion, and conclusion)
3% Quality of content across the Introduction (Clarity and focus, significance and proposition), Methodology (Accuracy/reliability - measurement instrument, collection, analyses, and context), Overall discussion (Interpretation and description, argument, and proposed perspectives)
1% Mechanics (language, correct use of figure and tables, citation and referencing)

Individual assessment on report portions related to individual areas visited (10%)

4% Synthesis of the information (well-supported argument for how their subject illustrates the concept or process taught in the class)
3% Analytical thinking (critically discuss the opportunities, limitations and ecotourism best practices with the adequate logical background supports)
3% Mechanics (Language and vocabulary usage)

C. Class Tests: 10%

Students will take two written class tests: one before midterm and one after the midterm (5% each) of 45-min duration covering 3-5 weeks of material.

D. Forum Discussion via VLE: 5%

Discussion 1 (5%): global ecotourism sector contemporary issues, benefits and challenges

Discussion 2 (5%): Bhutan ecotourism sector contemporary issues, benefits and challenges

The VLE forum discussions will be hosted over one day each, spread out over the semester. Students will be given readings on issues related to the upcoming discussion topic to be read, then reflected upon/discussed together in the VLE forum. Each student will have to participate with appropriate discussion points in the VLE forums in line to the flow of discussions therein. Students may make multiple posts as appropriate totalling to 300-500 words for each discussion. The contributions will be cumulately assessed once a particular discussion concludes.

3% Quality of analysis (originality, thoughtfulness of reflection, use of relevant and adequate support for all claims made, ties analysis to relevant module concepts)

2% Articulation, accuracy, and completeness

E. Midterm Examination: 15%

Students will take a written exam of 1.5-hr duration covering topics up to the mid-point of the semester. The exam will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

F. Semester-End Examination: 40%

Students will take a written exam of 2.5-hr duration encompassing all the subject matter covered in the semester. This assessment is comprehensive and summative in nature, and will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

Overview of assessment approaches and weighting

Areas of assignments	Quantity	Weighting
A. Individual Reflection Paper	1	10%
B. Block-week field-visit report	1	15%
C. Class tests	2	10%
D. Forum discussions via VLE	2	10%
E. Midterm Examination	1	15%
Total Continuous Assessment (CA)		**60%**
Semester-end Examination (SE)		**40%**

Prerequisites: None

Subject Matter:

Unit I: Introduction to ecotourism

1.1. Definition of tourism
1.2. Types of tourism (domestic tourism, inbound tourism and outbound tourism)
1.3. Ecotourism (definition, concepts and principles)
1.4. Related terms such as nature tourism, sustainable nature tourism, cultural heritage tourism, green/sustainable tourism
1.5. Historical development of ecotourism
1.6. Types of ecotourism (cultural, scientific, educational and adventure)
1.7. Ecotourism in the context of other tourism types
1.8. Existing scenario of ecotourism in Bhutan (role of government, non-governmental organizations, tourism operators and community people)

Unit II: Impacts of Ecotourism

2.1. Economic Impacts (employment and fiscal impacts)
2.2. Environmental Impacts (pollution, biodiversity, carrying capacities)
2.3. Socio-cultural impacts on locals
    2.3.1. Impact on population structure
    2.3.2. Transformation of types of occupation
    2.3.3. Transformation of values
    2.3.4. Influence on traditional way of life
    2.3.5. Modification of consumption patterns

Unit III: Emerging trends in ecotourism practices

3.1. Consumer Behavioural Trends
    3.1.1. Green travel
    3.1.2. Green accommodation
3.2. Eco-adventurer
3.3. Sustainable Tourism – dimensions of sustainability and benefits
3.4. Heritage Tourism – concept, UNESCO World Heritage Status
3.5. Responsible Tourism – concept, duties of a traveller
3.6. Wellness Tourism – yoga, meditation, Buddhism
3.7. Trekking, wildlife and bird tourism

Unit IV: Ecotourism Planning and Management

4.1. Ecotourism Management Plans and Frameworks
4.2. Integrated systems model for ecotourism planning
4.3. Resources system planning
    4.3.1. Natural resource inventories
    4.3.2. Cultural resource inventories
    4.3.3. Environmental impact assessments
    4.3.4. Biodiversity studies
4.4. Resource sustainability studies
4.5. Human system planning
    4.5.1. Needs assessments
    4.5.2. Social impact analysis
    4.5.3. Attitudinal surveys
    4.5.4. Economic impact assessments
    4.5.5. Market segmentation studies
4.6. Stakeholder involvement and management decision making
4.7. Ecotourism objectives
4.8. Ecotourism development considerations: Product/experience, Distribution, Price, Communications
4.9. Evaluation measures: Effectiveness, Efficiency, Equity

Unit V: Ecotourism development strategy and public relations

5.1. Public relations as a tool of ecotourism development strategy
5.2. Community participation, mobilization and group formation

5.3. Access to resources and benefit sharing
5.4. Support to nature conservation
5.5. Stakeholders collaboration
    5.5.1. Ecotourism organization network (international and national)
    5.5.2. Tourism Council of Bhutan
    5.5.3. Tour Operators
    5.5.4. National NGOs and local communities
    5.5.5. Concepts of certification systems (standards, assessment,certification, accreditation, recognition and acceptance)
    5.5.6. Information management
    5.5.7. National organizations – RSPN, TCB, ABTO, hotels, travel agents and tour operators
5.6. Case study (success and failure)

Unit VI: Regulations and Policy

6.1. Manila Declaration on World Tourism (1980), significance and objectives
6.2. International organizations and conventions
    6.2.1. International Ecotourism Society
    6.2.2. World Tourism Organization
    6.2.3. Linkages to Sustainable Development Goals
6.3. National tourism policies
    6.3.1. High value and low impact tourism policy in Bhutan
    6.3.2. Economic transformation of rural communities eg. Phojikha valley and Paro
    6.3.3. Tourism Rules and Regulations 2017
    6.3.4. Possible implications of 'Tourism Levy Act of Bhutan 2020'

List of practical work:

Students will participate in a block-week field visit to Paro and Haa, shared with other modules in this semester. During this field trip, students will carry out different activities under three distinct categories:

Pre-field work

a) Identify the key stakeholders and particular sites for the visit
b) Prepare data collecting instruments
c) Read all the relevant literatures

Field activities

a) Undertake interviews or surveys with ecotourism operators, community members, and tourists.
b) Prepare the outline of report
c) Data coding and screening

Post-field work

a) Data transcription and data analysis
b) Complete report writing/ prepare policy memo
c) Present the findings to the class

Reading List:

Essential Reading

Drumm, A., & Moore, A. (2002). *An introduction to ecotourism planning.* Virginia USA: Nature Conservancy.

Fennell, D.A. (2014). *Ecotourism (*4th ed.). New York: Routledge.

Gurung, D.B., & Seeland, K. (2008). Ecotourism in Bhutan: Extending its benefits to rural communities. *Annals of Tourism Research, 35*(2), 489-508.

Nature Recreation and Ecotourism Division (NRED) & Tourism Council of Bhutan (TCB). (2012). *Ecotourism Development in the Protected Areas Network of Bhutan*. Thimphu, Bhutan: Ministry of Agriculture and Forests.

Weaver, D.B. (Eds). (2001). *The encyclopaedia of ecotourism.* London, United Kingdom: CABI Publishing.

Additional Reading

Duffy, R. (2002). *A trip too far: Ecotourism, politics and exploitation*. London, United Kingdom: Earthscan Publications Ltd.

Gurung, D.B., & Seeland, K. (2011). Ecotourism benefits and livelihood improvement for sustainable development in the nature conservation areas of Bhutan. *Sustainable Development, 19*, 348-358.

Karst, H. (2016). "This is a holy place of Ama Jomo": buen vivir, indigenous voices and ecotourism in a protected area of Bhutan. *Journal of Sustainable Tourism*, 1-17.

Lickorish, L.J., & Jenkins, C.L. (1997). An Introduction to tourism. Butterworth

Royal Society for the Protection of Nature (RSPN). *Ecotourism Guideline for Phobjikha*. Thimphu, Bhutan.

Montes, J., & Kafley, B. (2019). Ecotourism discourses in Bhutan: contested perceptions and values. *Tourism Geographies*, DOI: 10.1080/14616688.2019.1618905.

Montes, J., Kafley, B., Subba, D., Dema, T., Dendup, T., & Selden, P. (2019). Ecotourism and social cohesion: Contrasting Phobjikha and Laya experiences. *Rig Tshoel, 2*(1), 23- 44.

Rinzin, C., Vermeulen, W., & Glasbergen, P. (2007). Ecotourism as a mechanism for sustainable development: the case of Bhutan. *Journal of Integrative Environmental Sciences, 4*(2), 109-125.

Wearing, S., & J. Neil. (1999). *Ecotourism: impacts, potentials, and possibilities*. Oxford: Butterworth-Heinemann.

World Tourism Organization. (2020). *Global code of ethics for tourism*. Set of principles from https://www.unwto.org/global-code-of-ethics-for-tourism.

Date: June 2021

Module Code and Title: **GIS302 Spatial Analysis in Geographic Information Sciences**
Programme: BSc in Environmental Management
Credit: 12
Module Tutor(s): Kinley Dorji (Coordinator), Jamyang Pelmo, Tshewang Dorji

General objective: This module allows students to develop practical skills for visualizing and analysing geospatial data. Students will acquire skills for applying a spatial analysis workflow to address geospatial problems.

Learning Outcomes – On completion of the module, students will be able to:

1. Gather and process GIS data.
2. Extract shape files for analysis.
3. Overlay shape files.
4. Perform proximal analysis.
5. Convert data from one form to another.
6. Interpolate GIS data and relate them to real world situations.
7. Apply the principles of geospatial analysis to an environmental management problem.
8. Present the results of a geospatial analysis using appropriate terminology and visualizations.

Learning and Teaching Approach:

Type	Approach	Hours per week	Total credit hours
Contact	Lectures	3	90
	Computer lab and field practical work	3	
Independent study	Assignments and projects	1	30
	Reading and review of class materials	1	
Total			120

Assessment Approach:

A. Practical tests: 30%

Students will undertake 2 practical based class tests covering 6-7 weeks of teaching. One will be conducted before the midterm, and the other will be after the midterm. The tests will be conducted in the computer lab for a duration of 2 h each.

B. Block-week field-visit report: 10%

Students will be taken for a block week field trip to Paro and Haa. Since the students will be assigned different tasks from other modules too, they will be asked to incorporate their knowledge of GPS usage in the tasks assigned. Students will learn to analyse different land use patterns in the places they visit and classify the forest types in different community forests they visit. The output will consist of a report 500-750 words in length and will be assessed based on the following rubric:

3% Completeness of the map
3% Analyses
2% Map elements and visual presentation
2% Report (methods, results and discussion)

C. Individual Project: 20%

Students will be asked to identify a problem related to a field of study under environmental studies and must be approved by the tutor. Based on the theme they have chosen, they will initiate a project using spatial analysis GIS tools to help solve the identified problem. They will produce a map(s) and a report of 750-1000 words hypothesizing a solution or recommendations to address the problem. Their report will contain a problem statement, objective(s) of their study, materials and methods, results and discussion. It will be conducted towards the end of the semester and assessed using following rubric:

5% Completeness of the map
5% Analyses
5% Map element and visual presentation
5% Report (methods, results and discussion)

D. Semester-End Examination: 40%

Students will take a written exam of 2-hr duration (20%) and a practical exam of 2.5-hr duration (20%) encompassing all the subject matter covered in the semester. This assessment is comprehensive and summative in nature. The written exam will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions. The practical exam will be conducted in the computer lab and require students to apply spatial analysis operations to analyse GIS data and generate GIS outputs.

Overview of assessment approaches and weighting

Areas of assignments	Quantity	Weighting
A. Practical tests	2	30%
B. Block-week field-visit report	1	10%
C. Individual Project	1	20%
Total Continuous Assessment (CA)		**60%**
Semester-end Examination (SE)		**40%**

Pre-requisites: GIS201 Fundamentals of Geographic Information Sciences

Subject Matter:

Unit I: Review of the basics of geospatial data

1.1. Data organization in appropriate formats: shapefile, geodatabase
1.2. Importance and role of coordinate system definition and projection between different coordinate systems
1.3. Differences between vector and raster data formats
1.4. Basic cartographic and data presentation techniques

Unit II: Introduction to geospatial analysis

2.1. Purpose and types of spatial analysis: locating; making measurements (size, shape, distribution); determining how places are related; finding the best locations and paths; detecting and quantifying patterns; making predictions

2.2. General process for the spatial analysis workflow: Asking questions, exploring & preparing data, analyzing and modelling, interpreting results, modifying analysis as necessary, presenting results, making decisions

2.3. Preparation of data sets for geospatial analysis

2.4. Preliminary check and characterization of quantitative data with descriptive statistics

Unit III: Queries and Joins

3.1. Basic structure of geodatabase SQL queries

3.2. Venn diagrams and Boolean operators in query construction

3.3. SQL queries for data filtering and feature selection by attribute

3.4. Spatial queries for data filtering and feature selection by location (proximity, containment, intersection)

3.5. Queries for identification of spatial patterns

3.6. Data selection by location with buffering

3.7. Joins and relates; one-to-one, one-to-many, many-to-one, many-to-many

Unit IV: Vector data analysis

4.1. Vector overlay analysis concepts: union, intersect and identity

4.2. Proximity analysis concepts: buffering points, lines and polygons

4.3. Most common geoprocessing tools and their usage: dissolve, buffer, clip, union, intersect, merge, append, erase

4.4. Use of overlay analysis to analyse multiple geospatial data sets together

4.5. Geospatial data model workflow to satisfy multiple location criteria

4.6. Basic concept of network analysis: determining routes and service areas

Unit V: Raster data analysis

5.1. Review of displaying rasters in GIS

5.2. Local raster operations, raster data reclassification, raster boolean analysis

5.3. Raster data map algebra, e.g., NDVI calculation

5.4. Topographic data analysis

- 5.4.1. Elevation data: slope, aspect and hillshade surfaces
- 5.4.2. Use of elevation and derived data sets for analysis of environmental issues
- 5.4.3. Viewshed analysis: technique and value in site selection analysis

5.5. Basic surface hydrological analysis

- 5.5.1. Stream generation using flow direction and accumulation surfaces
- 5.5.2. Watershed creation based on topographic data

Unit VI: GIS models and geoprocessing workflows

6.1. Purpose of modelling and role of GIS in modelling

6.2. Model types: descriptive vs. prescriptive, deterministic vs. stochastic, dynamic vs. static, deductive vs. inductive

6.3. Modelling process: selection, fitting, validation

6.4. Multi-step models using automation tools, e.g., Model Builder in ArcGIS

List of practical work:

a. Exploration of attribute and spatial data tables. Characterization of data using descriptive statistics.

b. Basic construction of SQL and spatial queries to select features and locations.

c. SQL and spatial queries with Boolean operators. Use of queries to identify spatial patterns.

d. Implementing one-to-one and one-to-many joins and relates of attributes and spatial data.

e. Geoprocessing using dissolve, buffer, clip, union, intersect, merge, append, erase.

f. Network analysis with vector data to determine routes and service areas.

g. Raster data reclassification exercises.

h. Map algebra for NDVI calculation.
i. Topographic data analysis of elevation data: slope, aspect, hillshade, viewshed.
j. Hydrological analysis: stream generation using flow direction and accumulation surfaces.
k. Hydrological analysis: Watershed creation based on topographic data.
l. Building multistep models and geoprocessing workflows.

Reading List:

Essential Reading

Chang, K. (2019). *Introduction to Geographic Information Systems* (9th ed.). New York, NY: McGraw-Hill Higher Education.

Law, M. & Collins, A. (2018). *Getting to Know ArcGIS Desktop* (5th ed.). Redlands, CA: Esri Press.

Mitchell, A. (2020). *The Esri guide to GIS analysis: Volume 1* (2nd ed.). Redlands, CA: Esri Press.

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 Reading

Bolstad, P. (2019). *GIS Fundamentals: A First Text on Geographic Information Systems* (6th ed.). Eider Press.

DiBiase, D. (continually updated). *Nature of Geographic Information.* Penn State: https://www.e-education.psu.edu/natureofgeoinfo/

Schmandt, M (continually updated). *GIS Commons: An Introductory Textbook on Geographic Information Systems*: http://giscommons.org

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

ESRI ArcNews. http://www.esri.com/news/arcnews/index.html

ESRI ArcUser. http://www.esri.com/news/arcuser/index.html

LearnGIS. (n.d.). LearnGIS Textbook. https://learngis.org/textbook/introduction-gis-table-contents

Kurland, K. S. and Gorr, W. L. (2016). *GIS Tutorial 1: Basic Workbook* (10.3 ed.). Redlands, CA: Esri Press.

Scally, R. (2006). *GIS for Environmental Management*. Redlands, CA: Esri Press.

Date: June 2021

Module Code and Title: **AEC201 Environmental Economics**
Programme: BA in Development Economics (borrowed)
Credit Value: 12
Module Tutor: Leishipem Khamrang (Coordinator), GP Sharma

General objective: This module focuses on economic causes of environmental problems. It examines the role of various economic institutions, economic incentives, other instruments and policies on environment. It aims to develop necessary skills for as the valuation of environmental quality, quantification of environmental damages and evaluation of environmental projects. Selected topics on international environmental problems are also discussed.

Learning outcomes – On completion of this module, learners should be able to:

1. Explain the nature of relationship between environment and economics.
2. Describe and analyse the market for environment.
3. Explain the factors leading to market failure.
4. Evaluate the environmental decisions made by economic agents.
5. Apply basic tools of environment accounting.
6. Describe and evaluate the regulatory framework for environmental issues.

7. Trace the policy response to various environmental issues.
8. Analyse the impact of risk and uncertainty on environmental decisions.
9. Identify the channels of impact on trade and environment.

Learning and Teaching Approach: This module will be taught by means of lectures, tutorials, group work, case studies and self-directed study. Lectures will aim at explanation of various concepts and theories. Focus will be placed on applying theories to the Bhutanese context and using relevant data. Lectures will be complemented by tutorials and guest lectures. Group work will involve students discussing and analysing particular issues and solving problems. Tutorials will also be used to facilitate problem solving.

Approach	Hours per week	Total credit hours
Lectures and case studies	3	45
Tutorials and group work	1	15
Independent study	4	60
Total		120

Assessment Approach:

A. Individual Assignment: 10%

Students will complete an essay based on library research covering topics related to environment markets. Each assignment should have a maximum limit of 750 words.

1% Adequacy of references used
1% Defining the concepts
2% Use of appropriate analytical tools
4% Analysis and findings
2% Conclusion

B. Group Work: 15%

In groups of 4 students will analyse data on locally relevant environment issues. The analysis will be presented as a 20 min presentation, with 5 min Q&A.

1% Situation analysis
2% Methodology of group work
6% Discussion on findings in the joint report
4% Peer review of individual reports
2% Presentation (individually marked)

C. Critical Essay: 20%

Students will complete individual essays on recent issues pertaining to market for environment services and products and assessment of environment programmes. Word limit: 750 words.

2% Logical flow of thoughts
8% Ability to comprehend relevant issues in the debate
4% Evidence based arguments
2% Language skills
2% Subtleness of conclusion
2% Structure of the Essay

D. Midterm Examination: 20%

Students will take a written exam of 1.5-hr duration covering topics up to the mid-point of the semester.

Overview of assessment approaches and weighting

Areas of assignments	Quantity	Weighting
A. Individual Assignment	1	10%
B. Group work and presentation	1	15%
C. Critical essay	1	20%
D. Midterm Examination	1	20%
Total Continuous Assessment (CA)		**65%**
Semester-End Examination (SE)		**35%**

Pre-requisites: None

Subject matter:

Unit I: Introduction

1.1. The Environment and Economics
1.2. Normative and Positive Economic Analysis, Basic Optimist Model
1.3. Changing perspectives on environment
1.4. Resource, environment and economic development

Unit II: Market for Environment

2.1. Social Choice for Environmental Protection
2.2. Efficiency and Markets; Market Failure
2.3. Public Goods, Public Bads and Externalities
2.4. Resource Allocation over the time
2.5. Valuing the Environment
2.6. Making Decisions about Environmental Programs
2.7. Demand for Environmental Goods
2.8. Hedonic Price Methods
2.9. Household Production and constructed Markets

Unit III: Ecological Economics and Environmental Accounting

3.1. Basic concepts of ecological economics
3.2. National income and Environment Accounting; Green accounting

Unit IV: Regulation

4.1. Regulating Pollution; Prices
4.2. Property rights
4.3. Spatial and Temporal Issues
4.4. Regulating Polluters with Unknown Costs
4.5. Audits, Enforcement and Moral Hazard
4.6. Voluntary Actions and Agreements

Unit V: Policy response

5.1. Global framework on sustainable development
5.2. Greening the economy
5.3. Climate change policy
5.4. Trade and environment

Unit VI: Advanced Topics

6.1. Risk and Uncertainty
6.2. International and Interregional Competition
6.3. Environment, Growth and Development

Reading List:

Essential Reading

Kolstad, C. (2010). *Intermediate environmental economics*. New Delhi, India: Oxford University Press.

Stavins, R. N. (Ed.). (2005). *Economics of the environment: Selected reading list*. New York, NY: W.W. Norton.

Additional Reading

Callan, S. J. & Thomas, J. M. (2010). *Environment economics and management: Theory, policy and applications*. Boston, MA: South-western Cengage Learning.

Harris, J. & Roach, B. (2014). *Environmental and natural resource economics: A contemporary approach.* London, UK: Routledge.

Perman, R., James, Y. M., McGilvray & Common, M. (2003). *Natural resource and environmental economics*. New York, NY: Pearson Education/Addison Wesley.

Date: January 15, 2016

Module Code and Title: **ENM306 Urban Environmental Management**
Programme: BSc in Environmental Management
Credit: 12
Module Tutor(s): Kinley Dorji (Coordinator) and Leishipem Khamrang

General objective: This module aims to teach the dynamics of urban development and environmental issues from the management and planning perspectives for inclusive and resilient cities. It focuses on the theories of urban planning, principles of green urban development, and analysis of existing urban policy and management studies, and integrates into a distinctive framework of issues and questions of urban development in different regions of the world to achieve sustainable development.

Learning Outcomes – On completion of the module, students will be able to:

1. Define Urbanization
2. Examine the underlying factors of urbanization.
3. Analyse the merits of urban development.
4. Describe urban climate and weather phenomenon in urban centres
5. Explain the environmental impacts of urban sprawl in regions worldwide and in Bhutan.
6. Discuss various components of urban planning.
7. Describe the concept of Green Cities.
8. Analyse the importance of Smart Growth for making cities liveable.
9. Discuss solid waste issues and management systems in urban centres.
10. Assess the opportunities and challenges of urbanization in mountain regions.
11. Review policies related to urban development of Bhutan.
12. Discuss the successes, failures, and challenges of urban environmental approaches in developing and developed countries.

Learning and teaching approach:

Type	Approach	Hours per week	Total credit hours
Contact	Lectures	3	60
	Discussions and class exercises	1	
Independent study	Written assignments	2	60
	Reading and review of class materials	2	
Total			120

Assessment Approach:

A. In-class discussion: 10%

During the semester students will be responsible for working with one or two partners to lead a class discussion. The discussion will be expected to last most of a class period or at least 40 minutes. The tutor may take the last ten minutes of class going over doubts, confusions or inaccuracies but will be a silent observer during the discussion. During the discussion students will be responsible for (1) summarizing the reading in their own words, including identifying and explaining key terms and concepts, (2) preparing discussion questions to stimulate class discussion (3) facilitating a clear and helpful discussion that will help them class as a whole to both understand the reading and engage more critically with its main arguments and ideas. Before the discussion, each pair will meet with the tutor to discuss the reading, clarify any doubts or questions they have about the reading. The discussions will surround topics such as, but not limited to, benefits of urban development on society, ecosystems, economics and ethics, urban sprawl and environment.

3% Pre-discussion meeting (preparedness)
3% Quality and accuracy of summary (focus should be on arguments)
2% Thoughtfulness and effectiveness of discussion questions
2% Quality and effectiveness of facilitation of discussion

B. Individual Written Assignment: 15%

Students will be (individually) asked to critically review four recently published journal articles on the challenges of urban development around the world – two from developing countries (Asia and African continent) and two from developed countries (America and Europe) or any of the reports from World Urban Forum - UN-Habitat. This activity will give clear perspectives on the current issues (socio-political, economic, technological and environmental) in the urban centres around the world. Furthermore, the comparative analysis of these issues in urban centres in the developing and developed world will give better understanding about the relationship between planning, management and sustainability. The written assignment will consist of 750 – 1000 words and will be submitted in two phases – draft and the final submission. The assignment will be assessed based on:

Part A: Draft: 5%

2% Content (originality, approach, result/discussion, scholarship)

1% Focus (relevance, organization, conclusion)

2% Language (style, mechanics)

Part B: Final submission: 10%

2% Depending on how many comments from the draft are incorporated for the final submission, the tutor can award them negative marking.

3% Synthesis of the information (includes an explanation of a key concept or process from the module, and well-supported argument for how their subject illustrates the concept or process taught in the class)

3% Analytical thinking (discuss the best practices of biodiversity conservation and propose remedial measures to reduce threats to different biodiversity, discuss different conservation techniques)

2% Mechanics (Language and referencing)

C. Practical work presentation 20%

In groups of five, students will choose any of the six different components of urban planning and infrastructural development in Thimphu City, 1. Local Economic Development, 2. Poverty and Social Inclusion, 3. Infrastructure development, 4. Environmental management, 5. Heritage Conservation, and 6. Municipal Finance and Capacities, and conduct an evaluative study to provide managerial perspectives of these development components. The students will visit their area of study once a week and make observations or conduct surveys, interviewing multiple stakeholders to identify issues, discuss the current projects aimed to address these issues and future plans, link stakeholder responsibilities, and evaluate opportunities and challenges of the development. Towards the end of the semester, students will present their outcome in detail in 20 minutes to the class. It will be assessed in group as well as individually using the following rubric:

Group assessment: 14%

2% Synthesis of the information
4% Analytical thinking (identifies issues, discusses the current projects aimed to address these issues and future plans, links the stakeholder responsibilities, and evaluates opportunities and challenges of the development.)
4% Quality of information (includes an explanation of a key concept or process from the module, and well-supported argument for how their subject illustrates the concept or process taught in the class)
2% Visual design and creativity
2% Discussion

Individual Assessment: 6%
2% Verbal skills (Enthusiasm and elocution)
2% Nonverbal skills (eye contact, body language and poise)
2% Content (Subject knowledge, organization and mechanics)

D. Midterm Examination: 15%

Students will take a written exam of 1.5-hr duration covering topics up to the mid-point of the semester. The exam will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

E. Semester-End Examination: 40%

Students will take a written exam of 2.5-hr duration encompassing all the subject matter covered in the semester. This assessment is comprehensive and summative in nature, and will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

Overview of assessment approaches and weighting

Areas of assignment	Quantity	Weighting
A. In-class discussions	2	10%
B. Individual Written assignment	1	15%
C. Practical work presentation	1	20%
D. Midterm Examination	1	15%
Total Continuous Assessment (CA)		**60%**
Semester-End Examination (SE)		**40%**

Pre-requisites: ENV102 Population, Development and Environment

Subject Matter:

Unit I: Introduction to Urban Development

1.1. Historical overview of urban growth and development
1.2. Concept of Urbanization
1.3. Characteristic and processes of urbanization
1.4. Rate of Urbanization
1.5. Benefits of urbanization
  1.5.1. Society
  1.5.2. Ecosystems
  1.5.3. Economy
  1.5.4. Ethics

Unit II: City/town as a system

2.1. Review of urban atmosphere and climate
  2.1.1. Historical trend, current climate, and global climate change.
  2.1.2. Pollution, acid deposition, Urban Heat Island (UHI), temperature inversion and air dispersal, air stability and plume behaviour, mitigation measures and adaptation.
2.2. Renewable energy in cities
  2.2.1. Negative impacts of rising energy use
  2.2.2. Energy efficiency and conservation
  2.2.3. Cities and renewable energy
  2.2.4. Priority areas for a transition
  2.2.5. City-level policies to promote renewables
2.3. Expanding cities
  2.3.1. Urban Growth (absolute and relative)
  2.3.2. Megacity, Hypercity and Supercities
  2.3.3. Cities of the world
  2.3.4. Migration and urbanization
2.4. Push and pull factor

Unit III: Environmental impacts of urban sprawl

3.1. Air (Indoor and outdoor pollution)
3.2. Water (quality and quantity)
3.3. Biodiversity

3.4. Waste
3.5. Transportation and traffic congestion
3.6. Sewage
3.7. Noise
3.8. Energy consumption and reduction
3.9. Cultural heritage
3.10. Human health

Unit IV: Urban Planning

4.1. Planning for infrastructure development
4.2. City planning city for defence and resilience
4.3. Industries and their management in urban areas
4.4. Compact neighbourhoods
4.5. Systematic Transport arrangement and enhancement; mass transits for liveable cities
4.6. Recreation facilities and aesthetics
4.7. Enhancement of Sewage treatment
4.8. Supportive zoning policies

Unit V: Urban challenges in the developing and developed world

5.1. Environmental threats (Loss of urban vegetation, Urban Heat Island, Climate change vulnerability, Deterioration of the quality of water, air, and soil)
5.2. Waste Production (solid waste, liquid waste and gaseous waste)
5.3. Resources (Economic development and resources consumption, Infrastructure development, Access to the common social infrastructure, Efficient Management of resources)
5.4. Inequality (Income inequality, Skill inequality, Social inequality)
5.5. Technology (Innovative urban governance, Spatial planning and design, Innovation for buildings, Efficient use of resources, Managing disasters)
5.6. Governance (Inadequate legal framework, Inefficient political, managerial and administrative processes, Poor local government respond)

Unit VI: Green urban development and smart growth of cities

6.1. Green cities
    6.1.1. Concepts
    6.1.2. 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.
    6.1.3. Benefits for urban dwellers
    6.1.4. Green certifications, e.g., LEED
6.2. Restoring urban ecological functions
    6.2.1. Redevelopment towards green cities
    6.2.2. Reintroduction of biodiversity, e.g., urban domestic gardens and parks
    6.2.3. Water and waste management restructuring

Unit VIII: Urbanization in mountains

7.1. Case study (on selected cities such as Kathmandu, Sri Nagar, Ladakh, Gangtok, Shimla, Aizawl, Kohima, Jammu Kashmir, Darjeeling, Thimphu)
7.2. Rate of urbanisation in Bhutan
7.3. Rural urban interface - peri-urban interface and rural urban fringe
7.4. Urban Development in Bhutan
7.5. Government policies in Bhutan: Scope and significance in urban development
    7.5.1. National Housing Policy 2020
    7.5.2. National Sanitation & Hygiene Policy 2020
    7.5.3. National Human Settlement Policy of Bhutan 2019

7.5.4. Thromde Finance Policy
7.5.5. The Bhutan Municipal Act 1999
7.5.6. Environmental Code of Practice (HIGHWAY ROADS)
7.5.7. Building Code 2018
7.5.8. Land Pooling & Land Re-adjustment 2018
7.5.9. Thromde Rules of the kingdom of Bhutan 2011
7.5.10. Urban Area and Property Regulations
7.5.11. Bhutanese Architectural Guidelines FINAL 2015
7.5.12. Bhutan GREEN Building Design Guidelines

Reading List:

Essential Reading

Botkin, D.B. (2014). *Environmental science, earth as a living planet (9th ed.). Hoboken, NJ:* John Wiley and Sons.

Daehnhardt, M. (2019). *Migration, development and social change in the Himalayas: An ethnographic village study*. Oxfordshire, UK: Routledge & CRC Press.

Datta, K. (2004). *Urbanisation in the eastern Himalayas: Emergence and issues.* New Delhi, India: Serial Publication.

Laconte, P. and Gossop, C. (2016). *Sustainable Cities: Assessing the Performance and Practice of Urban Environments*. New York, NY: Bloomsbury.

Oke, T. R., Mills, G., Christen, A. and Voogt J. A. (2017). *Urban Climates*. Cambridge, MA: Cambridge University Press.

Ragazzi, M. (2016). *Improving Urban Environments: Strategies for Healthier and More Sustainable Cities* (1st ed.). Cambridge, UK: Apple Academic Press.

Singh, A.L. and Fazah, S., eds. (2008). *Urban Environmental Management.* New Delhi: B.R. Publishing Corporation.

Additional Reading

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

Asian Development Bank. (2014). *ADB GrEEEn Cities Initiative*. http://www.adb.org/green-cities

Gaston, K.J. (2010). Urbanization. *Urban Ecology*. Cambridge, UK: Cambridge University Press.

Hanaki, K. (Ed.). (2008). *Urban environmental management and technology, volume 1 of csur-ut series: library for sustainable urban regeneration*. Berlin, Germany: Springer Science & Business Media.

Simon, D. (2016). *Rethinking sustainable cities: Accessible, green and fair*. Bristol, UK: Policy Press.

Singh, S. (1995). *Urbanization in Garhwal Himalaya: A Geographical Interpretation.* New Delhi, Inida: M.D. Publications

Date: June 2021

Module Code and Title: **BES301 Bhutanese Society, Culture and Economy**
Programme: BSc in Environmental Management
Credit: 12
Module Tutor(s): Jamyang Pelmo (Coordinator), Tshewang Dorji

General objective: This module provides an overview of Bhutanese society, culture, and economic growth along with accompanying structural changes in the Bhutanese economy during the periods of planned economic development. It focuses on the synergy of Bhutanese society with culture and social capital. Students will be introduced to Bhutan's development paradigm and its role in the nation's development.

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

1. Describe the fundamental sociological concepts and their historical evolution.
2. Investigate how social capital could be integral for human society.
3. Analyse the impacts of social change on the economy.
4. Explain the importance of social capital for the economy.
5. Analyse the time pattern of growth and accompanying structural changes in Bhutan.
6. Describe the economy as a social institution.
7. Examine the functions and importance of the cultural institutions for the Bhutanese society.
8. Discuss the significance of Gross National Happiness for Bhutanese economy.
9. Correlate the contribution of culture and social capital to the Bhutanese economy.

Learning and Teaching Approach:

Type	Approach	Hours per week	Total credit hours
Contact	Lectures	3	60
	Discussions and presentations	1	
Independent study	Written assignments	1	60
	Reading and review of class materials	3	
Total			120

Assessment Approach:

A. Individual Essay: 15%

Students are required to write an essay that investigates unique cases demonstrating how social capital can be an integral part of sustainable socio-economic growth in Bhutan. They are required to substantiate their arguments with examples and theoretical arguments discussed during class lectures. The assignment will be 1000-1250 words in length and be assessed according to the following criteria:

2% Proposal outlining the selected topic and proposed argument
5% Quality of content and argument (includes well stated and original analysis, use of relevant and adequate support for all claims made, ties analysis to relevant module concepts)
5% Application to Bhutanese context
3% Mechanics (Language and referencing)

B. Group Presentation: 15%

Students will be divided into small groups of 4 members. Each group will be assigned a particular topic from the theme discussed during the class related to cultural components of Bhutan. Group presentations will be 10-15 minutes in length.

8% Content (including the use of sources, how well does the presentation address all claims relevant and supported)
3% Organization, teamwork, language and discussion
4% Delivery (oral presentation, use of visual aid and effort to engage the audience)

C. Class Discussion: 15%

During the semester students will be responsible for working with one or two partners to lead a class discussion about 20-25 minutes, about a relevant reading (development policies and plans in Bhutan). During the discussion, students will be responsible for (1) summarizing the reading in their own words, including identifying and explaining key terms and concepts, (2) preparing discussion questions to stimulate class discussion (3) facilitating a clear and helpful discussion that will help the class both understand the reading and engage more critically with its main arguments and ideas.

3% Pre-discussion meeting (attendance and preparedness)
6% Quality and accuracy of summary (focus should be on arguments)
3% Thoughtfulness and effectiveness of discussion questions
3% Quality and effectiveness of facilitation of discussion (including balance between facilitator and class participation)

D. Midterm Examination: 15%

Students will take a written exam of 1.5-hr duration covering topics up to the mid-point of the semester. The exam will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

E. Semester-End Examination: 40%

Students will take a written exam of 2.5-hr duration encompassing all the subject matter covered in the semester. This assessment is comprehensive and summative in nature, and will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

Overview of assessment approaches and weighting

Areas of assignments	Quantity	Weighting
A. Individual Essay	1	15%
B. Group Presentation	1	15%
C. Class discussion	1	15%
D. Midterm Examination	1	15%
Total Continuous Assessment (CA)		**60%**
Semester-End Examination (SE)		**40%**

Pre-requisites: None

Subject matter:

Unit I: Introduction to Human society

1.1. Concept, meaning and origin of human society
1.2. Importance of society to the individual
1.3. Characteristics and functions of society
1.4. Factors of social changes
1.5. Social institutions
  1.5.1. Organizational differences in patterns of earning livelihoods
  1.5.2. Divisions of labour: traditional versus modern
  1.5.3. Social mobility: factors affecting social mobility
  1.5.4. Processes of social changes
  1.5.5. Social problems, societal crimes
  1.5.6. Means of social control: mores, morals, religion and law
  1.5.7. Functions of religion for individuals and society

Unit II: Social Capital

2.1. Concept and historical evolution
2.2. Importance of Social Capital
2.3. Conceptual framework and Method
  2.3.1. Structural social capital
  2.3.2. Cognitive social capital
  2.3.3. Cooperation and collective action (Self-rated happiness, poverty perception and social capital)
2.4. Bhutanese Society and Social Capital
  2.4.1. Diversity and strength of cultural traditions in Bhutan
  2.4.2. Social network and support
  2.4.3. Bhutanese social values as the basis of social capital
  2.4.4. Different forms of social capital in Bhutan
  2.4.5. Social capital and civil society

Unit III: Bhutanese Culture

3.1. Importance of values and beliefs in Bhutanese culture
3.2. The role of norms in preservation and conservation of culture
3.3. The significance of language in culture
3.4. Importance of symbols and technologies in preservation and conservation of culture
3.5. Functions and importance of the cultural institutions for the Bhutanese society
3.6. Case studies on culture and economy

Unit IV: Bhutanese Economy

4.1. Brief history of the Bhutanese economy prior to 1960
4.2. Pattern and growth of economy since 1960
4.3. Factors that leading to changes in Bhutanese economy
4.4. Sectoral growth and development
    4.4.1. Social and physical infrastructure
    4.4.2. Health and education
    4.4.3. Transportation and Communication
    4.4.4. Agriculture
4.5. Structural changes and economic development
4.6. Impacts of Bhutanese Economy on society and culture:
    4.6.1. Food habits
    4.6.2. Migration
    4.6.3. Birth and death
    4.6.4. Dress and etiquette
    4.6.5. Art and architect

Unit V: Development Planning and Policies

5.1. History of development plans and policies of Bhutan
5.2. Gross National Happiness: Concept; the domains of socioeconomic development; the pillar of environmental conservation
5.3. Institutional framework and policy measures: Role of GNH commission and local government
5.4. Review of development plans and policies: Five-year plans, Economic Development Policies

Unit VI: Social Capital and Economy

6.1. The relationship between economic development and social capital
6.2. Contributions of social capital to Bhutanese economy
6.3. Comparative analyses of past situations with the present, and future outlooks
6.4. Case Study on social capital and economic development

Reading List:

Essential Reading

Asian Development Bank. (2013). *Bhutan critical development constraints*. Mandaluyong City, Philippines.

Kumagai, S. (2018). *Buddhism, culture and society in Bhutan.* Kathmandu, Nepal: Vajra Books.

Macionis, J.J., & Plummer, K. (2013). *Sociology: A global introduction.* (5th ed.). Harlow, Englland: Pearson Education Ltd.

Lham Dorji, L., Jamtsho, C., Gyeltshen, S., & Dorji, C. (2013). *Bhutan's case: Social capital, household welfare and happiness*, Monograph Series 5. Thimphu, Bhutan: National Statistics Bureau.

Royal Government of Bhutan. *Five-year plan documents*. Gross National Happiness Commission.

Woolcock, M., & Narayan, D. (2000). Social capital: Implications for development theory, research, and policy. *World Bank Research Observer, 15*(2): 225-249.

Additional Reading

Choden, K., & Wangchuk, D. (2018). *Bhutan – Culture Smart: The essential guide to custom and culture.* London, England: Kuperard.

Coleman, J.S. (1988). Social capital in the creation of human capital. *American Journal of Sociology Supplement 94*, S95-S120.

Ellickson, R.C. (1991). *Order without law: How neighbours settle disputes.* Cambridge, MA: Harvard University Press.

Field, J. (2003). *Social capital (Key ideas).* London, England: Routledge.

Fukuyama, F. (2000). *Social capital and civil society.* IMF Working Paper WP/00/74. Washington, DC: International Monetary Fund.

Grootaert, C., & Van Bastelaer, T. (2001). *Understanding and measuring social capital: a synthesis of findings and recommendations.* Washington, DC: World Bank SCI.

Knack, S., & Keefer, P. (1997). *Does social capital have an economic payoff? a country investigation*. College Park, MD: Univ. of Maryland IRIS.

Mitra, S. & Jeong, H. Y (Eds.). (2017). *Bhutan: New pathways to growth.* New Delhi, India: Oxford University Press.

Schuelka, M.J. (Ed.). (2013). Proceedings from the International conference on leveraging Cultural Diversity, Thimphu, Bhutan: Royal Thimphu College and Helvetas.

Date: June 2021

Module Code and Title: **LAN202 Basic Journalism**
Programme: BA in English Studies (Borrowed)
Credit Value: 12
Module Tutor(s): Namkhai Norbu

General objective: This module aims to introduce students to the fundamentals of journalism and develop journalistic skills. It will also introduce them to the techniques of news writing for different media and will enable students to acquire these skills. Students will learn journalism's main components: what news is, different types of news, reporting news story and stories centred on people, and practical news reporting and writing, among others. It will also familiarize students with the history and emergence of media in Bhutan – looking into their achievements, the existing challenges and the way forward.

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

1. Write news articles at a level suitable for print in a local publication such as a college or club newsletter.
2. Distinguish different types of news articles (hard, feature, analysis, profile, editorial and column).
3. Critically analyse news content, identifying potentially dubious reporting.
4. Proofread and rewrite short texts in journalistic style.
5. Research and fact-check their own data collection for short news reports.
6. Explain the role of journalism vis-à-vis community or people journalism.
7. Differentiate restorative narratives from typical news stories.
8. Explain key ethical codes in the practice of journalism.
9. Describe the major milestones and key features of the emergence of media in Bhutan.

Learning and teaching approach:

Approach	Hours per week	Total credit hours
Lectures & Discussion	2	30
In-class writing practice	2	30
Independent Study	4	60
Total		120

Assessment Approach:

A. News writing assignment: Portion of Final Mark: 15%

Students will write a news article of 400 to 500 words based on scenarios given to them. The first draft will be graded on 5%, and the final piece on 10%, of which 3% will be allotted to improvements made on the feedback provided on the first draft. Assessments will be based on the 'Professional Writing' rubric.

B. Feature writing assignment: Portion of Final Mark: 15%

Students will be required to write a feature article of 600-800 words. The first draft will be graded on 5%, and the final piece on 10%, of which 3% will be allotted to improvements made on the feedback provided on the first draft. Assessment will be based on the 'Professional Writing' rubric.

C. Class participation and preparedness: Portion of Final Mark: 10%

Students will be expected to participate substantially in class discussions, with contributions reflecting adequate preparation for topics under discussion. 5% of class participation and preparedness will be assessed before midterm and the remaining 5% post midterm.

D. Real news reporting project: Portion of Final Mark: 15%

Students will write a real news article of 300-400 words. The first draft will be graded on 5%, and the final piece on 10%, of which 3% will be allotted to improvements made on the feedback provided on the first draft. The Assessment will be based on the "Professional Writing".

E. Editorial and column writing: Portion of Final Mark: 15%

Students will write an op-ed piece or column 400-500 words. Students should strive to get the same published in local newspapers. The first draft will be graded on 5%, and the final piece on 10%, of which 3% will be allotted to improvements made on the feedback provided on the first draft. Assessment will be based on the 'Professional Writing' rubric.

Overview of assessment approaches and weighting

Areas of assignments	Quantity	Weighting
1. News writing assignment	1	15%
2. Feature writing assignment	1	15%
3. Class participation and preparedness		10%
4. Real news reporting project	1	15%
5. Editorial and column writing	1	15%
Total Continuous Assessment (CA)		**70%**
Semester-End Examination (SE)		**30%**

Subject matter:

Unit I: Introduction to journalism

1.1. Overview of what is journalism
1.2. Elements of news
1.3. Different types of news writing
1.4. Introduction to various types of media components
1.5. Introduction to techniques of news writing for different media
1.6. Interview techniques and skills
1.7. Unique quotes and attribution

Unit II: Development of journalism in Bhutan

2.1. History of the media in Bhutan
2.2. Media laws and policies
2.3. Make up of news organizations and management and editorial structures
2.4. Perspectives on media in Bhutan
    2.4.1. Media in Bhutan: Now and Then by Dasho Kinley Dorji
    2.4.2. Media and the Maverick Mind: Need for Media Literacy: A Layman's View by Thakur Singh Powdyel
    2.4.3. Media Matters in Bhutan by Siok Sian Pek-Dorji
    2.4.4. Role of the Media in Achieving a Sustainable Society by Tim Bodt
2.5. Existing media scenario

Unit III: Print journalism

3.1. Writing/reporting for the print media
3.2. Makeup of a newspaper/ magazine
3.3. Structure and dissection of newspapers
3.4. Writing the different articles for newspapers (editorial, news story, column features, analysis and op-ed piece)
3.5. Practical assignment

Unit IV: Social media or the new journalism

5.1. Social media: Meaning and essential features
5.2. Impact of social media in journalism
5.3. Social media as a tool for journalism
5.4. Citizen journalism
5.5. Media consumption
5.6. Future of journalism

Unit V: Development journalism

6.1. Development journalism: Meaning and essential features
6.2. Significance of development related news for developing countries
6.3. Challenges, present trend and practices in Bhutan.
6.4. Development journalism as a community journalism
6.5. Getting stories of the plight of ordinary people
6.6. Analysis of development issues in Bhutan

Unit VI: Restorative narratives

7.1. Restorative narrative: Meaning and essential features
7.2. Analysis of restorative narratives by media organizations in Bhutan
7.3. Difference between restorative narratives and a typical news story
7.4. Focus on restorative narratives
7.5. Writing restorative narratives

Unit VII: Media ethics

8.1. Journalists' code of ethics/conduct
8.2. Libel, defamation and privacy issues
8.3. Plagiarism in journalism
8.4. Right to Information and freedom of press
8.5. Advertising ethics

Reading List: *(A course-pack of the shorter reading materials will be made available to students)*

Essential Reading

Bhutan InfoComm and Media Authority. (2006). Code of Ethics for Journalists. Retrieved from http://www.bicma.gov.bt/paper/jcc.pdf

Bodt, T. (2007). Role of the media in achieving a sustainable society. Retrieved from http://www.bhutanstudies.org.bt/publicationFiles/ConferenceProceedings/MediaAndPublicCulture/M-21.pdf

Dorji, K. (2006). Media in Bhutan: Now and then. Retrieved from http://www.bhutanstudies.org.bt/publicationFiles/JBS/JBS_Vol14/14-2.pdf

Kramer, M. and Call, W. (2007). *Telling True Stories: A Nonfiction Writers' Guide from the Neiman Foundation at Harvard University*. Penguin Publishing House.

Murthy, D. (2009). *Development Journalism: What Next?* Kanishka Publishing House.

Pek-Dorji, S.S. (2010). *Media matters in Bhutan.* Thimphu: Bhutan Centre for Media and Democracy.

Powdyel, T.S. (2007). Media and the maverick mind: Need for media literacy: A layman's view. Retrieved from http://www.bhutanstudies.org.bt/publicationFiles/ConferenceProceedings/MediaAndPublicCulture/M-14.pdf

Raman, U. (2009). Writing For The Media. Oxford University Press.

Rich, C. (2009). *Writing and Reporting News: A Coaching Method*. Cengage Learning Publication.

Strunk Jr, W. and White, E.B. (1999). *The Elements of Style*. Longman Publication.

Tenore, M.J. Restorative Narratives: Defining a New Strength-Based Genre. ivoh. Retrieved from http://ivoh.org/restorativenarrative/

Zinnser, W. (2008). *On Writing Well: The Classic Guide to Writing Nonfiction*. Paw Prints.

Additional Reading

David, R. (2011). *The Universal Journalist*. Pluto Press.

Palmer, P.J. (2011). *Healing the Heart of Democracy: The Courage to create a politics worthy of the human spirit*. John Wiley & Sons.

Date: May, 2018

Module Code and Title: **UGR301 Research Methodology**
Programme(s): BA in Development Economics (Borrowed)
Credit Value: 12
Module Tutor(s): Samir Patel (Coordinator), Leishipem Khamrang, GP Sharma

General objective: This module aims to provide students with a working understanding of research principles and a range of research methods and techniques. The module will enable students to define a clear research problem and select an appropriate method to address a research question. Students will develop the research skills and knowledge necessary to undertake an independent but supervised research project later in the programme.

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

1. Formulate a clear and focused research problem.
2. Identify and apply appropriate research methods to a given problem.
3. Develop an effective research design.
4. Assess the internal and external validity in a research design.
5. Collect information and data using an appropriate sampling strategy.
6. Present the results of research questions or hypothesis, using statistical/ explanatory analysis.
7. Identify the sources of biases in research.
8. Discuss the importance of ethical principles for research.
9. Explore current research using an appropriate theoretical perspective.

Learning and Teaching Approach:

Type	Approach	Hours per week	Total credit hours
Contact	Lectures	2	60
	In-class workshops and exercises	2	
Independent study	Written assignments	1	60
	Reading and review of class materials	3	
Total			120

Assessment Approach:

A. In-class Exercises: 20 Marks

Each student will complete two in-classes exercises (10 marks each) related to problem-solving / modelling a given situation, for example related to developing a research design or sampling strategy, or applying appropriate tools to analysing sample data and deriving conclusions. Each exercise will be conducted over a 2-hr block period in-class.

2 Knowledge on main concept of the exercise's theme
2 Knowledge of alternative approaches
4 Appropriate and correct application of approaches
2 Justification for the use of the selected research design / sampling / analytical methods

B. Draft Literature Review: 10 Marks

Each student will undertake a literature review a minimum of 8 articles. The review will be framed in a manner that starts with broad concept/issues and progresses to specific site-centric material that frames a justification for the proposed research. The literature review should be 1,000-1,250 words in length.

4 Quality of analysis, justification and literature support
4 Overall organizing argument(s) (clarity, logic, coherence)
2 Mechanics (Language and referencing)

C. Draft Research Plan: 10 Marks

Students will individually submit a draft research plan clearly explaining what they want to measure and state the appropriate research methods to be employed. Students will also explicitly mention a timeline for research activities and data analysis procedures. The research design will be written in 1,000-1,250 words and evaluated based on the following structure:

2 Introduction and research question(s)
2 Statement of the problems, formulating the objectives of the study
2 Research methods: Sampling design, procedure of sample selection and rationale of sample size
2 Research instrument, justification, processing and analysis of data
2 Mechanics (Language, organisation and referencing)

D. Research proposal: 15 Marks

Each student will be given sufficient time to improve upon the literature review and research design, and culminate these components into a final research proposal. The final version will be written in 2,000-2,500 words.

2 Clarity of research question(s), statement of the problems, objectives of the study and hypothesis
2 Relevant literature review that sets up the gap in existing knowledge to be addressed
2 Suitable research method and research instruments
2 Appropriate data analysis procedure and analysis
2 Incorporating ethical aspects and addressing biases
2 Mechanics (Language, organisation and referencing)

Research proposal presentation and defence: students will deliver a presentation of their research proposal. The presentations are expected to be 5-10 minutes duration.

2 Effective presentation (how well the presentation sets up the research question and proposes a suitable research design)
1 Effective defence – justification, response to questions in Q&A session

E. Midterm Examination: 15 Marks

Students will take a written exam of 1.5-hr duration covering topics up to the mid-point of the semester. The exam will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

F. Semester-End Examination: 30 Marks

Students will take a written exam of 2.5-hr duration encompassing all the subject matter covered in the semester. This assessment is comprehensive and summative in nature, and will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

Overview of assessment approaches and marks

Areas of assignments	Quantity	Marks
A. In-class Exercises	2	20 (10 each)
B. Draft Literature Review	1	10
C. Draft Research Plan	1	10
D. Research Proposal	1	15
E. Midterm Examination	1	15
Total Continuous Assessment (CA)		**70**
Semester-End Examination (SE)		**30**

Pre-requisites: None

Subject matter:

Unit I: Introduction

1.1. Defining scientific research, scientific method, research methods and methodology
1.2. Types of research: exploratory, descriptive and explanatory
1.3. Importance of research ethics
1.4. Overview of ethical principles in scientific research

Unit II: Basics of Research

2.1. Unit of analysis
2.2. Concepts and constructs
2.3. Variables: dependent, independent, moderating and control
2.4. Propositions and hypotheses
2.5. Theories and models; inductive and deductive reasoning
2.6. Defining a research problem
2.7. Introduction to paradigms of social research: positivism, post-positivism, ontology and epistemology

Unit III: Research Process

3.1. Overview of the research process: observation, rationalisation and validation; Functionalistic Research Processes: exploration, research design and execution
3.2. Literature review: methodology, search, selecting information, critical review, referencing

Unit IV: Research Design

4.1. Research approaches: qualitative, quantitative and mix methods
4.2. Key attributes: internal and external validity
4.3. Brief introduction to popular research designs: exploratory, experimental and quasi experimental, field survey and secondary data analysis, case research, action research and ethnography
4.4. Selecting research designs

Unit V: Measurement Constructs

5.1. Conceptualization and operationalization
5.2. Variable and data types: numeric, string
5.3. Levels of measurement and appropriate scales: nominal, ordinal, interval, ratio and binary
5.4. Indexes, their construction and uses

Unit VI: Sample Design

6.1. Sampling process: population, sample frame, sample
6.2. Probability sampling: simple random, systematic, stratified, cluster multi-stage sampling
6.3. Non-probability sampling: convenience, quota, expert and snowball
6.4. Statistics of sampling: sampling distribution, confidence interval, sample size determination

Unit VII: Common methods in social sciences research

7.1. Data collection methods and research instrument development: Observation, interview, questionnaire, schedule methods, focused group discussion, case study
7.2. Interviews: key informant interviews, focused group, role of interviewer
7.3. Research instrument development: Questionnaires: types, response formats, coding, content and wording, sequencing, and pilot test.
7.4. Biases in survey research: non response bias, sampling bias, recall bias
7.5. Interviews: key informant interviews, focused group, role of interviewer

Unit VIII: Overview of additional select research designs

8.1. Experimental research - introduction of the basic concepts, treatment and control groups, distinction with other non-experimental research designs
8.2. Case research – introduction of the basic concepts, selection of case sites, creating appropriate instruments: structured and unstructured interviews and selecting respondents

Reading List:

Essential Reading

Bhattacherjee, A. (2012). *Social science research: Principles, methods and practices.* Global Text Project. Retrieved from http://scholarcommons.usf.edu/oa_textbooks/3

Cresswell, J.W., & Cresswell, J.D. (2017). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (5th ed.). Sage Publications.

Kothari, C. R. & Garg, G. (2019). *Research methodology: Methods and techniques* (4th ed.). New Delhi, India: New Age International Publishers.

Kumar, R. (2014). *Research methodology: A Step-by-step guide for beginners* (4th ed). Thousand Oaks, CA: Sage.

Additional Reading

Becker, S. & Bryman, A. (Eds.). (2004). *Understanding research for social policy and practice.* Bristol: Policy Press.

Bromage, A. (2008). *A brief note on research ethics. Birmingham: Higher education resources.* Retrieved from http://highereducationresources.atspace.com/ethics.htm

Bryman, A. (2012). *Social research methods*. New York, NY: Oxford University Press.

Doane, D. & Seward, L. (2016). *Applied Statistics in Business and Economics* (6th ed.). New York, NY: McGraw Hill.

Dixon, J.C., Singleton, R. A., & Straits, B. C. (2018). *The process of social research*. New York, NY: Oxford University Press.

Date: June 2022

Module Code and Title: **ENM307 Environmental Pollution Management**
Programme: BSc in Environmental Management
Credit Value: 12
Module Tutor(s): Jamyang Pelmo (Coordinator), Bikram Sharma

General objective: This module concentrates on the major causes, effects, and control measures of pollution. It focuses on air, water and soil pollution. It will enable students to understand environmental problems, looking at causal linkages between pollution sources, exposure pathways and impacts to environmental quality and human health.

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

1. Define pollution, different pollutants and their characteristics.
2. Explain current forms of environmental pollution.
3. Discuss their causes and consequences to natural, economic and social systems.
4. Assess the role humans play in generation of these environmental pollutants.
5. Review and compare local, regional and international air and water quality standards.
6. Analyse different protocols and conventions of pollution.
7. Discuss the different pollution control measures.
8. Conduct simple test for water quality.

Learning and teaching approach:

Type	Approach	Hours per week	Total credit hours
Contact	Lectures	3	60
	Discussions and practical exercises	1	
Independent study	Written assignments	2	60
	Reading and review of class materials	2	
Total			120

Assessment Approach:

A. Class tests: 10%

Students will undertake a class test twice during the semester (5% each); once before mid-term (after completion of unit 2) and once after mid-term (after completion of unit 4). The written test will be conducted within the class for a duration of 40-50 min. The tests are intended to help students better prepare for the exams as well as serve as an early indicator for tutors to gauge student's level of understanding. Students will have to explain sources and effects of pollution and characterise pollutants.

B. Water Quality Test (Group): 10%

Students will be divided into five different groups and assigned a specific study site. They will collect multiple water samples from their site over a specified period of time, conduct water quality testing, and present their findings in their final report.

2% Description of the site/ summary of the visit (accuracy and completeness)

5% Quality of analysis (includes different para)

3% Mechanics (Language and referencing)

C. Individual report: 20%

This report (800 - 1000 words) is intended to make students apply all the concepts covered during the module and develop their critical analysis on pollution management. Students will choose one case study and produce a comprehensive analysis report on pollution problems in this particular chosen area. The report will include pollution issues, analysis of the legal framework, proposed solutions and alternatives to control pollution.

5% Plan and draft content of the report
5% (Final version) Case study analysis (pollution effects, legal aspects, context analysis)
10% (Final version) Proposed alternatives and solutions (relevance, justification, applicability)

D. Midterm Examination: 20%

Students will take a written exam of 1.5-hr duration covering topics up to the mid-point of the semester. The exam will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

E. Semester-End Examination: 40%

Students will take a written exam of 2.5-hr duration encompassing all the subject matter covered in the semester. This assessment is comprehensive and summative in nature, and will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

Overview of assessment approaches and weighting

Areas of assignments	Quantity	Weighting
A. Class tests	2	10%
B. Water Quality Test (Group)	1	10%
C. Individual Report	1	20%
D. Midterm Examination	1	20%
Total Continuous Assessment (CA)		**60%**
Semester-End Examination (SE)		**40%**

Pre-requisites: None

Subject matter:

Unit I: Key concepts of pollution

1.1. Definition of pollution
1.2. Forms of pollution
1.3. Implication of each sector in generation of pollution
    1.3.1. Agriculture
    1.3.2. Industrial

1.3.3. Commercial
1.3.4. Domestic

1.4. Pollutants and their characteristics
1.5. Classification of pollutants

Unit II: Water pollution

2.1. Sources of water pollution (point and non-point sources)
2.2. Surface and groundwater pollution
2.3. Forms of water pollution: oil pollution, eutrophication, thermal pollution, development of invasive species in water and health effects
2.4. Bioaccumulation, ecological effects of water contamination and impacts for human health

Unit III: Water pollution control

3.1. Water quality standards at the local (BDWQS,2016) and international level (EPA and WHO)
3.2. Water properties and self-purification
3.3. Strategies to control agricultural run-off
3.4. Strategies to control industrial sewage
3.5. Strategies to control domestic sewage

Unit IV: Air pollution

4.1. Atmospheric layers and composition
4.2. Major air pollutants: primary and secondary pollutants; Examples of different forms of air pollution: photochemical and sulphurous smog, Atmospheric Brown Cloud
4.3. Greenhouse gases and their sources
4.4. Impacts on ecosystems and human health

Unit V: Air pollution control

5.1. Air quality standards and regulation
5.2. Transport pollution strategies
5.3. Industrial air pollution abatement strategies: cyclone, scrubber, bag filter and electrostatic precipitator
5.4. Evolution of the legislation:
5.4.1. National Environment Commission (NEC)'s Air Quality Management Strategy, 2010
5.4.2. Global protocols and conventions (introductory references): Kyoto Protocol, Montreal Protocol, Paris agreement

Unit VI: Soil Pollution

6.1. Sources of soil pollution
6.2. Natural and anthropogenic soil pollution
6.3. Hazardous soil pollutants: Organic Pollutants and Inorganic Pollutants
6.4. Impacts of soil pollution: Human, plant and animal, and ecosystem
6.5. Effect of soil pollution on agriculture production
6.6. Mobility and accessibility of pollutants to soil organisms.
6.7. Land pollution and its effects on water bodies

Unit VII: Control of soil pollution

7.1. Extraction and separation techniques: Acid extraction; Solvent extraction
7.2. Thermal methods: Incineration; Pyrolysis; Specialized Thermal Systems; Direct heat transfer method (Open Flame); Indirect heat transfer method
7.3. Chemical methods: Ion exchange, Precipitation, Oxidation and Reduction, and Neutralization
7.4. Microbial treatment methods: Bioremediation; Use of fungal laccase in decolourization of synthetic dyes; Aerobic granulation in wastewater treatment;

Unit VIII: Noise Pollution and Control

8.1. Noise pollution
  8.1.1. Concepts and definition
  8.1.2. Sources of Noise pollution
8.2. Effects of Noise
8.3. Measurement of noise
8.4. Equivalent sound pressure level
8.5. Control measures
  8.5.1. NEC Standards on noise pollution

Reading List:

Essential Reading

Dwivedi, P. (2004*). Environmental pollution and environmental management*. Jodhpur, India: Scientific Publisher.

El-Nemr, A. (2010). *Impact, monitoring and management of environmental pollution*. Hauppauge, NY: Nova Science Publishers.

Marquita K. Hill (2010). *Understanding environmental pollution*. Cambridge, UK: Cambridge University Press.

Mirsal, I. (2008). *Soil pollution: Origin, monitoring & remediation* (2nd ed). Berlin, Germany: Springer

Sharma, N., Agarwal, A. K., Eastwood, P., Gupta, T. and Singh, A. P. (Eds). (2018). *Air pollution and control.* Singapore, Singapore: Springer.

Twardowska, I., Allen, H.E., Häggblom, M.M. and Stefaniak, S. (Eds.). (2006). *Soil and water pollution monitoring, Protection and Remediation*. Amsterdam, Netherlands: Springer.

Additional Reading

Gupta, A. (2002). *Environment pollution: Developed countries vs. less developed countries.* Dehradun, India: International Book distributors.

Harrision, R. M (Ed.). (2001). *Pollution: Causes, effects and control.* London, UK: Royal Society of Chemistry

Murphy, E. and King, E. (2014). Environmental noise pollution: Noise mapping, public health, and policy (1st ed). Amsterdam, Netherlands: Elsevier.

National Environment Commission (2020*). Environmental standards*. Thimphu, Bhutan: NEC.

National Environment Commission (2010). *Strategy for air quality assessment and management in Bhutan*. Thimphu,Bhutan: NEC.

Shyam, S. (2006). *Air pollution and its impacts on plant growth*. Delhi, India: Eastern Book Corporation.

Date: June 2021

Module Code and Title: **DEV201 Development Problems and Policies**
Programme: BA in Development Economics (borrowed)
Credit Value: 12
Module Tutor: Leishipem Khamrang (coordinator), Jamyang Pelmo

General objective: The module begins with a discussion of alternative conceptions of development and their justification. It then proceeds to aggregate models of growth and cross-national comparisons of the growth experience that can help evaluate these models. The axiomatic basis for inequality measurement is used to develop measures of inequality and connections between growth and inequality are explored. The module ends by linking political institutions to growth and inequality by discussing the role of the state in economic development and the informational and incentive problems that affect state governance.

Learning outcomes – On completion of this module, learners should be able to:

1. Describe various approaches to development.
2. Explain and analyse the historical perspective on economic growth.

3. Apply growth models to problem solving.
4. Explain and analyse inequality and poverty measurement approaches.
5. Apply different methodologies and approaches to poverty and inequality, and compare outcomes.
6. Discuss and examine the role of political institutions in economic development.
7. Provide logical and evidence-based arguments to the debates on issues related economic development.

Learning and Teaching Approach: This module will be taught by means of lectures, tutorials, classroom workshops, group work, debate, case studies and self-directed study. Lectures will aim at explanation of various concepts and theories. Focus will be placed on applying theories to the Bhutanese context, and using relevant data. Lectures will be complemented by tutorials, guest lectures and attending relevant conferences in Thimphu. Classroom workshops will be used for data analysis using alternative methodologies. Group work will involve students discussing and analysing a particular issue and undertaking debates with other groups. Tutorials will also be used to facilitate problem solving.

Approach	Hours per week	Total credit hours
Lectures	3	45
Tutorials, group work, and debates	1	15
Independent study	4	60
Total		120

Assessment Approach:

A. Individual Assignment: 10%

Students will explore how the long-term growth trajectory affects development indicators and identify factors that are important for such changes. The assignment should have a maximum limit of 300 words.

1% Adequacy of references used
2% Defining the concepts
3% Use of appropriate analytical tools
7% Analysis and findings
2% Conclusion

B. Group Work: 15%

Groups of 4 will complete a report based on an activity involving data analysis on poverty and inequality/ application of growth models/ cross sectional study on convergence. Report words limit: 750 words.

1% Situation analysis
2% Methodology of group work
6% Discussion on findings in the joint report
4% Peer review of individual reports
2% Presentation (individually marked)

C. Individual Critical Essay: 20%

Each student will complete an essay on the issues pertaining to political institutions and role of the state in economic development. Word limit: 500 words.

2% Logical flow of thoughts
7% Ability to comprehend relevant issues in the debate
3% Evidence based arguments
1% Language skills
1% Subtleness of conclusion
1% Structure of the Essay

D. Midterm Examination: 20%

Students will take a written exam of 1.5-hr duration covering topics up to the mid-point of the semester.

Areas of assignments	Quantity	Weighting
A. Individual Assignment	1	10%
B. Group Work	1	15%
C. Critical Essay	1	20%
D. Midterm Examination	1	20%
Total Continuous Assessment (CA)		**65%**
Semester-End Examination (SE)		**35%**

Pre-requisites: None

Subject matter:

Unit I: Conceptions of Growth and Development

1.1. Meaning of growth and development; Modern economic growth;
1.2. Historical perspective of growth: Rostow's stage theory
1.3. Basic indicators of development
1.4. Characteristics of developing world: diversity within commonality
1.5. Development trajectories across nations and within them

Unit II: Growth Models

2.1. Structural change model (Lewis Model)
2.2. Neo-classical counter revolution
2.3. Big push strategy
2.4. Harrod-Domar model
2.5. Solow model and its variants
2.6. Endogenous growth models and evidence on the determinants of growth

Unit III: Development Problems and Policies

3.1. Poverty and Inequality
- 3.1.1. Measuring inequality: Four criteria for inequality measurement, Lorenz curve, Gini coefficient
- 3.1.2. Inequality, income and growth: inverted-U curve hypothesis, uneven and compensatory changes
- 3.1.3. Political redistribution and growth
- 3.1.4. Absolute poverty: Extent and magnitude, Growth and poverty
- 3.1.5. Poverty measurement: Head count ratio, poverty gap, FGT index, Human Poverty Index, Multi-dimensional Poverty Index
- 3.1.6. Characteristics of the poor: demographic features, rural and urban poverty, women and children, assets, nutrition
- 3.1.7. Mechanisms that generate poverty traps and path dependence of growth processes
- 3.1.8. Approaches to poverty alleviation: redistribution, direct interventions

3.2. Financing Development
- 3.2.1. Domestic resource mobilisation: Taxes, capital market, frontloading, internal borrowing
- 3.2.2. External finance : International aid, FDI and external borrowing
- 3.2.3. Innovative development financing

3.3. Political Institutions
- 3.3.1. Rationale for development planning
- 3.3.2. Relation between democracy and development
- 3.3.3. Alternative institutional trajectories and their relationship with economic performance
- 3.3.4. With-in country differences in the functioning of state institutions
- 3.3.5. State ownership and regulations
- 3.3.6. Government failure and corruption

Reading List:

Essential Reading

Ray, D. (2009). *Development economics*. New Delhi, India: Oxford University Press.

Meier, G. M., & Rauch, J.E. (2005). *Leading issues in economic development* (8th ed.). London, UK: Oxford University Press.

Todaro, M. P., & Smith, S. (2014). *Economic development* (12th ed). New York, NY: Pearson.

Additional Reading

Banerjee, A., Benabou, R. & Mookerjee, D. (2006). *Understanding poverty*. London, UK: Oxford University Press.

Basu, K. (Ed). (2012). *The new oxford companion to economics in India.* New Delhi, India: Oxford University Press.

Dasgupta, P. (2007). *Economics: A very short introduction*. New Delhi, India: Oxford University Press.

Easterly, W. (2007). *The white man's burden: Why the West's efforts to aid the rest have done so much ill and so little good*. London, UK: Penguin.

Putnam, R. (1994). *Making democracy work: Civic traditions in modern Italy.* Princeton,. NJ: Princeton University Press.

Sachs, J. (2006). *The end of poverty: Economic possibilities for our time.* London, UK: Penguin Books.

Sen, A. (2000). *Development as freedom*. New Delhi, India: Oxford University Press.

UNDP (2012). Innovative financing for development: A new model for development finance? Discussion Paper.

Date: January 15, 2016

Module Code and Title: **ENM408 Waste Management**
Programme: BSc in Environmental Management
Credit: 12
Module Tutor: Jamyang Pelmo (Coordinator), Kinley Dorji

General objective: This module will provide students with a broad overview of waste generation and its management practices. Students will have an opportunity to visit municipal organization and waste management sites in the locality familiarizing students with current waste management practices and allow them to discover alternative measures 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 – On completion of the module, students will be able to:

1. Classify wastes into different categories.
2. Explain the factors affecting waste generation.
3. Explain the factors affecting waste decomposition.
4. Describe waste classification.
5. Discuss the impacts of solid and liquid wastes.
6. Apply waste management hierarchy concepts to the management of wastes in case studies.
7. Describe the roles of various systems for treatment of wastes.
8. Critically evaluate potential solutions for waste-related problems.
9. Explain the concept of cleaner production and its scope for sustainable development.
10. Examine the roles of various stakeholders in a holistic waste management approach.

Learning and Teaching Approach:

Type	Approach	Hours per week	Total credit hours
Contact	Lectures	3	60
	Discussions and presentations	1	
Independent study	Self-Study	3	60
	Reading and review of class materials	1	
Total			120

Assessment Approach:

A. Individual Presentation: 10%

Students will work to produce a strategy for creating awareness on solid waste management at individual, community and Gewog levels and make presentations. The duration for the presentation will be between 10-15 minutes.

6% Explanation of information and idea, completeness and accuracy
4% Delivery (Oral presentation, use of visual aids and efforts to engage audience and discussion)

B. Individual Assignment: 20%

Students will write a 1000-1200 words assignment on analysis of household waste production in Thimphu. The students will be required to select an area and keep record of total household waste generated over a period of one month and present their findings.

8% Content (appropriateness of material, scientific and literary accuracy of the text and diagrams)
8% Quality of analysis and reflection (includes well stated and original analysis, thoughtfulness of reflection, uses relevant and adequate support for all claims made)
4% Mechanics (Language, organisation and referencing)

C. Field Report: 15%

Students will individually write a report on a field trip made to a relevant site. In the report, students must focus on field observations of both organic and inorganic waste management in the Thimphu valley. They will discuss and analyse the related policies to waste. Students will be provided with a grading rubric that will help to guide the writing of the field report. Reports are expected to be 800-1000 words in length.

5% Description of their subject and its context/ summary of the visit (accuracy and completeness)
7% Quality of analysis (includes an explanation of a key concept or process from the module, and well-supported argument for how their subject illustrates the concept or process)
3% Mechanics (Language, organization and referencing)

D. Midterm Examination: 15%

Students will take a written exam of 1.5-hr duration covering topics up to the mid-point of the semester.

E. Semester-End Examination: 40%

Students will take a written exam of 2.5-hr duration encompassing all the subject matter covered in the semester. This assessment is comprehensive and summative in nature, and will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

Areas of assignments	Quantity	Weighting
E. Individual Presentation	1	10%
F. Individual Assignment	1	20%
G. Individual Field Report	1	15%
H. Midterm Examination	1	15%
Total Continuous Assessment (CA)		**60%**
Semester-End Examination (SE)		**40%**

Pre-requisites: ENV101 Introduction to the Environment and ENM307 Environmental Pollution Management

Subject matter:

Unit I: Introduction to Technical Concepts of Waste

1.1. Definitions
1.2. Categories of waste
1.3. Factors affecting waste generation
1.4. Waste decomposition and conversion
1.5. Waste hierarchy
1.6. Factors affecting waste decomposition
1.7. Wastes and public health
1.8. Benefits of waste conversion
1.9. Wastes as resources and environmental hazards

Unit II: Ethical Concepts of Waste Management

2.1. Ethical and legal responsibilities for proper waste management
2.2. Review of relevant theories in environmental ethics (different worldviews and their takes on human responsibility for waste management)
2.3. Review of 'Tragedy of the Commons' concept in the context of waste management
2.4. Polluter-pays principle: individual responsibility, legal enforcement thereof
2.5. Waste management hierarchy
2.6. Extended Producer Responsibility (EPR) for waste management
2.7. Challenges and opportunities in promoting individual and community-based responsible waste management

Unit III: Solid Waste

3.1. Types, sources, properties and impacts
3.2. Disposal and management strategies
3.3. Integrated solid waste management
    3.3.1. Collection, storage and transport
    3.3.2. Source reduction
    3.3.3. Product recovery
    3.3.4. Recycling
    3.3.5. Incineration
    3.3.6. Composting
    3.3.7. Sanitary landfill (infrastructure design and provisions for effluent and leachate– types, design and management)
    3.3.8. Modern biotechnological approaches (compost & biogas)

Unit IV: Liquid Waste

4.1. Definition of liquid waste
4.2. Classification of liquid waste
    4.2.1. Source
    4.2.2. Toxicity
4.3. Characterization of liquid wastes
4.4. Wastewater treatment
    4.4.1. Physical Treatment (Primary)
    4.4.2. Chemical Treatment (Secondary)
    4.4.3. Biological treatments (Tertiary)
4.5. Case studies (Oil spill, industrial effluent)
4.6. Reuse of greywater

Unit V: Hazardous Waste

5.1. Definitions

5.2. Types of hazardous waste
    5.2.1. Clinical waste
    5.2.2. Electronic waste
    5.2.3. Automatic waste
    5.2.4. Cosmetic waste
5.3. Management of hazardous waste
5.4. Conventions (Basel, Rotterdam and Stockholm)
5.5. Pollution prevention for a sustainable society
5.6. Case studies (gas explosion, nuclear waste)

Unit VI: Cleaner Production

6.1. Stages of CP
6.2. Advantages and disadvantages
6.3. Life Cycle Analysis
6.4. Case studies (Green road, Extended Producer Responsibility)

Unit VII: Waste management policy in Bhutan

7.1. Waste Prevention and Management Act, 2009
7.2. Waste Prevention and Management Regulation, 2012
7.3. Environmental codes of practice for Hazardous Waste, 2002
7.4. Integrated Waste Management Strategy, 2014
7.5. Plastic bag ban policy

Reading List:

Essential Readings

Berg, L., Hager M., & Hassenzahl, D. (2016). *Visualizing environmental science* (5th ed.). Hoboken, NJ: John Wiley & Sons.

Peavy, H. S. & T. George (2018). *Environmental engineering* (3rd ed.). New York: NY: McGraw-Hill

Quarrie, J. (1992). *Earth Summit '92, The United Nations conference on environment and development. Rio de Janerio*. London, UK: Regency Press

Queensland Litter Prevention Alliance. (2008). *Waste product decomposition time.* Queensland, Australia. http://www.qldlitter.com/pdfs/wastea3.pdf

Additional Readings

Aquarius ND Ltd. (2013). *Domestic wastewater treatment plants.* http://www.aquariusbg.com/en/Domestic-wastewater-treatment-plants/product.html

Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal. http://www.basel.int/

Bloch, M. (2009). *Waste decomposition rates.* Green Living Tips. http://www.greenlivingtips.com/articles/311/1/Waste-decomposition-rates.html

Botkin, D.B. (2014). *Environmental science, earth as a living planet* (9th ed.). Hoboken, NJ: John Wiley and Sons Inc., USA.

Casiday, R., Noelken, R. and Frey, R. (1999). *Treating the public water supply.* http://www.chemistry.wustl.edu/~edudev/LabTutorials/Water/PublicWaterSupply/PublicWaterSupply.html

Cunningham, W. P and Cunningham, M. A. (2004). *Principles of environmental science: Inquiry and application.* New York, NY: Tata McGraw Hill.

Gupta, S.K. (2009). *Methods in environmental analysis of water soil and air*. Jodhpur, India: Agribios.

Miller, G.T., and Spoolman, S.E. (2018). *Environmental science* (16th ed.). New Delhi, India: Cengage Learning.

National Environment Commission. (2007). *National environmental protection act of Bhutan 2007*. Thimphu, Bhutan: Phama Printing and Publishers.

National Environment Commission. (2009). *Waste prevention and management act of Bhutan. Timphu, Bhutan:* NEC.

National Environmental Commission. (2002). *Environmental code of practice for hazardous wastes management.* Thimphu, Inida: National Environmental Commission.

National Environmental Commission. (2004). *Environmental discharge standard*. Thimphu, Bhutan: National Environmental Commission.

Syed, S. (2006). Solid and liquid waste management. *Emirates Journal for Engineering Research, 11*(2), pp. 19-36.

Viessman, W. Jr. & Hammer M.J. (2005). *Water supply and pollution control.* London, UK: Pearson Education.

Willams, P. T. (2005). *Waste treatment and disposal.* Hoboken, NJ: John Wiley and Sons.

World Business Council for Sustainable Development. (2009). *Water Facts and Trends.* http://www.unwater.org/downloads/Water_facts_and_trends.pdf

Date: June 2021

Module Code and Title: **ENM409 Environmental Impact Assessment**
Programme: BSc in Environmental Management
Credit: 12
Module Tutor: Jamyang Pelmo (Coordinator), Bikram Sharma

General objective: The module will inform the students about the likely effects of a proposed development on the natural and man-made environment. The module will enable students to gain awareness of and practice with EIA procedures. The module also emphasizes goals and approaches to environmental planning, dealing with key environmental and social issues as well as natural hazards. This module will provide a background to the principles and practice of the EIA process and hands-on experience and skills training with realistic environmental impact scenarios.

Learning Outcomes – On completion of the module, students will be able to:

1. Discuss common methodologies involved in environmental assessment.
2. Describe key themes and approaches for environmental planning as a context for EIA.
3. Analyse and discuss current and future trends in the use of EIA.
4. Outline the processes for conducting EIA.
5. Describe the legislative context for EIA in Bhutan.
6. Analyse potential issues and bottlenecks that can arise with EIA.
7. Assess a sample EIA using the EIA tools.
8. Discuss the emerging approaches to environmental planning in the context of EIA.

Learning and Teaching Approach:

Type	Approach	Hours per week	Total credit hours
Contact	Lectures	3	67.5
	Discussions	1	
	Field visit	0.5	
Independent study	Written assignments and project	1.5	52.5
	Reading and review of class materials	2	
Total			120

Assessment Approach:

A. Individual Field Visit Report: 10%

Students will produce a field report based on a field trip to a site in the Thimphu area. The field trip will be intended to make the students aware of some environmental planning approaches and the state of their implementation. Students will collect the information and produce a critical reflection (500-750 word) on the trip, which must engage key informants/hosts in the field. The students have to combine theory and analysis learned in the classroom with methods of observation and practice applied outside of the classroom. The report will be evaluated on:

4% Accuracy and completeness of summary
3% Insightful use of class material to explain the significance of the findings

3% Mechanics (Language, organization and referencing)

B. Group Mock EIA Project: 25%

Students, in groups of 4, will undertake a mock EIA proposal in which they are to produce (1) a project proposal, (2) an Initial Environmental Examination (IEE), following the format provided by the National Environment Commission, and (3) a presentation. Students will be assigned a particular sector and be expected to draw up a proposal that highlights all necessary information required by the IEE. Reports must include maps of the project sites and show consideration to sustainable development pillars. The cumulative project report with all sections must be 2000-2250 words.

10% Project Proposal (5% Completeness/Accuracy, 2% Grammar/Referencing, 3% Originality)
8% IEE Application (7% Completeness/Accuracy, 1% Grammar/Referencing)
7% Presentation (4% Completeness/Accuracy, 3% Clarity/Delivery)

C. Class Tests: 10%

Students will take two written class tests: one before midterm and one after the midterm (5% each) of 45-min duration covering 3-5 weeks of material. Reflection on key concepts and applying them to case studies will be assessed.

D. Midterm Examination: 15%

Students will take a written exam of 1.5-hr duration covering topics up to the mid-point of the semester. The exam will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

E. Semester-End Examination: 40%

Students will take a written exam of 2.5-hr duration encompassing all the subject matter covered in the semester. This assessment is comprehensive and summative in nature, and will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

Overview of assessment approaches and weighting

Areas of assignments	**Quantity**	**Weighting**
A. Individual Field Visit Report	1	10%
B. Group Mock EIA Project	1	25%
C. Class tests	2	10%
D. Midterm Examination	1	15%
Total Continuous Assessment (CA)		**60%**
Semester-end Examination (SE)		**40%**

Pre-requisites: ENV101 Introduction to the Environment

Subject Matter:

Unit I: Environmental planning as a context for EIA

1.1. Conventional approaches to planning
  1.1.1. Types of environmental planning: Reactive, proactive and integrative planning
  1.1.2. Different Approaches to planning: Rational, comprehensive, incremental, participatory and advocacy
1.2. Incorporating interdisciplinary aspects
  1.2.1. Role of Interdisciplinary aspects: Market, state and civil society
1.3. Land use, urban sprawl, growth management
1.4. Industrial ecology: Concepts, definition and principles
1.5. Emerging approaches
  1.5.1. Community based planning
  1.5.2. Adaptive management
  1.5.3. Watershed management
  1.5.4. Ecosystem management

Unit II: Environmental impact assessment

3.1. Introduction, definition, history, principles
3.2. Overview of steps involved in EIA: Screening, scoping, impact analysis, managing impacts, implementation, monitoring & evaluation, adaptation
3.3. Procedures for obtaining environmental clearance in Bhutan

Unit III: EIA Methodologies: overview, uses/applications in specific cases, advantages, limitations

4.1. Public Participation
    4.1.1. Traditional ecological knowledge
    4.1.2. Participatory rural appraisal
    4.1.3. Rapid rural appraisal
4.2. Networks
4.3. Cost-Benefit Analysis:
    4.3.1. Determine the objective of CBA
    4.3.2. Identify the cost and benefits
    4.3.3. Value the cost and benefit
    4.3.4. Aggregate the cost and benefit
    4.3.5. Perform sensitivity analysis
    4.3.6. Consider distributional impacts
    4.3.7. Report
4.4. Similar Project Examination

Unit IV: EIA policies and practices in Bhutan

5.1. EA Act (2000) and Regulations (2016): overview of main principles and detailed analysis of sections
5.2. Roles and responsibilities of the National Environment Commission (NEC)
5.3. Guidelines & Initial Environmental Examination (IEE) forms: main requirements
5.4. Review of IEE Application and EIAs submitted to NEC

Unit V: Developments in EIA

6.1. Strategic environmental assessment: Screening, scoping, baseline assessment, opportunities and risk assessment, avoidance, enhancement and mitigation.
6.2. Community-based environmental assessment
6.3. Case Studies related to emerging EIA practices
    6.3.1. Mandatory EIA requiring sectors: Mining, hydropower and additional sectors (automobiles, food processing)

List of practical work:

a. Students will be taken to a field site (ongoing construction site) in the Thimphu area. This will be a one-day event that takes place during the semester. The students will be required to observe the impacts resulting from the construction and have to explore the process of environmental assessment.

Reading List:

Essential Readings

Carroll, B., Fothergill, J., Murphy, J. & Turpin, T. (2019). *Environmental impact assessment handbook: A practical guide for planners, developers and communities* (3rd ed.). London, UK: ICE Publishing

Glasson, J., & Therivel, R. (2005). *Introduction to environmental impact assessment* (5th ed.). London: Routledge

Mareddy, A.R. (2017). *Environmental impact assessment: Theory and practice.* London, UK: Butterwork-Heinemann.

Morris, P & Therivel, R. (2001). *Methods of environmental impact assessment.* London, UK: Spon Press.

Additional Reading

Monteiro, M.B., & Partidario, M.R. (2018). A comparative analysis on how different governance contexts may influence Strategic Environmental Assessment. *Environmental Impact Assessment Review, 72,* 79-87.

National Environment Commission. (2000). *Environment assessment act 2000.* Thimpu, Bhutan: NEC.

National Environment Commission. (2004). *Environmental discharge standards 2004.* Thimpu, Bhutan: NEC.

National Environment Commission. (2006). *Reference manual for environmental impact assessment training in Bhutan.* Thimpu, Bhutan: NEC.

National Environment Commission. (2007). *National environmental protection act of Bhutan 2007*. Thimpu, Bhutan: Phama Printing and Publishers.

National Environment Commission. (2016). *Bhutan state of the environment, 2016*. Thimpu, Bhutan: NEC.

National Environment Commission. (2016). *Regulations for the environmental clearance of projects*. Thimpu, Bhutan: NEC.

Quarrie, J. (1992). Earth Summit '92, *The United Nations Conference on Environment and Development.* Rio de Janiero. London, UK: Regency Press.

Randolph, J. (2004). *Environmental land use planning and management*. Washington, DC: Island Press.

Spaling, H. (2003). Innovation in environmental assessment of community-based projects in sub-Saharan Africa. *The Canadian Geographer, 47*(2), pp.151-168.

Tetlow, M. and Hanusch, M. (2012). Strategic environmental assessment: the state of the art. *Impact Assessment and Project Appraisal* (30)1, pp.15-24.

Date: June 2021

Module Code and Title: **ENM410 Environmental Conflict Management**
Programme: BSc in Environmental Management
Credit Value: 12
Module Tutor: Jamyang Pelmo (Coordinator), Leishipem Khamrang

General objective: This module provides an overview of the causes, dynamics, and consequences of environmental and natural resource conflicts. Students will learn about methods and tools used to manage environmental and natural resource conflicts, including concepts of negotiation, collaboration, and collaborative environmental policy.

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

1. Discuss the dimensions and characteristics of conflict.
2. Describe the multiple forms of environmental conflicts.
3. Discuss the main theories of environmental conflict.
4. Analyse the causes of environmentally induced conflict.
5. Explain the importance of environmental conflict management.
6. Describe different strategies and approaches to conflict management.
7. Describe the processes of conflict management and resolution.
8. Apply facilitation and negotiation skills for building agreements between multiple stakeholders.
9. Analyse the importance of collaborative approaches in preventing, mitigating, and resolving environmental conflicts.
10. Analyse the existing conflict management policies and practices in Bhutan.

Learning and teaching approach:

Type	Approach	Hours per week	Total credit hours
Contact	Lectures	3	60
	Discussions and presentations	1	
Independent study	Written assignments and project	2	60
	Reading and review of class materials	2	
Total			120

Assessment Approach:

A. Individual Conflict Case Study Presentation: 15%

During the semester, the students will research and present a case study of an environmental conflict. Presentations will be approximately 20 minutes and should include detailed information on the actors and resources involved in the conflict, the history and transformation of the conflict over time, what steps have been taken to resolve the conflict, and the current state.

8% Content (including the use of sources, how well does the presentation address all claims relevant and supported)
3% Organization, language and discussion
4% Delivery (oral presentation, use of visual aid and effort to engage the audience)

B. Class Tests: 10%

Students will take two written class tests: one before midterm and one after the midterm (5% each) of 45-min duration covering 3-5 weeks of material. Reflection on key concepts and applying them to case studies will be assessed.

C. Group Project: 20%

The students will work in a group of 4 members to create a video recording (15 minutes) of a pre-approved negotiation topic that includes dialogue demonstrating an integrative negotiation between two or more parties. Evaluation will be based on the following criteria:

3% use of narration (Main narration: Who is negotiating and what are they negotiating?)
3% identification and explanation of Concepts of Negotiation
5% demonstration and Identification of the Stages of Negotiation
5% demonstrate, identify and explain the Negotiation Tactics used
4% realistic, relevant issues

D. Midterm Examination: 15%

Students will take a written exam of 1.5-hr duration covering topics up to the mid-point of the semester. The exam will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

E. Semester-End Examination: 40%

Students will take a written exam of 2.5-hr duration encompassing all the subject matter covered in the semester. This assessment is comprehensive and summative in nature, and will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

Overview of assessment approaches and weighting

Areas of assignments	Quantity	Weighting
A. Individual Conflict Case Study Presentation	1	15%
B. Class Tests	2	10%
C. Group Project	1	20%
D. Midterm Examination	1	15%
Total Continuous Assessment (CA)		**60%**
Semester-End Examination (SE)		**40%**

Pre-requisites: None

Subject matter:

Unit I: Introduction to Environmental Conflict Management

1.1. Understanding environmental security and environmental conflict
- 1.1.1. Ecological complexity
- 1.1.2. Social complexity
- 1.1.3. Scientific uncertainty
- 1.1.4. Legal and procedural frameworks
- 1.1.5. Challenges for conflict resolution

1.2. Characteristics of environmental conflicts

1.3. Types of conflict
- 1.3.1. Policy measures perspective: Upstream, midstream, and downstream
- 1.3.2. Environment induced conflicts

1.4. Debates on environmental conflicts

Unit II. Models and theories of conflict

2.1. Early conflict theories - Marx and Engels

2.2. Growth machine and critics of capitalism

2.3. Treadmill of production theory

2.4. Modernization theories and development

2.5. Environmental scarcity and conflict
- 2.5.1. Supply-induced scarcity,
- 2.5.2. Demand-induced scarcity,
- 2.5.3. Structural scarcity

Unit III. Assessing conflict situations/conflict assessment

3.1. Introduction to conflict assessment

3.2. Conflict assessment process and importance

3.3. The practice of conflict assessment

3.4. Phases of conflict assessment
- 3.4.1. Phase 1: Introductions – preliminary work
- 3.4.2. Phase 2: Information gathering
- 3.4.3. Phase 3: Analysis
- 3.4.4. Phase 4: Process design
- 3.4.5. Report writing, feedback, distribution

3.5. Benefits of conflict assessment

Unit IV. Environmental conflict resolution (ECR)

4.1. Purpose of ECR

4.2. ECR: Scope, techniques, processes, and roles
- 4.2.1. Consensus-based process
- 4.2.2. Conflict assessment
- 4.2.3. Facilitation
- 4.2.4. Mediation
- 4.2.5. Conciliation
- 4.2.6. Negotiating rule-making

Unit V. Negotiation and conflict resolution

5.1. Introduction to negotiation: Meaning and feature

5.2. Process of negotiation
- 5.2.1. Pre-negotiation
- 5.2.2. Conflict assessment process and goals
- 5.2.3. Fact findings
- 5.2.4. Building relationships
- 5.2.5. Integrative negotiation process

5.3. Negotiation
- 5.3.1. Perceptions of parties and building relationships (Neutrality of the mediator, balancing power)
- 5.3.2. Negotiation techniques for environmental conflict resolution (distributive and integrative bargaining)

5.4. Implementation and aspects of agreement
    5.4.1. Binding and non-binding agreements
    5.4.2. Relationships and power
    5.4.3. Accountability
    5.4.4. Time frame
    5.4.5. Moving forward

Unit VI. Collaborative policy and approaches to environmental conflict

6.1. The Need for a collaborative approach
6.2. Collaborative approaches to environmental decision making
6.3. Required conditions for a collaborative approach
    6.3.1. Representation of multiple interests
    6.3.2. Voluntary participation
    6.3.3. Direct engagement
    6.3.4. Mutual agreement on process and decision
    6.3.5. Considering culture
6.4. Benefits of a collaborative approach

Unit VII. Environmental conflict management and collaborative approaches to conflict management

7.1. Customary systems and practises of conflict management
7.2. National legal systems for conflict resolution
7.3. Alternative conflict resolution
7.4. Balancing resolution and management
7.5. Human-wildlife conflict management strategy in Bhutan
    7.5.1. Understanding the conflict
    7.5.2. Spatial pattern of human-wildlife conflict
    7.5.3. State's measures and intervention
    7.5.4. Habitat Improvement
    7.5.5. Salt lick area management
    7.5.6. Corridor management
    7.5.7. Education and community awareness
    7.5.8. Indigenous preventative measures

Reading List:

Essential Readings

Clarke, T.L., & Peterson T.R. (2015). *Environmental conflict management*. London, UK: Sage

Diehl, P., & Gleditsch, N. P. (Eds.). (2000). *Environmental conflict*: *An anthology*. London, UK: Routledge.

O'Leary, R., & Bingham. (Eds). (2018). *Promise of environmental conflict resolution*. New York, NY: RFF Press.

Susskind, L., McKearnan, S., & Thomas-Larmer, J. (1999). *The consensus building handbook: A comprehensive guide to reaching agreemen*t. London, UK: Sage.

Additional Reading

Amy, D. (1987). *The politics of environmental mediation*. New York: Columbia University Press.

BenDor, T.K., & Scheffran, J. (2008). *Agent-based modeling of environmental conflict and cooperation*. FL: CRC Press,

Case, D. (1990). The community toolbox: the idea, methods and tools for Conflict management in community forestry. Community Forestry/FTPP.

Castro, A.P. & Ettenger, K. (1996). *Indigenous knowledge and conflict management: exploring local perspectives and mechanisms for dealing with community forest disputes.* Presented at the Global e-Conference on Addressing Natural Resource Conflict Through Community Forestry, Jan–Apr 1996. Forests, Trees and People Programme of the Food and Agriculture Organization of the United Nations, Rome, Italy.

Homer-Dixon, T. F. (1999). *Environment, scarcity, and violence*. Princeton, N.J.: Princeton University Press.

Isenhart, M., & Spangle, M. (2000). *Collaborative approaches to resolving conflict*. London: Sage

Susskind, L., Verdini, B., Gordon, J., & Zaerpoor, Y. (2020). *Environmental problem-solving: Balancing science and politics using consensus building tools*. London: Anthem Press.

Date: June 2021

Module Code and Title: **ENV403 Environmental Humanities**
Programme: BSc in Environmental Management
Credit: 12
Module Tutor: Leishipem Khamrang (Coordinator), Tshewang Dorji

General objective: This module will challenge students to think beyond conventional scientific framework, which is the common paradigm for understanding environmental crises. Students will examine alternative conceptualizations such as indigenous values practices, human imagination, belief systems, indigenous cosmologies, ethics, arts and literature. They will gain new perspectives on the complexities of human and non-human relationships, and learn how humanities approaches can aptly serve as appropriate approaches to environmental management issues.

Learning Outcomes – On completion of the module, students will be able to:

1. Explain the emergence of environmental humanities.
2. Explain the relevance of humanistic perspectives in addressing environmental issues.
3. Describe the 'spiritual landscape' construct.
4. Justify the usefulness of Traditional Ecological Knowledge in an age of science.
5. Discuss the interconnectedness of culture and nature among indigenous people.
6. Analyse the perspective that all living beings emerge from and make their lives within multispecies communities.
7. Contrast different cultural perspectives on the environment.
8. Describe the connection between environmental values and spiritual attachment.
9. Discuss sacred cosmologies relatedness in everyday life of the indigenous Trans-Himalayan communities.

Learning and Teaching Approach:

Type	Approach	Hours per week	Total credit hours
Contact	Lectures	3	60
	Discussions and presentations	1	
Independent study	Written assignments	1	60
	Reading and review of class materials	3	
Total			120

Assessment Approach:

A. Critical Reflection Paper: 15%

Students will individually produce one reflection paper based on assigned readings. Reading materials will be on diverse topics under the broad themes such as ecocriticism, ecosophy, indigenous cosmologies and spiritual landscape. Students will be expected to review key concepts and critically reflect on how lessons learned can be applied to environmental issues. Each response paper will be 750-1000 words in length.

7% Accuracy and completeness of summary
5% Insightful use of class material to analyse and critique the materials
3% Mechanics (Language, organization and referencing)

B. Individual Presentation: 10%

Students will be assigned topics under broad themes such as Traditional Ecological Knowledge, lively ethnography, eco-religion, multispecies and anthropocene. Students will prepare a 10-minute presentation to share their findings with the class. The presentation will be evaluated on:

4% Accuracy and completeness of material summary
3% Insightful use of class material to explain the significance of the findings
3% Presentation delivery and clarity

C. Case study (Individual): 20%

Towards the end of the semester, students will carry out a case study choosing a specific community, activist, movement, project site, etc. Students will write a case study report of 1250-1500 words.

6% Accuracy and completeness
6% Insightful use of class material, the relevant theory and course concepts, to analyse and critique the findings and facts given in the case.
5% Meaningful application drawn from the case study to solve environmental issues
3% Mechanics (Language, organization and referencing)

D. Midterm Examination: 15%

Students will take a written exam of 1.5-hr duration covering topics up to the mid-point of the semester. The exam will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

E. Semester-End Examination: 40%

Students will take a written exam of 2.5-hr duration encompassing all the subject matter covered in the semester. This assessment is comprehensive and summative in nature, and will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

Overview of assessment approaches and weighting

Areas of assignments	**Quantity**	**Weighting**
A. Critical Reflection Papers	1	15%
B. Individual Presentation	1	10%
C. Case Study (individual)	1	20%
D. Midterm Examination	1	15%
Total Continuous Assessment (CA) **Semester-End Examination (SE)**		**60%** **40%**

Pre-requisites: ETH201 Environmental Ethics

Subject Matter:

Unit I: Introduction to environmental humanities

1.1. Concept, meaning, and scope of environmental humanities
1.2. Overview of the interface of social sciences, natural science and the humanities
1.3. Emergence of the environmental humanities
  1.3.1. Anthropocene in the environmental humanities
  1.3.2. Ecocriticism and the analysis of the treatment of environmental issues in literary texts
  1.3.3. Ecosophy as an approach to ecological harmony
  1.3.4. Geography and environmental humanities
  1.3.5. The environmental turn

Unit II. Indigenous cosmovision, spirituality, and landscape

2.1. Indigenous cosmologies and spiritual landscape
2.2. Intertwining of spirit, nature, and place
2.3. Beyond dualities: nature-culture and human versus non-human
2.4. Rights of nature and indigenous cosmovision

Unit III. Indigenous epistemologies: Traditional ecological knowledge

3.1. Review of TEK definition and components
3.2. TEK as tools to understanding environmental ‘crises’
3.3. Protection of the nature – dualities of science and indigenous philosophy

3.4. Indigenous stewardship model

Unit IV. The green religion imagination

4.1. Review on major religious views on nature
4.2. Spiritual ecology and radical environmentalism
4.3. Earth spirituality and green religion
4.4. Spirituality, nature and conservation
4.5. Planetary challenges and religious engagement

Unit V. Key concepts of multispecies studies

5.1. Resituating human and non-humans
5.2. Human-animal intimacies
5.3. Co-becoming and more-than-human kin-making
5.4. Posthumanism and multispecies studies
5.5. The ecological thought and coexistentialism
5.6. Speciesism, symbiotic relation, and co-evolution
5.7. Ecocide and responses to geographies of extinction

Unit VI. The environmental imagination

6.1. Concept and definition of environmental imagination
6.2. Ecological affordances
6.3. Storying the environment; Concept of “lively ethnography” as a tool to recognize the meaningful lives of other (humans and non-humans)
6.4. Popular culture and creative re-envisioning of environmental issues
6.5. Environmental imagination – case studies
    6.5.1. Reading cultural texts
    6.5.2. Activisms and actions - development sites and projects
    6.5.3. Nature writing (literature), art and film
6.6. Pan-humanly sustainable intelligence and ethics

Unit VII. Environmental humanities in the Trans-Himalaya

7.1. Ecological animism and ecological humanism
7.2. Transhumance practices and the environment
7.3. Folk tales, folklores, oral history and the environment
7.4. Philosophical animism in the Trans-Himalaya
7.5. Sacred cosmologies, meaning, significance, and practices
7.6. Commoning and changing commons

Reading List:

Essential Readings

Barilla, J. (2021). *Naturebot: Unconventional visions of nature.* Abingdon, England: Routledge

Berkes, F. (2017). *Sacred ecology* (4th ed.). New York, NY: Routledge.

Emmett, R.S., & Nye, D.E. (2017). *The environmental humanities: A critical introduction*. Cambridge, MA: The MIT Press.

Heise, U.K., Christensen, J., & Niemann, M. (2017). *The Routledge companion to the environmental humanities.* Abingdon, England: Routledge.

Morton, T. (2007). *Ecology without nature: Rethinking environmental aesthetics*. Cambridge, MA: Harvard University Press.

Additional Reading

Bergmann, S., & Clingerman, F.J. (2018). *Arts, religion and the environment: Exploring nature’s texture.* Amsterdam, Netherlands: Brill Rodopi.

Buell, L., & Schneider, R.J. (Eds.). (2000). *Thoreau's sense of place: Essays in American environmental writing (American land & life).* Iowa City, IA: University of Iowa Press.

Burton, A. (2021). *Trees in nineteenth-century English fiction the silvicultural novel.* Abingdon, England, Routledge.

Carson, R. (1962). *Silent spring.* Boston, MA*:* Houghton Mifflin.

Ehlers, E. & Krafft, T. (Eds.). (2006). *Earth system science in the Anthropocene: Emerging issues and problems*. Berlin, Germany: Springer-Verlag Berlin Heidelberg

Ghosh, A. (2006). *The hungry tide*. Toronto, Canada: Penguin Canada.

Ghosh, A. (2016). *The great derangement: climate change and the unthinkable.* Toronto, Canada: Penguin Canada.

Gibson, J.J. (2014). *The ecological approach to visual perception: Classic edition*. New York, NY: Psychology Press.

Gladwin, D. (2018). *Ecological exile, spatial injustice and environmental humanities.* Abingdon, England: Routledge.

Gottieb, R.S. (Eds.). (2006). *The oxford handbook of religion and ecology.* New York, NY: Oxford University Press.

Ives, J. D. (2004). *Himalayan perceptions: Environmental change and the well-being of mountain peoples*. Abingdon, England: Routledge.

Jenkins, W.J., Tucker, M. E., & Grim, J. (2017). *Routledge handbook of religion and ecology*. Abingdon, England: Routledge.

Jorgensen, D. (2019). *Recovering lost species in the modern age: Histories of longing and belonging*. Cambridge: The MIT Press.

Jørgensen, D., Jørgensen, F. A., & Pritchard, S. B. (Eds.). (2013). *New natures: Joining environmental history with science and technology studie*s. Pittsburgh, PA: University of Pittsburgh Press.

Lovelock, J. (2000). *Gaia: A new look at life on earth*. Oxford University Press.

Marie, B., & Henderson, J. (2000). *Protecting indigenous knowledge and heritage*: *A global challenge*. Vancouver, Canada: British Columbia Press.

Nixon, R. (2011). *Slow violence and the environmentalism of the poor*. Cambridge, MA: Harvard University Press.

Plomin, R., DeFries, J.C., & Fulker, D. W. (2006). *Nature and nurture during infancy and early childhood*. Vancouver, Canada: UBC Press.

Roothan, A. (2019*). Indigenous, modern and postcolonial relations to nature negotiating the environment.* London, England: Routledge.

Ross, A., Sherman, R., Snodgrass, J.G., & Delcore, H.D. (2010). *Indigenous peoples and the collaborative stewardship of nature: Knowledge binds and institutional conflicts.* London, UK: Routledge.

Sponsel, L. E. (2012). *Spiritual ecology: A quiet revolution.* Santa Barbara, CA: Greenwood Publishing; Abc-Clio.

Taylor, S. M. (2007). *Green sisters: A spiritual ecology.* Cambridge, MA: Harvard University Press.

Thom, V. D. (2016). *Flight ways: Life and loss at the edge of extinction*. New York, NY: Columbia University Press.

Tsing, A. (2015). *The Mushroom at the end of the world: On the possibility of life in capitalist ruins*. Princeton, NJ: Princeton University Press.

Yü, D.S. & Maaker, E.D. (Eds.). (2021). *Environmental humanities in the new Himalayas symbiotic indigeneity, commoning, sustainability.* Abington, London: Taylor & Francis Ltd.Yü, D.S. (2001). *Mindscaping the landscape of Tibet: place, memorability, ecoaesthetics*. Berlin, Germany: De Gruyter.

Date: June 2021

Module Code and Title: **ENV404 Cultural and Human Geography**
Programme(s): BSc in Environmental Management
Credit Value: 12
Module Tutor(s): Leishipem Khamrang (Coordinator), Kinley Dorji, Tshewang Dorji

General objective: This module will introduce students to the existing various approaches to the human-environment relationship and the spatial organisation of human societies. Further, perspectives on the space including spatiality in the social, cultural and economic sense, and continued reordering of the human-environment nexus constitute the core focuses of the module.

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

1. Describe geographical approaches to human and environment relationships.
2. Describe the distribution of the broad social and cultural patterns of the world.
3. Interpret human categorizations using different lenses: ethnic origin, race, culture.
4. Explain cultural landscapes and cultural regions.
5. Analyse patterns and types of settlements.
6. Describe the spatial interaction and diffusion process.
7. Assess spatial reorganization that occurs through the contemporary socioeconomic development process.
8. Analyse examples of contemporary politics of place and identity.
9. Analyse the socio-cultural patterns of the Himalayas.

Learning and Teaching Approach:

Type	Approach	Hours per week	Total credit hours
Contact	Lectures	3	60
	Discussions and presentations	1	
Independent study	Written assignments	1	60
	Reading and review of class materials	3	
Total			120

Assessment Approach:

A. Individual response paper: 10%

Students will write a response paper in about 750-1000 words on a topic approved by the tutor related to module contents. They will be assigned to read 3-5 articles related to contemporary cultural process and spatial organization of space, cultural and identity politics etc. and be able to synthesize the main points into a reflective response paper.

4% Quality of analysis (originality, thoughtfulness of reflection, use of relevant and adequate support for all claims made, ties analysis to relevant module concepts)
3% Articulation, accuracy, and completeness
3% Mechanics (Language and referencing)

B. Forum discussions via VLE: 10%

This exercise will mainly focus on critical reading, comprehension, and participation in the ensuing discussions. Related reading(s) will be provided for this assignment in advance to be followed by in-class discussion. Students will then write short reflective notes on the topics discussed in 150-200 words and submit these on VLE on the same day. Assessment will be done four times, two before midterm and two after midterm. The final mark will be an average of the four, each out of 10 marks:

6% Quality of analysis (originality, thoughtfulness of reflection, use of relevant and adequate support for all claims made, ties analysis to relevant module concepts)
4% Articulation, accuracy, and completeness

C. Class tests: 10%

Students will take two written class tests: one before midterm and one after the midterm (5% each) of 45-min duration covering 3-5 weeks of material.

D. Group Presentation: 15 %

In groups of 4, students will present (20-25 min) on a topic related to the theme 'socio-cultural and religious life of the Himalayas'. Each group will select a specific religion, community, culture, etc., of a particular country or region in the Himalayas.

Group mark (5%):

3% Presentation flow – transition between presenters, presentation organisation and structure

2% Overall group performance – visual aids, time management and team coordination

Individual mark (10%):

6% Content analysis and discussion (use of relevant concepts, terms and terminology, consistency, accuracy, evidence-based argument and, justification)

4% Delivery (language, ability to capture audience attention, flow and articulation)

E. Midterm Examination: 15%

Students will take a written exam of 1.5-hr duration covering topics up to the mid-point of the semester. The exam will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

F. Semester-End Examination: 40%

Students will take a written exam of 2.5-hr duration encompassing all the subject matter covered in the semester. This assessment is comprehensive and summative in nature, and will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

Overview of assessment approaches and weighting

Areas of assignment	Quantity	Weighting
A. Individual response paper	1	10%
B. Forum discussions via VLE	4	10%
C. Class tests	2	10%
D. Group Presentation	1	15%
E. Midterm	1	15%
Total Continuous Assessment (CA)		**60%**
Semester-End Exam (SE)		**40%**

Pre-requisites: ENV102 Population, Development and Environment

Subject Matter:

Unit I: Introduction to human geography

1.1. Nature and scope of cultural and human geography
1.2. Perspective and relevance of cultural and human geography
1.3. Approaches to Human-nature relationship
  1.3.1. Possiblilism and determinism
  1.3.2. Cultural ecological approach
  1.3.3. System analysis approach
  1.3.4. Environmental psychology

Unit II: Race, cultural patterns and processes

2.1. Concept of humans as a cultural species
2.2. Human race, origin and classification
2.3. Cultural landscape and cultural regions
2.4. Language, culture and religion of the world
2.5. Cultural diffusion, acculturation, assimilation process, popular and folk culture
2.6. Cultural hegemony and imperialism

Unit III: Spatial patterns and organization of space

3.1. Concept of area, space, place and region
3.2. Location and spatial interaction
3.3. Innovation and diffusion as spatial processes
3.4. Spatial interaction - gravity model

3.5. Political and material contexts of the times and places
3.6. Socioeconomic development process and the reorganization of space

Unit IV: Human settlements

4.1. Pattern and types of human settlement
4.2. Rural-urban dichotomy
4.3. Hierarchy of urban settlements
4.4. Concept of urban and functional classification of town
4.5. Urban morphology
4.6. Rural-urban fringe

Unit V: Power, space and political geography

5.1. State, territories, and nations
5.2. Space, place and identity politics
5.3. Nation, nationalism and citizenship
5.4. Geography of representation, belonging and participation
5.5. The geography of power, territoriality and control

Unit VI: Human geography of the Himalayas

6.1. Himalayan region: A geographical overview
6.2. Cultural landscape of the Himalayas
6.3. Religion and ethnic landscape
6.4. Ethnic composition and distribution
6.5. Spatial pattern of growth, development and socio-cultural nuances in the Himalayas
    6.5.1. Socio-spatial structure and inequality.
    6.5.2. Cultural proximity and social organization
    6.5.3. Cultural abrasion and deflation
    6.5.4. Linking environment, religion, food habit, and culture

Reading List:

Essential Readings

Boyle, M. (2015). *Human geography: A concise introduction*. Chichester, England: John Wiley & Sons Ltd.

Knowles, R., & Wareing, J. (2014). *Economic and social geography* (4th ed.). Oxford, England: Butterworth-Heinemann.

Knox, P.L., & Marston, S.A. (2015). *Human geography: Places and regions in global context* (7th ed.). London, England: Pearson International

Norton, W., & Mercier, M. (2019). *Human geography* (10th ed.). London, England: Oxford University press.

Additional Reading

Anderson, K., Domosh, M., Pile, S., & Thrift, N. (Eds.). (2003). *Handbook of cultural geography.* London, England: Sage

Cloke, P.J., & Johnston, R. (2005). *Spaces of geographical thought: Deconstructing human geography's binaries.* London, England: Sage

Domosh, M., Neumann R.P., Price, P.L., & Jordan-Bychkov, T.G. (2011). *The human mosaic: A cultural approach to human geography.* New York, NY: W. H. Freeman and Company.

Duncan, J., Johnson, N., & Schein, R. (Eds.). (2004). *A companion to cultural geography*. Malden, MA: Blackwell Publishing.

Fouberg, W.H., Murphy, A.B., & De Blij.H.J. (2015). *Human geography, place, and culture* (11th ed.). Hoboken, NJ: John Wiley & Sons.

Flint, C., & Taylor, P.J. (2018). *Political geography: World-economy, nation-state and locality*. Abingdon, England: Routledge.

Fraser, N., & Bhattacharya, A. (2001). *Geography of a Himalayan Kingdom Bhutan.* New Delhi, India: Concept Publishing Company

Guneratne, A. (2010). *Culture and the environment in the Himalaya*. Abingdon, England: Routledge.

Ghosh, S. (2012). *Introduction to settlement geography*. Mumbai, India: Orient Longman

Ives J.D. (2004). *Himalayan perceptions: Environmental change and the well-being of mountain peoples*. Abingdon, England: Routledge.

Jones, A. (2012). *Human geography: The basics.* Abingdon, England: Routledge,

Mesoudi, A. (2011). *Cultural evolution: How Darwinian theory can explain human culture and synthesize the social sciences.* Chicago, IL: University of Chicago Press

Rubenstein, J. M. (2018). *Contemporary human geography* (4th ed.). New York, NY: Pearson.

Date: June 2021

Module Code and Title: **ENM411 Natural Hazards and Disaster Management**
Programme: BSc in Environmental Management
Credit Value: 12
Module Tutor(s): Jamyang Pelmo (Coordinator), Bach-Liên Ngo, Kinley Dorji

General objective: This module introduces students to biological and natural hazards, their potential to cause environmental disasters, and options for pre-planning or mitigating their effects. It focuses on risk assessment, adaptation strategies, resilience and mitigating the adverse effects of natural hazards.

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

1. Explain environmental hazards and natural hazards.
2. Discuss risk and disaster management strategy.
3. Explain the implication of human activities on biological and natural disasters at the local level.
4. Characterise a study area in terms of vulnerability, severity of natural hazards and preparedness plan in Bhutan.
5. Conduct a risk assessment study for a chosen study area.
6. Discuss the importance of community preparedness in managing risk.
7. Analyse potential strategies that would account for local specificities.
8. Analyse technologies implemented to mitigate the adverse effects of natural hazards.
9. Develop a natural disaster risk reduction plan.

Learning and teaching approach:

Type	Approach	Hours per week	Total credit hours
Contact	Lectures	3	60
	Tutorials	1	
Independent study	Written assignments and projects	2	60
	Reading and review of class materials	2	
Total			120

Note: Tutorials will comprise of class exercises, videos, case study analysis in class, group discussions and guest lectures.

Assessment Approach:

A. Class Tests: 10%

Students will undertake class tests twice during the semester (5% each); once before mid-term (after completion of unit 2) and once after mid-term (after completion of unit 4). Each test will be conducted within the class for a duration of 40-50 min.

B. Risk assessment study: 20%

Students, in groups of 3, will choose a study area for example hospital, petrol pump fire brigadier station and public spaces and conduct a risk assessment which would include identifying risk, risk management plan implemented in the chosen study area and then hazard/disaster management plan/strategy implemented. Each group will produce a risk assessment report. The report (750 -1000 words) will synthetize the results of the study: risk identification, risk analysis and proposed risk control measures.

3% Worksheet in field and results

7% Risk assessment process
7% Proposition of risk control
3% Mechanics (Language, organization and referencing)

C. Group project: 20%

Students in groups of 4 will be assigned with a potential disaster: earthquakes, floods, epidemics, etc. Each group will create a model of a resilient community and discuss their plan.

5% Plan design
5% Model design
5% Presentation
5% Justification

D. Midterm Examination: 20%

Students will take a written exam of 1.5-hr duration covering topics up to the mid-point of the semester.

E. End-semester seminar: 30%

The final assessment is intended to assess students' ability to prepare and effectively communicate to communities. Students in groups will explore a case related to natural hazards. Each group will create awareness, provide background information and train community members. Students will be asked to involve experts, governmental agents and/or community members.

5% Seminar paper
5% Individual participation
5% Originality and relevance of the topic
5% Involvement of external actors
5% Seminar presentation
5% Seminar organisation and materials

Overview of assessment approaches and weighting

Areas of assignments	Quantity	Weighting
A. Class tests	2	10%
B. Risk assessment study	1	20%
C. Group project	1	20%
D. Midterm Examination	1	20%
E. End-semester seminar	1	30%
Total Continuous Assessment (CA)		**100%**

Pre-requisites: None

Subject matter:

Unit I: Key concepts

1.1. Definition of hazard, risk and disaster
1.2. Environmental hazards and their effects
1.3. Classification of natural hazards and disasters
1.4. Concept of vulnerability and prediction
1.5. The Sendai Framework for Disaster Risk Reduction 2015-2030

Unit II: Biological hazards

2.1. Biological agents such as bacteria, virus and protozoa and their behaviour
2.2. Infectious diseases and risk of epidemics such as Malaria and Covid-19
2.3. Biological hazards management and international regulation
2.4. Anthropogenic hazards such as oil spill, environmental toxins, mercury poisoning and nuclear meltdown.

Unit III: Natural hazards

4.1. Brief review of the atmosphere-ocean system and the prediction of natural phenomenon

4.2. Potentially hazardous natural phenomena: atmospheric, seismic, geologic, hydrologic, volcanic, weather-related; acute vs. long-term

4.3. Patterns of different natural hazards (earthquakes, volcanoes, landslides, and severe storms)

Unit IV: Hazard identification and risk assessment

5.1. Steps of hazards assessment

5.2. Vulnerability factors

5.3. Tools and techniques: risk assessment matrix, remote sensing and GIS mapping

5.4. Human health risk assessment

5.4.1. Health hazard, health risk, exposure

5.4.2. Steps of human health risk assessment

Unit V: Hazard mitigation approaches

6.1. Community preparedness and mitigation

6.2. Review of national and international strategies for disaster resilience

6.3. Disaster communication plan: prevention of panic, health behaviour, response coordination, social media

6.4. Disaster recovery and rehabilitation

Unit VI: Natural hazards and disaster management in Bhutan

7.1. Natural and man-made disaster

7.1.1. Forest fire

7.1.2. Earthquake

7.1.3. Flash flood

7.1.4. Glacial lake outburst flood (GLOF)

7.2. Disaster management planning guidelines; Roles and involvement of GNH Commission (GNHC), Department of Disaster Management (DDM), National Centre for Hydrology and Meteorology (NCHM) and National Environment Commission (NEC)

7.3. Environmental management framework for Bhutan

7.4. Hazard zones

Reading List:

Essential Reading

Brassard, Caroline, Giles, David W., Howitt, Arnold M. (Eds.) (2015). *Natural disaster management in the Asia-Pacific: Policy and governance.* Berlin, Germany: Springer Science+Business Media.

Smith, K. (2013). *Environmental hazards: Assessing risk and reducing disaster* (6th ed.). London, UK: Routledge.

UN 2015. *Sendai Framework for Disaster Risk Reduction 2015-2030*. Retrieved from: https://www.preventionweb.net/files/43291_sendaiframeworkfordrren.pdf

Additional reading

Brower, David J. and Charles C. Bohl. *Principles and Practice of Hazards Mitigation*.

Burby, Raymond J., et al. *Building Disaster Resilient Communities.* Emmitsburg, MD: FEMA Emergency Management Higher Education Project College Course, May 2002. http://training.fema.gov/EMIWeb/downloads/BuildingDRCdoc.doc

Canton, Lucien G. (2007) *Emergency Management: Concepts and Strategies for Effective Programs*. Hoboken, NJ: Wiley Inter-Science.

Drabek, Thomas E (2003). *Strategies for Coordinating Disaster Responses*. Boulder, CO: University of Colorado.

Drabek, Thomas E (2004). *Social Dimensions of Disaster, 2nd Edition.* Emmitsburg, MD: FEMA Emergency Management Higher Education Project College Course.

Emmitsburg, (2000). MD: FEMA Emergency Management Higher Education Project College Course, April 2000. http://training.fema.gov/EMIWeb/edu/HMPrinciple.asp

Date: June 2021

Module Code and Title: **ENM412 Frontiers in Sustainable Development**

Programme: BSc in Environmental Management

Credit: 12

Module Tutor: Leishipem Khamrang (Coordinator), Tshewang Dorji

General objective: This module introduces students to the contemporary debate and discussion on environment and sustainable development. Conceptual paradigms, critiques and contemporary dialogue on sustainable development emphasising on the mainstream and counter currents of sustainable development constitute the core of the module. Further, the module also covers emerging challenges and threats to the environment and illustrate to students how people are striving to address and protect the many features of the world that we all share. 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 in doing so.

Learning Outcomes – On completion of the module, students will be able to:

1. Explain conceptual paradigm of sustainable development
2. Explain the various pillars of sustainable development, its goals and objectives
3. Critiques the mainstream logic of sustainable development
4. Identify the various initiatives that have been taken globally to encourage sustainable development practices
5. Explore the most current ways in which people are striving to address and protect the many features of the world.
6. Debate on key environmental issues of the day.
7. Critically evaluate evidence or examples presented in research reports against author(s)' claims and conclusions.
8. Discuss contemporary development dialogues and advocacies for sustainable development at international, regional and national levels
9. Discuss key agendas of sustainable development discussed at various regional and international events of the United Nations.
10. Analyse contemporary development scenarios and practices in Bhutan in the background of GNH philosophy.

Learning and Teaching Approach:

Type	Approach	Hours per week	Total credit hours
Contact	Lectures	3	60
	In-class exercise and discussion	1	
Independent study	Written assignments	3	60
	Reading and review of class materials	1	
Total			120

Assessment Approach:

A. Critical reflection paper: 15%

Students will individually write a critical reflection paper in about 750-1000 based on an assigned reading of a relevant article assigned by the tutor. Students will be expected to critically review on the article in line with the various theories of sustainable development. Reflection paper will be evaluated based on the following criteria:

5% Accuracy and completeness of summary
7% Insightful use of class topics to analyse and critique the material
3% Mechanics (Language, organization and referencing)

B. Individual presentation: 15%

Each student will make a presentation of 10 minutes on a topic proposed by the student related to the module and approved by the tutor. Topics should be based on specific events or initiatives drawn from current affairs within the past year. These should be related in the presentation to relevant theoretical frameworks of sustainable development, and the student should provide a critical reflection on the recent development in light of contemporary debates/stances. The presentation will be evaluated on:

4% Accuracy and completeness of the summarized current affairs event/initiative
4% Insightful relation of theoretical frameworks to the selected topic
4% Critical reflection
3% Presentation delivery and clarity

C. Class Test: 5%

Students will undertake one class test conducted within the class for a duration of 40-50 min and cover 2-4 weeks of material. Reflection on key concepts and applying them to case studies will be assessed.

D. Forum discussions via VLE: 10%

This exercise will mainly focus on critical reading, comprehension, and participation in the ensuing discussions. Related reading(s) will be provided for this assignment in advance followed by in-class discussion. Students will then write short reflective notes on the topics discussed in 150-200 words and submit these on VLE on the same day. Assessment will be done four times, two before midterm and two after midterm. The final mark will be an average of the four, each out of 10 marks:

6% Quality of analysis (originality, thoughtfulness of reflection, use of relevant and adequate support for all claims made, ties analysis to relevant module concepts)

4% Articulation, accuracy, and completeness

E. Midterm Examination: 15%

Students will take a written exam of 1.5-hr duration covering topics up to the mid-point of the semester. The exam will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

F. Semester-End Examination: 40%

Students will take a written exam of 2.5-hr duration encompassing all the subject matter covered in the semester. This assessment is comprehensive and summative in nature, and will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

Overview of assessment approaches and weighting

Areas of assignment	Quantity	Weighting
A. Critical reflection paper	1	15%
B. Presentation (Individual)	1	15%
C. Class test	1	5%
D. Forum discussions via VLE	4	10%
E. Midterm	1	15%
Total Continuous Assessment (CA)		**60%**
Semester-End Exam (SE)		**40%**

Pre-requisites: ETH201 Environmental Ethics

Subject Matter:

Unit I: Sustainable development

1.1. Meaning, history, and conceptual paradigms of sustainable development
1.2. Normative principles and pillars of sustainable development
1.3. Key indicators and factors influencing sustainable development
1.4. Theoretical and conceptual exploration of sustainable development
    1.4.1. Modernization theory and the emergence of new models of development

1.4.2. Sustainable development model – A new environmentalist approach

1.5. Approaches to sustainable development

1.5.1. The ladder of sustainable development - Anthropocentric approach and biocentric approach.

1.5.2. Integrated and systems approaches

1.5.3. Daly's Rule and its application

1.5.4. Circle of sustainability approach

1.5.5. Ecological footprint approach

1.5.6. Cultural approach

1.6. The Brundtland model of sustainable development

1.6.1. The Brundtland development paradigm

1.6.2. Key links in the economy-society-environment chain

Unit II: Indicator systems and sustainable development goals

1.1. Tracking and assessment of world poverty, hunger and food security

1.2. Reduce inequality through participation empowerment

1.3. Evaluation of trade-offs - Global partnership and inclusive growth

1.4. Universalize access to basic services - health, sanitation, education and sustainable energy

1.5. Urban livability: energy and sustainable infrastructure

1.6. Optimisation of resources use and conservation

1.7. Global peace, security, prosperity and development

1.8. Growth process and climate change

Unit III: Mainstream sustainable development

2.1. Deconstructing the mainstream discourse of SD: Formation, influences and practices.

2.2. Market environmentalism and green economy

2.3. Corporate environmentalism, sustainability and corporate greening

2.4. Ecological modernization

2.5. Environmental populism

2.6. Environmental limits and mainstream sustainable development

Unit IV: Critiques and counter currents of sustainable development

3.1. Primacy of economy & growth

3.2. Traditional vs modern perspectives

3.3. Alternatives, cultural economy, hybrid models

3.4. Green critiques of developmentalism: Radical environmentalism

3.5. Eco-socialism and sustainability

3.6. Eco-anarchism

3.7. Deep ecology movement

3.8. Eco-feminism and sustainable development

3.9. Political ecology and contemporary development practices

Unit V: Social dialogues and sustainable development - role of state and non-state actors

4.1. Advocacy, justice, and governance

4.2. Agenda 21 and the global development dialogues

4.3. Transforming our world: the 2030 Agenda for sustainable development

4.4. Conference of the parties (COP)

4.5. UN Sustainable Development Solutions Network (SDSN)

4.6. South Asia Forum on Sustainable Development Goals

Unit VI: Gross National Happiness and sustainable development practices

5.1. Bhutanese notion of happiness and the origin of GNH

5.2. The pillars of GNH and development practices

5.3. GNH-based governance and sustainable development practices

5.4. State of the environment – land, air, water, agriculture, biodiversity etc.

5.5. Challenges and case studies - sustainable development practices (protected areas and development projects)

5.6. Sustainable livelihood approaches – payment ecosystem services, community forest management, and integrated conservation development programs.

Reading List:

Essential Reading

Adams, W. M. (2019). *Green development: Environment and sustainability in a developing world* (4th ed.). London, England: Routledge.

Baker, S. (2006*). Sustainable development.* London, England: Routledge.

Monkelbaan, J. (2019). *Governance for the sustainable development goals. Exploring an integrative framework of theories, tools, and competencies*. Singapore: Springer.

Wilson, C. (2018*). Designing the purposeful world: The sustainable development goals as a blueprint for humanity.* London, England: Greenleaf Publishing & Routledge

Robertson, M. (2017). Sustainability principles and practice (2nd ed.). London, England: Routledge.

Additional readings:

Atkinson, G., Dietz, S., & Neumayer, E. (Eds.). (2007). *Handbook of sustainable development.* Cheltenham, England: Edward Elgar Publishing.

Brooks, J.S. (2013). Avoiding the limits to growth: Gross National Happiness in

Bhutan as a model for sustainable development. *Sustainability,* 5, 3640-3664.

Daly, H.E. (1990). Toward some operational principles of sustainable development. *Ecological Economics,* 2, 1-6.

Dresner, S. (2002). *The principles of sustainability.* London, England: Earthscan.

Essougong, K., Foundjem-Tita, D., & Minang, P.A. (2019). Addressing equity in community forestry: Lessons from 20 years of implementation in Cameroon. *Ecology and Society,* 24(1).

Gurung, D.B., & Seeland, K. (2011). Ecotourism benefits and livelihood improvement for sustainable development in the nature conservation areas of Bhutan. *Sustainable Development,* 19, 348-358.

Hove, H. (2004). Critiquing sustainable development: A meaningful way of mediating the development impasse? *Undercurrent, 1*(1), 48-54.

Lautensach, A. & Lautensach, S. (2013). Why 'sustainable development' is often neither: A constructive critique. *Challenges in Sustainability,* 1(1), 3-15.

Low, N., & Gleeson, B. (1998). *Justice, nature and society: An exploration of political ecology.* London, UK: Routledge.

Pascual, U., Phelps, J., Garmendia, E., Brown, K., Cobera, E., Martin, A., Gomez-Baggethun, E., & Muradian, R. (2014). Social equity matters in payments for ecosystem services. *BioScience,* 64(11), 1027- 1036.

UNEP. (2011). *Towards a green economy: Pathways to sustainable development and poverty eradication – A synthesis for policy makers.* France: United Nations.

Ura, K. (2005). *The Bhutanese development story.* Monograph No. 15. Thimphu, Bhutan: Centre for Bhutan Studies.

Zielinski, T., Sagan, I., & Surosz, W. (Eds.). (2018). *Interdisciplinary approaches for sustainable development goals: Economic growth, social inclusion and environmental protection.* Gewerbestrasse, Switzerland: Springer.

Date: June 2021

Module Code and Title: **ENM413 Environmental Management Systems and Auditing**
Programme: BSc in Environmental Management
Credit: 12
Module Tutor(s): Bikram Sharma (Coordinator), Kinley Dorji

General objective: This module familiarizes students with a set of practices and processes of environmental management systems, their development, implementation, and monitoring. Students will also learn about environmental regulations and the ISO series standards that an organization needs to uphold in order to avoid or minimize environmental degradation.

Learning Outcomes – On completion of the module, students will be able to:

1. Describe the key features of environmental management systems.
2. Discuss organizational drivers for environmental management.
3. Describe the procedure and process of ISO certification and accreditation.
4. Discuss the roles of ISO 14000 series components towards environmental impact management within an organization.
5. Explain elemental standards of ISO 14001 for EMS.
6. Describe the elements of the ISO series for environmental auditing.
7. Apply the procedures of compliance audit.
8. Explain the types and models of environmental management strategies.
9. Produce a sample EMS manual for a chosen organization based on the elements of the ISO 14000 series.
10. Discuss various classifications and criteria for environmental product labelling.

Learning and Teaching Approach:

Type	Approach	Hours per week	Total credit hours
Contact	Lectures	3	60
	Discussions and presentations	0.5	
	Field visit	0.5	
Independent study	Written assignments and projects	2	60
	Reading and review of class materials	2	
Total			120

Assessment Approach:

A. EMS manual: 15%

The tutor and students will select 10 different organizations. Four students will work in a group on one organization to develop a sample EMS manual based on any four elements of the ISO14000 series. The comprehensive EMS manual of 2000-2250 words should capture the adequate description of all the components like EMS Planning, EMS Development and Implementation (management committee, Planning-Do-Check-Act cycle, and management review), and EMS Certification Process.

2% Organization and structure
5% Description of EMS components (clarity/accuracy/reliability/feasibility)
3% Synthesis of the information (comprehension/accuracy/coherence/thoughtfulness)
3% Analytical thinking (critically discuss the scope, opportunities, limitations and recommendations)
2% Mechanics and conventions (language, correct use of figure and tables, citation and referencing)

B. Environmental Audit Report: 20%

Students in a group of four will choose an organization and do a mock environmental audit. Each student in the group will work on each of these parts - Environmental Management Systems Audits, Environmental Performance Audits, Environmental Financial Audits, and Environmental Compliance Audits - and all together produce an overall report of about 2000 - 2250 words and present their findings to the class. With the background knowledge of environmental auditing, students will observe, interact and discuss with the people from the chosen organization to audit the principal components of environmental auditing. This

assessment aims to develop technical competencies of observing, collecting, interpreting, recording and evaluating various information by employing *inquiry-based learning/investigation*.

Part A: Report: 15% (individual assessment)

7% Report (Introduction (clarity and focus, significance and proposition), Methodology (accuracy/reliability - measurement instrument, collection, analyses, and context), Results (organization, comprehensiveness, use of supportive statistical analysis with tables/figures, and interpretation), and Discussion (interpretation and description, argument, and proposed perspectives and recommendations).

3% Synthesis of the information (well-supported argument for how their subject illustrates the concept or process taught in the class)

3% Analytical thinking (critically discuss the opportunities, limitations and recommendations)

2% Mechanics (Language and referencing)

Part B: Presentation: 5% (group assessment) – 8 to 12 minutes

3% Content

2% Presentation (Organization, Delivery, visual aids)

C. Class Tests: 10%

Students will take two written class tests: one before midterm and one after the midterm (5% each) of 45-min duration covering 3-5 weeks of material.

D. Midterm Examination: 15%

Students will take a written exam of 1.5-hr duration covering topics up to the mid-point of the semester. The exam will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

E. Semester-End Examination: 40%

Students will take a written exam of 2.5-hr duration encompassing all the subject matter covered in the semester. This assessment is comprehensive and summative in nature, and will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

Overview of assessment approaches and weighting

Areas of assignments	Quantity	Weighting
A. EMS manual	1	15%
B. Environmental audit report	1	20%
C. Class tests	2	10%
D. Midterm Examination	1	15%
Total Continuous Assessment (CA)		**60%**
Semester-end Examination (SE)		**40%**

Pre-requisites: ENM409 Environmental Impact Assessment

Subject Matter:

Unit I: Environmental management systems (EMS)

1.1. Definition and background
- 1.1.1. Environmental risk management
- 1.1.2. Organizational drivers for environmental management: Energy efficiency, waste minimization, green company image, competitive advantage, supply chain pressures, environmental legislation protection, staff morale and social responsibilities

1.2. Scopes and development of EMS

1.3. Leadership and commitment as important components of effective EMS

1.4. Barriers to effective implementation of EMS: Unforeseen issues, lack of multidisciplinary team, structure and training

1.5. International Organization for Standardization (ISO)

1.5.1. History
1.5.2. ISO series
1.5.3. Certification and accreditation

1.6. Bhutan Standard Bureau
1.6.1. Mandates (As per Bhutan Standards Act 2010)
1.6.2. Management system certification scheme
1.6.3. Procedure for product certification

1.7. Case study on the EMS carried out in mining and mineral processing

Unit II: ISO 14000 family for Environmental Management Systems

2.1. Background and history of ISO 14000

2.2. ISO 14000 series
2.2.1. ISO 14001:2015 - Requirements with guidance for use
2.2.2. ISO 14002-1:2019 - Guidelines for using ISO 14001 to address environmental aspects and conditions within an environmental topic area
2.2.3. ISO 14004:2016 - General guidelines on implementation
2.2.4. ISO 14005:2019 - Guidelines for a flexible approach to phased implementation
2.2.5. ISO 14006:2020 - Guidelines for incorporating eco-design
2.2.6. ISO 14007:2019 - Guidelines for determining environmental costs and benefits
2.2.7. ISO 14008:2019 - Monetary valuation of environmental impacts and related environmental aspects

2.3. Continual improvement cycle approach: Plan-do-check-act model

Unit III: Environmental Auditing (EA)

3.1. Introduction to EA
3.1.1. Definition
3.1.2. Objectives
3.1.3. Benefits
3.1.4. EA scheme and components
3.1.5. Difference between EA and Environmental Impact Assessment (EIA)
3.1.6. History of EA

3.2. Principle areas of environmental auditing: scope, setting and general processes
3.2.1. Materials
3.2.2. Energy
3.2.3. Water
3.2.4. Health and safety
3.2.5. Environmental quality
3.2.6. Waste
3.2.7. Engineering

3.3. Types of Environmental Auditing (scope, components, methodologies and reporting)
3.3.1. Environmental Management Systems Audits
3.3.2. Environmental Performance Audits
3.3.3. Environmental Financial Audits
3.3.4. Environmental Compliance Audits
3.3.5. Environmental Auditing Report

3.4. ISO guidelines and procedure
3.4.1. 14010 guidelines for Environmental Auditing
3.4.2. 14011 EMS Procedure
3.4.3. 14012 qualifications criteria for Environmental Auditing

3.5. Challenges in auditing EMS

3.6. Bhutan’s environmental audit guidelines, 2019

Unit IV: Environmental Management Strategies

4.1. Introduction and background

4.2. Types of Environmental Management Strategies

4.3. Models of Environmental Management Strategies
4.3.1. Greening Models and Classification of environmental policies
4.3.2. Continuum models (Environmental Context, Strategic Options Model, and Five-Staged Model)

4.4. Integrated approach

Unit V. Environmental Product Labelling

5.1. Introduction
- 5.1.1. Concept and importance for environmental compliance
- 5.1.2. Definition
- 5.1.3. Objectives
- 5.1.4. Benefits
- 5.1.5. History

5.2. Criteria for Environmental Product Labelling
- 5.2.1. Life cycle analysis (cradle-to-grave approach)
- 5.2.2. Eco-parameters

5.3. Enhancing environmental product performance
- 5.3.1. Environmental effect analysis
- 5.3.2. Eco-design strategies
- 5.3.3. Eco-design checklists

5.4. Classification of Environmental Labelling and Information Schemes (ELIS)
- 5.4.1. ISO 14024 Type I Labels
- 5.4.2. ISO 14021 Type II Labels
- 5.4.3. ISO 14025 Type III Labels

Reading List:

Essential Reading

ISO. (2002). *ISO 19011: Guidelines for quality and/or environmental management systems auditing.* Geneva, Switzerland: International Organization for Standardization.

ISO. (2004). *ISO 14001: Environmental management systems-Requirements with guidance for use*. Geneva, Switzerland: International Organization for Standardization.

Jain, R. K., Cui, Z.C., & Domen, J. K. (2016). *Environmental impacts of mining andmineral processing: Management, monitoring and auditing strategies*. London, UK: Elsevier.

Hillary, R. (1998). Environmental auditing: Concepts, methods and developments. *International Journal of Auditing, 2*(1), 71–85.

Dentch, M. P. (2016). *The ISO 14001:2015 implementation handbook: using the process approach to build an environmental management system.* Wisconsin, WI: ASQ Quality Press.

Moision J. (2003). *Environmental management system ISO 14001*. Finland: Benchmarking Ltd.

Sheldon, C., & Yoxon, M. (2006). *Environmental management systems: A step-by-step guide to implementation and maintenance (3rd edition*). London, UK: Earthscan.

Additional readings:

Bhutan. (2016). *Procedure for product certification*. Thimphu, Bhutan: Bhutan Standard Bureau.

Brady, J. (2006). *Environmental management in organizations: The IEMA handbook*. London, UK: The Institute of Environmental Management and Assessment.

Cheremisinoff, N. P. (2006*). Environmental management systems handbook for refineries - Pollution prevention through ISO 14001*. Houston, TX: Gulf Publishing Company

Haider, S. I. (2011). *Environmental management system ISO 14001:2004: handbook of transition with CD-ROM.* London, UK: CRC Press.

Pain, S. W. (2010). *Safety, health, and environmental auditing: A practica*l. New York, NY: Taylor & Francis Group.

Royal Audit Authority. (2019). *Environmental Audit Guidelines.* Thimphu, Bhutan: Royal Audit Authority

UNOPS. (2009). *A guide to environmental labels.* Nairobi, Kenya: UNEP.

Date: June 2021

Module Code and Title: **ECL402 Restoration Ecology**
Programme: BSc in Environmental Management
Credit: 12
Module Tutor(s): Kinley Dorji (Coordinator), Bikram Sharma

General objective: This module aims to teach general theories and principles behind ecosystem restoration. The students will learn about various aspects and approaches of restoring different ecosystems involving multiple stakeholders. Students will come to understand that like ecosystems themselves, ecological restoration is a multifaceted field – and successful restoration requires a good understanding of site-specific conditions, ecosystem processes, monitoring and management.

Learning Outcomes – On completion of the module, students will be able to:

1. Explain the ethics and reasons for restoring ecosystems.
2. Discuss opportunities and challenges of ecological restoration.
3. Describe general procedure for restoring an ecosystem.
4. Identify suitable approaches for ecosystem restoration.
5. Prepare and evaluate ecological restoration and management plans.
6. Explain management approaches that can allow for mixed-use regions in or around riparian areas.
7. List appropriate approaches for forest landscape restoration.
8. Recommend ways to allow ruminant domestic livestock grazing without impairing forest and grassland ecosystems.
9. Identify various ways and methods to mitigate forest fires in Bhutan.
10. Suggest appropriate measures for controlling and eradicating invasive species.
11. Describe potential restoration methods for use around built areas.

Learning and teaching approach:

Type	Approach	Hours per week	Total credit hours
Contact	Lectures	2.5	60
	Discussions	1	
	Field Visit	.5	
Independent study	Written assignments	1	60
	Reading and review of class materials	3	
Total			120

Assessment Approach:

A. Individual Written Assignment: 15%

Students will individually write a review paper about land degradation and ecological restoration. The student must write the summary after thorough study on different types of degraded land evaluating disturbances and degradation in ecosystem functions using at least one of the evaluation methods discussed in class. Based on their study they will recommend a particular restoration practice. Their research summary of 1000 – 1200 words will be submitted in two phases – draft and final submission.

Part A: Draft: 5%

2% Content (originality, approach, result/discussion, scholarship)

1% Focus (relevance, organization, conclusion)

2% Language (style, mechanics)

Part B: Final submission: 10%

2% Depending on how many comments from the draft are incorporated for the final submission, the tutor can award them negative marking.

3% Synthesis of the information (includes an explanation of a key concept or process from the module, and well-supported argument for how their subject illustrates the concept or process taught in the class)

3% Analytical thinking (discuss the best practices of biodiversity conservation and propose remedial measures to reduce threats to different biodiversity, discuss different conservation techniques)

2% Mechanics (Language and referencing)

B. Project work: 20%

In groups of 3 to 4, students will propose a restoration/rehabilitation/reclamation project. Each group will be assigned a piece of degraded land from around the country. Their project will engage with aspects related to ecological restoration like soil stabilization, invasive plant management, rangeland management, forest fire management, riparian restoration, forest landscape restoration and wasteland management. Students will augment their 1330-1500 words proposal with constructed models of existing conditions and expected outcomes. They will exhibit their model in one of the class hours. The assessment for model presentation will be done out of 10% by invited external judges.

3% Completeness of model
2% Practicality
2% Restoration element
3% Visual presentation and creativity

The assessment for the written proposal will be done out of 10%.

2% Components and steps
3% Principles of ecological restoration and practicality
3% Mechanics and conventions
2% Use of maps and other models

C. Class Tests: 10%

Students will undertake two class tests, once before and once after midterm. The written tests will be conducted within the class for a duration of 40-50 min and cover the lessons of two to three weeks.

D. Midterm Examination: 15%

Students will take a written exam of 1.5-hr duration covering topics up to the mid-point of the semester. The exam will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

E. Semester-End Examination: 40%

Students will take a written exam of 2.5-hr duration encompassing all the subject matter covered in the semester. This assessment is comprehensive and summative in nature, and will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended essay questions.

Overview of assessment approaches and weighting

Areas of assignment	Quantity	Weighting
A. Individual written assignment	1	15%
B. Project work	1	20%
C. Class test	2	10%
D. Midterm Examination	1	15%
Total Continuous Assessment (CA)		**60%**
Semester-End Examination (SE)		**40%**

Pre-requisites: ECL101 Principles of Ecology

Subject Matter:

Unit I: Introduction

1.1. Definition and concepts
1.2. Responsibility and ethics of ecological restoration
1.3. Principles and guidelines for ecological restoration (According to the recommendations made by The Subsidiary Body on Scientific, Technical and Technological Advice on Conference of the Parties at its thirteenth meeting (2016), and International Union for

Conservation of Nature and Natural Resources' World Commission for Protected Areas Restoration Taskforce (2012))

1.4. Key ecological concepts underlying restoration
    1.4.1. Disturbance
    1.4.2. Succession
    1.4.3. Fragmentation
    1.4.4. Ecosystem functions
1.5. Institutions and Organizations: their roles and significance in
    1.5.1. Society for ecological restoration,
    1.5.2. International science & policy working group
    1.5.3. World Commission for Protected Areas under IUCN
    1.5.4. National Environmental Commission
1.6. Opportunities and challenges of ecological restoration (ecological, economic and environmental)

Unit II: General procedure for ecosystem restoration

2.1. Inventory and mapping (Basemap - Land Use or Cover, Ecological Units, Drainage, Invasive species and stressors)
2.2. Investigate historic conditions
2.3. Interpret landscape changes
2.4. Stakeholder consultation
2.5. Development of goals and objectives
2.6. Development of restoration plan
2.7. Development of a good monitoring program
2.8. Implementation of the project plan
2.9. Record keeping
2.10. Review of the project
2.11. Share the restoration process

Unit III: Riparian ecology and management

3.1. Concept of riparian ecology
3.2. Importance of riparian zones
    3.2.1. Biofilter concept
    3.2.2. Riparian ecosystem service
3.3. Riparian Integrity
    3.3.1. Structure and function
    3.3.2. Riparian ecosystem health
    3.3.3. Environmental flow
3.4. Threats and impacts on riparian ecosystem
3.5. Riparian degradation indicators (Vegetation, soil, stream bank and wildlife)
3.6. Ecological standards for riparian corridors
3.7. Stream bank reconfiguration
3.8. Ramsar convention and other related protocols

Unit IV: Forest fire management in Bhutan

4.1. History of forest fire
4.2. Causes: Induced and natural
4.3. Stages of forest fires
4.4. Effects of forest fires in Bhutan
4.5. Management and suppression of forest fires in Bhutan
    4.5.1. Role of organizations, private sectors, local communities, academicians and other
    4.5.2. Sustainable land-use to prevent forest fire

4.5.3. Fire management / suppression technologies, facilities and trainings
4.5.4. Public policies and nature conservation act

Unit V: Forest Landscape Restoration (FLR)

5.1. Concept, aims, objectives, and scope of FLR
5.2. Principles of FLR
5.3. FLR framework
5.3.1. Visioning and conceptualizing
5.3.2. Governance
5.3.3. Designing a FLR Project
5.3.4. Technical aspects of FLR project implementation
5.3.5. Monitoring mitigation and adaptation outcomes
5.3.6. Climate mitigation and adaptation methods
5.3.7. Communicating FLR Results
5.4. Tools and methods
5.4.1. Restoration Ecosystem Service Tool Selector (REST)
5.4.2. Forest Restoration Prioritization Tool (ROOT)
5.4.3. Land Degradation Surveillance Framework (LDSF)
5.5. Re-vegetation and timber harvesting activities
5.5.1. Revegetation
5.5.2. Afforestation
5.5.3. Reforestation

Unit VI: Restoring ecology in Bhutan

6.1. History of rangeland management in Bhutan
6.2. Livestock grazing: rotational, premature, trampling
6.3. Migratory habits of the herders and grazing in forests; impacts and solutions
6.4. Types of fodder species in Bhutan
6.5. Opportunities for improvement of fodder resources
6.5.1. National grazing policy
6.5.2. Presents trends and future scenario
6.5.3. Pros and cons of pasture land development
6.6. Invasive species management in Bhutan
6.6.1. Common invasive species of Bhutan
6.6.2. Tools and techniques for managing invasive species: chemical, biological, cultural, and physical.

Unit VII: Overview of built-areas restoration

7.1. Soil stabilization processes: Physical, chemical and biological
7.2. Erosion control measures around built areas, e.g., road
7.3. Urban land reclamation
7.4. Urban forestry
7.5. Protection of settlements and agricultural areas using restoration measures

Reading List:

Essential Reading

Allison, S.K. (2012). *Ecological restoration and environmental change: Renewing damaged ecosystems.* London, UK: Earthscan publications.

Hobbs, R. J., Higgs, E. S., & C. Hall. (2013). *Novel ecosystems: Intervening in the new ecological world order*. Hoboken, NJ: John Wiley & Sons.

Parkyn, S. (2004). *Review of riparian buffer zone effectiveness.* Ministry of Agriculture and Forestry (New Zealand), www.maf.govt.nz/publications

Royal Government of Bhutan, MOA/SFD FFMS. (2004). *Annual forest fire evaluation and compilation report,* Thimphu, Bhutan: MOA.

Simberloff, D. (2013). *Invasive species: What everyone needs to know.* New York, NY: Oxford University Press

Additional Reading

International Council for Science, (2002). *ICSU Series on Science for Sustainable Development No. 5: Science Education and Capacity Building for Sustainable Development*. Paris, France: ICSU

Kasemir, B., Jäger, J., Jaeger, C. C., & Gardner, M. T. (2003). *Public participation in sustainability science: A handbook.* London, UK: Cambridge University Press

Miller, G.T., & Spoolman, S.E. (2018). *Environmental science* (16th ed.).. New Delhi, India: Cengage Learning.

Ministry of Agriculture. (2001). *Proceedings of the national grazing policy workshop, Bumthang*, August 21-24, 2001. Thimphu, Bhutan: MOA.

National Environmental Commission. (1998). *The middle path: National strategy for Bhutan.* Thimphu, Bhutan: National Environmental Commission.

Schmandt, J., & Ward, C. H. (2000). *Sustainable development: The challenge of transition.* London, UK: Cambridge University Press

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)

Date: June 2021

Module Code and Title: **UGR404 Undergraduate Research Project**
Programme: BA in Development Economics (Borrowed)
Credit Value: 24
Module Tutor(s): Samir Patel (Coordinator), Leishipem Khamrang, GP Sharma

General objective: The module aims to enable students to engage in a focused and sustained piece of research and to apply the theoretical knowledge and skills developed in prior modules to the research process for the production of a written project report.

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

1. Compile an annotated bibliography.
2. Critically evaluate current research within a specialist research area drawing on appropriate theoretical perspectives.
3. Analyse relevant literature and write a literature review on a specific topic within the chosen subject area.
4. Develop focused research questions.
5. Select and use suitable methods and analyses to examine research questions appropriate to the research area.
6. Evaluate ethical constraints in the conduct of research.
7. Propose and defend an independent research project plan.
8. Collect data using methods appropriate to the area of work.
9. Evaluate the quality of data collected, including screening data for issues with reliability, validity, and bias.
10. Critically analyse data using appropriate methods and techniques.
11. Transform raw data into specific, concise outputs as appropriate for a particular project, e.g., graphs, tables, diagrams, etc.
12. Formulate sound discussion points and conclusions based on research findings.
13. Effectively communicate and defend their research work.
14. Propose possible alternative approaches and future directions.

Learning and Teaching Approach:

Sem	Type	Approach	Hours per week	Total credit hours
1 of 2	Contact	Lecture, General supervision	4	60
	Independent Study	Independent study (including literature review and work on research proposal) Field work / data collection	4	60
2 of 2	Contact	Workshops on select topics and presentations, General supervision	4	60
	Independent Study	Field work / data collection, Data analysis and report writing	4	60
Total				240

For this module, every student is required to study a specific topic under the supervision of a member of the academic staff. The work will be of an investigative nature and may have analytical, numerical, design and experimental elements involved in it. The initiative for carrying out all aspects of the work rests with each student. Individual students can carry out an investigation into a problem either chosen from a list of suitable problems proposed by the supervisor or of their own suggestion, in which case, it must be approved by the supervisor.

Projects will have to be taken up individually. A student project will lead to the production of a written report. A project can be based on primary data or secondary data or both.

Students will be required to research on any relevant topic, with the support of their supervisor, in order to develop a research question and to design a study. The supervisor's support will continue through data collection, data analysis and the discussion of results. A series of teaching sessions covering methods, analyses, ethics, and writing from both qualitative and quantitative perspectives will be provided in addition to supervisory support.

Semester	Tasks to be performed
Sem I, Year 4	1. Identify the research question(s) (by 3rd week) 2. Undertake literature review and maintain notes (by 7th week) 3. Determine an appropriate research method (by 8th week) 4. Design sample plan (if any) (by 9th week) 5. Determine the variables to be studied (by 10th week) 6. Prepare a research proposal (by 12th week) 7. Presentation (by 14th week) 8. Data collection (during winter break)
Sem II, Year 4	9. Arrange and Analyse the data (by 3rd week) 10. Prepare a draft report (by 7th week) 11. Improve upon the draft report based on feedbacks 12. Submit the final report (by 12th week) 13. Present and defend the findings (by 15th week)

Role of Supervisors

The primary function of the supervisor is to provide overall and general guidance to help student to develop a logical and rational basis for research. Key functions expected of the supervisor:

1. Assist the student: to clarify the topic; to be clearly focused and not be over-ambitious; and to advise the student on the viability of ideas.
2. Direct the student to relevant areas of information, literature sources and specialised internal/external help.
3. Advise on appropriate methodologies/techniques.
4. Advise on referencing style and the problem of plagiarism.

5. Maintain regular supervisory contact with the student.
6. Regularly monitor the student's work. Supervisors should keep a written log of the opportunities for formal work offered to students and encourage students to keep a written record of all supervisory contact/support noting key points of discussion.
7. Assist the student in managing the timetable of the project.
8. Assist the student in identifying when problems are liable to be encountered and how they might be tackled.
9. Ensure the student is made aware of inadequate progress, standards of work below the expected level or any assessments which do not reach the required standard - consistently unsatisfactory progress should be made known to the student in writing.
10. Read and comment on drafts of the project report and return such work with constructive criticism and in reasonable time.

Role of Students

The prime responsibility for the management of the project rests with the student, who must maintain dialogue with the supervisor. The responsibility for the work submitted is entirely that of the student. The student will:

1. Manage the relationship with his/her supervisor, keeping in regular contact with him/her as planned.
2. Discuss with the supervisor the type of guidance and feedbacks that he/she finds most helpful;
3. Agree a schedule of meetings with the supervisor for reports/briefing on progress, ensuring the agreed schedule is adhered to and any deadlines met.
4. Take the initiative in discussing any problems with the project work and/or its supervision so that these can be resolved as soon as possible.
5. Keep a logbook of work conducted related to the project. This would include: notes on discussions/correspondence with supervisor(s) and any other internal/external specialists; literature read and comments; ideas/designs; results of tests/experiments; problems found and solutions; equipment details and settings; project costs; resources used; diagrams, plans, sketches, photographs; raw data; etc.
6. Submit the project report and/or other items in the specified format.

Assessment Approach:

Students' performance will be assessed by several elements of continual assessment throughout the year. The first element consists of a Logbook, as an examinable record of personal input to the project. Next, there will be two panel meetings at which the student's project will be discussed with a panel of staff members, the second of which will include a formal presentation of the research work by the student. Between these meetings and shortly before the winter vacation, students will be required to submit a progress report, together with the logbook recording the activities, for assessment by the Module Coordinator and the supervisor. Finally, students will submit two copies of the final project report, for which detailed instructions will be provided in the procedure issued at the start of the project cycle.

Semester I of Year 4

A. Annotated bibliography: 5 Marks

   Students will require to read at least 5 articles for this exercise and submit the annotated bibliography using APA referencing style. Students will select primary articles from different sources as appropriate (e.g., journal article, edited book, web article). Each annotation will be accompanied by a brief write up of about 200 words.

   1 Statement of research topic along with APA references list of 10 potential sources
   3 Reflection/annotation on 5 articles: accuracy and clarity of the summary of the sources
   1 Mechanics (Language, organisation and referencing)

B. Literature review draft: 5 Marks

   Students will produce a literature review (1,250-1,500 words) on clearly identified bodies of literature pertaining to the topic chosen, incorporating analysis and synthesis as well as

some evaluation of outstanding knowledge gaps to justify the research work within the context and history of what is already known.

2 Quality and breadth of sources selected for adequate coverage of the topic
2 Review and evaluation of the sources
3 Incorporating analysis and synthesis of sources (ability to analyse and synthesize major arguments in the reviewed literature)
3 Mechanics (Language, organization and referencing)

C. Methodology draft: 5 Marks

Students will write the research methodology (approximately 1,000-1,500 words) describing 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.

2 Explanation and justification of the methods selected
3 Discussion on the research instrument selected for data collection
3 Procedure of sample selection, justification, statement on validity and ethics
2 Mechanics (Language, organization and referencing)

D. Research proposal: 15 Marks

Students must complete a research proposal (2,500-3,000 words) that clearly addresses the linkage between research question and research methodology and ensures that ethical considerations are incorporated. Students will be given sufficient time to improve upon the annotated bibliography, draft literature review and draft methodology, and culminate these components into the final research proposal

2 Clear and focused research question
2 Relevant and analytical literature review
2 Sound theoretical framework
2 Ethical considerations
2 Appropriate research methodology
1 Effective sample plan
2 Clear and realistic work plan
2 Proposal defence

E. Research process: 5 Marks

Students will regularly use a logbook for maintaining records. Supervisors will check the checking the progress of the students' work periodically through individual meetings and evaluation of logbook records, as well as communications by e-mail and through VLE. The research process will continue to be evaluated into the next semester.

2 Record keeping - required logbook entries are properly made
2 Student's adherence to the work plan and ability to meet deadlines as planned
1 Student's timely responses to the supervisor along with submission of required documentation and evidences as part of the academic communication process

Semester II of Year 4

F. Data collection and preliminary findings: 5 Marks

Students will submit their collected data along with a write-up of the preliminary findings of the research in approximately 1000-1250 words. This will give some sense of the research findings, allowing the module tutor to advise on the need for clarifications and future improvements.

3 Adequacy of data collected to support the research findings (data on all the variables collected as planned)
2 Reliability of data

G. Draft report: 15 Marks

Students will submit a comprehensive draft report in the desired format including all requisite sections.

2 Introduction, statement of the problem
3 Formulation of research question(s), objectives of the study and hypothesis
4 Literature review
3 Research method, data collection instruments and analysis procedure
6 Findings, discussion and conclusion
2 Mechanics (Language, organization and referencing)

H. Final report: 35 Marks

Students will submit a complete research report, written in 8,000-10,000 words, 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. Students will be provided with a full outline of the required sections and their expected contents along with grading rubrics for all components.

2 Introduction, statement of the problem
3 Formulation of research question(s), objectives of the study and hypothesis
9 Literature review
6 Research method, data collection instruments and analysis procedure
12 Findings, discussion and conclusion
3 Mechanics (Language, organization and referencing)

I. Presentation and defence of the findings: 10 Marks

Each student will make a 15-20 minutes presentation to the supervisor and additional examiners on the report and face Q&A session.

6 Effective presentation (how well does the presentation address specified criteria, quality of overall narrative and claims – content analyses)
2 Articulation and Language use
2 Effective defence – justification, response to questions in Q&A session

Overview of assessment approaches and marks

Areas of assignments	Quantity	Marks
A. Annotated bibliography	1	5
B. Literature review draft	1	5
C. Methodology draft	1	5
D. Compiled research proposal	1	15
E. Research process	1	5
F. Data collection and preliminary findings	1	5
G. Draft report	1	15
H. Final report	1	35
I. Presentation and defence of the findings	1	10
Total Continuous Assessment (CA)		**100**

Pre-requisites: UGR301 Research Methodology

Subject matter: (Note: tutors will give lecture/presentation on the upcoming topics, and provide general feedback on the previous tasks, 2 hours a week)

Unit I: Review on the research planning process

1.1. Importance of the literature review
1.2. Narrowing down a research area to a specific research question
1.3. Adoption of appropriate research designs
1.4. Selection of appropriate data collection and analysis methods
1.5. Realistic work planning for data collection

Unit II: Select topics in research ethics

2.1. Review on ethical considerations in research
2.2. Responsible conduct of research
2.3. Protection of research subjects and informed consent

2.4. Avoiding biases, common errors in question formulation and data analysis

Unit III: Select topics in data analysis

3.1. Evaluating data quality
3.2. Screening data for issues with reliability, validity, and bias
3.3. Guidelines and best practices on data presentation

Unit IV: Research reports

4.1. Standard parts of research reports
4.2. Drawing appropriate conclusions
4.3. Contextualizing research
4.4. Preparing research papers for publication
4.5. Guidelines on communicating and presenting research

Reading List:

Essential Reading

Bhattacherjee, A. (2012). *Social science research: Principles, methods and practices.* Global Text Project. Retrieved from http://scholarcommons.usf.edu/oa_textbooks/3

Cresswell, J.W., & Cresswell, J.D. (2017). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (5th ed.). Sage Publications.

Kothari, C. R. & Garg, G. (2019). *Research methodology: Methods and techniques* (4th ed.). New Delhi, India: New Age International Publishers.

Kumar, R. (2014). *Research methodology: A Step-by-step guide for beginners* (4th ed). Thousand Oaks, CA: Sage

Additional Reading

Becker, S. & Bryman, A. (Eds.). (2004). *Understanding research for social policy and practice.* Bristol: Policy Press.

Bromage, A. (2008). *A brief note on research ethics. Birmingham: Higher education resources.* Retrieved from http://highereducationresources.atspace.com/ethics.htm

Bryman, A. (2012). *Social research methods*. New York, NY: Oxford University Press.

Doane, D. & Seward, L. (2016). *Applied Statistics in Business and Economics* (6th ed.). New York, NY: McGraw Hill.

Dixon, J.C., Singleton, R. A., & Straits, B. C. (2018). *The process of social research*. New York, NY: Oxford University Press.

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

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

Date: June 2022

Module Code and Title: **DFL101 Introductory Dzongkha as a Foreign Language**
Programme(s): BSc in Environmental Management
Credit Value: 12
Module Tutor(s): Karma Gyeltshen (Coordinator)

General objective: The module is for learners who are non-Bhutanese and have had little or no prior exposure to Dzongkha. Learners will primarily use official Dzongkha Romanization for any reading/writing instead of the Dzongkha script. The module will help learners 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 will also 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 – On completion of the module, students will be able to:

1. Recite and correctly use frequently used spoken words, expressions and questions in familiar contexts (academic, social, and work-related) in conversation.
2. Indicate the gist of a Dzongkha speech by a native speaker speaking slowly and clearly, and from overheard conversations.
3. Distinguish between and use appropriate alternative expressions for familiar (informal) vs. formal contexts.
4. Construct limited meaning from reading materials (in Romanized Dzongkha) on learned topics.
5. Recognize a limited range of simple spoken isolated words, phrases and questions in Dzongkha script.
6. Demonstrate ability to copy letters of the alphabet, numbers and isolated words and phrases in Dzongkha script.
7. Write Romanized Dzongkha personal information and previously learned simple sentences and messages.
8. Produce correct sentences in a short loosely organized paragraph in Romanized Dzongkha.
9. Determine the meaning of new words and phrases with the help of a native speaker.
10. Recognize new words using visual clues in simplified reading material with the help of a native speaker.

Learning and Teaching Approach:

Type	Approach	Hours per week	Total credit hours
Contact	Lecture	2	60
	In-class practice	2	
Independent study	Assignments	2	60
	Reading and practice	2	
Total			120

Assessment Approach:

A. Written exercises: 30%

Students will take 20-min written in-class quizzes (5x) or take-home work (5x), each worth 3% covering topics covered within one week of classes, and marked on correctness of responses.

B. Oral exercises: 10%

Students will undergo 5-min viva once in the first half and once in the last half of the semester. The focus will be on casual conversation.

2% Appropriately contextualized responses
2% Accurately formed statements
1% Clarity and pronunciation

C. Presentation: 10%

Each student will do a 5-min presentation on oneself and description of a recent outing (done with pre-written notes).

2% Use of varied descriptive phrases with relevance to the topic
2% Accurately formed statements
1% Clarity and pronunciation

D. Midterm examination: 15%

Students will take a written exam of 1.5-hr duration covering topics up to the mid-point of the semester, in Romanized Dzongkha.

E. Semester-End Examination: 30%

Students will take a written exam of 2.5-hr duration encompassing all the subject matter covered in the semester, in Romanized Dzongkha. This assessment is comprehensive and summative in nature, and will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended short-response questions.

Overview of assessment approaches and weighting

Areas of assignments	Quantity	Weighting
A. Written exercises	10	30%
B. Oral Exercises	2	10%
C. Presentation	1	10%
D. Midterm examination	1	20%
Total Continuous Assessment (CA)		**70%**
Semester-end examination		**30%**

Pre-requisites: None

Subject matter:

Unit I: Welcome unit

1.1. Learning Objectives: Introduce themselves and others; Say hello and good-bye; Recognize Dzongkha script

1.2. Vocabulary: Introduction and greetings; Classroom items and people (teacher, students)

1.3. Speaking and Listening: Introductions; Greetings

Unit II: New encounters

2.1. 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

2.2. Vocabulary: Names and titles; Interesting jobs; Addressing people; Terms for respect

2.3. 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

Unit III: People and places

3.1. 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

3.2. Vocabulary: Nationalities; Family members; Numbers 0-101, higher denominations

3.3. 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

Unit IV: Conversing and posing questions on everyday items

4.1. Learning Objectives: Ask about and identify everyday items; Ask what something is called in Dzongkha; Talk about clothes and possessions; Describe favourite possessions

4.2. Vocabulary: Everyday items; Clothes and colours

4.3. 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

Unit V: Daily life

5.1. 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

5.2. Vocabulary: Ways of getting around; Days of the week and routines; Parts of a house

5.3. 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

Unit VI: Free time and shopping

6.1. 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

6.2. Vocabulary: Shopping activities; Leisure activities and places; Numbers and monetary units, simple negotiation

6.3. 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

Unit VII: Work and play

7.1. 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

7.2. Vocabulary: Jobs; Abilities

7.3. 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

Unit VIII: Food

8.1. 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)

8.2. Vocabulary: Food; Grocery shopping

8.3. 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

Unit IX: In the neighbourhood

9.1. 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

9.2. Vocabulary: Places in the neighbourhood; Places to visit

9.3. 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

Unit X: Around Bhutan

10.1. Learning Objectives: Indicate Dzongkhags of Bhutan; List key historical figures and events; Describe rural village life, and simple traditions

10.2. Vocabulary: Places around Bhutan; Historical figures and events; Rural life, including agricultural terms, crops, livestock, tools, and practices

10.3. 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

Unit XI: Art and culture

11.1. Learning Objectives: Recognize and list the 13 traditional arts; Recognize and name common religious iconography: Describe what is happening at a tsechu

11.2. Vocabulary: Zorig Chusom; Handicrafts; Tsechu and religious arts and practices; Common deities

11.3. 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

Unit XII: Conversing and inquiring about what people are doing

12.1. 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

12.2. Vocabulary: Actions and prepositions; Activities

12.3. 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

Unit XIII: Past experiences

13.1. 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

13.2. Vocabulary: Weekend activities; Things to do

13.3. 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

Unit XIV: Getting away

14.1. Learning Objectives: Describe where they were in the past; React to news; Talk about their last vacation; Describe a vacation

14.2. Vocabulary: Adjectives; Vacation activities

14.3. 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

Unit XV: Occasions

15.1. 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

15.2. Vocabulary: Months and dates; Party checklist; Religious holidays

15.3. 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

Reading List:

1. Essential Reading
    1.1. RTC. (2014). *Coursepack for Introductory Dzongkha as a Foreign Language*. Royal Thimphu College.
2. Additional Reading
    2.1. Dzongkha Development Commission. (1990). *Dzongkha Rabsel Lamsang*. Thimphu: Royal Government of Bhutan, Dzongkha Development Commission.
    2.2. Van Driem, G. (1991). *Guide to Official Dzongkha Romanization*. Thimphu: Royal Government of Bhutan, Dzongkha Development Commission.
    2.3. 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: June 2021

Bridge Course in Biochemistry

Programme: BSc in Environmental Management

Module Tutor(s): Kinley Dorji (Coordinator), Tshewang Dorji, GP Sharma

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

Learning Outcomes – On completion of the module, students will be able to:

1. Describe chemical foundations of life.
2. Explain the basics of biochemistry.
3. Explain metabolism processes in living organisms.
4. Discuss the cellular life cycle.
5. Explain plant and animal physiology.
6. Discuss the evolutionary processes.

Learning and Teaching Approach:

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 50% of the total time and be guiding and facilitating students in the computer lab for self-learning for another half of the time.

Type	Approach	Hours per week
Contact	Lecture	1.5
	Disscussion and in-class exercises	1.5
Independent study	Assignments	1
	Reading and reactice	1
Total		

Assessment Approach:

Students will be assessed with three one-hour tests, one at the end of each week of the course, worth 30%, 30%, and 40%. The pass mark overall is 40%. The student's failing the bridge course will be compulsorily made to sit for the learning resources centre for three hours every week for the first semester.

Course contents:

Unit I: The Chemistry of Life

a.1. The Chemical Foundation of Life

- a.1.1. Phases and Classification of Matter and Physical and Chemical Properties
- a.1.2. Measurements, Measurement of Uncertainty, Accuracy, and Precision
- a.1.3. Mathematical Treatment of Measurement Results
- a.1.4. Atoms, Isotopes, Ions, and Molecules: The Building Blocks
- a.1.5. Atomic Structure, Chemical Bonding and Molecular Structure
- a.1.6. Chemical Thermodynamics and Ionic Equilibrium

a.2. Introduction to biochemistry

- a.2.1. Fundamentals of Organic Chemistry

a.2.2. Stereochemistry

a.2.3. Hydrocarbons, Alcohols and Ethers, Aldehydes, Ketones, Carboxylic Acids, Esters, Amines, and Amides

a.3. Proteins and Enzymes

a.3.1. Primary, Secondary, Tertiary and Quartenary structure

a.3.2. Introduction to enzymes

a.3.3. Features of enzyme catalysis

a.3.4. Regulation of enzyme activity

a.4. Carbohydrates & Lipids – metabolism

a.4.1. Introduction to Intermediary metabolism

a.4.2. Glucose: central role in metabolism

a.4.3. Carbohydrate synthesis

a.4.4. Glycogen metabolism

a.4.5. Lipid digestion

a.5. Biochemical Techniques (Separation Techniques, Chromatography, Electrophoresis, Centrifugation, Spectrophotometry, and Fluorimetry)

Unit II: Organization of life

1.1. Electrophoresis, Centrifugation, Spectrophotometry, and Fluorimetry)

1.2. Cell Structure (prokaryotic cells and eukaryotic cells, the cytoskeleton, connections between cells and cellular activities and transportation – active, passive and bulk)

1.3. Cellular Metabolism (energy and metabolism, potential, kinetic, free, and activation energy, Laws of Thermodynamics, Adenosine Triphosphate, and enzymes)

1.4. Cellular Respiration

1.5. Cell Reproduction (Cell Division, The Cell Cycle, Control of the Cell Cycle, Prokaryotic Cell Division, and Meiosis and Sexual Reproduction)

Unit III: Plant physiology and processes

3.1. Physiology of non-flowering and flowering plant

3.2. Photosynthesis and respiration

3.3. Propagation

3.4. Plant development

Unit IV: Animal physiology and processes

4.1. Animal development and classifications

4.2. Key physiological processes in animals

Unit V: Genetics and evolution

E.1. Genetics (Mendel's Experiments and Heredity, Modern Understandings of Inheritance, DNA Structure and Function, Gene Expression, and Biotechnology and Genomics)

E.2. Evolutionary Process (Evolution and the Origin of Species, the Evolution of Populations, and Phylogenies and the History of Life)

Reading materials

Flowers, P., Theopold, K., Langley, R. and Robinson, W. R. (2017). Chemistry. Houston: Rice University. Retrieved from https://openstax.org/details/books/chemistry.

Rye, C., Wise, R., Jurukovski, V., Desaix, J., Choi, J. and Avissar, Y. (2017). *Biology.* Houston: Rice University. Retrieved from https://openstax.org/details/books/biology-2e.

Bridge Course in Mathematics

Programme: BSc in Environmental Management

Module Tutor(s): Jigme Tashi (Coordinator)

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 in 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 tests, one at the end of each week of the course, worth 30%, 30%, and 40%. The pass mark overall is 40%.

Course contents

Unit I: Introduction to mathematics

a. Introduction to various numbering systems- natural number, whole numbers, rational, irrational, integers, fractions and decimals.
b. Importance of knowing different numbering systems.
c. Accuracy, precision and estimation
    i. Error, accuracy, precision
    ii. Calculation of absolute error, relative error and percentage error
    iii. Combination of errors; rules for sum and difference; rules for product and quotient
    iv. Scientific notation
    v. Significant figures; rules for counting the number of significant figures
    vi. Rounding

Unit II. Measurements and conversions (British, SI, and, Bhutanese systems)

a. Linear, square, and cubic measures
b. Weight measures
c. Temperature (F, C, Kelvin)
d. Area and volume calculations
    i. Flat objects / land: perimeter, and area: rectangular, triangular, circular; other polygons
    ii. Volumetric objects: height, surface area and volume

Unit III: Working with data

a. Definition, types of data
b. Data presentation and interpretation in various types of graphs
c. Measures of central tendency: mean, median and mode
d. Measures of dispersion: Range, mean deviation, standard deviation
e. Metrics for trends: growth rate, doubling rate/time, increases and decreases.

Reading materials

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

Service Modules

Module Code and Title: **SRE101 Scientific Reasoning**
Programme: BSc in Environmental Management (borrowed)
Credit: 12
Module Tutor: Kinley Dorji

General objective: The module aims to improve scientific literacy, reasoning skills, and ability for informed decision-making for students without strong science backgrounds. Students will be introduced to the historical development of science and scientific thought and approaches. The module presents science as a proven and reliable method of comprehending the natural world as distinct from non-formal approaches. Students will learn how to apply fundamental scientific concepts to distinguish science from non-science, bad science, and pseudoscience by analysing a variety of claims and through case studies. The module draws from basic principles, facts, laws, and theories from the natural sciences and, as appropriate, from psychology.

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

1. Discuss historical perspectives of scientific advancements.
2. Analyse common fallacies and perceptual biases that interfere with the ability to draw reasonable and/or correct conclusions.
3. Differentiate between facts, informed opinions, and uninformed opinions.
4. Apply scientific terminology pertaining to the nature and conduct of science such as: observation, hypothesis, law, theory, data, control, placebo.
5. Interpret reported outputs and findings in light of potential uncertainties.
6. Apply a critical thinking framework in handling evidence in relation to science.
7. Evaluate claims based on the methods of reasoning used by scientists: Falsifiability, Logic, Comprehensiveness of evidence, Honesty, Replication of research, and Sufficiency of evidence.
8. Relate common phenomena observed in daily life with evidence, models, and scientific explanations.

Learning and Teaching Approach:

Type	Approach	Hours per week	Total credit hours
Contact	Lectures	3	60
	Case studies, and presentations	1	
Independent study	Assignments	2	60
	Reading and review of class materials	2	
Total			120

Assessment Approach:

A. Journal Entries on VLE: 15%

Students will maintain a journal as regular submissions (3 total) on the VLE, noting pseudoscientific or superstitious beliefs or claims they come across in daily life. Each entry of 200-300 words is marked out of 5%:

2% Description of the pseudoscientific or superstitious beliefs or claims with relation to the nonformal approaches highlighted therein
3% Identification of the role of fallacies, opinion, anecdotes, biases and/or uncertainties in the pseudoscientific or superstitious beliefs or claims

B. Class Test: 15%

Students will be provided readings in advance on a recent scientific discovery or advance reported in at least three popular media sources (at least one of which is a reputed science news outlet). Based on the readings, the class test of 1 hr duration comprising structured and open-ended questions will cover elements of scientific inquiry and approaches exhibited in the reported scientific discovery.

C. Individual Presentation: 15%

Students will individually present on self-proposed (tutor-approved) topics from current news or popular media (within past six months) related to discoveries or claims that seem

questionable or misinformative. Students should apply the operational approach to critical thinking (four questions) and the FiLCHeRS framework to evaluate the discoveries/claims. Each 10 min. presentation will be followed by 3 min. of Q & A.

3% Introduction of the discovery/claim within its wider scientific field and context
4% Application of the operational approach to critical thinking
5% Application of FiLCHeRS
3% Discussion on alternative conclusions that are more scientifically reasonable

D. Midterm Examination: Portion of Final Mark: 15%

Students will take a written exam of 1.5-hr duration covering topics up to the mid-point of the semester. The exam will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended problem-solving and scenario interpretation questions.

E. Semester-End Examination: Portion of Final Mark: 40%

Students will take a written exam of 2.5-hr duration encompassing all the subject matter covered in the semester. This assessment is comprehensive and summative in nature, and will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended problem-solving and scenario interpretation questions.

Overview of assessment approaches and weighting

Areas of assignments	Quantity	Weighting
A. Journal Entries on VLE	3	15%
B. Class Test	1	15%
C. Individual Presentation	1	15%
D. Midterm Examination	1	15%
Total Continuous Assessment (CA)		**60%**
Semester-end Examination (SE)		**40%**

Pre-requisites: None

Subject matter:

Unit I: Scientific ways of knowing vs. non-formal approaches to truth

1.1. Importance of reason and risks of informal fallacies; historical cases of risks and dangers of unscientific and pseudoscientific beliefs or superstitions
1.2. Opinion vs. knowledge and expertise; limitations of truth from personal experiences and anecdotal evidence; problems with human perception and memory, relevant cognitive biases
1.3. Science as an inquiry; features of scientific inquiry
1.4. Processes of scientific inquiry: Problem statement, collecting information, forming a hypothesis, experiment to test the hypothesis, recording and analysing the data, and result
1.5. Use of reasoning in science: Inductive reasoning and Deductive reasoning

Unit II: Introduction to empirical approaches

2.1. Scientific evidence and evidence meter
2.2. Observation and Inferences/interpretation: Empiricists and theoreticians (Case study on Ptolemy's observation Geocentrism and Copernicus's observation and Heliocentrism)
2.3. Scientific theory; characteristics of good scientific theory: principle of parsimony; Case: considering both Geocentrism and Heliocentrism as theories
2.4. Hypothesis: Conjecture, Model, Theory, and Law (Case study on the Kepler's Laws of Planetary Motion)
2.5. Observation and technology: Natural observation and experimentation, activity on Galileo's inclined Ramp Experiment, activity on Eratosthenes calculation the radius of the Earth, and Galileo's discovery with the telescope)

Unit III: Uncertainty of science

3.1. Logical fallacy: meaning and types (Case study on Galileo's Dialogue)
3.2. Scientific uncertainty: types of scientific uncertainty and addressing them
3.3. Error, bias and uncertainty (Case study on the Carbon-14 dating)

3.4. Graph and data interpretation in relation to uncertainty
3.5. Data ambiguity, data distortion, and data distraction

Unit IV: Critical thinking and scientific-reasoning framework

4.1. Evaluating claims (scientific or pseudoscientific) with an operational approach to critical thinking when presented with a claim by asking 1) What am I being asked to accept? 2) What evidence supports the claim? 3) Are there alternative explanations/hypotheses? 4) What evidence supports the alternatives?
4.2. Lett's rules for use of scientific reasoning in ordinary life to evaluate claims - FiLCHeRS: Falsifiability, Logic, Comprehensiveness of evidence, Honesty, Replication of research, and Sufficiency of evidence

Unit V: Science of everyday life and health

5.1. Food and health - Balanced diet and the quality of food; food deterioration & its causes; nutrition and non-communicable diseases
5.2. Pollution - air, water, and land pollution: Impacts on human health; Case study on biomagnification
5.3. Scientific discoveries regarding morbidity and germ theory of disease; Case study on Ignaz Semmelweis and hand-washing
5.4. Communicable diseases and public health; Case study on COVID-19 information and misinformation
5.5. Evaluating health claims: diet & supplements, eating practices & fitness

Unit VI: Evolution: science of life's diversity

6.1. Approaches in history to origin of life and evolution
6.2. Darwin and Natural Selection; case study on Galapagos finch evolution
6.3. Evolution as a non-random process based on random variation
6.4. Genes and heritability
6.5. Processes and patterns of evolution, sexual selection; case of female birds evaluating male birds before mating
6.6. Evidence of evolution; case of evolutionary relationship between whales and land mammals including humans
6.7. Basics of human evolution
6.8. Adaptation and evolution; case studies on antiviral drug resistance (HIV), antibiotic resistance (multi-drug-resistant Mycobacterium tuberculosis [MDR-TB]), and SARS-CoV-2 variants

Unit VII: Climate Change

7.1. Introduction to atmospheric chemistry, greenhouse gases, radiative forcing, and the estimate of climate sensitivity
7.2. Key concepts such as climate and weather, science of climate change: early discoveries, energy, balance model
7.3. Sources of scientific data on climate and climate change
7.4. Questions and evidence on anthropogenic climate change including attribution science; case study on climate change denial
7.5. Observed and projected trends and impacts - surface temperature, precipitation, ocean pH, sea-level and Arctic sea-ice extent
7.6. Climate feedback loop
7.7. Global climate governance - Kyoto Protocol, IPCC, UNFCCC etc.
7.8. Climate change mitigation - Strategic frameworks and policy approaches
7.9. Climate change adaptation - Vulnerability assessment, selecting adaptation options and development planning

Reading Lists:

Essential Reading

Bryson, B. (2004). *A short history of nearly everything*. Crown.

Hewitt, P. G., Lyons, S., Suchocki, J., & Yeh, J. (2019). *Conceptual integrated science* (3rd ed.). Pearson Education Limited.

Schick, T., & Vaughn, L. (2019). *How to think about weird things: Critical thinking for a new age* (8th ed.). McGraw-Hill Education.

Shermer, M. (2002). *Why people believe weird things*. Holt Paperbacks.

Additional Reading

Johnson, A.E. & Wilkinson, K. K. (2020). *All we can save: Truth, courage, and solutions for the climate crisis.* One World.

Feynman. R. (1974). Cargo cult science: Adapted from the Caltech commencement address given in 1974. Retrieved from http://calteches.library.caltech.edu/51/2/CargoCult.pdf

Lett, J. (1990). A field guide to critical thinking. *Skeptical Inquirer, 14*: 153–160.

Overbye, D. (2009, January 29). Elevating science, elevating democracy. *New York Times*.

Pollack, H. N. (2005). *Uncertain science... uncertain world*. Cambridge University Press.

University of California Museum of Paleontology. (2004). Understanding evolution. Retrieved from http://evolution.berkeley.edu/

Date: June 2022

Module Code and Title: **QRE101 Quantitative Reasoning**
Programme: BSc in Environmental Management
Credit: 12
Module Tutor: Jigme Tashi

General objective: This module enables students without strong backgrounds in maths or statistics to understand and analyse real-world problems on a variety of themes from a quantitative perspective. Students should develop general purpose skills with basic algebra, statistics, and probability for problem solving.

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

1. Interpret authentic real-world texts and visuals containing quantitative information.
2. Draw inferences from quantitative models such as graphs, tables, and formulas.
3. Represent quantitative information symbolically, visually, and verbally using appropriate quantitative mathematical language.
4. Apply arithmetic, algebraic, and statistical methods to solve problems.
5. Develop solutions to open-ended questions requiring multiple problem-solving steps.
6. Determine reasonableness of quantitative results to problems.
7. Evaluate possible biases in quantitative information presented in real-world contexts such as in news, advertising, or internet postings.
8. Use technology tools appropriate for a given problem solving context such as interest calculation.

Learning and Teaching Approach:

Type	Approach	Hours per week	Total credit hours
Contact	Lectures	2	60
	Tutorials	1	
	Computer lab practice	1	
Independent study	Written assignments and project	2	60
	Reading and review of class materials	2	
Total			120

Assessment Approach:

A. Class exercises: 20%

Two in-class group exercises (groups of 3-4) will be conducted (each worth 5%), that will comprise 100-min duration and cover (1) logical arguments and (2) percentages and ratios.

B. Problem-solving individual assignments: 20%

Once before and once after the midterm, students will individually be assigned distinct problem-solving scenario assignments to assess problem-solving skills, ability to identify a

problem, and decide why and how a particular quantitative analysis technique can be applied to find and present a solution. Problem definitions, approaches, and solutions should be concisely described in 200 - 300 words, accompanied by appropriate graphical visuals. Each assignment is marked on:

1% Ability to understand a problem
2% Identifying and using appropriate quantitative techniques to solve the problem
5% Finding accurate solutions
2% Interpretation of the findings

C. Individual AV Presentation: 5%

Students will individually submit an AV presentation on assigned topics related to interpreting and evaluating real-world recent information in news, reports, and online media drawing on quantitative data and figures.

1% Identifying the data sources, inputs, variables
2% Description of the data presented including how it has been derived
2% Interpretation and evaluation of the presented quantitative information including assumptions, biases, and other limitations

D. Midterm Examination: 15%

Students will take a written exam of 1.5-hr duration covering topics up to the mid-point of the semester. The exam will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended problem-solving and scenario interpretation questions.

E. Semester-End Examination: 40%

Students will take a written exam of 2.5-hr duration encompassing all the subject matter covered in the semester. This assessment is comprehensive and summative in nature, and will comprise structured questions like MCQ, fill-in-the-blanks, matching, definition, as well as open-ended problem-solving and scenario interpretation questions.

Overview of assessment approaches and weighting

Areas of assignments	**Quantity**	**Weighting**
A. Class exercises	2	20%
B. Problem-solving individual assignment	2	20%
C. Individual AV presentation	1	5%
D. Midterm Examination	1	15%
Total Continuous Assessment (CA)		**60%**
Semester-end Examination (SE)		**40%**

Pre-requisites: None

Subject matter:

Unit I: Introduction to Quantitative Reasoning

1.1. Quantitative reasoning as an important type of literacy (“numeracy”) for general purposes
1.2. Relevance and applications of quantitative reasoning in coursework, careers, and daily life
1.3. Accuracy vs. precision; emphasis of accuracy over precision in estimations; importance of reasoning vs. purely mechanical computation

Unit ll: Critical thinking foundations

2.1. Concept of a logical argument, common fallacies
2.2. Building a logical argument
  2.2.1. Propositions
  2.2.2. Logical connectors (and, or, not; inclusive vs. exclusive)
  2.2.3. Conditionals (if … then)
  2.2.4. Converse, inverse
  2.2.5. Determining truth values for one or two propositions using a truth table
2.3. Sets and relationships in venn diagrams; venn diagrams for categorical propositions; numerical values in venn diagrams

2.4. Analysing inductive and deductive arguments; evaluating validity and soundness using venn diagrams

Unit III: Approaches to quantitative problem solving

3.1. Unit analysis
- 3.1.1. Understanding key words and symbols (such as “per”, “of”, hyphens) when interconverting between verbal/written statements and mathematical expressions of the same (including common fractions, decimal forms, percentages)
- 3.1.2. Squares and cubes
- 3.1.3. Unit conversions; principles of the metric system
- 3.1.4. Problem solving with Units, preventing errors
- 3.1.5. Unit-based problem-solving scenarios: distance, time, speed, and mileage; pricing; electricity consumption and bills; density and concentration

3.2. Working forwards and backwards from inputs and outputs with elementary algebra
- 3.2.1. Representing general numbers using variables
- 3.2.2. Structure, components, and notation of algebraic expressions; simplifying expressions
- 3.2.3. Solving algebraic expressions; basic rules for adding/subtracting, multiplying/dividing

3.3. General problem-solving process: understanding a problem, making a problem-solving strategy, carrying out the strategy, interpreting and checking the result

3.4. Approaching problems from different angles; considering simpler / similar problems; using approximations

Unit IV: Uses of percentages and ratios

4.1. Percentages as fractions (proportions) of larger totals

4.2. Use of percentages to describe changes in quantities; absolute vs. relative changes

4.3. Use of percentages for comparisons; absolute vs. relative differences

4.4. Interpreting and using appropriate terminology in relation to percentages: *Of*, *More than*, *Less than*

4.5. Use and examples of ratios

4.6. Inappropriate uses of percentages: incomparable reference values; impossible percentage decreases; illogical averaging of percentages

Unit V: Quantities in perspective

5.1. Perspective through estimation

5.2. Orders of magnitude perspective (powers of 10); magnitudinally smaller and larger quantities and related vocabulary

5.3. Perspective through comparisons

5.4. Perspective through scaling

5.5. Case studies: global vs. local population sizes, distances and areas; sizes of different national economies; extreme wealth vs. poverty; timeframe of human history vs. age of the earth

Unit VI: Quantitative reasoning in understanding and managing financial matters

6.1. Essentials of managing personal finance: tracking inputs, balances, expenditures

6.2. Basics of budgeting

6.3. Savings and loans: interest
- 6.3.1. Simple interest
- 6.3.2. Basics of powers and roots; rules for solving algebraic expressions with powers and roots
- 6.3.3. Compound interest formula
- 6.3.4. Case study: power of compounding; compound interest as exponential growth
- 6.3.5. Impacts of interest rate differences
- 6.3.6. Making personal savings and investment plans; working backwards from targets
- 6.3.7. Using software tools (online, desktop, mobile) for savings and loan calculations

6.4. Taxation basics

Unit VII: Statistical reasoning

7.1. Concept of statistics as the science of collecting, organizing, and interpreting data
7.2. Most common statistical figures and their presentation in tables and graphs: frequencies, means, distributions in quartiles (boxplots), or histograms
7.3. Basis of statistical figures and conclusions: studies of samples and populations
7.4. Drawing conclusions and making claims using statistical figures
7.5. Areas of caution: assumptions; biases; poorly defined, hidden or poorly measured variables; improper presentation or graphical distortion of results; considering the context
7.6. Case studies on interpreting infographics

Unit VIII: Modelling

8.1. Interpreting and writing functions for mathematical models: independent and dependent variables; notation
8.2. Representing simple functions on the coordinate plane
8.3. Linear models: slopes as rates of change; intercepts as constants
8.4. Linear vs. exponential growth; doubling time
8.5. Approaching carrying capacity: logistic growth (visual approach)
8.6. Case studies on population growth; spread of COVID-19

Reading Lists:

Essential Reading

Bennett, J. & Briggs, W. (2018). *Using & understanding mathematics: A quantitative reasoning approach* (7th ed.). London, UK: Pearson.

Few, S. (2021). *Now you see it: An introduction to visual data sensemaking* (2nd ed.). El Dorado Hills, CA: Analytics Press.

Praveen, R.V. (2012). *Quantitative aptitude and reasoning* (3rd ed.). New Delhi: PHI Learning.

Saraf, S., & Swarup, A. (2019). *Quantitative aptitude and reasoning*. New Delhi: Cengage India.

Additional Reading

Grawe, N. (2018, May 07). Developing quantitative reasoning. Retrieved April 1, 2021, from https://serc.carleton.edu/sp/library/qr/index.html

Zaslow, E. (2020). *Quantitative reasoning: Thinking in numbers*. New York, NY: Cambridge University Press.

Date: August 2021