Far Western University
Faculty of Engineering

Bachelor of Engineering (Civil)
Elective Course

Far Western University
Faculty of Engineering
Bachelor of Engineering (Civil)
Course of Study

Course Title: **Advance Environmental Engineering**	Credit: 3
Course Code: **CE 4520**	Number of lecture/week: 3
Nature of the Course: Theory	Tutorial/week: 1
Year/Semester: Fourth/VII or VIII	Total hours: 60

1. **Course Introduction:**
   The course is aimed to provide the basic knowledge of advance environmental engineering including air pollution, water pollution, life cycle and environmental assessments and to promote the achievement of Sustainable Development Goals (SDGs) from the perspective of advance environmental engineering works, through analyzing and finding the interrelationship between the advance environmental engineering works and the related specific target for each goal.

2. **Course Objectives:**
   At the end of this course the student should be able:
   - To understand the ecology, environment and its constituents, environmental engineering, environmental pollution and strategy for environment management.
   - To know about the sources of air pollution and its appropriate control technologies, ambient air quality and emission standards.
   - To understand the water pollution, wastewater characteristics and its treatments, industrial wastewater sources, its effects, treatments, drinking water and effluent standards.
   - To understand the concept of life cycle assessment, types of environmental assessments, its benefits, impacts, environmental protection measures and management plan and preparation of assessment report.
   - To understand about the sustainable development and the contribution of advance environmental engineering works on SDGs achievement.

3. **Specific Objectives and Contents:**

Specific Objectives	Contents
• Familiar with the concept, emergence and importance of the SDGs • Familiar with enviornmental related SDGs	**UNIT 1: Concept of Sustainable Development and Environment-related SDGs (3 hours)** • Emergence of the SDGs. • The 17 SDGs, Targets, Indicators • Role of Environmental Engineering in achieving the SDGs

• Understand the ecology, environmental engineering, environment pollution and projects impacts on enviornment	**UNIT 2: Introduction to Enviornmental Engineering (6 hours)** • Concept of ecology, definition of Environment and its constituents • Defintion of Engineering, Environmental Engineering • Impact of engineering projects on the environment • Environement pollution, monitoring of pollution • Concept of productivity, environmental health, pollution cost • Strategy for a livable environment, international institutions for environmental management
• Understnd about sources, classification, effects of air pollution and meteorological parameters	**UNIT 3: Air Pollution and Meterology (8 hours)** • Definition, sources and classification of air pollution • Effects of air pollution on human health, plants, materials, properties, aesthetic value and visibility • Meteorological parameters, Wind roses (diagrams), emperature lapse rates and stability, dispersion of air pollutants, stack height calculation, the Gaussian plume model
• Understand pollutants monitoring, control techniques of particulate and gaseous, and control measures of indoor air pollution • Know the contribution of the management of air pollution that can make to meeting the SDGs	**UNIT 4: Air Pollution Monitoring and Control (8 hours)** • Monitoring of pollutants, ambient monitoring, stack monitoring, stack emission monitoring, analysis of air pollutants, high volume sampler • Principles and techniques for control of particulate and gaseous emissions. • Control of Autoexhaust emission • Indoor air pollution control measures • Ambient air quality standards • Vehicle Emission standards • Contribution of the management of air pollution can make to meeting the 17 SDGs

• Understand the water pollution, natural process of purification, standards, characteristics of wastewater, its treatment and deisgn. • Know the contribution of wastewater treatment into SDGs	**UNIT 5: Water Pollution (8 hours)** • Introduction, classification of water pollutants, quality of water for other uses, self purification of streams, Streeter-Phelps water quality, • Wastewaters characteristics: physical, chemical, biological • Wastewater treatment: preliminary treatment, primary treatment, secondary (biological) treatment, design of activated sludge process, trickling filters, oxidation pond, sludge treatment and disposal, advance treatment, nitrogen and phosphorous removal • Drinking water standards and effluent standards. • Role of wastewater treatment in achieving SDGs: 1, 2, 3, 6, 7, 8, 9, 11, 12, 13 and 14, specifically.
• Understand eutrophication and its detection • Understand sources, characteristics, effects, treatment options and effluents of industries	**UNIT 6: Industrial Wastewater (8 hours)** • Wastewater impacts to lakes, eutrophication of lakes, • Measurement and detection of eutrophication • Wastewaters from some typical industries: sources, characteristics, effects, treatment options and effluents- Leather tanning, dairy, sugar and distilleries, pulp and paper, pharmaceutical, textiles, steel plants, thermal power plants, fertilizer, soap and detergents, cement.
• Know environmental impact assessment its necessity, principles, legal provisions, methods, impacts, management plan and preparation of EIA report • Know the contribution of EIA on SDGs achievement.	**UNIT 7: Environmental Impact Assessment (EIA) (10 hours)** • Concept of Enviornmental Assessments (EAs) • Types of EAs (BEA, IEE, EIA) • EIA benefits, principles, legal provisions and its steps • Base line data collection, • Impact identification, prediction and evaluation. • Enviornmental Protection Measures (EPMs) • Preparation of Environmental Management Plan (EMP) • Preparation of EIAs of a project • EIA is a tool for achieving the SDGs **Examples:** o What percentage of forest in the catchment area of the proposed project will be lost due to the project? And what measures are proposed to replant trees to offset those lost? (SDG 15.1.1) o Provide a detailed EMP on how all waste on the proposed project will be managed with particular emphasis on recycling. (SDG 12.5.1)

• Understand of life cycle analysis for sustainability assessment, environmental management and environmental standards.	**UNIT 8: Environmental Management Systems (9 hours)** • Introduction to sustainability concepts and Life Cycle Assessment (LCA), LCA methodology and its components, life cycle inventory and life cycle impact assessment • Design for sustainability, sustainable engineering design principles, enviornmental cost analysis, eco-labelling, • Green engineering, green building and green energy concepts and management • International Environmental Standards: ISO 14001

References:

1. Peavy H.S., Rowe D.R. and Tchobanoglous G. *Environmental Engineering*, McGraw Hill.
2. Eckenfelder, W. W, Davis L. F, and Andrew J. E. *Industrial water quality*, McGraw-Hill Education, 2009.
3. Rao C. S. *Environmental Pollution Control Engineering*, New Age International, 2006.
4. De Nevers N. *Air Pollution Control Engineering,* McGraw Hill
5. Longhurst, J., Barnes, J., Chatterton, T., De Vito, L., Everard, M., Hayes, E. N. D. A., ... & Williams, B. *Analysing air pollution and its management through the lens of the UN sustainable development goals: A review and assessment*. *WIT Trans. Ecol. Environ*, 2018.
6. Bishop P.L. *Pollution Prevention: Fundamentals and Practice,* McGraw Hill International, 2000.
7. Metcalf L., Eddy H.P. and Tchobanoglous G. *Wastewater engineering: treatment, disposal, and reuse*. McGraw-Hill.
8. Garg S.K. *Environemntal Engineering (Vol. I)Waster Water Engineering*, Khanna Publishers.
9. Rao M.N. and Dutta, *Waste Water Treatment*, Oxford and IBM Publications Ltd.
10. Birdi G.S. and Birdi J.S. *Water Supply and Sanitary Engineering,* DhanpatRai Publishing Company.
11. Obaideen K., Shehata N., Sayed E.T., Abdelkareem M. A., Mahmoud M.S. and Olabi A.G. *The Role of Wastewater Treatment in achieving Sustainable Development Goals (SDGs) and Sustainability Guideline. Energy Nexus*, 2022
12. Khadka, R.B., Gorzula, S., Joshi, A.R., Guragain, S., and Mathema, A.J. *Environmental Impact Assessment: Processes, Methods, and Practices in South Asia (Bangladesh, Bhutan, India, and Nepal).* School for Environmental Management (SchEMS) and Institute of Environment and Development: Research and Capacity Building Initiatives (IED/RCBI), Kathmandu, 2013.
13. Act, Regulations, Guidelines of Government of Nepal on EIA [such as EPA, EPR]
14. Curran, M. A. ed. *Life cycle assessment handbook: a guide for environmentally sustainable products*. John Wiley & Sons, 2012.
15. UN, *Sustainable Development Goals*. http://www.un.org/sustainabledevelopment/sustainable-development-goals/

Far Western University

Faculty of Engineering

Bachelor of Engineering (Civil)

Course of Study

Course Title: Infrastructure for Sustainable Development	**Credit: 3**
Course Code:CE4540	**Number of Lecture/week: 3**
Nature of Course: Theory	**Tutorial/Week: 1**
Year/Semester: Fourth/VII or VIII	**Total hours: 60**

Context and Need: Sustainable development goals (SDGs) are the global agenda agreed by the member nations of the United Nations. SDGs set a common framework of development, for achieving prosperity in harmony with nature/environment, by focusing on five dimensions, namely, people, prosperity, planet, partnership and peace. Therefore, SDGs are to be internalized within the mainstream development activities. The crux of SDGs is to strike a balance between development and environment, which is extremely challenging given its uniqueness across different countries. A standard template of strategies or guiding principles cannot be replicated across different locations. Each country should define and realize its own state of balance and the development professionals working for the infrastructure construction in Nepal should realize the state of balance deemed appropriate for Nepal. The Far Western University realizes this unique need of the country, and develops this new course on "Infrastructure for Sustainable Development" for its civil engineering students.

Learning Objectives: This course aims to familiarize the students about the concept of Sustainable Development, SDGs, and Sustainability. Students will acquire both theoretical and practical knowledge enabling them to generate an in-depth analysis of relevant case studies as well as practical experiences using relevant data and tools. It highlights the importance of a sustainable approach for infrastructure development and prepares students to find appropriate ways of infrastructure development for contributing to the attainment of the SDGs. The course will teach students to perform basic analysis of carbon footprint and the life cycle assessment.

Specific Objectives and Contents

Specific Objectives	Contents
To be familiar with the modern day development trend and its toll on the environment	**UNIT 1: INTRODUCTION [3 hr]** ● Broader perspectives on development discourses, development aspirations, infrastructure construction, economic prosperity, and human development ● Environmental concerns with development discourses - The Earth Summit; greenhouse gas emissions; global warming and climate change
To be familiar with 17	**UNIT 2: SUSTAINABLE DEVELOPMENT GOALS (SDGs)**

SDGs and memorize at least 6 of them.	**[6 hr]** ● Millennium development goals (MDGs) as the predecessors ● The 17 SDGs; Targets; Indicators ● Integration and internalization of SDGs on development initiatives ● Exercise to identify the relevant SDGs during the appraisal of an infrastructure project
To be adept with the SDG Roadmap of Nepal by NPC. To understand the challenges of SDG attainment	**UNIT 3: SDG ROADMAPS, PROGRESS, AND CHALLENGES [6 hr]** ● Worldwide progress and prospects ● SDG Roadmap and its localization with specific focus on Nepal ● Challenges - planning and periodic monitoring; implementation skills and capabilities; expenditure capacity; investment projection (for SDGs and for infrastructure development component) and securing funds; prioritization; interdependence, synergy and conflicts of the goals and indicators; climate change context; optimal development (a holistic viewpoint towards environment).
To develop the conscience to become a civil engineer connected with the people, society, community and environment. To develop the ability to recognize any development project as a unique initiative and to evaluate it for the specific circumstance	**UNIT 4: SUSTAINABLE INFRASTRUCTURE PLANNING, DEVELOPMENT, AND MANAGEMENT [6 hr]** ● Conceptualizing sustainability in infrastructure planning context – Guiding principles for sustainable engineering ● Sustainable infrastructure planning: concept; alignment with the national roadmap and the SDG targets; holistic and specific view points for sustainability ● Sustainable infrastructure development: Best practices and poor practices for selected civil infrastructure (i.e., Housing, Transportation, Water Resources/Hydropower, Parks, Cultural Heritages and Urban Infrastructure) ● Sustainable building and infrastructure rating systems
To be thoughtful on the optimum use of natural resources and have the ability to make the best choice in a sustainable way	**UNIT 5: SUSTAINABLE USE OF RESOURCES [9 hr]** ● Water resources: Hydrology, water demands, water conservation and sustainable water use ● Energy: energy sources (e.g., fossil-based, biomass, hydro, wind, solar and hydrogen), various uses of energy (including lighting, cooking, heating/cooling, transportation, etc.); per capita energy needs and consumption pattern; Energy mix, energy conversion and energy density of various sources; Energy generation, transmission and distribution; global trends and future outlook of energy; Energy economy, energy security, cross border trading. ● Land resources; biomass and forest resources; mineral resources and ores ● Natural construction materials ● Exercise on option analysis, alternatives and optimization
To identify the poor practices and weaknesses	**UNIT 6: SUSTAINABLE URBAN REGENERATION [6 hr]** ● Analysis of existing urban condition with sustainability

in the existing urban infrastructure. To identify a sustainable solution for the identified problem	perspective ● Improvement of existing urban system including buildings, settlement, transportation, recreation, restoration of water bodies, parks, open spaces and greenery ● Sustainable sewage, storm water and waste management with a emphasis on waste as a resources ● Principles of reduce, reuse and recycling, and circular economy
To develop the ability to perform basic level of LC analysis of engineering projects	**UNIT 7: FUNDAMENTALS OF LIFE CYCLE ANALYSIS (LCA) [9 hr]** ● Introduction ● The LCA methodology ● Environmental life cycle costing, social life cycle assessment and life cycle sustainability assessment ● LCA applications in engineering ● Carbon footprint and its calculation ● Exercise to perform LCA of various engineering processes and products
To develop the skill of evaluating engineering infrastructure from sustainability perspective with assessment of LCA and carbon footprint	**CASE STUDIES AND PROJECT WORK [15 Hrs]** ● Infrastructure project case studies from literature including road, housing, urban development, water supply, river training projects (reflecting contents in Unit 1-7) ● Group work on theoretical project case studies with carbon footprint, LCA, rating system as applicable and out- of- the-box thinking: project work, report and presentation

REFERENCES

- Pollalis, S. N., Georgoulias, A., Ramos, S. J., and Schodek, D. (2012). *Infrastructure Sustainability and Design*. Routledge.
- *UNCTAD. (2014). World Investment Report 2014: Investing in the SDGs: An Action Plan. United Nations Publication.*
- *NPC (2017). Sustainable development goals: Status and Roadmap 2016-2030*. National Planning Commission, Government of Nepal.
- *NPC (2017). Needs assessment, cost estimate and financial strategy for sustainable development goals. National Planning Commission, Government of Nepal.*
- Ramjeawon, T. (2020). *Introduction to Sustainability for Engineers*. CRC Press.

Selected journal publications and institutional reports

Far Western University
Faculty of Engineering
Bachelor of Engineering (Civil)
Course of Study

Course Title: **Environmental Impact Assessment**	Credit: 3
Course Code: **CE 4523**	Number of lecture/week: 3
Nature of the Course: Theory	Tutorial/week: 1
Year/Semester: Fourth/VIII	Total hours: 60

1. **Course Introduction:**

Environmental Impact Assessment (EIA) is an important tool for public and private development and planning decisions toward creating a sustainable society. In this course, students learn about the fundamental concept of EIA, its procedure, acts/regulations and its historical process with several case studies. Scientific aspects such as identification, predictions and evaluation methods of impacts as well as democratic aspects relating to public participation will be explained. This course will also explore 'strategic environmental assessment' as new areas of EIA. In addition to lectures, presentations by students will also be conducted. The course is designed to teach the students of civil engineering stream about the functions of the various components of natural and manmade environment and their interaction with development activities.

The course is aimed at imparting the knowledge of EIA as relevant to various types of development projects. Students will be aware of prevailing practices of carrying out Brief Environmental Assessment/Study (BEA/S), Initial Environmental Examination (IEE) or EIA studies for different governmental, non-governmental organizations and international donor agencies. The course is also aimed to promote the achievement of Sustainable Development Goals (SDGs) from the perspective of BEA/S, IEE or EIA projects, through analyzing and finding the interrelationship between BEA/S, IEE or EIA and the related specific target for each goal.

2. **Course Objectives:**

At the end of this course, students should be able:

- To understand the concepts of Environmental Assessments (e.g. IEE, EIA) and prepare the environmental assessments reports for the successful implementation of the project.
- To understand the concept of sustainable development and the contribution of environmental assessments on SDGs achievement.

3. **Specific Objectives and Contents:**

Specific Objectives	Contents

• Familiar with the emergence and concept of the SDGs .	**UNIT 1: Concept of Sustainable Development and Environment-related SDGs (3 hours)** • Emergence of the sustainability, concept of SDGs. • Environmental related SDGs, targets, indicators • Environmental assessments (e.g., IEE, EIA) as a tool for achieving the SDGs.
• Know to examine the project that needs of EIA, IEE or BEA/S • Understand screening, BEA/S and IEE	**UNIT 2: Screening and Initial Environmental Examination (IEE) (4 hours)** • Introduction and objectives of screening • Screening procedure: BEA/S, IEE or EIA • Concept of BEA/S and IEE
• Understand the concept of EIA, its benefits, chronology of EIA in world and Nepal and EIA in development project. • Understand National commitment with Environment.	**UNIT 3: Introduction to Environmental Impact Assessment (EIA) (6 hours)** • Concept of Environmental Assessments (EAs) and impacts and their types • Concept and emergence of EIA • History of development of EIA in Nepal • EIA benefits and principles • Misconceptions about EIA • Project types • Steps in EIA process • EIA process and project cycle • Environmental legislative and policies in Nepal • Public participation in EIA
• Understand the purpose, importance, andprocess of scoping and TOR • Know to prepare scoping report	**UNIT 4: Scoping and Preparation of Terms of Reference (ToR) (4 hours)** • Objectives of scoping • Scoping process • Terms of Reference and its main components

• Understand the environmental setting, purpose and importance of baseline • Know the collection of baseline data	**UNIT 5: Establishing the Environmental baseline (8 hours)** • Introduction to baseline environment study • Environmental parameters: physical, biological, socio-economic, cultural (environmental setting) • Purpose of baseline data • Methods of baseline data collection: Primary and secondary data collection (physical, chemical, biological, socio-economic, cultural environments) • Importance of baseline data • Challenges for environmental baseline development
• Understand how to identify, predict, evaluate impacts and know EIA report writing	**UNIT 6: Impact Identification, Prediction and Evaluation Techniques (7 hours)** • Methods of impact identification: Checklists, matrix, networks, overlay mapping, GIS, expert judgment • Methods of impact prediction: Extrapolative, normative, mathematical/statistical models, GIS, field/laboratory experiments, expert judgment • Impact evaluation technique • Writing EIA report • Numerical on impact prediction and evaluation
• Understand about environmental protection measures and able to analysis and suggest EPM	**UNIT 7: Environmental Protection Measures (EPMs) (6 hours)** • Introduction and principle of EPMs • Types of EPMs: Mitigation measures, enhancement measures • Implementation of EPMs **SDGs related example:** What percentage of forest in the catchment area of the proposed project will be lost due to the project? And what measures are proposed to replant trees to offset those lost? (SDG 15.1.1) **SDGs related example**: Provide a breakdown of the employment profile of the workforce by origin of worker, sex, age and disability and demonstrate how this will affect the employment rate in the district in which the project is located. (SDG 8.5.2)
• Know about monitoring and auditing of environment • Know to prepare environmental management plan	**UNIT 8: Management of EIA process (7 hours)** • Environmental Management Plan (EMP) **SDGs related example:** Provide a detailed EMP on how all waste on the proposed project will be managed with particular emphasis on recycling (SDG 12.5.1)

• Know to review the EIA report	• Environmental Monitoring: Concept, principles, types, methods **SDGs related example:** How will the proposed new urban expressway affect the annual mean levels of fine particulate matter (e.g. $PM_{2.5}$ and PM_{10}) in the city in which it is being developed (population weighted)? (SDG 11.6.2) • Environmental Auditing: concept, physical, biological, socio-economic aspects • EIA Report Review and Decision Making • Stakeholders • Stakeholder Consultation and Public Participation **SDGs related example**: Did the stakeholder engagement process include meaningful consultation with the local affected parties, giving all groups (based on age, sex, disability) an equal opportunity to be heard and included in decision-making? (SDG 16.7.2)

Tutorials:

Numerical exercises, air pollution, water pollution and land erosion, etc.

Practical/Project work:

Prepare Timelines of EIA, Prepare Environmental Setting table, Prepare scoping Documents, Environmental Management Plan, Environmental Monitoring Plan, Environmental Auditing Plan, Review of EIA Report, Process of stakeholder consultation and public participation

Case Studies: Case studies of some projects in which EIA studies have been carried out.

References:

1. Canter L. W. *Environmental Impact Assessment*, McGraw Hill, 1996.
2. Khadka, R.B., Gorzula, S., Joshi, A.R., Guragain, S., and Mathema, A.J. *Environmental Impact Assessment: Processes, Methods, and Practices in South Asia (Bangladesh, Bhutan, India, and Nepal).* School for Environmental Management (SchEMS) and Institute of Environment and Development: Research and Capacity Building Initiatives (IED/RCBI), Kathmandu, 2013.
3. Upreti, B. K. *Environmental Impact Assessment: process and practice*. Published by Uttara Uprety, Koteshwor,Kathmandu, 2003
4. IUCN/Nepal, *EIA Training Manual for Professionals and Managers*. Published by IUCN/Nepal, 2003
5. Act, Regulations, Guidelines of Government of Nepal on EIA [such as EPA, EPR]
6. International Treaty , Commitment , Declaration, etc. related to Environment
7. UN, *Sustainable Development Goals*. http://www.un.org/sustainabledevelopment/ sustainable-development-goals/

Far Western University
Faculty of Engineering
Bachelor of Engineering (Civil)
Course of Study

Course Title : **Air Pollution Engineering**	Credit : 3
Course Code : **CE 4521**	Number of lecture / week: 2
Nature of the Course : Theory	Tutorial /week : 1
Year /Semester : Fourth/VII or VIII	Total hours: 45

1. Course Introduction:

This course is aimed to focus the fundamental knowledge of air pollution, its sources, classification, effects, impacts, sampling and measurement of pollutants, mitigate applying the engineering technology and norms and to promote the achievement of Sustainable Development Goals (SDGs) from the perspective of air pollution engineering projects and works, through analyzing and finding the interrelationship between air pollution engineering projects and works and the related specific target for each goal.

2. Course Objectives :

At the end of this course the student should be able:

- To understand the basic concept, sources, causes, effects and impacts of air pollution, sampling and measurement of pollutants and their controls by applying appropriate technology and norms.
- To get an insight into the national and international legislative framework on air quality.
- To understand the concept of sustainable development and contribution of air pollution engineering works on SDGs achievement.

3. Specific Objectives and Contents:

Specific Objectives	Contents
• Familiar with the concept, emergence and importance of the SDGs • Familiar with air pollution related SDGs	**UNIT 1: Concept of Sustainable Development and Air Pollution related SDGs (3 hours)** • Emergence of the SDGs • The 17 SDGs, targets, indicators • Broad linkages between SDGs and Air pollution

• Understand structure, composition and importance of the atmosphere and its constituents • Understand the sources and classification of air pollutants • Understand air pollution of Nepal and aboard	**UNIT 2: Introduction to Atmosphere and Air Pollution (5 hours)** • Structure and composition of the atmosphere • Importance of the atmosphere • Definition of air pollution, sources, classification and properties of air pollutants • Factors affecting air pollution • Major air pollution episodes and lesson learnt • State of air pollution in major cities: Nepal and World • Concept of Indoor, Vehicular, Industrial air pollution and Hazardous air pollutants or radioactive pollutants • Introduction on Green House Gases (GHGs), Total Suspended Particulates (TSP), Black carbon, and others.
• Understand the effects of air pollution on human, animals, visibility, agricultural production, local and global environment.	**UNIT 3: Effects of Air Pollution (4 hours)** • Effects of air pollution on human health, plants, animals, materials, properties, aesthetic value and visibility. • Global Effects: Global warming, Ozone layer depletion, Snow melt, Rise in sea level, Climate change and Impacts on economy.
• Understand the sampling and measurement of air pollutant	**UNIT 4: Air Pollution Sampling And Measurement (4 hours)** • Pollutant sampling and measurement • Ambient air sampling and stack sampling • Collection of gaseous and particulate pollutants • Analysis of air pollutant • High volume sampler etc.

• Understand the control technologies of particulate and gaseous pollutants. • Understand the causes of air pollution inside kitchens and to get the real solution to minimize the air pollution	**UNIT 5: Air Pollution Control Technologies and Techniques (6 hours)** • Principles and techniques for Control of particulate emission: Settling chambers, Cyclone separators, Wet collectors, Fabric filters, Electrostatic precipitators. • Principles and techniques for Control of gaseous emission: Adsorption, Absorption, Combustion • Auto Exhaust: Catalytic converters • Use of ventilation or alternatives to exit gases from indoors e.g. Kitchens and others • Control measures
• Understand national and international policies, standards, agreements and guidelines to maintain the air quality • Understand EU policies targeting air pollution and the reduction of its impacts contribute directly or indirectly to the achievement of SDGs	**UNIT 6: Air Pollution Policies and Standards (8 hours)** • National Ambient Air Quality Standards: Nepal, India, China, Japan, USA, and WHO • Government Plan and Policy for National Ambient Air Quality Standard • Vehicle Emission Standards • Government Air Pollution Monitoring/ Forecasting Plan and Policies • National Transport policy • National Petroleum Product Act for quality fuels • Agreement in between Government of Nepal and UN and other allies to follow the Environment protection norms • EU policies targeting air pollution and the reduction of its impacts contribute directly or indirectly to the achievement of SDGs 1, 2, 3, 6, 7, 8, 9 11, 12, 13, 14 and 15, specifically.

• Explore basic ideas about the existing local and global air pollution problems and their mitigation • Learn how to prepare the case study, proposals, articles and papers about the research finding • Know the contribution of the management of air pollution that can make to meeting the SDGs	**UNIT 7: Tutorial (15 hours)** • Group based case study **(** to investigate the root causes, sources and policy based , technical based solution**)** • Prepare the proposal for the mitigation of air pollution **(**in group**)** • **C**ollect the air pollution data and prepare articles related to pollution and finally present the paper **(**in group**)** • Collect air pollution data of Nepal and Abroad and compare them and finally present the paper **(**in group**)** • Review the contribution of the management of air pollution can make to meeting the 17 SDGs and finally present the paper (in group) • Review the SDG targets related to air pollution: 3.9 (Health), 6.3 and 6.6 (Water), 9.4 (Industry), 11.2 and 11.6 (Cities), 12.4 (SCP), 13.2 (Climate), 15.1 (Land), etc. and finally present the paper (in group)

Prescribed Text:

Davis, Wayne T., Joshua S. Fu, and Thad Godish. *Air Quality*. CRC Press, 2021.

References:

1. Srivastava, K. P. *An Introduction to Environmental Study*, Kalyani Publishers, 2001.
2. Pandey, G. N. *Environmental management*. Vikas Publishing House, 1997.
3. Adhikari, A.P. *Urban and environmental planning in Nepal: Analysis, policies and proposals*, 1998.
4. Rao C. S. *Environmental Pollution Control Engineering*, New Age International, 2006.
5. Longhurst, J., Barnes, J., Chatterton, T., De Vito, L., Everard, M., Hayes, E. N. D. A., ... & Williams, B. *Analysing air pollution and its management through the lens of the UN sustainable development goals: A review and assessment*. *WIT Trans. Ecol. Environ*, 2018.
6. Noel de N. *Air Pollution Control Engineering*, Third Edition, Waveland Press, 2016.
7. State of Environment of Nepal, Ministry of Population and Environment, Government of Nepal, 2001
8. Intergovernmental Panel on Climate Change Reports, 2014
9. Environmental Statistics of Nepal, 2015
10. UN, Sustainable Development Goals. http://www.un.org/sustainabledevelopment/sustainable-development-goals/
11. Research articles will be advised as required.

Far Western University
Faculty of Engineering
Bachelor of Engineering (Civil)
Course of Study

Course Title : **Water Resources Management** Credit : 3
Course No : **CE 4510** Number of Hours per week : (3+1)
Nature of the Course : Theory + Tutorial Total Hours : 45
Practical : 1.5 / 2 Hour each week Level : Bachelor of Engineering (Civil)
Year : Forth Semester : Seventh/ Eighth

1. **Course Introduction:**
This course is advance course for Bachelor students. This course develops the technical as well as managerial skills of students. The pre-requisite for this course is the students should know the basic knowledge in fluid mechanics, hydraulics engineering, Hydrology, Irrigation, Water Supply and Sanitary Engineering prescribed for bachelor level. This course aimed to deliver the knowledge to the Civil Engineering Student of Forth Year Second Part (i.e. VIII part) at Bachelor Level about the application of fluid mechanics, hydraulics engineering, Hydrology, Irrigation, Water Supply and Sanitary Engineering and some managerial skills about implication of water resources available. This course aims to deliver the knowledge to the students for demand analysis, planning, design, operation, maintenance and management of available Water Resources.
2. **Course Objectives:**
At the end of this course the students should be able -
   - To understand the fundamental terms used in Water Resources Planning and Management.
   - To know the behavior of Water Resources Engineering in management and its behaviour.
   - To know the problems arise in Water Resources Planning.
   - To know the Overall system design of Water Resources.
   - To know the act, rule and regulations in Water Resources
3. **Specific Objectives and Contents:**

Specific Objectives	Contents
➢ To know the concepts of Water Resources management ➢ To know Concept of System ➢ To know the Water Management situation in Nepal	**Unit 1. Introduction (2 Hour)** 1.1 Global as well as Local Water Sources 1.2 Introduction to Water System Engineering 1.3 Scope and Approach of Water Resources Management 1.4 Water Resources Management in Nepalese context and its importance
➢ To Understand the system planning objectives ➢ To know Importance of Environment and water dynamics and its planning ➢ To know the Real Water Resources Project Problems and solution approach	**Unit 2 . Issues and the System Planning Approach (7 Hours)** 2.1 Objectives of System Planning 2.2 Water System Dynamics 2.3 Environment and Resources 2.4 Issues in Water Resources Development 2.5 Planning Morphology and Approach 2.6 Water Resources System Studies and its constraints 2.7 Trends in Water Resources Management 2.8 Alternatives of Water Resources Management 2.9 National level Water Resources Project – A Case Study
➢ To know the objectives of technical, sociologic water	**Unit 3 . Objectives and Evaluation Criteria (4 Hours)**

issues and its appraisal handling ➢ To know the nature of multi-objective problems in water resources	3.1 Technological Objectives 3.2 Socio-Economic Objectives 3.3 Practical Project Appraisal 3.4 Environmental-Ecological Objectives and Evaluation Criteria 3.5 Multi-objective Analysis
➢ To know hydrological analysis in different types of water sources (e.g. surface source, ground source etc.) ➢ To understand the Computer model and its uses in water resources problem handling	**Unit 4 . Hydrologic Input Analysis (6 Hours)** 4.1 Watershed Functional Analysis 4.2 Soil Sub-system Analysis 4.3 Groundwater Sub-system 4.4 Stream flow generation 4.5 Simulation of a Basin using Computer Model
➢ To know the types of water demands and their nature and demand addressing methods	**Unit 5 . Demand analysis (5 Hours)** 5.1 Types of Water Resources Demand 5.2 Demand Projections and Policy Formulation 5.3 Water Supply Demand for Human Settlements and International Standard for drinking water 5.4 Agricultural Demand 5.5 Hydro-electric Power Demand 5.6 Industrial Demand 5.7 Navigation, Waterways and Recreation Demand
➢ To understand the system and its elements uses ➢ To know the system handling approach for reservoir system ➢ To know the real case handling methods	**Unit 6 . System Elements and Planning (5 Hours)** 6.1 Water Conveyance and Distribution Systems 6.2 Reservoir Systems and Applications 6.3 Conjunctive Surface and Groundwater Development 6.4 Practical example of System planning – A case study
➢ To know the Water Quality Management issues and its solution approach ➢ To know the salinity and its effects in Agriculture ➢ To know the river basin water quality	**Unit 7 . Water Quality Management Planning (6 Hours)** 7.1 Nature of the Problem 7.2 Management Issues 7.3 Water Quality Dynamics 7.4 Water Quality Description 7.5 Water Quality Screening Model 7.6 Quality Management by Treatment 7.7 Flow Augmentation 7.8 Wastewater Transport 7.9 Artificial Aeration Methods 7.10 Irrigation Related Salinity Management 7.11 Management of River Basin Water Quality
➢ To know the water management methods for multipurpose development sector (Hydropower, w/s, Irrigation) ➢ To understand the watershed	**Unit 8 . Multipurpose Development Issues (5 Hours)** 8.1 Flood Management 8.2 Conjunctive Flood Mitigation and Water Resources Enhancement 8.3 Hydropower Development and Power estimation

and its management ➢ To know the sedimentation and its affects in water resources	8.4 Inland Water Transportation and Planning 8.5 Watershed management 8.6 Sedimentation and remedies
➢ To know the difference national and international policies in water resources sector ➢ To know the water quality management policies available and adopted	**Unit 9 . Policy Issues** **(5 Hours)** 9.1 System Planning Policy Issues 9.2 Technological Policy Issues 9.3 Water Resources Act, Rule and Regulation implemented in Nepal (Latest) 9.4 Water Supply Policy Issues 9.5 Agricultural Policy Issues 9.6 Water Quality Management Policy Issues

7 Practical / Tutorials :

The sufficient Tutorials will be performed during the course.

Field Visit :

One week field visit should be carried out to the students in suitable water resources projects (Water Supply, Irrigation, Hydropower and Industrial Sector).

After the field visit, students should submit the field visit report which reflects the detail description of Power plants they visited.

Evaluation System

External Evaluation	Marks	Internal Evaluation	Weightage	Marks	Practical	Marks
End Semester Examination (Details are given at the end)	60	Assignments	50%	15		
		Quizzes				
		Presentation				
		Group work				
		Mid-term Exam	50%	15	Field Reports	10
Total External	60	Total Internal		30	Total	10

External Evaluation

End Semester Examination

It is a written examination at the end of the semester. The questions will be asked covering all the units as per their allocated lecture duration. Following table shows the question model with full marks.

Full Marks: 100, Pass Marks: 45, Time: 3 hours

Nature of Questions	Total Questions to be asked	Total Questions to be Answered	Total Marks	Weightage	External Exam Marks
Numerical and theory mixed type Questions	10	10	100	100%	60

Note: Each student must secure at least 45% marks in internal evaluation in order to appear in the end semester examination.
The students unable to secure 45% marks in internal examination, will not be eligible to appear in the End Semester Examination

Internal Evaluation

Assignments

Each Student must submit the assignments individually within specified time.

Quizzes

Pre-informed and surprises quizzes / tests will be taken by the respective subject teachers at least two times within each semester. The students will be evaluated accordingly.

Presentation and Group work

Depending upon the topics taught in the class, respective subject teacher may form the group and ask for group presentation. In this presentation, student performance will be marked accordingly.

Mid-Term Exam / Minor Tests

The midterm written examination will cover all the topics that already taught at the time of examination date. It will be evaluated individually.

Practical / Tutorial Work and Field Visit

All prescribed practical/ Tutorial works should be done as per class routine. Each Student must submit the Lab / Tutorial report within prescribed time frame. And Lab/ Tutorial report will be evaluated individually for marking. At the end of field visit, students should carry out the field report in specified format and it will be evaluated as necessary.

Instruction Techniques

- Lecture and discussions
- Group work and Individual assignments
- Class tutorial
- Assignments at home
- Term paper writing
- Presentation by students
- Case study
- Quizzes
- Guest Lecture

Note: Students are advised not to leave any classes at optimum. If a student does not attend the class/s, it is his/her sole responsibility to carryout self study the topics that taught at his/her absence.

References:

1. Arceivala, S. J., and Asolekar, S. R., "Wastewater Treatment for Pollution Control and Reuse", Tata McGraw-Hill, New Delhi, 2007.
2. Bhave, P. R., "Water Resources Systems", Narosa Publishing House, New Delhi, 2011.
3. Butler, D., and Memon, . A., "Water Demand Management", IWA Publishing, London, 2006.
4. Chaturvedi, M. C., "Water Resources System and Management", Tata McGraw-Hill, New Delhi, 2012.
5. Chow, V. T., "Open Channel Hydraulics", McGraw-Hill, New York, 1959.
6. Garg, S. K., "Irrigation Engineering and Hydraulic Structures", Khanna Publishers New Delhi, 2009.
7. Garg, S. K., "Water Supply Engineering", Khanna Publishers, New Delhi, 1977.
8. Linsley, R. K., and Franzini, J. B., "Water Resources Engineering", McGraw-Hill, New York, 1982.
9. Loucks, D. P., Stedinger, J. R., and Haith, D. A., "Water Resources Planning and Analysis", Prentice-Hall, Englewood Cliffs, New Jersey, 1981.
10. Mays, L. W., "Water Resources System Management Tools", McGraw-Hill, New York, 2005.
11. Punmia, B. C. and Lal, P. B.B., Jain, A.K. and jain A.K. "Irrigation and Water Power Engineering", Laxmi Publications, Delh , 2009.

Far Western University
Faculty of Engineering
Bachelor of Engineering (Civil)
Course of Study

Course Title: Analysis and design for Wind and Earthquake Effects **Credit: 3**

Course Code: CE4502 **Number of lecture/week: 3 Year/Semester: Fourth / Seventh** **Tutorial/week: 2**

Level: BCE (Bachelor of Civil Engineering) **Total Lectures: 45 hrs**

1. Course Introduction

The main aim of the first part of the course is to provideknowledge of wind characteristics and evaluation of wind load that should be considered for design of a building as a whole as well as elements of a building structure. It also includes evaluation of wind load for towers, wires, cables and bridge structure. In the second part of the course, earthquake characteristic as well as dynamic response of structure is described. Design earthquake loads evaluation techniques are also included in the second part.

2. CourseObjectives

At the end of the course the students should be able to

- Nature of wind and dynamic effect on structure
- Measurement of wind load on building and elements of a building
- Evaluation of wind force on sloped roof
- Wind load on tower and bridge
- Earthquake characteristics and choice of design earthquake
- Dynamic response of structure
- Determination of design lateral forces

3. Course Outline

Specific Objectives	Contents	Duration
	Part-A: Analysis and Design for Wind Load	
• Wind characteristics	**1. Wind characteristics** 1.1. Forms of wind: gales, cyclones, hurricanes, typhoons, tornadoes, thunderstorms, etc. 1.2. Characteristics, variation of speed and turbulent nature of wind 1.3. Dynamic effect, vortex shedding and return period of wind	4 hrs
• Design wind pressure	**2. Wind pressure intensity** 2.1. Basic wind speed 2.2. Design wind speed 2.3. Design wind pressure	2 hrs
• Wind force on building	**3. Wind loadon structures** 3.1. Wind load on a building, walls, roof and other elements of building 3.2. Effect of medium and large opening on wind load and force coefficient	6 hrs

	3.3. Force coefficients, shielding factor and Gust factor	
• Wind load on tower and bridge	**4. Wind load on tower and bridge** 4.1. Wind load on tower, 4.2. Force coefficients for wires, cables and towers 4.3. Wind load on bridge superstructure and sub structure 4.4. Gust factor, shielding factor and drag coefficient	4 hrs
Part-B: Analysis and Design for Earthquake Load		
• Earthquake characteristics	**5. Earthquakes and wave characteristics** 5.1. Characteristics of earthquake: magnitude, intensity and waves 5.2. Characteristics of earthquake accelerograms: Accelerograms, vertical acceleration, soil effects, directional effects, geographic amplification 5.3. Attenuation relationships	6 hrs
• Design earthquake	**6. Choice of design earthquake** 6.1. Intensity and ground acceleration relationship 6.2. Probability of occurrence 6.3. Seismic risk, design limit states, economic considerations	4 hrs
• Dynamic response of structures	**7. Dynamic response of structures** 7.1. Response of single-degree-of-freedom (SDOF) system to lateral ground acceleration 7.2. Elastic response spectra 7.3. Response of inelastic single-degree-of-freedom (SDOF) systems 7.4. Response of multistory buildings	7 hrs
• Determination of earthquake force	**8. Determination of design earthquake forces** 8.1. Equivalent lateral force procedure 8.2. Model superposition technique 8.3. Dynamic inelastic time history analysis	6 hrs
• Equivalent lateral force	**9. Equivalent lateral force procedure** 9.1. First mode period of structure 9.2. Factors affecting the seismic base shear force: zone factor, importance factor, response acceleration coefficient, response reduction factor 9.3. Distribution of base shear over the height of a building 9.4. P-Δ effects in frame structures 9.5. Torsion effects	4 hrs
• Lateral load resisting systems	**10. Lateral load resisting systems** 10.1. Structural wall systems: coupled wall, squat wall 10.2. Dual system 10.3. Diagonal bracing systems	2 hrs

Note: Tutorial Classes may be added as per requirements.

References:

1. A.K.Chopra,Dynamics of Structures.
2. Jaikrishna&Chandrasekaran,Elements of earthquake engineering.
3. N. Subramanian, Design of Steel Structures, Oxford University Press.
4. Agrawal, P., Shrikhande, M. 2006. Earthquake Resistant Design of Structures, PHI Learning Private Limited, New Delhi (Reprint 2008)
5. T. Pauly& M.J.N. Priestley, Seismic design of reinforced concrete and masonry buildings, A Wiley Interscience Publication.

Evaluation scheme

The questions will cover all the chapters in the syllabus.

Far Western University

Faculty of Engineering

Bachelor of Engineering (Civil)

Course of Study

Course Title: Planning and Design of Building Services	Credit: 3
Course Code.CE 4503	Number of lecture/week: 3
Nature of the Course: Theory	Tutorial/week: 1
Year/Semester: fourth/ seventh or eighth (electives)	Total hours: 60

1. **Course Introduction:**
   The course is aimed to provide the basic knowledge of Building Services and its Design.
2. **Course Objectives:**
   At the end of this course student should be able:
   - To understand the concept of Building Services
   - To understand the types of Building
   - To design different services for Building
   - To Understand the regulatory environment in Building Services
   - To Prepare and Understand Building Services Drawings.
3. **Specific Objectives and Contents:**

Specific Objectives	Contents
• Understanding Evolution of Shelter and Building and various services required.	**UNIT 1. Introduction (2 Hours)** 1.1.Building 1.2.Services 1.3.Building Services
• Understand the types of Buildings used and method of its classification	**UNIT 2. Classification of Building(5 Hours)** 2.1 Residential Building 2.2 Educational Building 2.3 Institutional Building 2.4 Assembly Building 2.5 Business Building 2.6 Mercantile Building 2.7 Industrial Building. 2.8 Storage Building 2.9 Emergency Shelter
• To be able to Design different services for Building	**UNIT 3. Design of Building Services (20 Hours)** 3.1 Mechanical System: 3.1.1 HVAC: Heating, Ventilation andAir-conditioning 3.1.2 Site Drainage: Water, Drainage, Sanitary Disposal, Gas supply 3.1.3 Plumbing: Water Distribution, Water Treatment, Sanitary Facilities 3.1.4 Fire Protection: Water Supply, Stand pipe, Fire and Smoke Detection, Annunciation 3.2 Electrical System:

Specific Objectives	Contents
	3.2.1 Electrical Power: Normal, Standby, Emergency Power Supply and Distribution 3.2.2 Lighting: Interior, exterior, Emergency Light 3.2.3 Auxiliary: Telephone, Data, Audio and Video Sound 3.2.4 Operation System 3.2.5 Transportation: Elevators, Escalators, Moving Walkways 3.2.6 Processing: Product, Food, Services 3.2.7 Automation: Environmental Control and Management
• Understand the state regulatory system for building construction. • To provide the concept of planning Buildings	**UNIT 4. Planning andRegulatory System of Building (6 Hours)** 4.1 Building Codes 4.2 Bylaws 4.3 Provision of Central Government 4.4 Provision of Federal Government 4.5 Provision of Local Government 4.6 Concept of Land use. 4.7 Site Investigation. 4.8 Preparation of Design Documents and Approval
• To be able to design Water Supply and Sanitary Components for Building • Prepare As Built Drawing and Understand its Importance.	**UNIT 5. Design and Layout of Building Services (12 Hours)** 5.1 Water Supply Network in Building 5.2 Drainage and Sanitary Network in building 5.3 Solid Waste Collection in Building 5.4 Preparation of Detailed Construction Drawing with all Services 5.5 Necessity of As Built Drawing and Its Preparation

Prescribed Text:

1. By David V. Chadderton, *Building Services Engineering,* Routledge Tyalor And Francis Group, London/ New York
2. *Birdie, G.S. And Birdie, J.S, Water Supply And Sanitary Engineering, Dhanapat Rai & Sons Publishers, Nai Sarak, Delhi- 110006, India.*
3. *Panchadhari, A.C., Water Supply And Sanitary Installations, New Age International Publishers Limited, And India.*
4. *Barry, R, The Construction Of Building (Volume 5) Building Services, Affiliated East- West Press Pvt. Ltd., New Delhi*