First Year (1st Semester)/Semester I

FMS 201: Introductory Forestry

Course Number	Course Title	Credit (Th + Pr)
FMS 201	Introductory Forestry	3 (3 + 0)

SCOPE

This course offers a basic understanding and importance of forestry beginning with global to national perspectives. In addition, it deals with the global forest goals and the contribution of forestry to sustainable development goals including food security. The teaching styles of the course will include classroom learning, field study and field excursion.

OBJECTIVES

- Understand the basic concept and principles of forestry and its importance
- Familiarize with the state of global and national forest scenario
- Learn the forest types and classifications
- Gain knowledge about the concept of forest ecosystem and management
- Understand the relationship between forests and people
- Gain understanding of the importance of forests' role in food security

EXPECTED OUTCOMES

On completion of this course, students will be able to understand the basic concept of forest and forestry and its role vis a vis contribution to national development. In addition, they understand forests' role and contribution in the global and national context in achieving sustainable forest management.

COURSE DESCRIPTION

UNIT 1. INTRODUCTION (6)

1.1 Definition of forest and forestry
1.2 Basic terms related to forestry such as forest cover, afforestation, regeneration, dense forest, open forest, annual felling, clear cut, objective of silviculture and rotation
1.3 Natural and artificial regeneration
1.4 Classification of forest by functions
1.5 Importance of forests
- 1.5.1 Provide natural habitat
- 1.5.2 Serve as watershed region
- 1.5.3 Support biodiversity
- 1.5.4 Purify the air
- 1.5.5 Regulate global temperature and water cycle
- 1.5.6 Enrich the soil
- 1.5.7 Provide economic benefits

UNIT 2. STATE OF FORESTS (9)

2.1 Global and Nepal forest scenario
2.2 Six global forest goals and its linkages with sustainable development goals
2.3 Sustainable development goals (17 sustainable development goals)
2.4 Challenges of achieving global forest goals
2.5 Other land with tree cover/trees outside forests
2.6 Primary forests and planted forest/High forests and planted forests
2.7 Major threat to forests
2.7.1 Deforestation
2.7.2 Forest fires
2.7.3 Air pollution

UNIT 3. FOREST CLASSIFICATION (7)

3.1 Forest classification based on
3.1 Age (regular forest and irregular forest)
3.2 Growing stock (normal forest and abnormal forest)
3.3 Regeneration (high forest and coppice forest)
3.4 Species composition (pure forest and mixed forest)
3.5 Territorial (block, compartment, and sub-compart)
3.6 Ownership (Government, private, and community)
3.2 Forest classification of Nepal
3.2.1 Tropical forest (altitude and forest type)
3.2.2 Sub-tropical forest (altitude and forest type)
3.2.3 Temperate forest (altitude and forest type)
3.3.4 Sub-alpine forest (altitude and forest type)
3.3.5 Alpine forest (altitude and forest type)

UNIT 4. INTRODUCTION TO FOREST MANAGEMENT (6)

4.1 Concept and definition of forest management
4.2 Concept of yield and sustained yield
4.3 Normal forest and its characteristics
4.4 Kinds of abnormality in the forests
4.5 Sustainable forest management
4.6 Components of sustainability
4.7 Genesis of sustainability concept
4.8 Concept and definition of multiple use forest management
4.9 Importance of multiple use forest management and its objectives

UNIT 5. FOREST ECOSYSTEM (7)

5.1 Concept and definition of ecosystem and forest ecosystem
5.2 Key attributes of forest ecosystem
5.3 Component of forest ecosystem
5.3.1 Abiotic components
5.3.2 Biotic components
5.5 Plant succession
5.6 Characteristics of plant succession

UNIT 6. PEOPLE AND FORESTS (10)

6.1 People's relationship with forests
6.2 Use of forest resources for food, fodder, shelter, energy, medicine and income generation
6. 3 Use of forest biodiversity for recreation and tourism
6.4 Forests and poverty
6.5 Contribution of forests and trees to food security

6.5.1 Availability (the actual or potential presence of food)
6.5.2 Forest biodiversity and sustainable agriculture
6.5.3 Access to food
6.5.4 Utilization of food (consumption of adequate nutrition and energy)
6.6 Forest and livelihoods: concept and definition
6.7 Deforestation and degradation in Nepal
6.8 Impact of deforestation and degradation in Nepal
6.8.1 Erosion
6.8.2 Sustainability of agricultural production systems
6.8.3 Biodiversity

REFERENCES

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WEM 202: Geology and Forest Soils

Course Number	Course Title	Credit (Th + Pr)
WEM 202	Geology and Forest Soils	3 (2 + 1)

SCOPE

This course covers concept of geology and its component including geomorphology and geological process. In addition, it deals with soil properties, formation, classification, and mapping. Students will be exposed to different soil forming factors such as topography, climate, parent material, geological time, and living organism. The teaching style of this course will include a combination of classroom learning integrating with practical class and field excursions.

OBJECTIVES

- Identify different types of rock and minerals
- Understand soil properties and their effects on soil quality
- Understand the soil formation and its systematic description and classification
- Understand the role of geology on soil development
- Analyze the physical and chemical properties of soils
- Gain skills to develop mechanism in managing soil sustainably.

EXPECTED OUTCOMES

Upon the completion of the course, students will be able to understand the concept of geology & soil, the soil formation process and classification. They will gain skills to develop a sustainable soil management approach and able to manage the problematic soils.

COURSE DESCRIPTION

UNIT. 1 INTRODUCTION TO GEOLOGY AND GEOLOGY OF NEPAL (8)

1.1 Definition and concept of geology
1.2 Components of geology
1.3 Origin of the Earth
1.4 The interior of the earth
1.5 Geological Framework of Nepal
1.6 Tectonics of Nepal Himalayas (HFT, MBT, MCT, STDFS, MT, CCT)
1.7 Geological history of Nepal Himalayas

UNIT 2: TYPES OF ROCKS AND MINERALS (6)

2.1 Minerals and its classification, relationship with rocks and minerals and plant growth

2.2 Formation and classification of igneous, sedimentary, and metamorphic rocks

UNIT 3: GEOMORPHOLOGY AND GEOLOGICAL PROCESS (5)

3.1 Introduction to different landforms in Nepal

3.2 Exogenous and endogenous earth process

3.3 Role of geomorphic process inland stability, plant germination, regeneration, and plant growth

UNIT4: SOIL PROPERTIES (6)

4.1 Introduction to Soil Science

4.2 Soil as a Medium for Plant Growth,

4.3 Soil Physical Properties: Soil Texture, Color, Structure, Bulk Density, Soil Porosity, Soil Moisture

4.4 Soil Chemical Properties: Soil pH, CEC, buffering of soils, liming and management of problematic soils

4.5 Soil biological properties: soil organism

UNIT 5. SOIL FORMATION, CLASSIFICATION AND MAPPING (10)

5.1 Soil forming factors and process,

5.2 Soil profile and diagnostic horizons,

5.3 Soil Classification systems (USDA Soil Taxonomy and WRB)

5.4 Soil Survey and Sampling, Basics of Digital Soil Mapping (DSM)

UNIT 6: SOIL ORGANIC MATTER (OM) AND SUSTAINABLE SOIL MANAGEMENT (10)

6.1 Distribution of OM in soils,

6.2 C:N ratios and its significance in soils, Humus,

6.3 Carbon, Nitrogen and Phosphorus cycles in soils

6.4 Sustainable Soil Management (SSM),

6.5 Integrated Plant Nutrient Management System (IPNS),

6.6 Soil as source and sink of carbon, Climate change and Soils.

PRACTICAL

1. Forest Soil Sampling and Sample preparation for chemical analysis
2. Soil Particle size determination (Texture) – Hydrometer Method
3. Soil pH Determination (pH H2O and pH KCl)
4. Determination of Soil Moisture and Bulk Density
5. Laboratory analysis of Soil Nitrogen, Phosphorous and Potash (N,P ,K)
6. Determination of SOM (Soil Organic Matter), and its calculation per hectare
7. Study and identification of minerals and rocks

Soil Part

1. Soil Description
2. Soil Profile/Pedon Description
3. Filed Soil Survey and Sampling
4. Soil Analysis in Laboratory
5. Group Report Submission and presentation

Geology Part:

1 Familiarizations of regional geomorphic features
2 Field visit to Siwalik and Lower Himalayan zone of Nepal to:
    2.1 Study of rocks, minerals, and their distribution
    2.2 Study of erosional and depositional features
    2.3 Study of weathering pattern and its role in soil formation and soil profile development

REFERENCES

1. Brady, N. C., & Weil, R. R. (2015). *The nature and properties of soils*. Upper Saddle River, N.J: Prentice Hall.
2. Mukharjee, P.K. (2019) A Text Book of Geology. 13th. Edition. Publisher: World Press Private Ltd
3. R. B. Ojha and D. Panday (eds.), The Soils of Nepal, World Soils Book Series, https://doi.org/10.1007/978-3-030-80999-7_1

WPM 203: Wildlife Biology and Ecology

Course Number	Course Title	Credit (Th + Pr)
WPM 203	Wildlife Biology and Ecology	3 (2 + 1)

SCOPE

The course deals with tropical vertebrate wildlife in particular important birds and mammals and their habitats of Nepal. Beyond the theoretical lectures, students will be familiarized in the field methods (through field trips) of threatened animal species, their population and habitats.

OBJECTIVES

- Build up understanding of the basic concepts of wildlife biology, diversity and conservation.
- Understand the scientific and biological principles pertaining to wildlife populations.
- Understand the mechanisms of and concepts related to wildlife habitat.
- Understand the concepts of different types of animal behavior and its significance.
- Familiarize with application of ecological theory of wildlife management; skill and practical knowledge of terrestrial vertebrates.

EXPECTED OUTCOMES

Upon completion of this course students will gain basic understanding of important wild animal species, their population dynamics, habitat characteristics and in addition, gain comprehensive understanding of the principles and practices of ecology and conservation of species, communities and ecosystems.

COURSE DESCRIPTION

UNIT 1. INTRODUCTION TO WILDLIFE BIOLOGY AND ECOLOGY (4)

1.1 Introduction to wildlife biology, basic concepts and technical terms, historical perspective.

1.2 Introduction to basic wildlife ecology; energetics of energy production, transfer and flow of energy through food chains of ecosystems, interrelationships within species, community biomes.

UNIT 2. WILDLIFE POPULATIONS (5)

2.1 Population ecology as a science
2.2 Population dynamics
2.3 Age structure and sex-ratio
2.4 Natality and mortality
2.5 Models in population ecology
2.6 Exponential population growth models
2.7 Logistic population growth models
2.8 Introduction to Population viability analysis (PVA)
2.9 Wildlife population survey technique

UNIT 3. WILDLIFE HABITAT (5)

3.1 Introduction to Habitat components
3.2 Habitat fundamentals (Habitat and niche)
3.3 Types of wildlife habitat and associated major wildlife species
3.4 Habitat heterogeneity (Edge effect, Ecological traps etc.)
3.5 Habitat fragmentation, loss and degradation
3.6 Habitat sharing and habitat overlapping
3.7 Alien and invasive species
3.8 Wildlife habitat restoration ecology

UNIT 4. ANIMAL BEHAVIOR (6)

4.1 Habitat selection, (Linking habitat selection to fitness and demography)
4.2 Social behavior
4.3 Dominance and Territoriality
4.4 Courtship and Mating behavior, Altruism
4.5 Reproductive physiology and behavior
4.6 Parental care
4.7 Aestivation, hibernation
4.8 Circadian and circannual rhythms , Imprinting
4.9 Migration and their causes

UNIT 5. FOOD AND FEEDING BEHAVIOUR (5)

5.1 Define Food and diet
5.2 Macro-nutrients (Carbohydrates, Fats and Proteins)
5.3 Micro-nutrients (Vitamins and minerals)
5.4 Feeding behavior and defense (concept of herbivore, frugivory and predation)
5.5 Review of optimal foraging theory, Nutritional ecology
5.6 Food selection and pattern of habitat utilization.
5.7 Response to food shortage
5.8 Prey predator relationship
5.9 Diet analysis (Tools, techniques and applications of diet analysis)

UNIT 6. WILDLIFE ECOLOGY AND CONSERVATION (5)

6.1 Introduction to wildlife ecology and conservation
6.2 Evolutionary and physiological ecology
6.3 Species diversity
6.4 Succession and island biogeography
6.5 Human impacts and global change
6.6 Different level of conservation approaches in Nepal (Illustrate with conservation case studies)
6.7 Ecological principles of conservation and management of wildlife in wetland environments

PRACTICALS

- To study the structure, working, use and care of simple and compound microscope.
- Morphological identification of important wildlife species (Birds, Mammals and herpetofauna) in the lab and their classification.

- Types of feathers in bird and their identification in the lab
- Diet analysis (Micro histological analysis) of available carnivore and herbivore scat and dung/pellets
- Use of GIS in Wildlife science
- Case studies of important birds and mammals

REFERENCES

1. Alcock, J. (1975 and 2013). Animal Behavior: An evolutionary approach (10th ed.). Arizona State University, USA.
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WEM 204: Forest and Climate Change

Course Number	Course Title	Credit (Th + Pr)
WEM 204	Forest and Climate Change	3 (3 + 0)

SCOPE

This course covers the analysis of meteorological data (temperature and precipitation) as well as highlight the national and global climate change policy and agreement. It explores the relationship between climate change and forests, synergies and trade-offs involved in climate-smart forest management and how mitigation and adaptation measures can benefit both forests and environment. The teaching style of this course will include the combination of both classroom learning and field excursions.

OBJECTIVES

- Understand the climate change impact in different ecosystem
- Integrate knowledge of forest management and Climate Change mitigation measures
- Apply knowledge of and techniques from forest management for climate change adaptation
- Analysis of the International and National policies for future Forest Management in the context of climate change
- Analysis the long-term meteorological data collected nearby station for future scenario

EXCEPTED OUTCOMES

After completion of the course, students will be able to synthesize and articulate potential climate change impact to different ecosystems. Additionally, they will be able to gain skills in assessing and estimating carbon stock in different ecosystems, particularly forest.

COURSE DESCRIPTION

UNIT 1. UNDERSTANDING CLIMATE CHANGE AND FUTURE SCENARIO (8)

1.1. Climate Change and related terminology, Green House Gas (GHG)
1.2 Structure and composition of the atmosphere
1.3 Weather, climate meteorology and climatology
1.4 Weather elements: temperature, precipitation, humidity, and wind
1.5 Climate scenario: past, present, and future temperature
1.6. Measurement of weather elements: data gathering instruments and their use (nearby meteorology station and analysis of long-term temperature and precipitation data)

UNIT 2. IMPACT OF CLIMATE CHANGE IN DIFFERENT ECOSYSTEM (8)

2.1 Forest Ecosystem
2.2 Wetland Ecosystem
2.3 Range Land Ecosystem and High Mountain
2.4 Wildlife and Biodiversity
2.5 Agroecosystem

UNIT 3. CARBON POOL AND FLUX IN FOREST ECOSYSTEM (8)

3.1 Carbon Cycle
3.2 Carbon pool in the Forest ecosystem
3.3 Present and Future Carbon Sources and Sinks

3.4 Carbon Sequestration as a Forestry Opportunity in a Changing Climate

3.5 Measurement of Carbon stock in the Forest area

UNIT4. FORESTS ROLE IN CLIMATE CHANGE MITIGATION (7)

4.1 Technology for climate change mitigation

4.2 Biological methods for climate change mitigation

4.3 Forest Management for Mitigating climate change

4.4 Afforestation, Reforestation and Reduced Deforestation to Sequester Carbon and Reduce Emissions

UNIT.5. ADAPTATION IN THE FOREST MANAGEMENT (7)

5.1 Forest management for climate change adaptation

5.2 Nature based solution and Ecosystem based climate change adaptation

5.3 Evaluate and apply climate adaptation principles within a forest management context.

5.4 Synergies and trade-offs between adaptation and mitigation

UNIT 6. CLIMATE CHANGE POLICIES, AND INSTITUTIONS (7)

6.1 International and National Policy on Climate Change

6.2 Climate Change Policy in Nepal

6.3 Sustainable development goal and Forest Mgt and CC

6.4 Different Institutions and their involvement in climate change mitigation and adaptation activities

6.5 IPCC, Kyoto- Protocol, Conference of Party (CoP), NAPA framework, LAPA framework, REDD+

6.6 Implications for Future Forestry and Related Environmental and Development Policy

EXCURSION

Visit nearby meteorology station to observe weather measurement instruments (data gathering instruments such as rain gauge, barometer, and thermometer and their use)

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1. Bhattarai, S., Regmi, B., Uprety, D. R. and maraseni, T. 2021. Sustaining ecosystem-based adaptation: The lessons from policy and practices in Nepal: Land Use Policy, Volume 104.
2. Climate Change Policy 2019. MOFE, GON. Kathmandu Nepal.
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FPU 205: Plant Biochemistry

Course Number	Course Title	Credit (Th + Pr.)
FPU 205	Plant Biochemistry	3 (2 + 1)

SCOPE

This course covers the concept and theory of plant biochemistry and its application in forestry focusing to chemistry of natural products. It deals with alkaloids terpenoids and carotenoids, flavonoids and anthocynin and natural antioxidant. It makes students to gain knowledge and skills through lecture, lab works and field observations.

OBJECTIVES

- Develop knowledge in the fundamental concept of plant biochemistry
- Understand primary and secondary metabolism of carbohydrate, protein, hormones, and vitamins
- Understand the importance key plant species of biochemistry and phamacology
- Able to enumerate molecular of a living cell, structural and functional hierarchy of biomolecular in plant origin and natural products

EXPECTED OUTCOMES

Upon the completion of the course, students will be able to understand the importance of plant products and their compositions. Moreover, they can generate ideas of natural bioproducts and their importance in human body.

COURSE DESCRIPTION

UNIT 1. GENERAL REVIEW OF PLANT CHEMISTRY (5)

1.1 Concept of Primary and Secondary Metabolites
1.2 Major sources of Carbohydrate, Protein, Lipid and their functions
1.3 Role of Hormones and Minerals in plant

Unit 2. ALKALOIDS (4)

2.1 Introduction and characteristics features
2.2 Structure of Quinine, Morphine and Caffeine
2.3 Biological importance of Alkaloids

UNIT 3. TERPENOIDS AND CAROTENOIDS (6)

3.1 Sources, Isoprene rule and classification of Terpenoids
3.2 Biological importance of Mono, Sesqui, Diterpene and Triterpene
3.3 Sources and roles in human diet of Carotenoids
3.4 Chemical structures of Beta Carotene, retinol and lycopene

UNIT 4. FLAVONOIDS AND ANTHOCYNIN (4)

4.1 Introduction and sources of Flavonoids and Anthocynin
4.2 General structure of Flavonoid
4.3 Importance of Flavonoids and Anthocynin in prevention of chronic diseases

UNITT 5. NATURAL ANTIOXIDANT (4)

5.1 Free radical, antioxidant
5.2 Sources of edible fruit and vegetables and their principal bioactive compounds

5.3 Role of bioactive compounds in different diseases

UNIT 6. BIOCHEMISTRY AND PHAMACOLOGY OF FOLLOWING SPECIES (7)

6.1 *Tinospora cardifolia*,

6.2 *Cordyceps synensis*,

6.3 *Glycyrrhiza glabra*

PRACTICALS

1. Detection of Carbohydrate (Molisch test, Benedict's test)
2. Detection of Protein (Millon's test, Ninhydrin test)
3. Detection of Fat/ Oil (Spot, Saponification test)
4. Qualitative Phytochemical screening of
   a) Alkaloids (Dragendorff's test, Mayer's test)
   b) Flavonoid (Shinoda test, Shibata test)
   c) Terpenoids (Salkowski test)
   d) Plant Steroid (Libbermann's Burchcard test)
5. Isolation of B, carotene from carrot
6. Extraction of important MAPs (chiraito, kutki, and talispatra)

REFERENCES

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FMS 206: Field Study: Vegetation Zoning

Course Number	Course Title	Credit (Th + Pr.)
FMS 206	Field Study I: Vegetation Zoning	1 (0 + 1)

SCOPE

This course is designed to interact with the real field situation by allowing students to observe vegetation and other natural resources in different zones ranging from tarai to high hills of Nepal. It examines the climate and their impact on plant species, growth and diversity at different altitudes and their interactions with nature. The class exercise is limited to field observation and de-briefing.

OBJECTIVES

- Understand the concept of vegetation variation and wildlife distribution at different altitudes
- Familiarize with the working environment in the field of forestry and natural resources.
- Gain knowledge and skills and prepare herbarium
- Develop skills in identifying the tree species
- Familiarization of geological features and develop skills in identifying different rocks

EXPECTED OUTCOMES

Upon completion of the field work, students will be able to understand the concept of vegetation variation, identify tree species, and differentiate vegetation zoning accordingly.

COURSE DESCRIPTION

Students will be planned for one-week in the real field situation and allow to observe vegetation in different vegetation transition zones ranging from tarai to high hills of Nepal selecting the area either from one province or two, depending on the accessibility. During their visit, they will ask to identify plants (herbs, shrubs, and trees species) and collect their samples from three ecological zones and prepare herbarium. At the same time, they will be familiar to identify the different rocks and minerals.

Note: Field schedule should be arranged as per convenience.

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2. Kayastha, 1985. Silvics of the Trees of Nepal. Community Forestry Development Project, Ministry of Forests, Nepal.
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