

Environmental Science

FOURTH YEAR

Course Title: Env. Resources and Biodiversity Conservation **Lecture hours: 150**
Course No: ENV. 401 **Full marks: 100**
Nature of Course: Theory (Compulsory - I) **Pass marks: 35**

Objectives

The broad objective of the course is to provide basic theoretical knowledge on environmental resources and biodiversity conservation. The specific objectives of the course are as follows:

- To give an overview of a concept and issues of natural resource: water resource, land and mineral resource, biological resource, energy resource and food resource
- To familiarize the students with the human resources, indigenous knowledge and their importance on sustainable natural resources management
- To acquaint students with the current state of global and national biodiversity
- To provide extensive knowledge on major threats to biodiversity and threatening processes
- To familiarize students with the practices and approaches to biodiversity conservation
- To familiarize students with conservation policies leading to sustainable development

A. Environmental Resources

Unit 1: Water, Land and Mineral Resources **20 hrs**

1.1 Water Resource 10 hrs

Introduction; Major sources of water; Types of storage structure: aquifers, cisterns, ponds, reservoirs; Existing water use; Water scarcity; Sustainable management of water resources; Rain water harvesting techniques; Watershed management; Planning for water resources development; Hydrology of urban area and agricultural lands; Water quality control.

1.2 Land and Mineral Resources 10 hrs

Land resource: Land resource and land use; Land type: Land capability, land suitability; Land reform; Mineral resource: Introduction; Type: Metallic, non-metallic and energy minerals; Mineral resource potential in Nepal; Mining practices; Adverse effect of mining practice in environment (exploration, transportation and uses); Mine field reclamation, Mineral based industries in Nepal.

Unit 2: Food and Energy Resources

20 hrs

2.1 Energy Resources

10 hrs

Concept of energy and energy units; Production and consumption of energy: Global, regional and national scenario; Energy efficiency: industry, transportation, commercial and residential buildings; Non-renewable energy resources: Coal, oil and natural gas; Renewable energy resources: Solar, wind power, hydropower, biomass, geothermal, tidal, wave, oceanic, nuclear and energy from wastes; Status and issues of energy resources in Nepalese context.

2.2 Food Resources

10 hrs

Major food resource and production; World food problems; New trends in food resource; Human nutrition and health problem associated with food; Food sufficiency; Food aid; Organic food product and environmental benefit.

Unit 3: Indigenous Practices in Resource Management

15 hrs

Human population growth trends in global, regional and national level; Human population distribution, regulation; Development of human society and use of environmental resources; Environmental crisis on planet earth; Natural resources and community values; Concept of indigenous knowledge, Indigenous knowledge practices in Nepal; Case study.

B. Biodiversity Conservation

Unit 1: Introduction and Status of Biodiversity

25 hrs

Biodiversity: concepts, levels (gene, species, ecosystem); Scope and importance of biodiversity; Patterns in distribution of biodiversity; Factors affecting distribution of biodiversity; Gradients of biodiversity: Major hypotheses in biodiversity gradients; Biodiversity crisis (ecocrisis); Conservation history: Antiquity (eastern versus western practices and philosophies), the middle ages, the industrial ages, the post industrial age (*Silent Spring*, *The Quiet Crisis*); Conservation movement: Pinchotism, Chipko movement; The Land Ethics; The death of environmentalism; Conservation science as a mission driven discipline: Challenging the global challenge.

Current state of biodiversity: Global, regional and national; Biodiversity and ecosystem services, biodiversity and ecosystem functioning; Value of biodiversity: Instrumental value and intrinsic value; Monetizing value of biodiversity; Payment for ecosystem services (PES).

State of biodiversity in Nepal: Forests (types and distribution, importance, degradation and its causes, consequences of forest degradation), wetlands (types, distribution, Ramsar Sites, importance), rangelands (coverage and distribution, importance: grazing, medicinal plants), agro-biodiversity; Rare, endangered, endemic and protected species of Nepal (flora and fauna);

Protected species of Nepal - flora and fauna.

Unit 2: Threats to Biodiversity

20 hrs

Biodiversity crisis: Prehistoric extinctions, recent extinctions and endangerment; Extinction forces, impacts of extinctions; Major threats and threatening processes: Current patterns and processes of global endangerment, vulnerability of species to extinctions, economic and social contexts of endangerment.

Major threats to biodiversity: (a) Habitat degradation and loss: Patterns of habitat transformation, human activities that cause habitat degradation, pollution as a form of habitat degradation; (b) Habitat fragmentation: Fragmentation and heterogeneity, fragmentation processes, biological consequences of fragmentation; (c) Overexploitation – impacts of exploitation on target and non-target species and on ecosystems, wildlife trade; (d) Species invasion: Invasive species and invasion process, conservation implications of invasions, biological impacts of invasions (case studies on *Mikania micrantha*, *Eichhornia crassipes*, *Lantana camara*, *Parthenium hysterophorus*); (e) Climate change: biological impacts of climate change, conservation implications of climate change; Impacts of loss of biodiversity; Nature of biodiversity problems between developed and developing worlds; Development versus conservation: Dams and roads in the Himalayas; Challenges to biodiversity in urban areas.

Unit 3: Conservation and Management of Biodiversity

25 hrs

Responses to the biodiversity crisis: Approaches to global habitat conservation (hotspots, Global 200 eco-regions, crisis eco-regions, wilderness protection), sustainable resource use: Biological theory of sustainable exploitation, methods of calculating sustainable yields; Management of invasive species: Invasion control, invasion protection;

Methods and aspects of biodiversity conservation: *in-situ* and *ex-situ* conservation; Conservation genetics (use and importance of genetic information in biodiversity conservation), species and landscape approaches to conservation, ecosystem approaches to conservation; Protected areas (goals, limitation and designs, IUCN categories of protected areas); Restoration of damaged ecosystems and endangered species (ecological restoration, animal reintroduction); Community-based conservation: Community participation, community mobilization in biodiversity conservation; Indigenous knowledge and practices in biodiversity conservation: Recoupling culture and environment, culture and holistic management.

Biodiversity conservation in Nepal: Shifting paradigm in biodiversity conservation in Nepal; Protected areas of Nepal; Conservation management in buffer zone; Conservation outside protected areas: Challenges and opportunities; Conservation of agro-biodiversity; Community forestry: contribution in biodiversity conservation.

Unit 4: Conservation and Sustainable Development

20 hrs

Nexus between development and biodiversity conservation; Ecological economics and

biodiversity conservation; Sustainable development: Goals, principles, pillars and indicators; Sustainable conservation: Integrated conservation and development projects (ICDPs); Ecotourism: principles and sustainability; Ecotourism as source of conservation finance; Wildlife tourism; Green economy and sustainable development.

Unit 5: Conservation Policies

15 hrs

Conservation challenges in 21st century: Problems of commons; Integration of conservation science and policy; Use of scientific knowledge in conservation; International policy for management of global commons: Convention on Biological Diversity (CBD), Convention on International Trade in Endangered Species (CITES) – pitfalls of CITES implementation in Nepal, Ramsar Convention; Aichi Target; Intellectual Property Rights (IPR) and Patent Rights (PR); Advanced Informed Agreement (AIA).

National policy for conservation of biological diversity in Nepal; Institutional arrangements for biodiversity conservation in Nepal; Effectiveness of conservation policies on biodiversity conservation.

References:

Environmental Resources

1. Brady, N.C. and Well, R.R. (2007). *The Nature and Properties of Soils*. Pearson Prentice Hall, New Delhi.
2. Klee, G.A. (1991). *Conservation of natural resources*. Prentice Hall Publ. Co., New Jersey.
3. Landon, M. (2006). *Environment, Health and Sustainable Development*. Tata McGraw-Hill.
4. Miller, Jr. G.T. and Spoolman, S.E. (2009). *Living in the Environment: Concepts, Connections, and Solutions*, 16th Edition. Brooks/Cole, Cengage Learning.
5. Nalini K.S. (1993). *Environmental Resources and Management*. Anmol Publishers.
6. Ristinin, R.A. and Kraushaar, J.J. (2006). *Energy and Environment*. John Wiley and Sons, Inc., New York.
7. Sharma, V.K. (1985). *Water Resources Planning and Management*. Himalaya Publishing House.

Biodiversity Conservation

1. Bhaju, U.R., Shakya, P.R., Basnet, T.B., and Shrestha, S. (2007). *Nepal Biodiversity Resource Book: Protected Areas, Ramsar Sites and World Heritage Sites*. International Centre for Integrated Mountain Development (ICIMOD) and Ministry of Science, Technology and Environment (MoSTE), Government of Nepal (GoN), Kathmandu.

2. Carson, R. (2012). Silent Spring, Anniversary Edition with an introduction by Linda Lear and an afterword by E.O. Wilson. Houghton Mifflin, Boston, MA.
3. Chaudhary, R.P. (1998). Biodiversity in Nepal: Status and Conservation. S. Devi, Shanpur (UP), India and Tecpress Books, Bangkok.
4. Chhetry, D.K. (2013). Biodiversity and Protected Areas of Nepal. Neupane Publication, Buddhanagar, Kathmandu
5. Groom, M.J., Meffe, G.K., and Carroll, C.R. (2006). Principles of Conservation Biology. Sinauer Associates Publication, Sunderland.
6. Jordan, C.F. (1995). Conservation: Replacing Quantity with Quality with a Goal for Global Management. John Wiley and Sons, Inc., New York.
7. Leopold, A. (1949). A Sand County Almanac and Sketches Here and There. Oxford University Press, New York, NY.
8. MoFSC. (2014). Nepal Fifth National Report to Convention on Biological Diversity. Ministry of Forests and Soil Conservation, Kathmandu, Nepal.
9. Primack, R.B., Paudel, P.K., and Bhattarai, B.K. (2013). Conservation Biology: A Primer for Nepal, 1st Edition. Dreamland Publications, Kathmandu.
10. Sodhi, N.S., and Ehrlich, E.R. (2010). Conservation Biology for All. Oxford University Press, Oxford.
11. Wilson, E.O., and Peter, F.M. eds. (1988). Biodiversity. National Academy Press, Washington, DC.

Course Title: Env. Resources and Biodiversity Conservation Lecture hours: 150
Course No: ENV. 402 Full marks: 50
Nature of Course: Practical (Compulsory-I) Pass marks: 20

This practical paper of 50 marks shall be evaluated under two heads: lab based exam of 30 marks and field based studies of 20 marks. It is compulsory for a student to pass in the above-mentioned examination separately.

Environmental Resources

1. Estimation of water resources potential by different methods.
2. Analysis of human population composition, population growth trend and population distribution by using population census data of Nepal.
3. Analysis of the major food resources in different regions of Nepal.
4. Calculate the calorific value of fuel (solid, liquid based).
5. Study energy consumption in different sectors with D-P-S-I-R framework in Nepal.

Biodiversity Conservation

1. Estimation of ecosystem services value of an ecosystem:
 - a. Wetlands
 - b. Forests

2. Study on distribution of plants/animals along an environmental gradient:
 - Altitude,
 - Disturbance
3. Estimation of ecotourism potential of a protected area.
4. Study on carrying capacity (ecotourism) of a protected area.
5. Study on effectiveness of *ex-situ* conservation (a) zoological garden, (b) botanical garden, (c) animal breeding centers.
6. Determination of basal area, wood volume and standing biomass of trees in forest ecosystem.
7. Study of carbon sequestration (carbon stock and rate) of forest ecosystem.
8. Structural attributes and canopy mapping of forest.

Field Work

It is mandatory that all the students participate in the 10 days field visit (any protected area or protected forest or community forest designated by the Government of Nepal) program managed by the Department. Based on this field visit, each student has to prepare a report which is to be submitted during the practical examinations. Some suggested themes for the field visit in the protected area/forest are:

1. Growth pattern of trees in forest ecosystem.
2. Carbon inventory of community forest or protected area/forest.
3. Preparation of inventory of flora and fauna and their environmental values.

Course Title: Pollution Monitoring and Control
Course No: ENV. 403
Nature of Course: Theory (Compulsory-II)

Lecture hours: 150
Full marks: 100
Pass marks: 35

Objectives

The broad objective of this subject is to acquaint students on the environmental pollution monitoring and control techniques. The specific objectives of the course are as follows:

- To familiarize students with air, water, noise and land pollution monitoring and control techniques
- To acquaint students with municipal and hazardous solid wastes
- To make students familiar on different discipline of toxicology and fate of toxicants in ecosystem

Unit 1: Air Pollution Monitoring and Control

25 hrs

Combustion: Pre combustion Control, Combustion modification, post combustion control, new industrial processes, energy conservation (combustion control and energy saving), Air pollution

control: Atmospheric cleansing processes, Equipment selection, Best Available Technology (BAT), Better Fuel Counter measures, Preventive and control technology, Guiding principles (long-term & short-term); Industrial air pollution control: Specific control devices for particulates and gaseous pollutants; Transportation pollution controls: Air to fuel ratio, Fuel additive, Road infrastructure, Traffic management, Alternative/blended fuel, Specific control devices and Aircraft emission (regulatory, technical, operational & economic measures); Indoor Air pollution: Improve Cooking Stove (ICS), Indoor air emission control, Building design, Building code; Legal and regulatory tools for air pollution control in Nepal; Specific case assessment: general and advance air pollution control technologies for cement and brick kiln industries.

Unit 2: Water Pollution Monitoring and Control

25 hrs

Water Pollution Consequences: Nutrient enrichment, sedimentation, aquatic toxicity, groundwater contamination; Ecological impacts of water pollutants: Heavy metals (Cadmium, Chromium, Lead and Zinc), Manmade Organics; Bioaccumulation & bio magnification (specific case with mercury), storm water runoff pollution (Diversification, Sedimentation & Nutrient Enrichment); Sampling: Ingredients of sampling protocol, Sampling type (Grab, Composite, Depth and area representative); Monitoring frequency for surface & ground water, and industrial effluent; Sampling equipment, General sampling techniques for microbiological and physical/chemical water quality; Guidelines, Standards and Water quality Legacy: Water quality criteria & guidelines; Fundamentals of criteria selection for health based drinking water contaminants (microbial, inorganic and organic substances, treatment/construction chemicals & design), lake trophic criteria; Glimpses in water legislative tools in Nepal

Drinking water production & treatment: Drinking water treatment steps, RWH, HH drinking water treatment methods; Wastewater treatment: General approach on screening, grit removal, flow equalization; settling; Design parameters, sludge processing - storage and disposal; Principles of biological treatment (Bio-oxidation, nitrification and denitrification mechanisms); Glimpses on advance WW treatment; Disinfection, constructive wetland approach – examples of wastewater treatment system in municipalities & urban centers.

Unit 3: Noise Pollution Monitoring and Control

25 hrs

CB analysis of noise pollution control (approach on direct and indirect cost, CB ratio for standards and control) - problems in performing CB analysis, cost effectiveness, risk analysis, key components of cost and benefits; Aspects of noise pollution control; Concept; Anechoic chamber, dampening and vibration control methods; Examples of noise barriers and absorbers; Design modification; Receiver control - ear plugs and ear muffs; Traffic noise abatements - noise barriers, alternatives to noise barriers; Noise control strategies: standards and guidelines; Endorsement of standards (National) and guidelines (WHO); Approach on noise abatement measures - ISO, ILO, American Conference of Government Industrial Hygienists (ACGIH), OSHA, etc.; Provision of national labor and industrial enterprises acts – Nepal.

Unit 4: Land Pollution Monitoring and Control

25 hrs

Importance of soil; Role of soil in natural (environmental) purification; Changes in soil chemical characteristics: Hazardous waste dumping, Chemicals contamination; Soil health indicators & functions: biological, chemical, physical, and interpretation framework for soil health indicators; Concept of soil quality index and soil health: Introduction of SQI, soil quality index values and associated soil property threshold values and interpretation; Remediation and reclamation strategies: site assessment and mapping, excavation and dredging, pump and treat, solidification and stabilization, oxidation, tillage practices, soil vapor extraction, bioremediation, phyto-remediation and land farming, policy and legislative framework: policies, legislation (Act), regulatory framework.

Unit 5: Solid Waste Management

25 hrs

Definitions and concepts; Sources, types and composition solid waste; Principles of solid waste management; Integrated solid waste management; Solid waste management techniques: Reuse, reduce, recycling, composting, vermi-composting and disposal; Landfill site: site considerations; Sanitary land filling, treatment of leachate; Environmental quality monitoring at landfill sites; Hazardous SWM: Secure land filling, radioactive waste management; Hazardous waste management techniques; Energy recovery from solid wastes; Special wastes and e-wastes and their management; Solid waste management issues in Nepalese context; Municipal wastes in Nepalese cities and management practices; Municipal SWM problems and opportunities; Legal provisions on solid waste management in Nepal: SWM Act 2011 and SWMR 2013; UNEP guidelines and national level institutional set up and legal framework for solid waste management.

Unit 6: Eco-toxicology

25 hrs

Disciplines of toxicology: Environmental, economic, forensic and Industrial toxicology; Scope and importance of eco-toxicology; Toxicants and toxicity: sources and types of toxicants, types of toxic effect; Routes of toxic agents in biological system; Movement, distribution, behavior and fate of toxicants in ecosystem; Toxicity of heavy metals and bioremediation; Bioaccumulation, bio-concentration, bio-magnifications and biotransformation; Dose-response relationship: Dose-response curve, effect and response of dose, indices of toxicity; Biological and chemical factors influencing toxicity; Mechanism to minimize toxic effects; Laboratory determination of toxicity-bioassays.

References:

1. Agrawal, K.M., Sikdar, P.K., and Deb., S.C. (2005). A Text Book of Environment. Macmillan India Limited.
2. Amacher, Michael C.; O'Neil, Katherine P.; Perry, Charles H. (2007). Soil vital signs: A new Soil Quality Index (SQI) for assessing forest soil health. Res. Pap. RMRS-RP-65WWW. Fort Collins, CO: U.S. Department of Agriculture
3. APHA. (1998). Standard Methods for the Examination of Water and Wastewater. American Public Health Association, Washington.
4. Bradley M.J. & Associates. (2005). Best Available Technology for Air Pollution Control: Analysis Guidance and Case Studies for North America, Manchester, US
5. Chhetry, D.K. (2012). Environmental Toxicology. Uma Silwal Karki, Kathmandu.
6. Conrad, J. and Hemond Jr., (1983). Engineering Acoustics and Noise Control. Prentice-Hall International Inc., London.
7. De, A.K. (2010). Environmental Chemistry, 17th edition. New age international publishers.
8. Masters, G.M. and Ela, W.P. (2013). Introduction to Environmental Engineering and Science, 3rd Edition. PHI Learning Pvt. Ltd, Delhi.
9. Metcalf & Eddy. (2004). Wastewater Engineering Treatment & Reuse, Fourth Edition, McGraw-Hill Education (India) Pvt. Ltd.
10. Miller, Jr. G.T. and Spoolman, S.E. (2009). Living in the Environment: Concepts, Connections, and Solutions, 16th Edition. Brooks/Cole, Cengage Learning.
11. Santra, S.C. (2005). Environmental Science, 2nd Edition. New Central Book Agency (P) Ltd, Kolkata.
12. Sapkota, B. (2004). Fundamental of Noise Pollution, Department of Physics, Pulchowk Campus, Lalitpur, Nepal
13. Tchobanoglous, G. and Kreith, F. (2002). Handbook of Solid Waste Management Second Edition; McGraw-Hill Publication, New York Chicago San Francisco.
14. UNEP (2009). Converting Waste Plastics into Resource – Assessment Guidelines, Revised version
15. Vesilind, P.A., Perirce, J.J., and Weiner, R.F. (1990). Environmental Pollution and Control. Butterworth- Heinemann, USA.
16. World Bank (1998). Airborne Particulate Matter: Pollution Prevention Control; Pollution Prevention & Abatement Handbook

Course Title: Pollution Monitoring and Control
Course No: ENV. 404
Nature of Course: Practical (Compulsory)

Working hours: 150
Full marks: 50
Pass marks: 20

This practical paper of 50 marks shall be evaluated under two heads: lab based exam of 30 marks and field based studies of 20 marks. It is compulsory for a student to pass in the above-mentioned examination separately.

1. Study on quality monitoring techniques for air, water, soil environment.
2. Emission inventory base on fuel use.
3. Determination of Phosphate and Nitrate from a sample of water.
4. Preparation and interpretation of noise hazard map.
5. Study on techniques for Hazard Identification (FETI, Past Accident Analysis, HAZOP and Consequence Analysis).
6. Monitoring of sound pressure level in different micro-environmental settings and to calculate equivalent sound pressure level.
7. Calculation of percentile level (L_{min} , L_{95} , L_{90} , L_{50} , L_{10} , L_5 , L_{max}).
8. Study on solid waste sampling technique, proximate analysis and solid waste management equipment.
9. Study about vermi-composting techniques.
10. Physio-chemical analysis of leachate.
11. Water quality analysis of water and waste water treatment plant.
12. Collection of soil samples from contaminated sites (industrial, land field etc.) and analyze the contaminants.
13. Impacts of contaminants on growth of plants (control and treatment experiments).
14. Plant potential for removal of contaminants.

Field Visit

The students have to be mandatorily involved in the 7 days field visit program managed by the Department, based on this field visit, each student in a group has to prepare a report which is to be submitted during the practical examination.

1. Air quality monitoring stations; Vehicular emission monitoring – Nepal Police/Transportation Office.
2. Study of municipal drinking water supply plant, and wastewater treatment plant.
3. Noise level assessment of different places (e.g. airport, industries, movie theatre etc.).
4. Visit to observe different types of incinerators in Hospitals etc.
5. Visit to industrial sites to observe waste disposal and management practices.
6. Field visit to transfer stations, sanitary landfill, leachate treatment plant.

Course title: Urbanization and Sustainable Development

Lecture hours: 150

Course Code: ENV. 405

Full marks: 100

Nature of Course: Theory

Pass marks: 35

(Optional, Applied Science leading to core subject)

Objectives

The broad objective of the course is to enhance knowledge on urbanization and sustainable development in prospect of national and international issues. The specific objectives of the course are as follows:

- To provide an overview of urbanization, urban growth and pattern
- To understand the socio-cultural and environmental issues of urbanization
- To highlight the concept of sustainable cities, strategies for sustainable urbanization, and urban management initiatives
- To explain briefly the concept, scope, challenges and approaches of sustainable development
- To acquaint with the status of sustainable development in Nepalese context
- To understand national and international initiatives of environmental sustainability

Unit 1: Introduction to Urbanization

15 hrs

Concept and characteristics of urban, trend, process and pattern of urbanization; Historical analysis of urbanization and development; Urban growth and urbanization in developed and developing countries; Influencing factors and patterns of urban growth and urbanization in Nepal.

Unit 2: Urban Environmental Concerns

30 hrs

Introduction to urban environment and environmental concerns; Concept of urban ecology; Economic and ecological components of urbanization; Socio-cultural and environment impacts; Urban infrastructures, water supply and solid waste, sanitation and drainage, traffic congestion, air and noise pollution, urban land use change and patterns; Urban poverty, slum and socio-economic crimes and urbanization; Environmental sustainability and urban health; Socio-economic challenges; Environmental Good Practices – a case study of any one municipality of Nepal.

Unit 3: Sustainable Cities and Urban Management Initiatives

30 hrs

Concept on sustainable cities; Sustainable urbanization; concept of inclusive urban development; Strategies for sustainable urbanization; Green infrastructure, zoning and land pooling, carrying capacity, bioregionalism, Initiatives: Eco- cities, energy and water efficient cities; National: Nepal initiatives and urban governance; Urban planning, policies and institutions; Laws and

policies related to urban issues including ; Urban perspective plan; Global: Global initiatives of urban planning and policy; Development control of zoning regulations; Global urban plan preparations; Integrated urban management; SDG 11: Sustainable Cities and Communities.

Unit 4: Introduction to Sustainable Development

30 hrs

Introduction to development; Theories of development; Socio-economic dimensions of development; Concept of sustainable development; Evolution of sustainable development; Importance, scope and key indicators of sustainable development.

Issues and approaches of sustainable development: Environmental issues and sustainable development; An overview of local, regional and global environmental issues; Natural resources and sustainable livelihoods; Application of sustainability principles for solving environmental problems.

Economics of Sustainable Development: Concept of resource economics; economic growth and development; resources in classical and neoclassical economics; Ecology and economy nexus in reference to environmental sustainability; Environmental limits of economic growth; Communal properties and tragedy of commons; Cost benefit analysis; Green growth: origin and development of green economy; Green business; Green design and design for environment; Human Development Approaches: Pillars of human development; Vulnerability dimensions of human development: Equity, social justice and empowerment; Resource and knowledge based human development; Ecological footprints; Equally weighted indices (living planet index and environmental sustainability index); Integrated sustainable development index; Unequally weighted indices: Environmental pressure indices, well-being of nations; Eco-efficiency; Tools for sustainable management of resources.

Unit 5: Sustainable Development in Nepal

20 hrs

Practices and sustainable development planning in Nepal; Prospects and problems for sustainable development; Sustainable development in rural and urban areas; Planned development and developmental activities in Nepal; Emerging priorities for sustainable development; Eco-villages; eco-city development; Environmental design and sustainable community; Integrated ecosystem management and livelihood; Integrated urban management; Institutional and capacity building; Media and sustainable development; Education for sustainable development (ESD); Leading change for sustainability.

Unit 6: Policy Framework on Environmental Sustainability and Development Goals 25 hrs

Concept of development paradigms and shift to sustainable development and policy regulations; Resource policy and ladder of sustainable development; Global Initiatives towards environmental sustainability: Evolution; international environmental policies, plans, strategies

and commitments; National Initiatives towards environmental sustainability: environmental policies, plans and strategies and their effectiveness in Nepalese context; International and national environmental institutions, their role and responsibilities; Millennium Development Goals; Sustainable Development Goals.

References:

1. Brundtland, G.H. (1987). *Our Common Future*. World Commission on Environment and Development. Oxford University Press, Delhi India.
2. Dahal, M. K. & Dahal, D. R. (1998). *Environment and Sustainable Development. Issues in Nepalese Perspective*. Nepal Foundation for Advanced Studies (NEFAS), Kathmandu.
3. Elliott, J.A. (1994). *An Introduction to Sustainable Development: The Developing World*. Routledge, London.
4. Field B. C. (2001). *An Introduction of Natural Resources Economics*. McGraw Hill, Boston.
5. Furtado, D.R and T. Belt (2000). *Economic Development and Sustainability*. The World Bank, Washington, DC.
6. Joshi, A. R., Shrestha, S.L & Joshi, K. (2003). *Environmental Management and Sustainable Development at the Cross Road*. Ankus, Kathmandu Nepal.
7. Joshi, Jibgar (2009). *Regional Strategies for Sustainable Development in Nepal*, Lajmina Joshi, Kathmandu.
8. Mitlin, Diana and Satterthwaite D. (1994). "Cities and Sustainable Development", background paper, Global Forum '94, Manchester.
9. MoUD. (2015). *National Urban Development Strategy (NUDS), 2015 (Final Draft)*. Ministry of Urban Development, Government of Nepal, Kathmandu.
10. National Planning Commission, 2015: *Sustainable Development Goals, 2016-2030, National (Preliminary) Report*. Government of Nepal, National Planning Commission, Kathmandu, Nepal
11. Price, Charles and Tsouros A., eds. (1996). *Our Cities, Our Future: Policies and Action Plans for Health and Sustainable Development*. Healthy Cities Project Office, Copenhagen.
12. Rodney R. (1994). *White Urban Environmental Management: Environmental Change and Urban Design*. John Wiley & Sons, Chichester.

Course Title: Project Work
Course Code: ENV. 406
Nature of Course: Field and/or Lab Work (Optional)

Working hours: 300
Full marks: 100
Pass marks: 40

Objectives

To develop the basic research skills in laboratory and field based research areas.

Specific Objectives

- To develop basic scientific observation on natural and built environment
- To develop the basic field research and laboratory skills
- To develop confidence on seminar presentation and defend of the project work

This research project is designed as an elective paper for the interested students in order to develop skills and handle the basic research work independently. The interested student has to select one research topic covering a contemporary issue in environmental science after the completion of third year final examination and undertake under the supervision of concern faculty. The duration of this project will be of one academic year. The duration can however be extended by the department/campus with the consent of the head of the department/concerned authority on request from the student and the recommendation of the concerned supervisor with reasonable explanation.

A supervisor (sometimes also a co-supervisor) is formally appointed to guide the student. However, the student will work independently and will take full responsibility of completing the proposed task on time. The supervisor will be available for consultation and review. The student has to make seminar presentation for the final evaluation and the research project will be evaluated by a committee of expert including an external examiner.

Evaluation

The project work will be evaluated by a panel of experts comprising external examiner, supervisor, co-supervisor (where applicable) and head of the department or internal examiner allocated by the concerned authority of the department/campus. The evaluation includes three components:

- a. research process and methodology,
- b. quality of contents, and
- c. quality of oral presentation (by panel of the experts).

The weightage marks for each examiner is presented in the following table:

Examiner	Marks%
Supervisor/Co-supervisor	60

External Examiner	20
Internal Examiner	10
Head of the Department	10
Total	100

Some major points related to the aforementioned project work:

1. The concerned campus/department may charge additional fee (as specified by IOST/research committee of the concerned department) to the student who are willing to take the project work as an elective subject for the partial fulfillment of their academic degree.
2. The work load for the project work will be three times more than that of theory paper however both the paper carry same weightage i.e. 100 marks.
3. The decision will be done at department/campus level that either to offer or not and if offered what will be the modality of selecting the project work as an elective subject on the basis of physical and human resources availability in their campus/department.
4. The department/campus may form a research cell to look after the research work at the department and formally appoint a coordinator for the same in order to conduct research activities smoothly.

Course Title: Climate Change

Course No: ENV. 407

Nature of Course: Theory (Interdisciplinary)

Lecture hours: 75

Full marks: 50

Pass marks: 17.5

Objectives

- To develop understanding of climate change
- To enable student to use CC vulnerability assessments tools
- To understand climate change impacts and their mitigations
- To acquaint students with adaptation modules and approaches

Unit 1: Introduction to Climate and Climate Change

15 hrs

Concept of climate and weather; Paleoclimatology: Introduction to the climate system; surface energy balance; Climate Archives, Data and Models; Global warming and science of climate change, Causes and major impacts of climate change; Climate change scenario in Nepal.

Unit 2: Climate Change Impacts

15 hrs

Climate change impacts on: agriculture and food security, water resources and energy, human health, forests and biodiversity, settlement and infrastructure, tourism and economy.

Unit 3: Climate Change Risk and Vulnerability Assessment

15 hrs

Concept and terminologies; Criteria to identify vulnerability; Climate change vulnerability index; Vulnerability assessment methods and tools; Implication of vulnerability assessment and framework for developing CCA strategies.

Unit 4: Climate Change Adaptation and Strategies

15 hrs

Concept, adaptation characteristics and processes; Types of adaptation; Community based adaptation and Ecosystem based adaptation; Climate Change adaptation plans, policies and strategies; National plans, policies and strategies: Nepal's NAPA, climate change policy, LAPA and NAP process; Clean Development Mechanism (CDM): REDD, REDD+ and payment for carbon; Carbon sequestration: Concept, mechanism, driving factors of carbon sequestration.

Unit 5: Climate Change Mitigation

15 hrs

Concept; Greenhouse gas emission: scenario and projections; Mitigation gap: global carbon budget; Mitigation Strategies and Global effort to reduce emission; Responding to mitigation challenges and ways to reduce emission.

References:

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