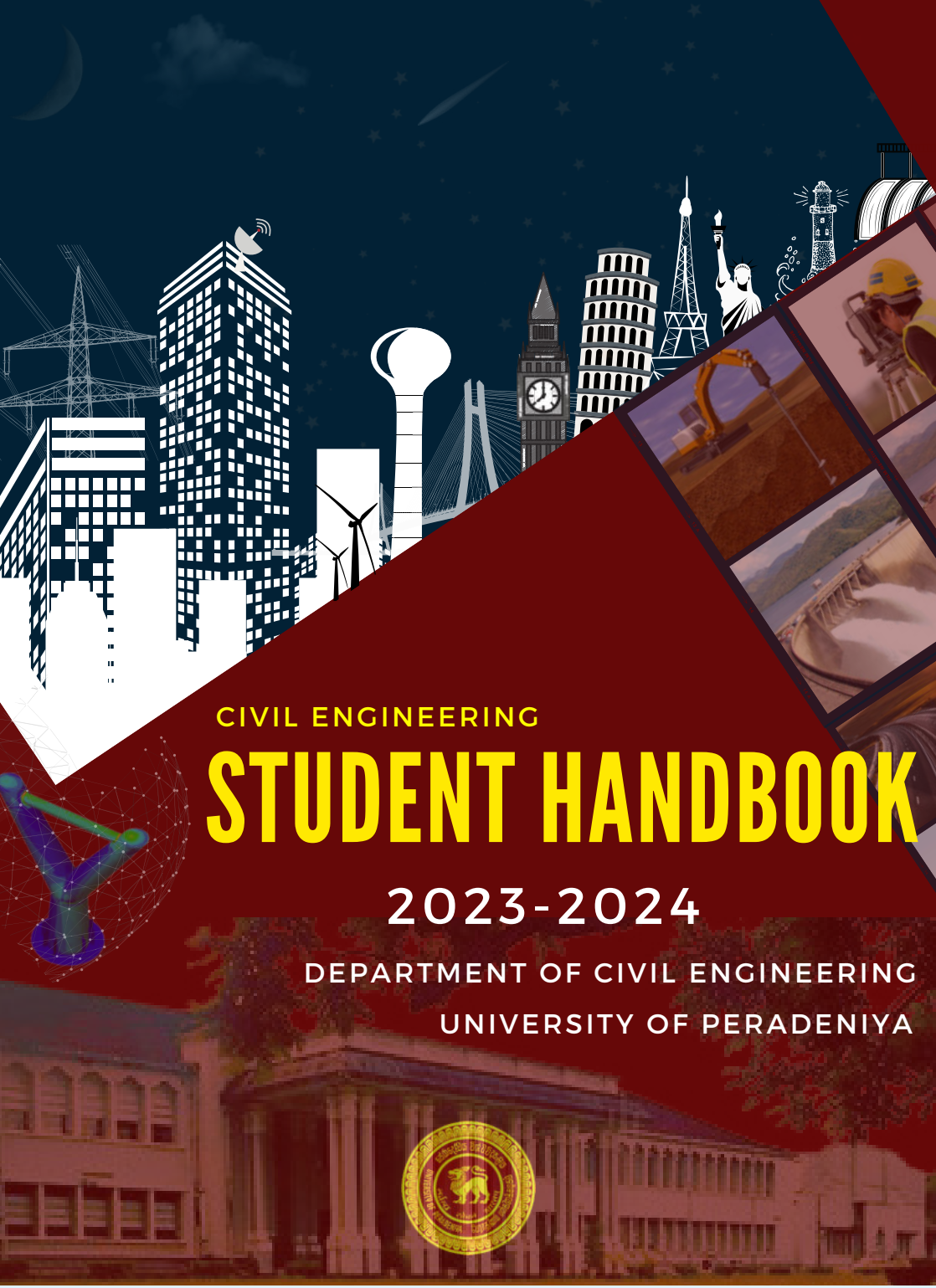

CIVIL ENGINEERING

STUDENT HANDBOOK

2023-2024

DEPARTMENT OF CIVIL ENGINEERING

UNIVERSITY OF PERADENIYA

CIVIL ENGINEERING

STUDENT HANDBOOK

2023-2024

DEPARTMENT OF CIVIL ENGINEERING

FACULTY OF ENGINEERING

UNIVERSITY OF PERADENIYA

"Pioneers in Civil Engineering Education in Sri Lanka"

EDITED BY:

COMMITTEE FOR HANDBOOK PREPARATION

Prof. KDW Nandalal

Prof. KK Wijesundara

Dr MMGT de Silva

Dr DTKK Chamindu

EDITORIAL ASSISTANCE:

Mr Uthapala Kaushalya

Mr Dushan Nimesha

| OCTOBER, 2023

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Welcome by the Head of the Department

It is indeed with great pleasure that I warmly welcome you to the Department of Civil Engineering, Faculty of Engineering, University of Peradeniya.

As the pioneers in civil engineering education in Sri Lanka, the Department of Civil Engineering at the University of Peradeniya has made significant contributions to the nation over the past seven decades and continues to produce engineers of high calibre, fortified with engineering knowledge as well as skills in design, problem solving, research, management and communication, amongst other, whilst performing high-quality research and providing services to the nation.

The efforts of our founding fathers and their foresight and wisdom together with the core values that they have instilled are the solid foundation upon which the department has grown and continues to stand stronger. The pioneering works of the men and women of this institution over the history of its existence, be it in teaching, in research and development, or through industry interaction, have shown the way forward for others to follow. The students of the department have graduated to become leaders of the industry and in academia as well as in administration, and above all, useful and productive citizens of the country.

With an annual intake of 150 undergraduate and a nearly equal number of postgraduate students, together with an extremely well-qualified academic staff of 37 and 47 members of non-academic staff, and covering all major sub-disciplines of civil engineering, the department is one of the largest of its kind in the country, the region and beyond.

The B.Sc. Engineering degree programme in Civil Engineering discipline offered by the department is designed to provide the students with, first, a sound founding in basic sciences, mathematics and fundamentals of engineering, followed by a deeper knowledge in core areas of civil engineering as well as vital skills and aptitude in engineering design, research, project management and finances, amongst other. Several supplementary courses and activities included in the programme enable further fostering and enhancement of other important attributes to be a well-rounded graduate engineer.

The high-standards and rigour of the academic programme maintained by the department is also intended to raise the intellectual capacity of students to a higher plane as well as acquisition of necessary practical skills so as to be able to practice as a proficient civil engineer, working on complex tasks in a challenging environment, for the benefit of the society.

As the Head of the Department, I am pleased to say that we all, the staff, the students and other key stakeholders, continuously strive to be the best we can be in delivering the core parts of our mission to guide you to achieve your target of becoming a technically competent and socially responsible civil engineer.

I wish you all success and an intellectually and socially enriching experience during your stay with us.

Professor JJ Wijetunge, BScEng, PhD (Cambridge)
Head, Department of Civil Engineering
University of Peradeniya

Preface

The Civil Engineering Handbook (2023-2024) contains important information related to the Department of Civil Engineering, Faculty of Engineering, University of Peradeniya which can be useful to all its stakeholders including students, staff, industry partners as well as the general public.

The information provided in the handbook is updated on a regular basis to provide most updated information and will have an unrestricted access via the Department's official website.

The factual information provided hereunder have been extracted from the respective original documents approved by the Senate of the University of Peradeniya. Some relevant information can also be found in the Handbook of the Faculty of Engineering, University of Peradeniya. In case of any discrepancy, the original documents shall prevail over, and supersede, the information presented in this handbook.

Committee for Handbook Preparation-2023

Department of Civil Engineering, University of Peradeniya

October, 2023

CONTACT US

+94(0)81 2393502

HEADCIVIL@ENG.PDN.AC.LK

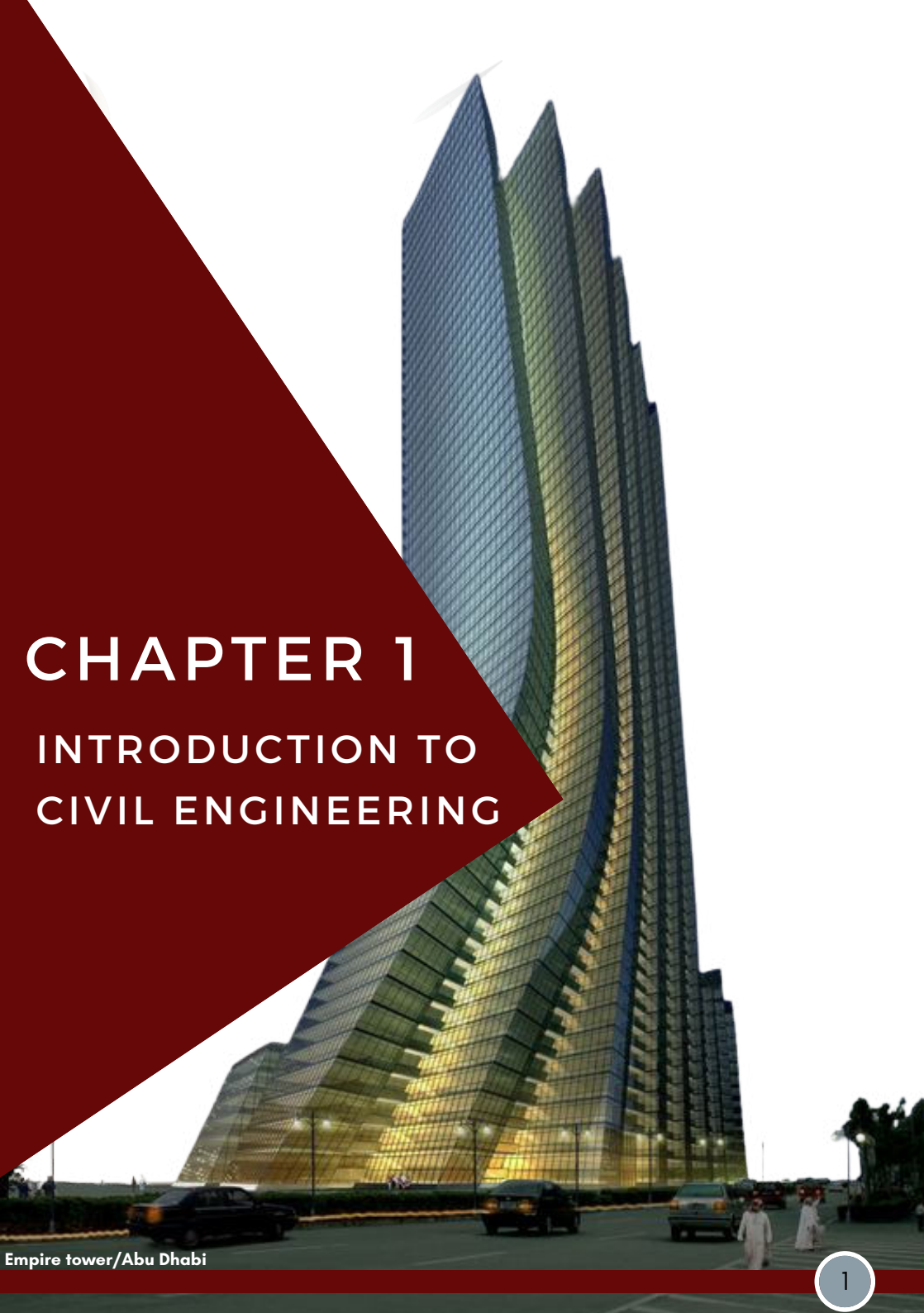
DEPARTMENT OF CIVIL ENGINEERING
FACULTY OF ENGINEERING
UNIVERSITY OF PERADENIYA
PERADENIYA 20400
SRI LANKA

HTTPS://ENG.PDN.AC.LK/CIVIL/

+94(0)81 2393500

CHAPTER 1

INTRODUCTION TO CIVIL ENGINEERING



Empire tower/Abu Dhabi

1. Introduction

1.1 Brief Introduction to Civil Engineering

Civil Engineering has been an integral part of human lives since the beginning of human civilization. The earliest roots of Civil Engineering go back to a history between 4000 and 3000 BC when the Mesopotamian and Egyptian civilizations had been prospering. Although the term 'Civil Engineering' has not been used as it is, there are enough evidences for the existence of Civil Engineering in ancient times, such as in pyramids, buildings, and road networks. Apart from the still-standing massive 4500-year-old pyramids, the structures such as *Qanats* that can convey water from aquifers through underground tunnels to human settlements were built by the people of ancient West Central Asia to facilitate drinking and irrigation water needs 3000 years ago. During the following centuries, Civil Engineering had been evolving and spreading worldwide. As a result, wonders such as the Parthenon in Greece (5th century BC), the Appian Way in Rome (4th century BC), the Great Wall of China (7th century BC), Caesar's Rhine bridges (1st century BC), *Pont du Gard* in Rome (1st century AD), Hohokam irrigation system (7th century AD), Machu Picchu in Peru (15th century) and many other were erected all over the world.

Concurrently, ancestors of Sri Lanka were also experts in erecting massive and efficient infrastructure to fulfil the needs of people and to make the cities aesthetic. Buildings such as *Lovamahapaya* (2nd century BC), the palace of King *Parakramabahu* (12th Century AD), *Vatadageya* in *Medirigiriya* (7th century AD), stupas such as *Jetavanaramaya* (3rd century AD), the stone bridge across *Malvatu Oya* (between 5th and 7th centuries AD), massive reservoirs such as *Parakrama Samudraya* (12th century AD), *Kala Wewa* (5th century AD) along with sophisticated irrigation and canal systems can still be seen all over the country. Therefore, Civil Engineering has not been a strange technology to Sri Lankans as it has been practised for thousands of years.

With such a great history, Civil Engineering in modern day has become well-organized and structured with many sub-disciplines in a multi-disciplinary setting.

Modern-day Civil Engineering is a discipline which involves the analysis, design, construction, maintenance and rehabilitation of a built environment. It is not confined to a limited extent, and its contribution is essential to every component of infrastructure development. With the industrial revolution and rapid development of technology, civil engineers have now achieved marvels that people in the past could not even dream. Massive skyscrapers, giant dams, bridges with longer spans, tunnels and many more blended with modern architecture have been erected owing to the development of new analysis methods, construction technologies, data acquisition systems and continuous research accompanied with multi-disciplinary engineering. On the other hand, modern-day civil engineering has to face several challenges, such as natural disasters, climate change and the increasing complexity of human behaviour and needs.

Liebian Building/China

Therefore, we, as civil engineers, are highly responsible for making people's lives better and comfortable while preserving the environment and ensuring sustainability.

1.2 History of Civil Engineering Education in Sri Lanka

The University of Ceylon was established in 1942 in Colombo as the first university in the country. After eight years of its commencement, the Faculty of Engineering was set up in 1950 as the first of its kind. The Department of Civil Engineering was one of the three founding departments of the faculty, which was later transferred to the present site in Peradeniya with the faculty in 1964. Almost 22 years after the commencement of University of Peradeniya, the Faculty of Engineering, University of Moratuwa, was founded as the Katubedda Campus of the University of Ceylon. The Civil Engineering degree programme at University of Moratuwa was commenced in 1978. With the expansion of the Sri Lankan university network, several other universities with engineering faculties were established in the country, and thus enabling Civil Engineering higher education opportunities to a wider cohort of students in Sri Lanka. The Civil Engineering departments were established at University of Ruhuna in 1999, Univeristy of Jaffna in 2011, South Eastern University of Sri Lanka in 2012, the Open Univeristy of Sri Lanka in 1995 and University of Sri Jayawardenapura in 2016. In addition, several other state and private institutions have been established in the country to offer civil engineering higher study opportunities.

CIVIL ENGINEERING

(A few examples, many more..)

Geotechnical Engineering

Structural Engineering

Transportation Engineering

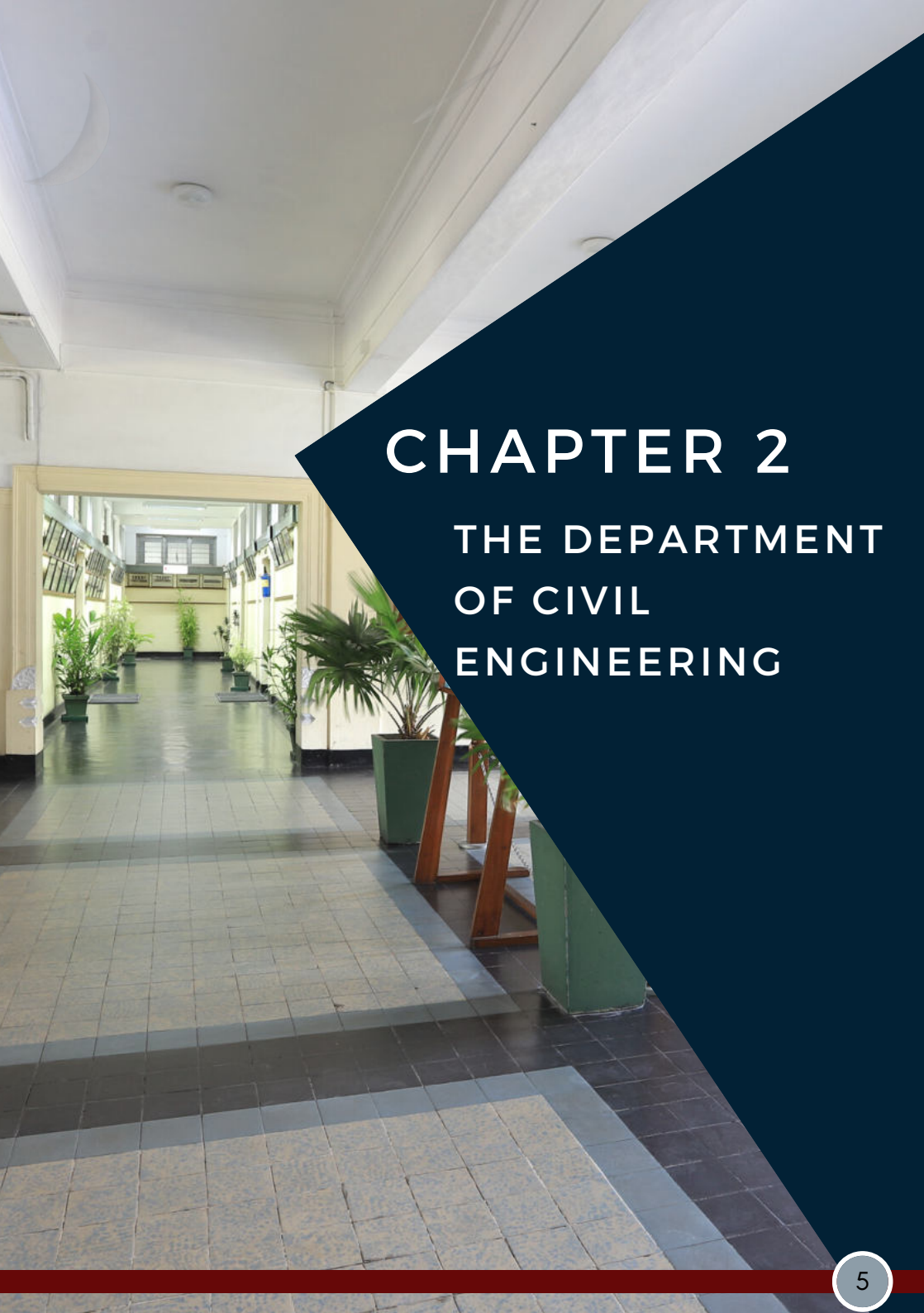
Hydraulics and Water Resources Engineering

Environmental Engineering

Wind Engineering

Earthquake Engineering

Construction Engineering



CHAPTER 2

THE DEPARTMENT OF CIVIL ENGINEERING

2. The Department of Civil Engineering

2.1 Preamble

The Department of Civil Engineering is one of the first departments established at the Faculty of Engineering, University of Peradeniya. Over the last seven decades, the Department of Civil Engineering has continued to serve the esteemed institution; University of Peradeniya as a prominent department, producing well-educated, capable and talented civil engineers to the country.

The Department of Civil Engineering currently provides engineering education to over 450 undergraduates annually, with approximately 150 in each batch. The graduands acquire the degree of the Bachelor of the Science of Engineering Honours specialising in Civil Engineering with an interdisciplinary knowledge and a professional industrial training. As a Civil Engineering undergraduate at University of Peradeniya, you will be benefitted with unmatched facilities, renowned academic staff and a convenient environment of the largest Civil Engineering department in the island.

2.2 Department's Vision and Mission

Vision

The vision of the department is to become the best Civil Engineering department in South Asia as the center of excellence in teaching, research and development, and consultancy.

Mission

To acquire, promote, develop and disseminate knowledge and application of Civil Engineering in particular to produce engineers with skills and attitudes who attain competence as professional engineers providing leadership in the national and international arena and to interact with local industry and community for sustainable development leading to enhanced quality of life while preserving national heritage.

2.3 Past Heads of the Department and Emeritus Professors

2.3.1 Heads of the Department

Prof. EOE Pereira (1950 – 1965)
Prof. HB de Silva (1966 – 1972)
Prof. A Thurairajah (1972 – 1975, 1977 – 1982)
Prof. M Amarathunga (1982 – 1986)
Prof. R Galappaththi (1986 – 1987)
Prof. Maliyasena (1987)
Prof. MP Ranaweera (1988 – 1991)
Dr. HHJ Keerthisena (1991 – 1994)
Prof. GE Amirthanathan (1995 – 1997)
Prof. KGHCN Seneviratne (1997 – 2000)
Mr H Abeyruwan (2000 – 2003)
Prof. SBS Abayakoon (2003 – 2005)
Dr APN Somaratna (2005 – 2008)
Prof. WMSB Weerakoon (2008 – 2009)
Prof. KDW Nandalal (2009 – 2012)
Dr ALM Mauroof (2012 – 2014)
Prof. PBR Dissanayake (2014 – 2017)
Dr AGHJ Edirisinghe (2017 – 2020)
Dr UI Dissanayake (2020 – 2021)
Prof. JJ Wijetunge (2021 – Present)

2.3.2 Emeritus Professors

Four emeritus professors, Professor M. Amaratunga, Professor M. P. Ranaweera, Prof. U. de S. Jayawardana and Professor K. P. P. Pathirana are currently attached to the department.

Professor M Amaratunga has served in the department for 27 years and he was the Head of the Department (1982 – 1986) and the Dean of the Faculty (1986 – 1990).

Professor MP Ranaweera has served in the department for 38 years and he was the Head of the Department (1988 – 1991) and the Dean of the Faculty (1988 – 1991).

Professor U.de S. Jayawardena has served in the department for 35 years.

Professor K.P.P. Pathirana has served in the department for 25 years.

2.4 Academic and Non-academic Staff

The Department of Civil Engineering comprises a group of well qualified and professional academic staff as well as experienced non-academic staff for the smooth functioning of the high quality teaching-learning process. The academic staff includes three emeritus professors, four senior professors, four professors, twenty-eight senior lecturers, and two lecturers. Moreover, to assist the teaching-learning process, up to about 30 temporary instructors are appointed. In addition, there are 47 non-academic staff including 17 technical officers, 13 laboratory attendants, 13 supporting staff members, two masons, and two management assistants.

In addition, over 30 full-time postgraduate research students are currently performing their research in the department.

2.5 Organizational Structure of the Department

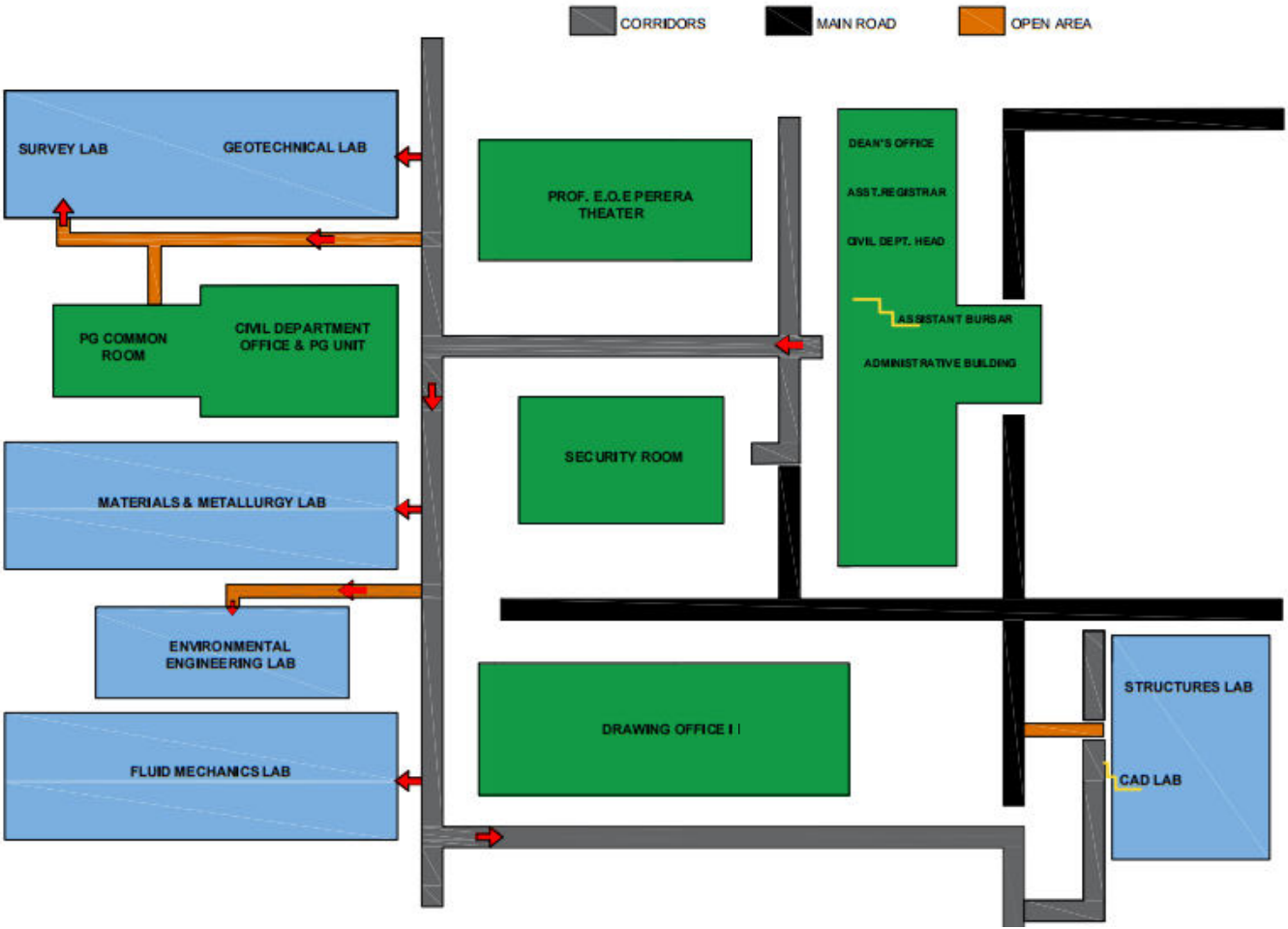
The Department of Civil Engineering comprises eight major laboratories and the Office of the Department to facilitate the teaching-learning process as well as administration in a structured manner.

- Computer-Aided Design (CAD) Laboratory
- Environmental Laboratory
- Fluid Mechanics Laboratory
- Geotechnical Laboratory
- Materials Laboratory
- Metallurgy Laboratory
- Structures Laboratory
- Surveying, Highway and Transportation Laboratory

Two other departmental entities have been established with specific objectives:

- Departmental Quality Assurance Cell (DQAC)
- Department-Industry Interaction Cell (DIIC)

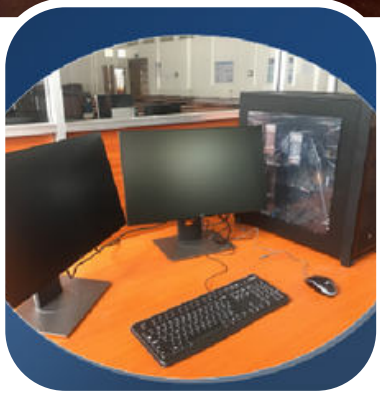
Furthermore, 24 standing committees have been appointed by the Head of the Department to effectively coordinate and perform regular departmental activities.

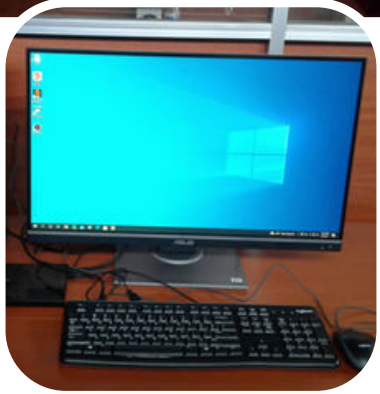


Layout of the Department Facilities

2.5.1 Computer-Aided Design (CAD) Laboratory

Computer-Aided Design (CAD) Laboratory facilitates all the sub-disciplines in Civil Engineering by providing necessary computational tools or software to analyze and design engineered systems and also developing solutions to industry requirements. The CAD laboratory is equipped with a computer network of two high-end servers, 34 desktop computers and 73 laptop computers with necessary hardware, specialized software for applications in different sub-disciplines of civil engineering: MIDAS FEA, FLAC and SAP2000 and drafting software to name a few of them. Furthermore, the CAD laboratory provides undergraduate and postgraduate students with remote access to the facilities to conduct their research studies.





CAD Laboratory

Academic Staff

There are two academic staff members attached to the CAD laboratory.

Prof. KK Wijesundara (**Lecturer-in-Charge**)

Professor

BScEng Peradeniya, MSc Pavia, PhD Pavia, AMIE SL

Expertise:
Finite element formulation and modeling of structures, Applications of finite element methods in multi-disciplinary engineering, Direct displacement-based design philosophy for seismic design of structures, Earthquake engineering and Structural dynamics

kushanw@eng.pdn.ac.lk, kalmithkush@yahoo.com +94-81-2393553

Dr NMSH Bandara

Lecturer (Probationary)

BScEng Peradeniya, PhD Melbourne

Expertise:
Guided wave-based techniques for structural health monitoring, Condition assessment of timber structures and Machine learning algorithms for health monitoring techniques

sahan@eng.pdn.ac.lk +94-81-2393553

Non-academic staff

Two non-academic staff members are attached to the CAD laboratory.

Mr AS Weerasinghe

Technical Officer

Mr ANGP Rangana

Laboratory Attendant

Full-time Postgraduate Students

Two PhD candidates on full-time basis are currently working in the laboratory.

Mr TMS Tennekoon
PhD Candidate

Research Topic:
Impact of natural hazards and their consequences on cascades of dams in Mahaweli River basin, Sri Lanka

Mr RMMP Rathnayaka
PhD Candidate

Research Topic:
Design of Geopolymer/Alkali Activated Concretes using advanced Machine Learning techniques

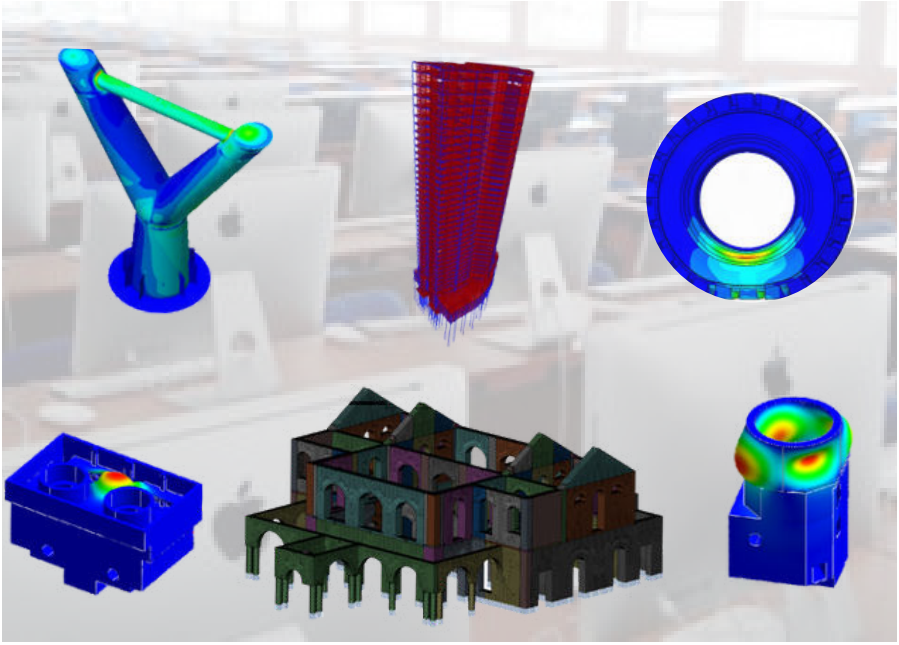
Temporary academic staff

Mr LHSU Balasooriya is currently attached to the laboratory as a Temp. Instructor.

Research and Services

At present, the CAD laboratory is conducting research related to mixed finite element formulation for shear critical reinforced concrete elements, development of direct displacement-based design philosophy for seismic design of structures, extracting modal characteristics of structures from ambient vibration measurement using wavelet transformation, numerical simulation of ground motion prediction in Sri Lanka due to near- and far- field seismic events, seismic assessment of typical school buildings in Sri Lanka using fragility curves, and nonlinear dynamic analysis of structures for extreme earthquake and wind loadings.

In addition, the CAD laboratory provides specialised services such as advanced linear and nonlinear analysis of structures, structural assessment and detailed stress analysis of structural components incorporating different material models for various load combinations. Furthermore, CAD laboratory provides specialized services to provide solutions to multi-disciplinary engineering problems through numerical simulations.



2.5.2 Environmental Laboratory

Environmental Engineering is a broad area, which mainly focuses on preserving the environment by providing sustainable and innovative solutions to the existing and emerging environmental issues. The environmental engineering laboratory in the department faciltates a wide range of environmental engineering related analyses to serve this purpose. Combined also with a microbiological laboratory, the environmental engineering laboratory is endowed with modern instruments such as Atomic Absorption Spectrophotometer, Gas Chromatograph, HPLC Ion Chromatograph, HPLC Carbamate Analysis System, Organic Elemental Analyser and Total Organic Carbon Analyser. Moreover, general water and wastewater quality parameter testings such as BOD, COD, TSS, turbidity, MLVSS etc. are frequently carried out in the laboratory.

Academic Staff

There are four academic staff members including two professors and two senior lecturers attached to the Environmental Engineering laboratory.

Prof. GBB Herath

Professor

BScEng Peradeniya, MEng AIT Bangkok, PhD Tokyo

Expertise:
Water and wastewater treatment and disposal technologies, Appropriate sanitation technologies, Solid waste management, Water resources management and Water quality monitoring

gemunuh@pdn.ac.lk

+94-81-393572

Prof. KBSN Jinadasa

Professor

BScEng Peradeniya, MEng Singapore, PhD Saitama, AMIE SL

Expertise:
Development of sustainable water and wastewater management technologies, Development of biological wastewater treatment methods for industrial wastewaters, Development of Innovative methodologies in environmental protection and Constructed wetlands for water quality management in tropical regions.

shamj@pdn.ac.lk

+94-81-2393571

Dr GMPR Weerakoon

Senior Lecturer

BScEng Peradeniya, MSc Newcastle, PhD Peradeniya, AMIE SL

Expertise:

Development of sustainable water and wastewater management technologies, Development of biological wastewater treatment methods for industrial wastewaters, Development of Innovative methodologies in environmental protection and Constructed wetlands for water quality management in tropical regions.

prabhaw@eng.pdn.ac.lk +94-81-2393570

Dr. RMLD Rathnayake (Lecturer in-charge)

Senior Lecturer

BScEng Peradeniya, MEng Hokkaido, PhD Hokkaido, AMIE SL

Expertise:

Development of biological treatment systems for wastewater treatment, Water quality monitoring, Development and application of microsensors, Greenhouse gas emission from wastewater treatment, Solid waste treatment.

englashi@gmail.com, lashithar@eng.pdn.ac.lk 94-81-2383950

Temporary Academic Staff

Two temporary instructors are currently attached to the laboratory.

1. Ms. HGSSU Priyankara
2. Ms. WOH Pramudika

Non-academic Staff

Two technical officers, a laboratory attendant and a supporting staff member are attached to the laboratory.

Mr. KPCM Wijewardhana
Technical Officer

Mrs. MHF Zuhara
Technical Officer

Mr. WMJKM Wijesundara
Laboratory Attendant

Mr. AWADB Abeykoon
Laboratory Attendant

Mr. DRM Jayathilaka
Supporting Staff Member

Full-time Postgraduate Students

At present, two PhD candidates and one MPhil candidate on full-time basis are working in the laboratory.

Mr LMLKB Lindamulla
PhD Candidate

Research Topic:
Investigation of landfill leachate treatment using membrane bioreactor

Mr HMP Wijeyawardana
PhD Candidate

Research Topic:
Development of biochar based functional concrete material

Ms J Ketharani
MPhil Candidate

Research Topic:
Identify the fouling mechanism of Nano-filtration membrane during the filtration of groundwater with DOM and high hardness

Laboratory Classes

The practical classes conducted in the laboratory include the following:

- Membrane filtration
- BOD test

Research and Services

At present, the Environmental Engineering laboratory is engaged with research related to the development of water treatment technologies, waste and landfill monitoring, waste and wastewater characterization, and adsorbent material characterization.

In addition, the laboratory provides specialised services such as quality parameter testing for wastewaters, ground water and drinking water, soil and bio-solid sample testing, design and construction supervision, environmental impact assessment, initial environmental examination, quality assurance of bottled water industry, and water quality analysis.

2.5.3 Fluid Mechanics Laboratory

Hydraulic engineering consists of the application of fluid mechanics to water flowing through a confined or closed environment (pipe, pump) or in an open channel (river, lake, ocean) whereas water resources engineering is basically about analysis, design and providing solutions to all phases of the water cycle. A well-equipped and spacious Fluid Mechanics Laboratory was established to facilitate teaching and research in these areas. Wind tunnels, tilting flumes with fixed and movable beds, wave flumes, a towing carriage with tank (36 m^3) and facilities for testing scale models, test rigs for testing of pipes, pumps, turbines and fans are among the key equipment available for the demonstrations of principles and applications in fluid mechanics, hydraulics and hydrology to undergraduate and postgraduate students as well as for their research activities.

Academic Staff

Fluid Mechanics laboratory comprises eight academic staff members including two senior professors and two professors.

Prof. WMSB Weerakoon

Senior Professor

BScEng Peradeniya, MEng, DEng Tokyo, CEng, FIE SL, Int.PE SL

Expertise:
Hydraulic and water quality modeling, Hydrological modeling in ungauged basins, Computational fluid dynamics, River flow computations, Mini hydropower development

sbweera@eng.pdn.ac.lk

+94-81-2393566

Prof. KDW Nandalal

Senior Professor

BScEng Peradeniya, MEng AIT Bangkok, PhD Wageningen, CEng, FIE SL, Int.PE SL

Expertise:
Water resources systems analysis, Flood modeling, Application of soft computing techniques in water management, System dynamics in water management, Reservoir water quality modeling

kdwn@eng.pdn.ac.lk

+94-81-2393573

Prof. JJ Wijetunge (Head of the Department)

Professor

BScEng Moratuwa, PhD Cambridge, CEng, MIE SL

Expertise:
Coastal engineering and coastal zone management, Wave and harbour processes, Wave-structure interaction, Tsunami and storm surge hydrodynamics, Coastal hazard analysis and assessment, Coastal sediment transport and morphological evolution, Wave-current boundary layers, Flow and sediment dynamics in rivers and channels

jjw@eng.pdn.ac.lk, headcivil@eng.pdn.ac.lk

+94-81-393500
+94-81-2393561

Prof. KGN Nanayakkara

Professor

BScEng *Peradeniya*, PhD *NUS*

Expertise:

Electrochemical disinfection, oxidation and reduction, Advanced oxidation processes, Development and optimization of materials for pollution control, Materials behaviour in marine and corrosive environments.

nadeen@eng.pdn.ac.lk

+94-81-2393517

Dr WCTK Gunawardana

Senior Lecturer

BScEng Peradeniya, PG Diploma Peradeniya, PhD QUT

Expertise:

Pollutant sorption by natural materials and modification of adsorbents, Pre-filter media development for excess pollutant loads, Rainwater harvesting and water quality assessment, Stormwater pollution and best management practices

chandimag@pdn.ac.lk

+94-81-2393569

Dr NGPB Neluwala

Senior Lecturer

BScEng *Peradeniya*, MEng *Tokyo*, PhD *Tokyo*

Expertise:
Flood prediction and mitigation, Climate change, Weather prediction, Dam safety, Water distribution systems

pandukaneluwala@eng.pdn.ac.lk

+94-77-662048

Dr MMGT De Silva

Senior Lecturer

BScEng Peradeniya, MPhil Peradeniya, PhD Tokyo, AMIE SL

Expertise:
Climate change analysis, Hydrological and hydro-dynamic modeling and analyses, Socio-hydrology, Flood modeling and risk management

gouri@eng.pdn.ac.lk

+94-81-393560

Mr DD Dias (Lecturer-in-Charge)

Lecturer

BScEng Peradeniya, MEng Hokkaido

Expertise:
Coastal morphology and sediment transport, River bank protection and rehabilitation, Renewable energy, Flood modelling

daham@eng.pdn.ac.lk

+94-81-2393575

Temporary Academic Staff

Three temporary instructors are currently serving in the laboratory.

1. Ms. S Ranwala
2. Ms. EMYC Ekanayake
3. Ms. WAP Prabashinie

Non-academic Staff

Three technical officers, two laboratory attendants and a supporting staff member are presently attached to the laboratory.

Mr NASCB Ekanayake

Technical Officer

Mrs DMAD Dissanayake

Technical Officer

Mr KRN Abeysinghe

Technical Officer

Mr AMPGS Ekanayake

Laboratory Attendant

Mr PK Warshamana

Laboratory Attendant

Mr RGPK Hettimulla

Supporting Staff Member

Full-time Postgraduate Students

A PhD candidate and an MScEng candidate on full-time basis are currently attached to the laboratory.

Ms PDPO Peramuna
PhD Candidate

Research Topic:
Numerical simulation of cascade dam breach floods due to natural hazards in Mahaweli river basin, Sri Lanka

Ms PLLN Perera
MScEng Candidate

Research Topic:
Forecasting compound flooding in Kelani river basin

Laboratory Classes

The practical classes conducted in the laboratory include the following:

- Hydraulic machines
- Flow in pipe systems
- Aerodynamic forces on buildings
- Ground water flow
- Flow in open channels

Research and Services

The Fluid Mechanics laboratory is currently conducting research related to a wide scope including all phases of the water cycle: Weather and climate analysis, flow and sediment dynamics in rivers and channels, system dynamics in water resources management, reservoir water quality modeling, flood modeling, application of CFD and othercomputing techniques in water management,sediment transport with non-uniform sediments, catchment erosion, performance of berm and reef breakwaters, dam safety and emergency action plan, water and wastewater treatment, material development for advance water treatment processes, and water

quality and water safety, coastal engineering and coastal zone management, wave and harbour processes, wave-structure interaction, tsunami and storm surge hydrodynamic,coastal hazard analysis and assessment, coastal sediment transport and morphological evolution.

In addition, the laboratory provides specialised services to the industry such as testing of pumps, calibration of instruments such as current meters, aerodynamic model tests for buildings and ships, discharge measurements in canals, streams and rivers and yield tests in tube wells. Moreover, consultancy services for water resources projects, water resources systems management and designs, and feasibility studies and designs of hydro-power, irrigation, water supply systems, and harbours are also some important services provided by the laboratory.

2.5.4 Geotechnical Laboratory

Geotechnical Engineering primarily involves invesigation of engineering properties of earth materials for the analysis and design of engineered geosystems. The Geotechnical Laboratory was established to facilitate teaching and research in this area. The laboratory is equipped with facilities to carry out field and laboratory tests in the fields of geotechnical engineering and engineering geology such as Seismic Refraction Test, Resistivity Test, Classification Tests, Triaxial Tests, Direct Shear Test, Consolidation Test, Compaction Test, CBR test, Permeability Test, Rock Shear Test, LAAV Test, Slake Durability Test, Soundness Test and Determination of Shear Wave Velocity.

Academic Staff

Six academic staff members including a senior professor are attached to the Geotechnical Laboratory.

Prof. SBS Abayakoon

Senior Professor

BScEng Peradeniya, MASc, PhD British Columbia, CEng, FIE SL, Int.PE

Expertise:
Geotechnical engineering, Seismic response analysis, Timber engineering, Disaster management and mitigation, Use of finite element methods in engineering.

sbsa@pdn.ac.lk

+94-81-2393513

Dr LC Kurukulasuriya

Senior Lecturer

BScEng *Moratuwa*, MEng, PhD *Saitama*, CEng, MIE *SL*

Expertise:
Shear strength anisotropy of soils, DEM simulation of granular media, Use of geosynthetics in ground improvement

chank@pdn.ac.lk

+94-81-2393514

Dr DdeS Udakara

Senior Lecturer

BScEng Peradeniya, MEng AIT Bangkok, PhD Hong Kong

Expertise:
Laboratory and field testing in geotechnical engineering

deepthiu@pdn.ac.lk

+94-81-2393518

Dr MCM Nasvi (Lecturer in-Charge)

Senior Lecturer

BScEng Peradeniya, PhD Monash, MIE SL

Expertise:
Flow and mechanical behaviour of well cement, Geopolymers for well cementing applications, Alkali activated geopolymer concrete, Geopolymers as soil stabilizers, Mechanical method of ground improvement, Adaptability of Eurocode 7 for geotechnical design

cnasvimcm@eng.pdn.ac.lk +94-81-2393516

Dr AMRG Athapaththu

Senior Lecturer

BScEng *Peradeniya*, MPhil *Peradeniya*, DEng *Hiroshima*, AMIE *SL*

Expertise:
Ground improvement techniques, Engineering behaviour of peat, Slope stability and erosion control on vegetated slopes, Development of prediction models using ANN, Engineering geology and geological properties of residual soils, rocks, Foundation engineering

rasika@eng.pdn.ac.lk +94-812393520

Dr SK Navaratnarajah

Senior Lecturer

BScEng Peradeniya, MSc *Oklahoma*, PhD *Wollongong*, PE *California*

Expertise:
Performance enhancement of ballasted rail track, Artificial inclusions in Transport Geotechnics, Numerical simulation of granular materials (FEM & DEM), Permanence improvement of highway pavements, Ground improvement techniques, Artificial Neural Network (ANN) models for Civil Engineering Problems

Email: navask@eng.pdn.ac.lk +94-81-2393519

Temporary Academic Staff

Three temporary instructors are attached to the laboratory at present.

1. Ms. P Tharsika
2. Ms. JMGM Jayasinghe
3. Mr. BMST Basnayaka

Non-academic Staff

Two technical officers, two laboratory attendants and two supporting staff members are serving in the laboratory.

Mr AGDL Wijeratne
Technical Officer

Ms NWGRV Hathurusinghe
Technical Officer

Mr DT Bandara
Laboratory Attendant

Mr PGI Lal Bandara
Laboratory Attendant

Mr AK Nanayakkara
Supporting Staff Member

Mr BG Jayatissa
Supporting Staff Member

Full-time Postgraduate Students

Currently, three PhD candidates, and three MScEng candidates on full-time basis are working in the laboratory.

Ms S Venuja
PhD Candidate

Research Topic:
Enhancing the performance of ballasted rail tracks using geosynthetic inclusions

Ms JANN Jayakody
PhD Candidate

Research Topic:
Improving the accuracy of degradation prediction for road infrastructure in Sri Lanka incorporating cross assets

Ms MMALN Maheepala
PhD Candidate

Research Topic:
Performance of geopolymer based binders in improving the expansive subgrades in road construction

Ms WAGTN Gunawardhana

MScEng Candidate

Research Topic:
Colloid mobilization and colloid-facilitated transport of heavy metals: a geo-environmental insight to the ckdu problem in Sri Lanka

Mr AMSN Abeysinghe

MScEng Candidate

Research Topic:
Characterization and development of an optimized stabilization technique for expansive soils in the central province of Sri Lanka

Ms J Sangeetha

MScEng Candidate

Research Topic:
Feasibility of using blended fly ash, rice husk ash, and lime treated marginal soil for road construction in Sri Lanka

Laboratory Classes

The practical classes conducted in the laboratory includes the following:

- Mechanical Analysis
- Permeability Test
- CBR Test
- Atterberg Limits
- 1D consolidation Test
- Site Investigation
- Direct Shear Test
- Compaction test
- Triaxial Test

Research and Services

Currently, the research related to the soil improvement chemical stabilization, alkali activated Geopolymers as borehole well cement, mechanical integrity of well cement, mechanical method of ground improvement, feasibility of using pozzolanic materials (fly ash, silica fume, etc.) for geotechncial applications, geotechnical characteristics and modelling of municipal solid waste dump sites, shear strength characteristics and degradation of ballast in railroads, use of geomats for reinforcing earth, soil-gas diffusivity measurements and modeling in differently-characterized soils, diffusivity-based characterization of porous media for earth and space-based applications, and modeling multiphase transport of multicomponent gases in heterogeneous porous media are carried out in the Geotechnical Laboratory.
In addition, the laboratory provides specialised services to the industry such as site investigation and feasibility studies, design of earth structures, foundations and special foundations, slope stabilisation, ground improvement techniques, instrumentation and monitoring, model testing, computer aided design and analysis, evaluation of proposals, and providing technical assistance to national projects.

2.5.5 Materials Laboratory

Materials Engineering is the study and analysis of engineering properties of various materials. The Materials Laboratory in the department is resourced with numerous facilities for investigation of physical, mechanical and durability characteristics of diverse types of engineering materials such as cementitious products, concrete, metals, timber, polymers, ceramics, and asphalt. The laboratory is equipped with a universal testing machine, a torsion machine, a compression testing machine, and the apparatus for strain measurements, rebound hammer test, photo-elasticity, ultrasonic tests, hardness and permeability tests, and aggregate tests.

Academic Staff

Five staff members are attached to the Materials laboratory including one professor.

Prof. HD Yapa (Lecturer-in-Charge)

Professor

BScEng *Moratuwa*, PhD *Cambridge*, MIE *SL*

Expertise:
Shear behaviour of concrete structures, Structural retrofitting, Non-linear simulation of concrete structures, Temperature modelling of concrete, Time-dependent behaviour of concrete, Non-structural cracking of concrete.

hdy@pdn.ac.lk

+94-81-393544

Dr KRB Herath

Senior Lecturer

BScEng *Peradeniya*, MSc *Illinois*, PhD *California*

Expertise:
Engineering mechanics and materials

krbherath@eng.pdn.ac.lk

+94-81-393543

Dr PBG Dissanayake

Senior Lecturer

BScEng Peradeniya, PhD Hong Kong, MIEAust, Member PMI, AMIE SL

Expertise:
Construction management, Construction planning, Application of earned value management

pujitha@eng.pdn.ac.lk

+94-81-2393541

Dr HADS Buddika

Senior Lecturer

BScEng Peradeniya, MEng TIT, PhD TIT

Expertise:
Earthquake-resistant design and analysis of structures, Precast/prestressed structural systems, Self-centering structures, Seismic pounding of structures, and Structural fire Engineering

samithbuddika@eng.pdn.ac.lk

+94-77-2171984

Dr KC Chandrasiri

Senior Lecturer

BScEng *Peradeniya*, MSc *New York*, PhD *New York*

Expertise:Chemistry and microstructure of concrete (cement hydration, morphology and phase changes), Nano-technology and application in concrete (nano-silica, nano-clay and nano-limestone), Numerical modeling of chemical processes/reaction kinetics of cementitious material, Sustainable concrete materials (uses of slag, fly ash, silica fume, recycled aggregate, geopolymer, etc.), Mechanical, durability and rheological performance of concrete, Synthesize and/or formulate low CO2 footprint concrete material, Chemical admixtures for concrete

cchandrasiri@pdn.ac.lk

+94-81-239xxx

Temporary Academic Staff

At present, three temporary instructors are attached to the laboratory.

1. Mr. SAS Madushan
2. Mr. DMRP Gunatilleke
3. Ms. MMF Fazra

Non-academic Staff

Eight non-academic staff members are attached to the Materials laboratory including two technical officers, a mason, two laboratory attendants and four supporting staff members.

Mr AHE Parakkrama
Technical Officer

Mr ARMCJK Ratnayake
Technical Officer

Mr AG Jayaratne
Mason

Mr SMUK Karunarathna
Laboratory Attendant

Mr HMK Bandara
Supporting Staff Member

Mr EGM Munaweera
Supporting Staff Member

Mr MHMWK Medagoda
Supporting Staff Member

Mr PG Hemapala
Supporting Staff Member

Full-time Postgraduate Students

Two PhD candidates, one MPhil candidate and one MScEng candidate on full-time basis are working in the laboratory.

Ms HC Egodagamage
PhD Candidate

Research Topic:
Aerated alkali activated slag in prefabricated modular construction

Mr SMKCSB Egodawela
PhD Candidate

Research Topic:
High resolution image processing for structural defect identification and quantification

Mr DGIS Deegoda
MPhil Candidate

Research Topic:
Investigation into Warping of Chrysotile Fiber Cement Thin Sheets

Mr SAP Madusanka
MScEng Candidate

Research Topic:
Development of heat of hydration profiles for high strength concrete mixes

Laboratory Classes

The practical classes conducted in the laboratory include:

- Behavior of structural elements
- Analogy based stress analysis
- Reinforced concrete beam experiment

Research and Services

The materials laboratory is currently engaged with research related to Engineering mechanics and materials, shear behaviour of concrete structures, structural retrofitting, non-linear simulation of concrete structures, temperature modelling of concrete, time-dependent behaviour of concrete, non-structural cracking of concrete, earthquake-resistant design and analysis of structures, precast/prestressed structural systems, self-centering structures, seismic pounding of structures, and structural fire Engineering.

In addition, the Materials laboratory provides specialized services such as appraisal of existing structures (Stress analysis of Stupas such as *Jetavanaya*, *Abhayagiriya*, *Tissamaharamaya* and *Mirisawetiya*, monitoring movements of national monuments etc.), consultancy work relating to engineering materials, stress analysis of structures and components incorporating different materials models, and concrete mix design.

2.5.6 Metallurgy Laboratory

Metallurgy Engineering is a domain of Materials Engineering which specifically deals with the study and analysis of metals. Metallurgy Laboratory which is housed within the same building of Materials Laboratory comprises facilities for investigating the impact and hardness, microscopic analysis using metallurgical microscopes and the atomic absorption spectrometer, x-ray views for investigating metals and heat treatments of metals.

Academic Staff

Metallurgy laboratory includes two academic staff members.

Dr SR Herath (Lecturer-in-Charge)

Senior Lecturer

BScEng Peradeniya, MEng Nagoya, PhD California

Expertise:
Design of customized bone implants, Mechanics of nanostructures

shobhaherath@eng.pdn.ac.lk

+94-81-393555

Dr CK Pathirana

Senior Lecturer

BScEng Peradeniya, MScEng Peradeniya, PhD Peradeniya, CEng, MIE SL

Expertise: Alkali aggregate reaction in concrete, High-strength concrete structures, and sustainable concrete

chinkupathi@eng.pdn.ac.lk

+94-81-393554

Temporary Academic Staff

Ms. MLT Abeysingha is now attached to the laboratory as a temporary instructor.

Non-academic Staff

Three non-academic staff members are attached to Metallurgy Laboratory including a technical officer, a laboratory attendant and a supporting staff member.

Mr JRC Sampath
Technical Officer

Mr DAA Dissanayake
Laboratory Attendant

Mr RUSK Leelarathne
Supporting Staff Member

Laboratory Classes

Heat treatment of steel is conducted in the laboratory.

Research and Services

Chemistry and microstructure of concrete, design of customized bone implants, mechanics of nanostructures, nano-technology and application in concrete, numerical modeling of chemical processes/reaction kinetics of cementitious material, use of sustainable concrete materials such as slag, fly ash, silica fume, recycled aggregate, geopolymer, etc., performance of concrete, synthesize and formulate low CO2 footprint concrete material, and chemical admixtures for concrete are some research areas covered by the metallurgy laboratory.

The Metallurgy laboratory provides specialised services such as chemical analysis using Atomic Absorption Spectrometer, coating thickness measurements, X - Ray Analysis, microscopical analysis of material, case hardening of steel and heat treatment.

2.5.7 Structures Laboratory

Structural Engineering is a branch of civil engineering which deals with analysis, design, retrofitting and construction of buildings, bridges and other structures. The Structures Laboratory is dedicated to perform such tasks at the Department of Civil Engineering. It is equipped with a strong floor of 6 m x 12 m with reaction frames supporting 500 kN and 250 kN static hydraulic jacks capable of testing medium-scale precast products such as Hume pipes, Manhole covers, Steel gratings, etc. for relevant SLS, BS and other similar standards. In addition, the laboratory possesses a pre-stressing bed with pre-stressing jacks, static and dynamic data loggers, load cells, displacement transducers, strain gauges, accelerometers, ground penetration radar unit, rebound hammer, ultrasonic pulse velocity tester, concrete core cutter, half-cell potential meter, cover meter, and non-destructive hardness tester. The laboratory can also provide onsite structural testing facilities to measure deflections, strains, accelerations with online monitoring and data logging facilities for both static and dynamic testing.

Academic Staff

There are five academic staff members attached to the Structures Laboratory including a senior professor and a professor.

Prof. PBR Dissanayake

Senior Professor

BScEng Peradeniya, MEng, PhD Ehime, CEng, FIE SL, MSSE SL

Expertise:
Disaster Mitigation; Evaluation and Seismic Retrofitting of Structures, Structural Health Monitoring of Structures, Structural Optimization, Sustainable Built Environment.

ranjith@eng.pdn.ac.lk

+94-81-2393581

Prof. CS Bandara

Professor

BScEng Peradeniya, MSc Peradeniya, PhD Peradeniya, CEng, MIE SL

Expertise:
Metal fatigue, damage assessment of structures, structural health monitoring, blast effects on structures, disaster resilience of structures and sustainability aspects of structures

csbandara@eng.pdn.ac.lk

+94-81-2393583

Dr UI Dissanayake (Dean-Faculty of Engineering)

Senior Lecturer

BScEng Peradeniya, PhD Sheffield, CEng, MIE SL, MSSE SL

Expertise:
Steel and Steel-Composite Structures, Cost effective structural systems

udaya@eng.pdn.ac.lk
deaneng@pdn.ac.lk

+94-81-2393300

Dr AJ Dammika

Senior Lecturer

BScEng Peradeniya, MEng AIT, PhD Saitama, AMIE SL

Expertise:
Structural Health Monitoring, Structural Dynamics, Bridge Engineering

dammikaaj@eng.pdn.ac.lk

+94- 81-393549

Dr JASC Jayasinghe (Lecturer-in-Charge)

Senior Lecturer

BScEng Peradeniya, MEng AIT, PhD Tokyo, AMIE SL

Expertise:
Structural dynamics, Large scale numerical simulation, Automated model construction

supunj@eng.pdn.ac.lk

+94-81-39XXX

Temporary Academic Staff

Three temporary instructors are now attached to the laboratory.

1. Mr HMADNLH Malaviarachchi
2. Mr UGK Prabodya
3. Mr Anjana Indunil

Non-academic Staff

At present, two technical officers, one mason, and two laboratory attendants are attached to the laboratory.

Mr CW Jayawardhana

Technical Officer

Mr BJBC Perera

Technical Officer

Mr UP Wijewardena

Mason

Mr UP Wijewardena

Laboratory Attendant

Mr GCPS Upulsisri

Laboratory Attendant

Full-time Postgraduate Students

Three PhD candidates, one MPhil candidate and two MScEng candidates on full-time basis are currently attached to the laboratory.

Mr HGS Mayuranga
PhD Candidate

Research Topic:
Application of rubber inclusions to improve the performance of railway tracks for faster and heavier trains

Ms SU Sathya
PhD Candidate

Research Topic:
Optimum data collection for structural integrity management of railway infrastructure

Ms T Thevega
PhD Candidate

Research Topic:
Novel uses of glass recycling technology for sustainable civil engineering applications

Ms WMAD Wijethunge

MPhil Candidate & Departmental Temporary Research Assistant

Research Topic:
Numerical and experimental investigation on lateral distortional buckling in steel concrete composite beams

Mr LN Dissanayake

MScEng Candidate

Research Topic:
Strengthening university-enterprise collaboration for resilient communities in Asia

Laboratory Classes

The practical classes conducted in the laboratory include:

- Bending of beams
- Instrumentation

Research and Services

At present, the Structural laboratory is facilitating research related to the structural health monitoring, structural failures, stress analysis, fatigue of metals, earthquake engineering, blast resistant structures, ferro-cement, ground penetration radar, corrosion of steel structures, and new teaching tools for structural design and analysis.

In addition, the laboratory provides specialized services to the industry such as testing of Hume pipes, electrical poles, man-hole covers, wall panels, and pre-cast beams, design of steel, concrete and composite structures, non-destructive testing of steel and concrete structures, rehabilitation proposals and strengthening schemes for damaged or distressed structures, testing of concrete in existing structures, detecting underground structures, rock and soil layers, voids etc., and vibration monitoring.

2.5.8 Surveying, Highway and Transportation Laboratory

Highway and Transportation Engineering is a branch of Civil Engineering which deals with planning, designing, construction and maintenance of highways and transportation systems. The well-equipped Surveying, Highway and Transportation Engineering Laboratory facilitates this purpose. Total Stations, theodolites, levels and electronic distance meters and GPS/GIS are available for comprehensive land surveying and contouring. Furthermore, Benkelman beam, variety of surface roughness/ resistance testing equipment and weight bridges for highway pavement evaluations and all laboratory testing equipment related to bitumen and asphalt testing (Marshall test, penetration elongation, softening point, flash and fire point) are also available in this laboratory..

Academic Staff

Surveying, Highway and Transportation Engineering laboratory comprises five academic staff members..

Dr AGHJ Edirisinghe

Senior Lecturer

BScEng Peradeniya, MEng, PhD Ehime

Expertise:
Natural disasters, Road traffic accidents

jayalath@eng.pdn.ac.lk

+94-81-393534

Dr IMS Sathyaprasad

Senior Lecturer

BScEng Moratuwa, MEng AIT Bangkok, DEng Yokohama

Expertise:
Transportation and traffic planning in small cities, urban environmental issues, two-lane highways, modeling school transport, low-cost methods in traffic estimation

imss@eng.pdn.ac.lk

+94-81-2393535

Dr HK Nandalal

Senior Lecturer

BScEng Peradeniya, MSc Wageningen, PhD Peradeniya, CEng, MIE SL

Expertise:
Hydrology, GIS and RS application in hydrology, Flood modeling, Flood hazard, Vulnerability and risk assessment

hemalin@eng.pdn.ac.lk

+94-81-393532

Dr WMVSK Wickramasinghe (Lecturer-in-Charge)

Senior Lecturer

BScEng Peradeniya, MEng, PhD Hokkaido

Expertise:
Travel behavior analysis, transport safety studies,
Public transportation system planning and route network efficiency analysis, Multi-criteria decision support system modeling for traffic issues, Highway asset management, Disaster risk evaluation and mitigation measures

vskw@eng.pdn.ac.lk +94-81-2393517

Dr WRSS Dharmarathna

Senior Lecturer

BScEng Peradeniya, MPhil Peradeniya, PhD Tokyo, AMIE SL

Expertise:
Transportation planning, Discrete choice modeling (mode choice and route choice), Behavior in networks, Traffic engineering

samal@eng.pdn.ac.lk +94-81-2393531

Temporary Academic Staff

Three temporary instructors are currently serving in the laboratory.

1. Mr. PMGDM Herath
2. Mr. TDB Koralegedara
3. Mr. DYKS Illesinghe

Non-academic Staff

Three technical officers, one laboratory attendant and three supporting staff members are attached to the laboratory.

Mr M Piyal Gamini

Snr. Staff Technical Officer

Mr PB Rajakaruna

Technical Officer

Mr RMSB Rathnayake

Technical Officer

Mr PM Daminda

Laboratory Attendant

Mr WHMSB Herath

Supporting Staff Member

Mr RMNI Rathnayake

Supporting Staff Member

Mr RMH Rupassara

Supporting Staff Member

Laboratory Classes

The practical classes conducted in the laboratory includes the following:

- Route planning
- Surveying

Research and Services

Presently, the Surveying, Highway and Transportation Engineering laboratory is working with research related to highway pavement behaviours, pedestrians' safety and behaviors, efficiency of transport modes, and GIS applications for land use changes.

In addition, the laboratory provides specialised services to the industry such as land surveying and contouring, hydrographic surveying, highway design and analysis, testing of highway pavements and materials, transportation planning and evaluation, and GIS applications.

2.5.9 Office of the Department

One technical officer, two management assistants, and two supporting staff members are attached to the office of the Department of Civil Engineering.

Mr APK Perera
Senior Staff Technical Officer

Ms MIS Farisa
Management Assistant/
Secretary to the Head of the Department

Mr NB Mawelagedara
Management Assistant

Mr MGA Chulanatha
Supporting Staff Member

Mr TRS Bandara
Supporting Staff Member

2.5.10 Other Departmental Entities

Two entities are established in the department with specific objectives: Departmental Quality Assurance Cell (DQAC) to maintain and improve the standards of the degree programme and Department–Industry Interaction Cell (DIIC) to strengthen the relationship between the Department of Civil Engineering and the industry leading to a mutually beneficial partnership.

Departmental Quality Assurance Cell (DQAC)

The Departmental Quality Assurance Cell (DQAC) of the Department of Civil Engineering was established in 2017 under the coordination of a senior staff member and overall supervision of the Head of the Department. The DQAC is the dedicated entity to coordinate and implement the best practices to ensure programme quality and accreditation essentials of the Civil Engineering Degree Programme and maintains the quality assurance related documents of the programme.

The DQAC is managed by a coordinator and a committee appointed by the Head of the Department and is responsible for:

- Implementing the quality assurance action-plan of the Civil Engineering degree programme of the department and monitoring the performance of the quality control process,
- Representing the department on quality assurance matters of the Civil Engineering degree programme,
- Preparing the department for external reviews and internal reviews at the faculty and university levels,
- Submitting recommendations to uplift the quality of the Civil Engineering degree programme based on stakeholder feedback, public surveys, statistics and other information, and
- Liaise with the Internal Quality Assurance Cell (IQAC) of the Faculty of Engineering in relation to faculty and university level policies and practices.

Department - Industry Interaction Cell (DIIC)

The Department-Industry Interaction Cell (DIIC) was established on 1st February 2022 to strengthen the relationship between the Department of Civil Engineering and the Industry leading to a mutually beneficial partnership. The DIIC comprises three permanent academic staff members of the Department of Civil Engineering on voluntary, part-time basis and assigned by the Head of the Department (HoD), who function under the overall guidance and direction of the HoD. An advisory panel comprising nominated staff members and eminent industry personnel is associated with DIIC for consultation on a regular basis. Among other activities, the DIIC organizes consultative committee meetings twice a year with leaders of the industry and civil engineering practice in the country and organises the 'Research for Industry (R4I)' webinar series to sustain a continuous interaction with the industry and to understand the latest trends and industry requirements.

The tasks assigned to the DIIC include:

- Dissemination of information on ongoing and completed research to the industry
- Identification and collation of research requirements of the industry
- Securing of mutually beneficial funding for research and postgraduate training
- Application and commercialization of research outcomes in partnership with the industry
- Initiation and organization of industry visits, seminars by industry experts
- Organizing and hosting of Research for Industry Webinar series
- Facilitation of Department-Industry Consultative Committee (DICC) meetings
- Coordination with faculty level Engineering Technology Incubation Centre (ETIC)
- Matters connected to students undergoing industrial training in liaison with ITCGU

DICC Meeting, 2018
IESL Headquarters, Colombo

2.5.11 Departmental Committees and Activities

The Head of the Department has appointed an array of standing committees to effectively coordinate and perform regular departmental activities. There are 23 such departmental committees currently covering all aspects of the department including the following areas.

Curriculum Development, Programme Analysis and Accreditation

There are several committees working integrated with each other to ensure that an updated curriculum is maintained up to the Washington Accord standards. The main tasks of the above committees are those related to IESL/Washington accord accreditation reviews, further enhancement of staff-wide capacity in developing course/programme learning outcomes and 'mapping' in association with the departmental quality assurance cell, conducting awareness sessions for students on PEOs, expected attributes and outcomes, submitting revised/re-oriented curriculum for the full programme, implementing the revisions, benchmarking the programme with appropriate reputed overseas universities, exploring and initiating links with selected regional and world recognised Civil Engineering departments, maintaining and improving an effective teaching and learning environment including LMS and the associated document management system, collating and analyzing of data and feedback from stakeholders including recent graduates regularly, guiding students and staff on faculty level examination-related matters, teaching work distribution among academic staff of three major sub-disciplines, assisting head of the department in preparation of evaluation panels, collation of information necessary for preparation of timetables.

Student Wellbeing, Counselling and Career Guidance

Since the primary beneficiaries of the degree programme are the undergraduates, the department strives to support them in many ways including through mentoring, and counselling where needed. In addition, a proper guidance to their career is immensely helpful as the graduates move directly to the industry as professionals. In order to achieve this aim, the committees tasked with the student wellbeing, counselling and career guidance as well as health and safety have formulated strategies and plans for further strengthening of departmental level student wellbeing, welfare, counselling and career guidance particularly in view of the ongoing challenging economic situation, monitoring and reviewing of implementation of such strategies and plans, paying attention to the general health and safety issues related to teaching and learning, and ensuring the preparedness and coordination in managing health and safety concerns, issues and emergencies.

Academic Coordinators

The Department of Civil Engineering, as a whole, is a large department with an array of sub-disciplines, laboratories, and courses. Therefore, in order to ensure the smooth and efficient administration, the coordination of the academic programme and other activities has been distributed among the academic staff members who ultimately report to the Head of the Department. A course coordinator is assigned to each course offered by the department to whom the undergraduates may direct their queries regarding that particular course.

In addition, each batch of students has been assigned with an academic coordinator who overlooks the overall performance of each batch and addresses their queries, if any. Moreover, every 5-6 students of each batch have been assigned to a student advisor/mentor. The student advisor guides the students/mentees in the course registration process, and clarify and address issues pertaining to the students at a closer level.

Research Promotion and International Collaboration

The research output of a university is one of the main components that contribute to its international standing and reputation and both postgraduate and undergraduate students of the Department are engaged in a wide-array of high-quality research. Further, a series of regular research seminars are being conduced to present and discuss ongoing research activities by the staff members as well as postgraduate students. In addition, the research promotion and internal collaboration committee promotes research work with local/overseas universities and institutions, supports staff members to initiate and sustain research work, facilitates smooth progress of ongoing research, plans strategies for securing funding, organises departmental research seminar series, initiates collaborations with local/foreign universities and institutions, advises the Civil Engineering Research Club (CERC) composed of full-time research students of the department, and disseminates completed and ongoing research to stakeholders and the general public.

Health and Safety

Considering the importance of health and safety aspects of the students in laboratory and field work, the department takes precautions to minimize the potential risks to the students, staff and the instruments. All students are provided with a health and safety guide which they shall adhere to during experimental and field studies. They are supposed to carry out a safety audit before commencing any experiment in a laboratory. Some laboratories have laboratory-specific safety measures in addition to the general safety guide.

CHAPTER 3

DEGREE PROGRAMME

3. Degree Programme

3.1 Programme Educational Objectives

The BScEngHons graduate specializing in Civil Engineering is expected to achieve the following Programme Educational Objectives (PEOs):

1. Identify, analyze and solve complex problems based on basic principles of engineering sciences and mathematics

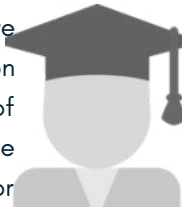
2. Produces innovative engineering designs and solutions considering functionality, aesthetics, safety, cost effectiveness, environmental friendliness and socio-cultural aspects

3. Manage and execute engineering projects of multi-disciplinary nature giving due consideration to local community, local industry and national heritage

4. Promote themselves as leaders in the international arena in their chosen profession as well as in other interested areas through effective communication, lifelong learning, research and development activities

3.2 Graduate Profile

The Civil Engineering Graduates of University of Peradeniya are expected to have acquired the following attributes/characteristics upon graduation. These graduate attributes are based primarily on those of the International Engineering Alliance (IEA) and adopted by the Washington Accord (WA) signatory countries across the world for accreditation of engineering degree programmes. The Department of Civil Engineering has fortified the following to the attitude profile of its graduates.



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GRADUATE ATTRIBUTES

1 ENGINEERING KNOWLDGE

Apply knowledge of mathematics, natural science, computing, and fundamentals of general engineering and the engineering specialization to develop solutions to complex engineering problems

2 PROBLEM ANALYSIS

IIdentify, formulate, research literature and analyse complex engineering problems to reach substantiated conclusions using principles of natural and engineering sciences, mathematics and other computational tools with holistic considerations for sustainable development

3 DESIGN/DEVELOPMENT OF SOLUTIONS

Design solutions for complex engineering problems and design systems, components or processes in a holistic manner to meet identified needs with appropriate consideration for public health and safety, whole-life cost, net zero carbon as well as resource, cultural, societal, national heritage, environmental and disaster risk considerations as required.

4 INVESTIGATION/RESEARCH

Conduct investigations of complex engineering problems using existing knowledge and new knowledge derived through research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions

5 TOOL USAGE

Create, select and apply appropriate techniques, resources, and modern engineering, computational and IT tools, including prediction and modelling, to complex engineering problems, with an understanding of the limitation

6 THE ENGINEER AND THE WORLD

Analyse and evaluate sustainable development impacts to society, the economy, sustainability, health and safety, legal frameworks, cultural sensitivities, and the environment, when solving complex engineering problems

7 PROFESSIONAL ETHICS

Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice, understand the importance of standing against unethical practices, adhere to relevant national and international laws, and demonstrate an understanding of the need for diversity and inclusion

8 INDIVIDUAL AND COLLABORATIVE TEAM WORK

Function effectively as an individual, andas a member or a leader in diverse teams and in multi-disciplinarysettings

9 COMMUNICATION

Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective and authentic reports and prepare design documentation, make effective presentations, and give and receive clear instructions

10 PROJECT MANAGEMENT AND FINANCE

Demonstrate knowledge and understanding of engineering management principles, sound finance and economic decision-making and apply these to one's own and collective work, as a leader and/ or a member in a team, to optimally manage projects and in multi-disciplinary environments

11 LIFELONG LEARNING

Recognize the need for, and have the preparation, desire and ability to engage in independent and lifelong learning in the broadest context of technological change

12 CREATIVITY AND INNOVATION

Creativity in engineering solutions; innovative thinking and approaches to engineering tasks and problem solving

13 RESPONSIBLE CITIZEN

Cultivates a strong value system that incorporates punctuality, fidelity, honesty, dependability, dignity, caring, approachability, simplicity, empathy, integrity, respecting procedures as well as respect for the autonomy of others, does no harm and does not tolerate harm (physical or emotional) and, being beneficial to others while ensuring fairness and equity at all times

3.3 Structure of the Degree Programme

The degree programme spans over four academic years duration in 8 semesters, with the General Programme in Engineering of one academic year comprising 2 semesters and a Special Session, and the Specialization Programme in Engineering of three academic years comprising 6 semesters and an industrial training course of total duration not less than 20 weeks. After the successful completion of the general programme of engineering in the first year of the degree programme, 150 undergraduates are selected every year to the Civil Engineering specialization programme. The full course is conducted and assessed in the medium of English and the entitled degree is Bachelor of the Science of Engineering Honours (BScEngHons). The courses are organized at five different levels indicated by the course codes in 100, 200, 300, 400 (based on academic year) and 500 series (elective courses). Further details of the curriculum and the courses offered are provided in Chapter 4.

3.4 Examinations and Assessment Strategy

Teaching and assessment at the faculty are essentially conducted in English language. The department ensures effective implementation of the teaching and assessment strategy at the Faculty of Engineering and the course unit system by limiting the class size to 150 students at lectures, 75 students in design classes, 35-40 students at tutorial/discussion classes and generally about six students in laboratory classes. The students shall maintain at least 80% course participation to be eligible to sit for the end of semester examination. The assessment is done for a combination of continuous assessment consisting of assignments, presentations, coursework, project work, quizzes, and tutorials, and examinations held at the mid-semester and at the end of the semester examination. In general, each course is assigned a range of 40% to 60% of marks for the end of semester examination and the balance for mid-semester examination where applicable and for continuous assessments.

The undergraduate course is basically comprised with two stages as general programme and specialized programme. Students should earn 36 credits from the general programme to qualify for the specialized programme. In order to claim the degree, 114 credits should be earned from the specialization programme.

Courses/Projects	Credits for BScEngHons Degree	
Core courses	84	
Regular courses		75
Multi-disciplinary design projects		03
Civil Engineering research project		06
Elective courses	24	
Technical electives		16
General electives		08
Industrial Training	06	
Total	114	

114

TOTAL CREDITS TO BE EARNED

(for specialized programme)

Methods of Assessment

Grade points shall be awarded for each course with grade points allocated on a four-point scale as tabulated below. The table also shows the recommended conversion from percentage score to a grade where assessment for a course is expressed as a percentage score.

Marks	Grade	Grade points
>85	A+	4.0
80 - 84	A	4.0
75 - 79	A-	3.7
70 - 74	B+	3.3
65 - 69	B	3.0
60 - 64	B-	2.7
55 - 59	C+	2.3
50 - 54	C	2.0
45 - 49	C-	1.7
40 - 44	D+	1.3
35 - 39	D	1.0
< 35	E	0.0

The minimum grade required to earn credit in any course shall be a C. The maximum grade point accruing to a student repeating a course shall correspond to a grade C. To be eligible to follow a course with prerequisites, a student should have a grade of D or above in every course that is stipulated as a prerequisite. Under exceptional circumstances, acceptable to the Faculty Board, the Dean may authorize awarding an "Incomplete" grade to a student who fails to comply with a compulsory requirement of a course based on a written submission supporting compelling reasons. An "Incomplete" grade will enable the student to complete the course concerned at a later date with the approval of the Dean.

The Grade Point Average (GPA) is the weighted average of the grade points secured by the student in the courses that are valid for calculating the GPA for the programme concerned.

$$GPA = \frac{\sum_{i=1}^{N} C_i g_i}{\sum_{i=1}^{N} C_i}$$

where, Ci is the credit of the ith course, g*i* is the best grade point earned for the course and N is the total number of courses offered that are valid for the calculation of the GPA; and the GPA is rounded up to the nearest 0.01. English II is not considered in the calculation of the GPA in the General Programme. The General Elective courses and the Industrial Training are not considered in the calculation of the GPA in the Specialization Programme.
For a student repeating a course, the best grade earned subject to a maximum of 'C', should be considered for the calculation of the GPA.

Requirement for the award of the Degree of Bachelor of the Science of Engineering Honours

a) Successful completion of the General Programme in Engineering
b) Successful completion of the Specialization Programme within the stipulated period with a minimum GPA of 2.00
c) Successful completion of mandatory training courses prescribed by the Faculty Board with the approval of the Senate
d) Securing a minimum total of 144 credits excluding the credits from the Industrial Training course but including the credits that accrue to the student on the successful completion of the General Programme in Engineering

a) A student who has followed the prescribed courses with a combined total of 108 course credits excluding the credits from the Industrial Training course in the Specialization Programme in Engineering may be deemed to have earned minimum 108 course credits, provided that the grade in any of the courses is not below a D and the cumulative credit deficit (CCD) defined as follows, does not exceed 12.

b) CCD = Σ cidi for all courses with a grade of D, D+ or C- where, ci is the number of credits associated with a course in which the student has secured a grade of D, D+ or C- and di is the deficit weightage, defined as 1 for a D, 2/3 for a D+ and 1/2 for a C-.

The grade point average is calculated from the courses in the Specialization Programme excluding General Elective courses and the Industrial Training course for the award of Classes.

First Class:	GPA $\geqslant$ 3.70
Second Class (Upper Division):	3.30 $\leqslant$ GPA < 3.70
Second Class (Lower Division):	3.00 $\leqslant$ GPA < 3.30
Pass with Merit:	2.70 $\leqslant$ GPA < 3.00
Pass:	2.00 $\leqslant$ GPA < 2.70

3.5 Awards

The university awards the following medals and prizes (i & ii) at the General Convocation to engineering graduates specializing in Civil Engineering. Academic merit is the sole criterion for the award of Medals and Prizes.

(i) Medals and Prizes for Overall Performance

a) Mr. Helarisi Abeyruwan Gold medal in Civil Engineering is awarded for the student who has recorded the best performance at the BSc. Eng Degree Programe in Civil Engineering based on the highest GPA in Civil Engineering stream.

b) *The Ceylon Development Engineering Prize for Civil Engineering* endowed by the Ceylon Development Engineering Co. Ltd. is awarded to the student with the highest GPA obtained in the Civil Engineering Specialization of the BSc Engineering Honours Degree Programme.

(ii) Prizes for Performance in a Subject

1. The EOE Pereira Prize for Structures (I) endowed by friends and well-wishers of Professor EOE Pereira and awarded to the student with the best performance in CE208 - Structural Analysis
2. The EOE Pereira Prize for Structures (II) endowed by friends and well-wishers of Professor EOE Pereira and awarded to the student with the best performance in CE307 - Finite Element Methods in Solid Mechanics
3. The HB de Silva Prize for Surveying endowed to the Engineering Alumni Awards Fund by Dr AGKdeS Abeysuriya is awarded to the student with the best performance in CE210 - Engineering Surveying
4. The A Thurairajah Prize for Geotechnics endowed to the Engineering Alumni Award Fund by Mr PM Gunasekara is awarded to the student with the best performance in CE310 - Geotechnical Engineering
5. The M Amaratunga Prize for Strength of Materials endowed to the Engineering Alumni Awards Fund by Professor MP Ranaweera and awarded to the student with the best performance in CE201 - Mechanics of Materials (I)
6. MP Ranaweera Prize for Finite Element Methods in Solid Mechanics awarded based on the performance in the course CE307 - Finite Element Methods in Solid Mechanics
7. MP Ranaweera Prize for Computer Aided Structural Design is awarded based on the performance in the course CE594 - Computer Aided Structural Analysis and Design

Award for Best Civil Engineering Projects

Prof. Nimal Seneviratne Award for Best Civil Engineering Projects, with three awards in each sub-discipline, namely Geotechnical and Transportation Engineering; Materials and Structural Engineering; and Water and Environmental Engineering.

Awards/Prizes through PEFAA

1. Dr N. Nandakumar prize for the best performance in CE205 Engineering Hydrology.
2. Prof. E.F. Bartholomeusz prize engineering mathematics projects.

CHAPTER 4

CURRICULUM AND COURSES

4. Curriculum and Courses

4.1 Curriculum

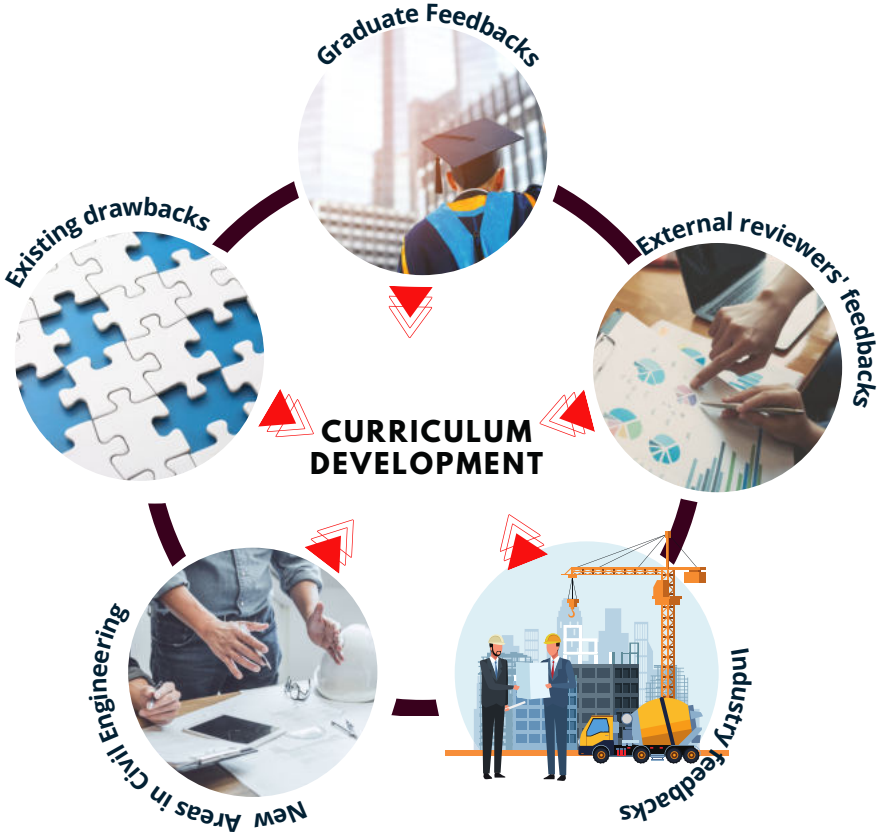
The course structure for specialization in Civil Engineering commencing from the third semester is summarized in the following. The detailed curriculum is presented in the **Annex.**

		CODE	TITLE	CREDITS	PRE-REQUISITES
YEAR 2	SEMESTER 3	CE201	Mechanics of Materials I	3	-
		CE202	Fluid Mechanics I	3	-
		CE210	Engineering Surveying	3	-
		EE280	Introduction to Electrical Engineering I	3	-
		EM211	Ordinary Differential Equations	2	-
		EM213	Probability and Statistics	2	-
		ME202	Mechanical Engineering for Civil Engineers	3	-
	SEMESTER 4	CE204	Geomechanics	3	CE201
		CE205	Engineering Hydrology	3	-
		CE208	Structural Analysis	3	CE201
		CE209	Building Construction	3	-
		CE219	Civil Engineering Laboratory I	1	CE201, CE202
		EM212	Calculus II	2	-
		MA201	Engineering Management	3	-

YEAR 3	SEMESTER 5	CE302	Environmental Engineering	3	-
		CE305	Hydraulics	3	-
		CE312	Design of Structures II	3	CE208
		CE310	Geotechnical Engineering	3	CE204
		CE318	Transportation and Highway Engineering	3	-
		CE319	Civil Engineering Laboratory II	1	CE202, CE204
		EM315	Numerical Methods for Civil Engineers	2	-
			General Electives		
	SEMESTER 6	CE306	Design of Structures I	3	CE208
		CE307	Finite Element Methods in Solid Mechanics	3	CE201
		CE308	Geotechnical Design	2	CE310
		CE311	Hydraulic Engineering and Design	3	-
		CE316	Advanced Mechanics of Materials	2	CE201
		CE317	Civil Engineering field work	3	CE210
		CE320	Civil Engineering Laboratory III	1	CE219, CE319
			Technical Electives/General Electives		
YEAR 4	SEMESTER 7	CE403	Construction Management	3	MA201
		CE405	Civil Engineering Project I	3	-
			Technical Electives/General Electives		
	SEMESTER 8	CE402	Multi-Disciplinary Design Project	3	-
		CE406	Civil Engineering Project II	3	CE405
			Technical Electives/General Electives		

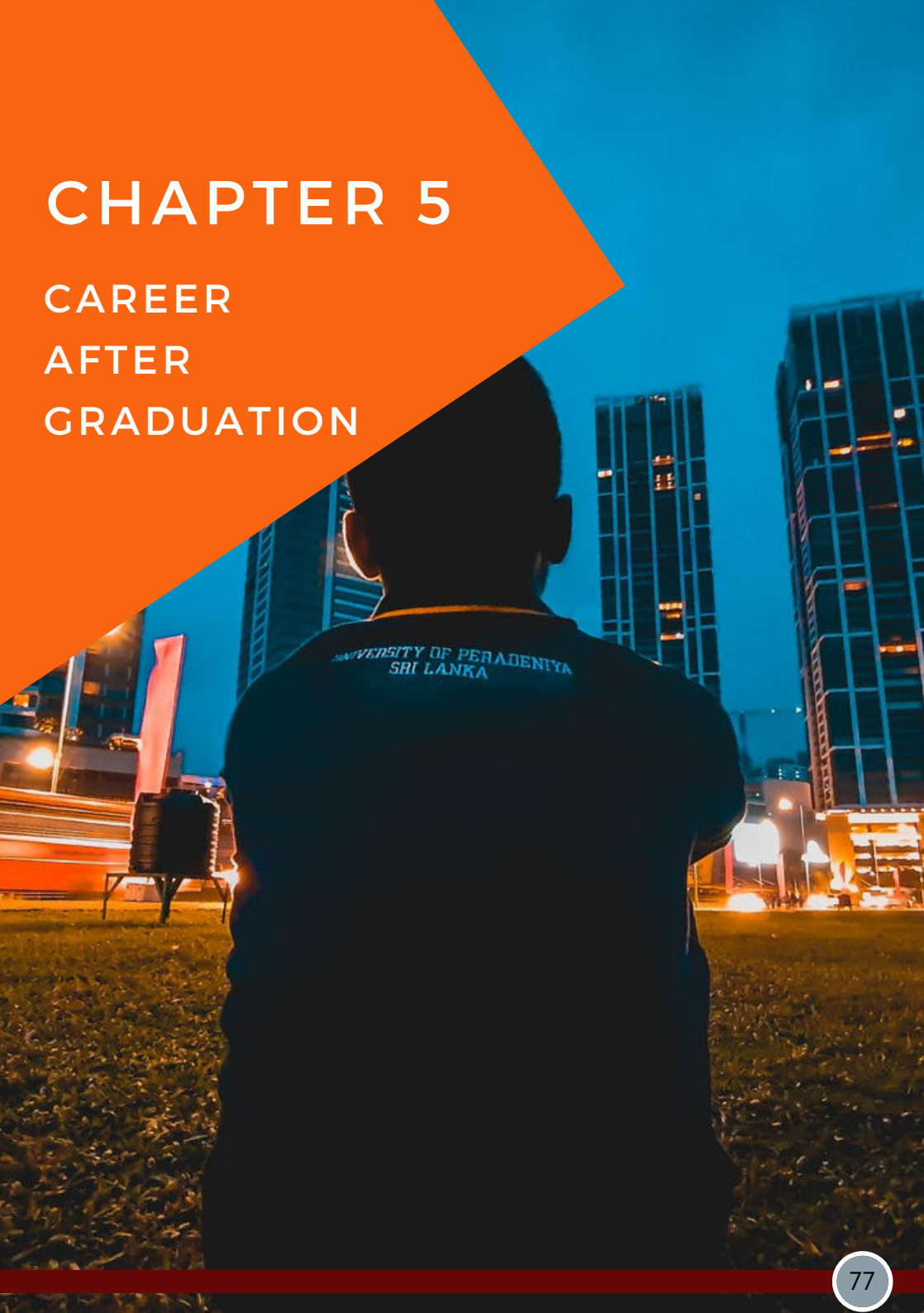
4.2 Curriculum Development

The Department of Civil Engineering strives to be up-to-date to provide the students with the state-of-the-art knowledge in all its major subdisciplines. Accordingly, the Department regularly reviews the existing curriculum and embarks on continuous curriculum enhancement also considering the feedback of undergraduates, graduates, external reviewers and the industry, while assessing existing drawbacks and exploring the incorporation of new technologies and developments.



CHAPTER 5

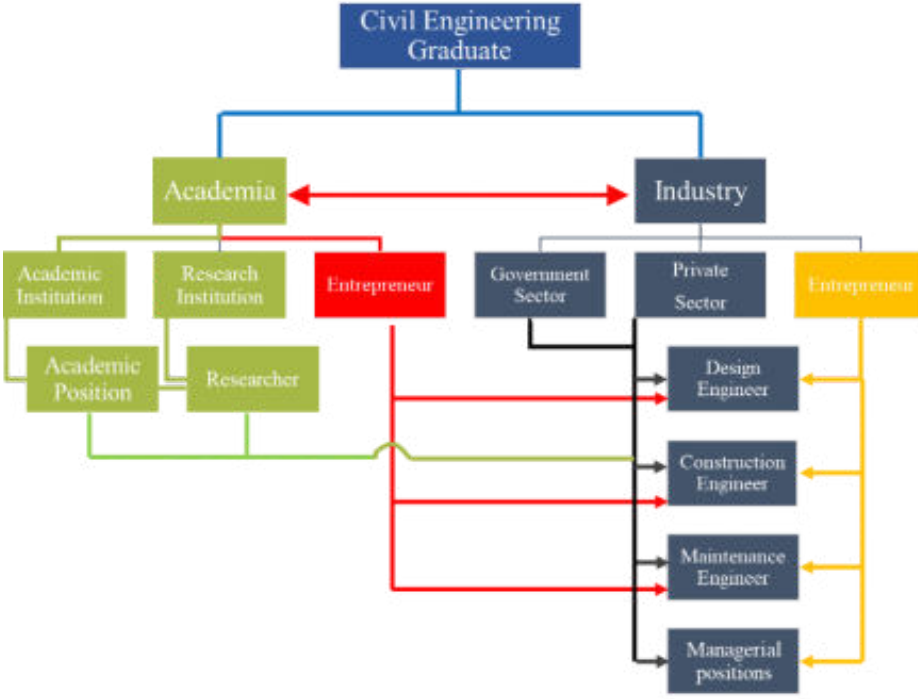
CAREER AFTER GRADUATION



5 Career After Graduation

5.1 Overview

A civil engineering graduate may join the industry or academia according to his/her preference. Both the industry and academia have different roles for civil engineers to play and most of them are interconnected. The following figure illustrates the different paths that a civil engineering graduate may take in after graduation and how they are inter-connected.



5.2 Industry Opportunities

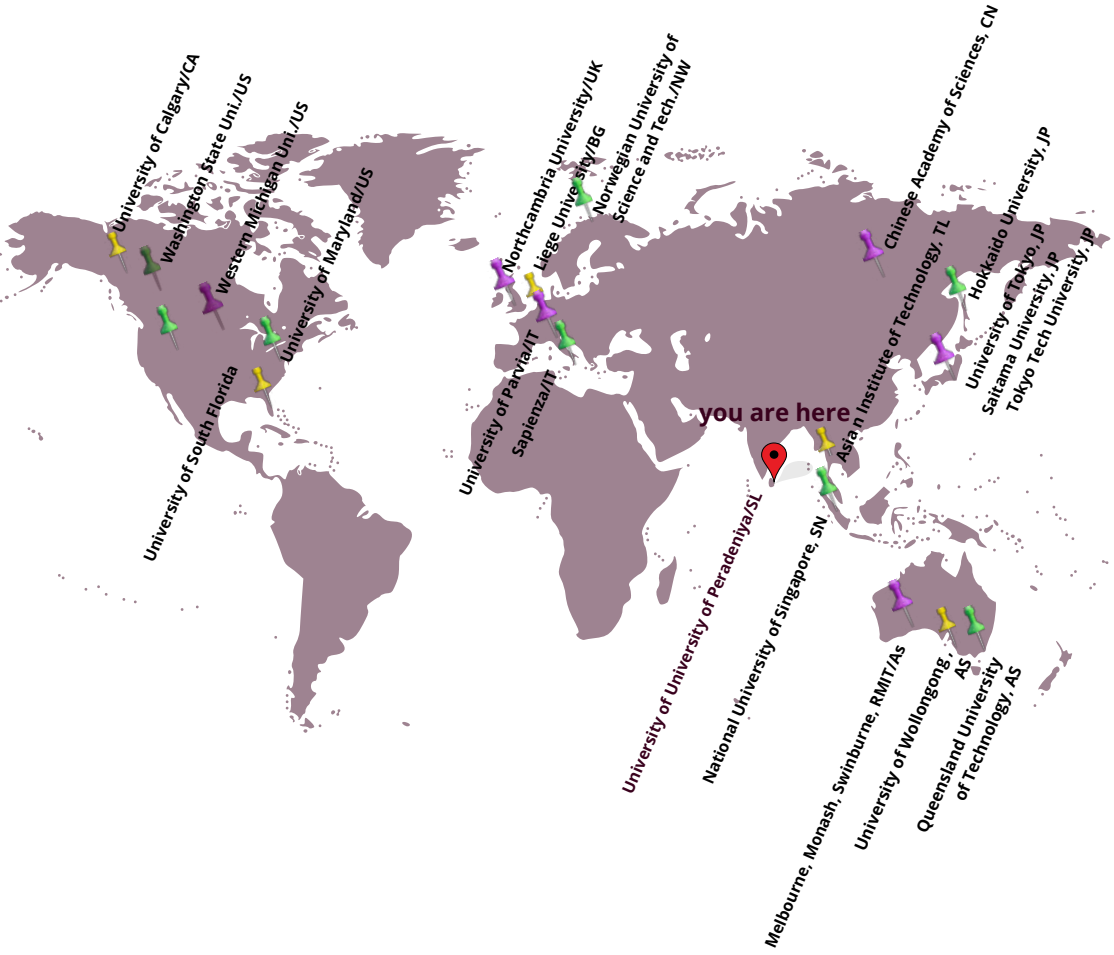
Civil Engineers have opportunities to mainly work in both governmental and private sector organizations at national and international levels and are involved in the analysis, design, construction, maintenance and rehabilitation of a built environment. The broad range of organizations and firms recruiting civil engineers include small startups to multi-national companies. Moreover, civil engineering graduates are involved in different stakeholder positions such as client, consultant, or contractor, for example, in new infrastructure development projects, and after completion, they may hold different roles in maintenance, rehabilitation and expansion as well. The roles and responsibilities of civil engineers in these positions vary depending upon their qualifications and experiences. For instance, civil engineers who work as consultants usually plan, design and supervise a project, while a contractor's engineer is responsible for employing the workforce, procuring materials and machinery, and carrying out the construction according to the client's requirements. Furthermore, the graduates from the department have opportunities to pursue better employment opportunities in the field of engineering in 25 signatory countries of the Washington Accord (WA) including many developed countries, since the degree programme offered by the department is accredited under WA. A Civil Engineer is an essential asset to an infrastructure development project since he/she possesses necessary technical and soft skills to manage the workforce, resources, and finances optimally.

As Civil Engineers are involved in creation and maintenance of built environments in connecting between physical space and social consequences, they have employment opportunities to collaboratively work with other engineering disciplines or in different fields such as financial services, insurance services and public services.

5.3 Opportunities for Postgraduate Studies and in Academia

A large number of graduates have enrolled in Masters and Doctoral degree programmes in renowned foreign universities all over the world, securing prestigious scholarships offered by such universities. For instance, since 2018, more than 48 students from four batches have secured scholarships at over 28 renowned universities/institutions to pursue their postgraduate studies. In addition, every year, many graduates get opportunities to pursue their postgraduate studies in the department and some of which is funded by local/international research projects and through joint-programmes with reputed foreign universities/institutions. Currently, more than 30 graduates are following their postgraduate research full-time at the department. Furthermore, up to four scholarships are offered annually to follow the MScEng degree programme on full-time basis in the department.

Postgraduates can have opportunities to hold academic positions in local and foreign universities for teaching and research in different sub-disciplines. Furthermore, they can join research organizations/institutions to engage in developing new knowledge with industrial applications.



Some of the overseas universities where former students of the Department are pursuing their postgraduate studies in the past 2-3 years

CHAPTER 6

CIVIL ENGINEERING SOCIETY

6 Civil Engineering Society (CES)

Being one of the longest serving societies within the Sri Lankan university system, the CES has survived and thrived through nearly 50 years of its history. The Civil Engineering Society of the University of Ceylon was established in 1973 under the auspices of Prof. HB De Silva, the dean of the faculty and Prof. A Thurairajah, for the purpose of serving a whole gamut of academic and co-curricular requirements of students as well as the staff. Dr K Shanmuganthan had the privilege of bearing the inaugural presidency of the society. Due to the untiring efforts of Dr K Shanmuganthan and Prof. A Thurairajah and the commitment of all members, the society managed to achieve an appreciable growth within its first year of existence itself.

The first activity organized by the society on the 15th of February 1973 was a talk on hydrology by Mr DGL Rathnathunge of the Irrigation Department. The annual seminar of the CES which is one of the awaited events of the University of Peradeniya was also started in the inaugural year of the society. Further, a symposium on housing was held in June 1973 at the faculty auditorium.

Prof. A Thurairajah was elected to the presidency in 1974 which he held for two consecutive years and rendered an enormous service towards the development of the society.

The structure of the committee and the constitution of the society has not changed much since the time of establishment apart from the addition of the post of editor in 1979, and the establishment of a number of permanent sub-committees in early 1990. The CES acquires more than 150 new members each year and most of them take part in its activities in various capacities.

Being the largest engineering body based in the University of Peradeniya, the main objective of this society is to bring the staff, students and the industry to a common platform; and thereby improve the standards of the Civil Engineering profession by exchanging the facts and views of different segments of the profession. In achieving this goal, the CES engages itself in organizing various activities, such as, industrial visits, presentations and talks, seminars, and social activities, etc. The society has stood a firm test of time for nearly 50 years and has proven itself to be fit and worthy to survive the times to come.

Vision

The Civil Engineering Society will be a significant contributor to the Faculty of Engineering in achieving its vision of becoming the center of excellence in engineering education and research in South Asia

Mission

The mission of the Civil Engineering Society is to provide a common platform, through various activities, for the Civil Engineering students, the staff and the industry to interact and thereby, enrich their academic and professional lives.

The regular activities conducted by CES include:

- CES talks series is organized twice a month under the patronage of resource persons from the industry and higher education institutes to share their experiences
- CES annual seminar links, industry and the faculty.
- CES soft skills workshops provides an opportunity to improve soft skills of the students.
- Civil Engineering field trips provide budding engineers the way theory is in practice.
- Civil Engineering Project Symposium is a stage for final year engineering students to exhibit their research potential.

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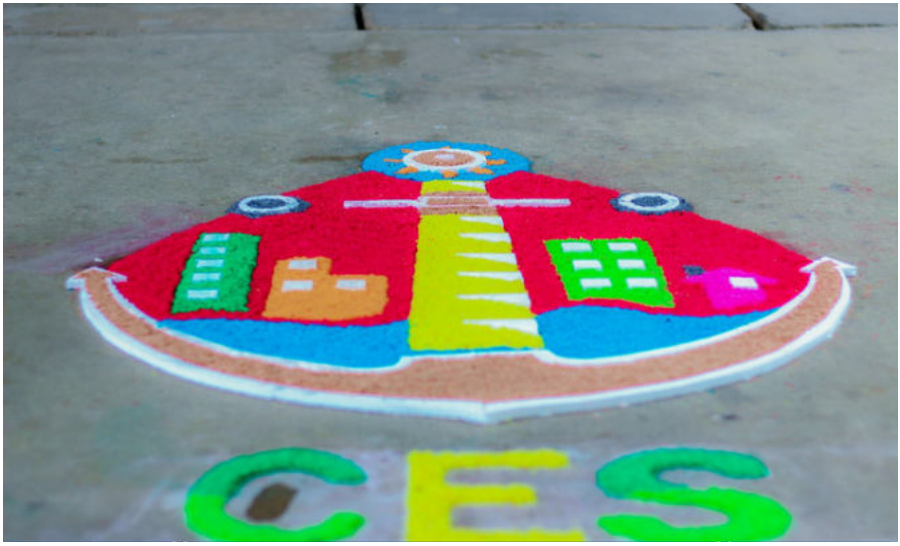


Dr WRSS Dharmarathna
Secretary

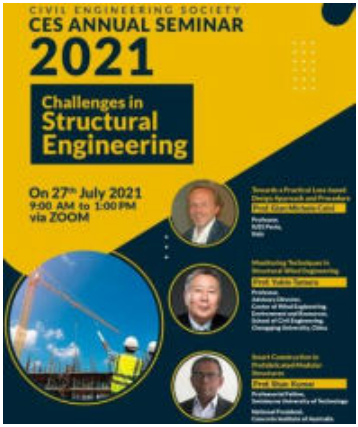
Prof. KK Wijesundara
President

Dr. Sahan Bandara
treasurer

Glimpses of Recent CES Activities

A session on "Role of Engineers in Application of Water Safety Plans" - June 2022

Snaps from CES talk series



CES Annual Seminar 2021 (virtual)

CES Annual Seminar 2018

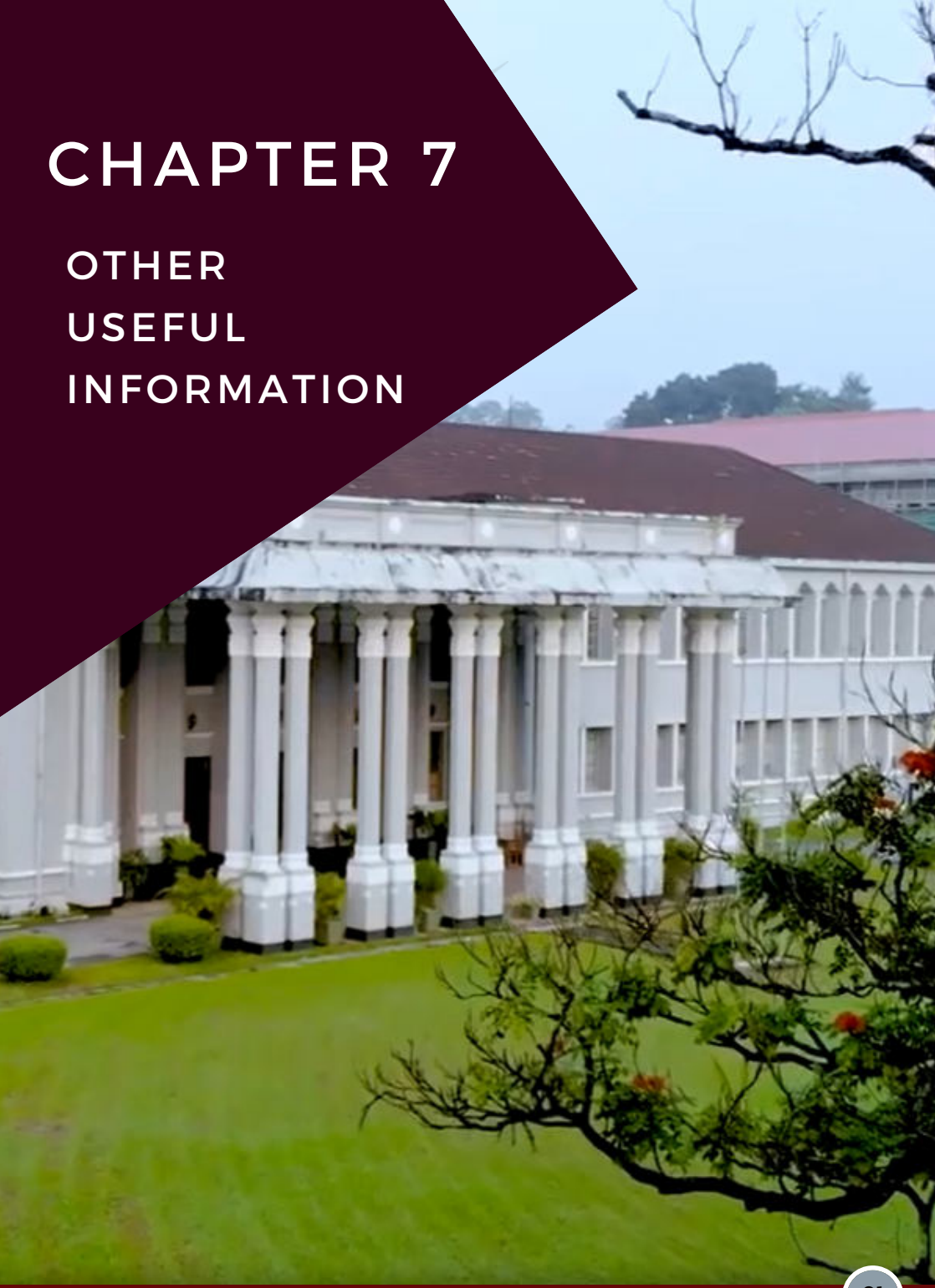
Glimpses of Recent CES Activities

Glimpses of Recent CES Activities

Glimpses of Recent CES Activities

CHAPTER 7

OTHER USEFUL INFORMATION



7.1 Department and Faculty websites

Department of Civil Engineering | University of Peradeniya

https://eng.pdn.ac.lk/civil/

Faculty of Engineering | University of Peradeniya

https://eng.pdn.ac.lk/

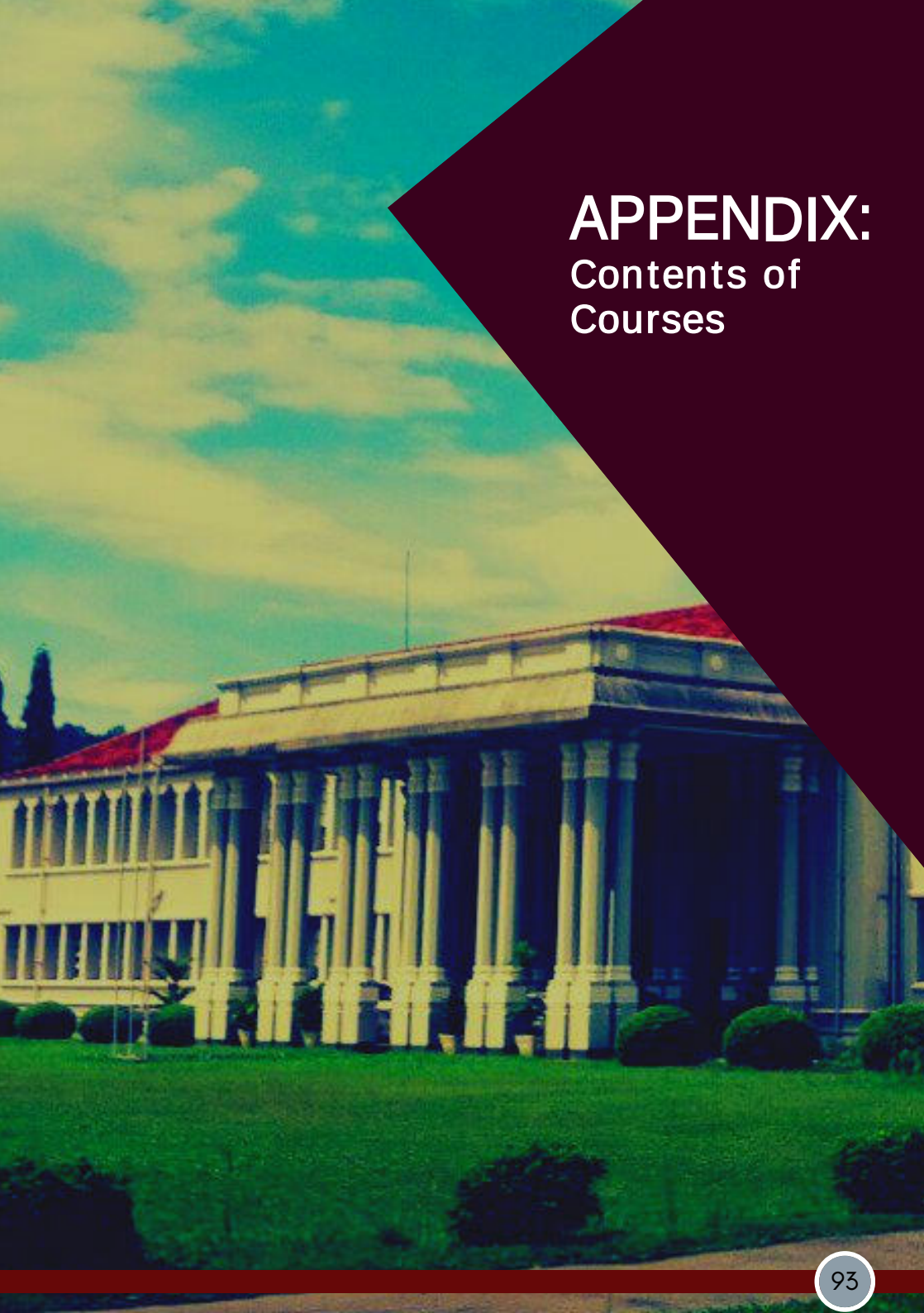
7.2 Link to the Department's Research Magazine

https://eng.pdn.ac.lk/civil/resources/insight.php

Volume 1 Issue 1
2022-MAR

Volume 1 Issue 2
2022-AUG

Volume 2 Issue 1
2023-MAR



APPENDIX:
Contents of Courses

Appendix: Contents of Courses

Course Code	CE201
Course Title	Mechanics of Materials I
No. of Credits	3
Pre-requisites	GP110
Compulsory/Optional	Compulsory

Aim(s): To introduce the fundamental concepts of mechanics of materials to provide basic approaches for analysis of various types of structural members subject to different loadings and their load combinations.

Intended Learning Outcomes:

On successful completion of the course, the students should be able to;

1. Identify different types of structural/machine components along with corresponding boundary conditions and loading.
2. Apply the fundamental concepts of equilibrium, compatibility and constitutive relationships to analyse various elements subjected to external loads.
3. Evaluate internal resultant forces, stresses, displacements and strains of such elements.
4. Determine the state of stress and strain at a point under 2D plane stress conditions on any inclined plane and to determine the principal stresses and strains.

Time Allocation (Hours): Lectures 35 Tutorials 7 Practical Assignments 6

Course content/Course description:

1. **Introduction to Mechanics of Materials:** Concepts of stress and strain in 1D, normal and shear components, stress-strain relations, material constants: Young's modulus E, shear modulus G and Poisson's ratio v; strain energy
2. **Basic sectional properties:** First moment of area, centroid, centroidal axes, second moments of area, radii of gyration, section moduli and polar moment of area; transformation of axes for second moment of area
3. **Derivation of simple bending formula for a prismatic beam**

and estimation of direct stresses induced by bending

4. **Composite sections, transformed section approach**
5. **Calculation of deflection in statically determinate beams:** Differential equation approach and moment-area theorems of Mohr; statically indeterminate beam analysis
6. **Estimation of shear stress variation in a beam section:** Jourawski's theory and Timoshenko beam theory; Shear flow and shear centre, compound beams, shear connectors
7. **Derivation of torsion formula for circular shaft**
8. **Transformation of 2D stress and strain:** Equilibrium equations and concept of Mohr's circle; Introduction to principal stresses, principal strains, maximum shear stress and strain, introduction to failure criteria.
9. **2D stress-strain relationship for isotropic linear elastic materials:** Relationship among Young's modulus *E*, shear modulus *G* and Poisson's ratio *v*, application of concept of 2D stress-strain
10. **Introduction to 3D stress-strain relationship for isotropic linear elastic materials:** Bulk modulus *K*; relationship among Young's modulus *E*, shear modulus *G*, bulk modulus *K* and Poisson's ratio *v*
11. **Buckling of ideal struts**

Recommended Texts :

1. Gere, JM, Goetsch, DE & Goodno, BJ 2010, *Strength of Materials*, 6th edn.
2. Hibbler, RC 2011, *Mechanics of Material's* 8th edn, Prentice Hall, London.
3. Timoshenko, SP and Young DH 2011. *Elements of Strength of Materials*, 5th edn, East-West Press.
4. Timoshenko, SP 2002, *Strength of Materials Part 1 and 2,* 3rd edn, CBS Publisher.

Assessment	**Percentage Mark**
In-course	
Assignments/Quizzes	20
Mid Semester Examination	30
End-semester	50

Course Code	CE202
Course Title	Fluid Mechanics I
No. of Credits	3
Pre-requisites	-
Compulsory/Optional	Compulsory

Aim(s): To introduce the students to the fundamentals of the behaviour and analysis of motion of fluids.

Intended Learning Outcomes:
On successful completion of the course, the students should be able to;

1. Explain the fundamental kinematic concepts related to fluid flow.
2. Solve fluid flow problems through application of conservation laws of mass, momentum and energy.
3. Analyze flow in the pipe system under laminar and turbulent flow conditions.
4. Apply dimensional methods to solve problems and physical model testing in fluid mechanics.
5. Derive performance characteristics of positive displacement and rotodynamic machines and select them for specific application.

Time Allocation (Hours): Lectures: 36 Tutorials: 6 Practical: Assignments: 6

Course content/Course description:

1. **Kinematics of fluid flow:** Continuum concept, types of flow, acceleration, Velocity potential, stream function, complex potential, control volume analysis, continuity equation
2. **Dynamics of fluid flow:** Force-Momentum equation, energy equation, frictionless flow, Bernoulli's equation, Flow measurements, Flow in pipes
3. **Laminar flow and turbulent flow:** Moody diagram, Local losses, Pipe flow computations, Pipe systems; Pipe networks
4. **Dimensional methods:** Dimensional analysis, Pi Theorem Similitude, Dynamic similarity, Physical model studies
5. **Hydraulic machines:** Positive displacement machines, rotodynamic machines, performance characteristics, cavitation

and NPSH, selection of pumps and turbines
Recommended Texts: 1. White, FM 2003, *Fluid Mechanics*, 5th edn, New York, McGraw-Hill. 2. Streeter, VL & Wylie E 1983, *Fluid Mechanics*, New York, McGraw-Hill. 3. Cengel, YA & Cimbala RJM 2014, *Fluid Mechanics: Fundamentals and Applications*, McGraw-Hill Education Ltd, 3rd edn, India.

Assessment	**Percentage Mark**
In-course	
Tutorials/Assignments/Course work/Quizzes	30
Mid Semester Examination	20
End-semester	50

Course Code	CE204
Course Title	Geomechanics
No. of Credits	3
Pre-requisites	CE201
Compulsory/Optional	Compulsory

Aim(s): To impart knowledge and an understanding of soil mechanics and basic geology, and to familiarize with geotechnical and geological terminology and concepts commonly encountered in engineering practice.

Intended Learning Outcomes:

On successful completion of the course, the students should be able to;

1. Determine basic engineering and physical properties of soils and classify soils for engineering purposes to improve the soil properties by compaction where required.
2. Determine total and effective stress distribution of soils and analyse seepage forces and the seepage through soils using permeability and Darcy's law.
3. Apply consolidation and shear strength properties of soils and compute time dependent settlement using one dimensional Terzaghi theory.
4. Describe internal (plate tectonics theory) and external geological processes (weathering, erosion) and the geology of Sri Lanka.
5. Identify the rock forming minerals, rock types and classify rocks for engineering purposes.

Time Allocation (Hours): Lectures: 41 Tutorials: 4 Practical: Assignments:

Course Content/Course Description:

1. **Basic characteristics of soils:** Soil formation, structure and phase relationship, mineralogy, soil classification and description, problematic soils
2. **Elements of stress analysis:** Effective stress concept, stresses in ground, unsaturated zone, stress-strain relationships, stress state at a point in soil mass, stress induced by applied loads on soils
3. **Permeability and Seepage:** Darcy's law, coefficient of permeability, layered soil, anisotropy, seepage theory, flow nets,

uplift pressures and seepage forces

4. **Compressibility:** Compaction, 1D compression characteristics, oedometer tests, consolidation settlement, Terzaghi 1D consolidation theory, determination of coefficient of consolidation
5. **Shear strength:** Mohr-Coulomb failure criterion, shear strength of sand and clays
residual strength, pore pressure coefficients, determination of shear strength parameters: triaxial tests (UU, CU, CD), direct shear test, vane shear test
6. **Basic Geology:** Theory of plate tectonics, rock forming minerals and rock types,
geological structures, geological processes, geology of Sri Lanka

Recommended Texts:

1. Craig, RF 2004, *Soil Mechanics*, Chapman & Hall, 7th edn, New York.
2. Das, BM 2011, *Principles of Foundation Engineering*, 7th edn, PWS Publishers.
3. Lamb, TW & Whitman, RV 2008, *Soil Mechanics,* SI Version, Wiley India Pvt. Limited.
4. Cooray, PG 1967 & 1984, *An Introduction to the Geology of Sri Lanka,* National Museums of Sri Lanka.
5. Blyth FGH & De Freitas MH, 1984. *Geology for Engineers*, 7th edn, ELBS Publication.

Assessment	**Percentage Marks**
In-Course	
Assignments/Course work/Quizzes	20
Mid Semester Examination	20
End-semester	60

Course Code	CE205
Course Title	Engineering Hydrology
No. of Credits	3
Pre-requisites	-
Compulsory/Optional	Compulsory

Aim(s): To introduce the essential components and function of the hydrologic cycle including precipitation, evaporation/evapotranspiration, overland flow and surface storage, groundwater flow and storage, and channel flow and to be able to perform engineering hydrology computations in the analysis of unit hydrograph, routing, frequency analysis, and groundwater flow.

Intended Learning Outcomes:
On successful completion of the course, the students should be able to;

1. Explain the governing processes of the hydrological cycle including exchange processes between atmosphere and soil surface, surface water runoff, and groundwater.
2. Formulate hydrological processes in mathematical terms.
3. Solve problems related to water resources development including groundwater and surface water.
4. Recognize the limitations of hydrological data.

Time Allocation (Hours): Lectures: 35 Tutorials: 8 Practical: - Assignments: 4

Course Content/Course Description:

1. **Hydrological Processes:** Introduction, hydrological processes (precipitation, interception, depression storage, evaporation, transpiration, evapotranspiration, infiltration and stream flow) and their measurement
2. **Hydrograph analysis:** Shape and components, effective rainfall, unit hydrograph, synthetic unit hydrograph, instantaneous unit hydrograph, hydrologic storage routing, hydrologic channel routing
3. **Frequency analysis:** Recurrence interval, return period, frequency factor method, plotting position method, risk analysis
4. **Groundwater hydrology:** Subsurface water, aquifers, Darcy's law, steady groundwater flow (unidirectional and radial flow),

recharge and barrier boundaries; unsteady groundwater flow

Recommended Texts :

1. Subramanya, K 2013, *Engineering Hydrology*, Tata McGraw-Hill Publishing Company Limited, New Delhi.
2. Chow, Ven Te, Maidment, DR & Mays, LW 1988 *Applied Hydrology*, McGraw-Hill Book Company, Singapore.

Assessment	**Percentage Marks**
In-Course	
Tutorials/Quizzes	20
Mid Semester Examination	30
End-semester	50

Course Code	CE208
Course Title	Structural Analysis
No. of Credits	3
Pre-requisites	CE201
Compulsory/Optional	Compulsory

Aim(s): To idealize structures and analyse for internal forces, deflections and support reactions, and to identify failure mechanisms.

Intended Learning Outcomes:
On successful completion of the course, the students should be able to;

1. Identify different forms of structures and support conditions, and convert the real structure to an idealized structure.
2. Explain load-path and behaviour of structures subjected to external loads.
3. Analyse statically determinate and indeterminate structures using classical methods; draw bending moment, shear force & axial force diagrams and deflected shapes.
4. Evaluate collapse loads of structures.

Time Allocation (Hours): Lectures: 38 Tutorials: 7 Practical: Assignments:

Course content/Course description:

1. **Introduction to modelling concept for structural analysis:** Definition of a structure; Idealization of a structure: joints, members, support conditions and loading conditions; calculation of internal forces; free body diagrams and reactions
2. **Identification of the degree of static indeterminacy of structures and check for stability**
3. **Analysis of statically determinate structures:** Trusses, frames, three pin arches and unstiffened suspension cables
4. **Combined effect of bending and axial forces**
5. **Development of influence lines for statically determinate structures, Muller-Breslau principle**
6. **Calculation of deflection of statically determinate structures:** principle of virtual work, Castigliano's theorems and reciprocal theorem
7. **Identification of the degree of kinematic indeterminacy of**

structures

8. **Analysis of statically indeterminate structures:** Force methods, three moment equation, displacement methods, slope deflection method, moment distribution method
9. **Introduction to plastic analysis of beam and frame structures**

Recommended Texts:

1. Hibbeler, RC 2005, *Structural Analysis*, 5th edn, Prentice Hall.
2. Kassimali, A 2009, *Structural Analysis*, 4th edn, Cengage Learning.
3. Schodek, DL 2013, *Structures*, 7th edn, Pearson Education.

Assessment	Percentage Mark
In-course	
Tutorials/Quizzes	15
Mid Semester Examination	25
End-semester	60

Course Code	CE209
Course Title	Building Construction
No. of Credits	3
Pre-requisites	-
Compulsory/Optional	Compulsory

Aim(s): To introduce the students to the terminology, basic principles of building construction, other Civil Engineering constructions and to develop the skills of the students in planning a complete building construction project including architectural planning, selection of materials and methods, planning building services, preparation of bill of quantities, etc. as applied to a real-life 2 storied dwelling unit.

Intended Learning Outcomes:
On successful completion of the course, the students should be able to;

1. Describe different stages of a Civil Engineering project, organizational structures and the roles of professionals involved.
2. Explain functional and aesthetic requirements, building regulations and space utilization of a residential building.
3. Compare alternative construction materials and techniques for different building elements and make appropriate selections.
4. Plan building services such as water supply, sewerage, ventilation, lighting, thermal comfort and acoustics for a residential building.
5. Prepare Bill of Quantities (BOQ) and estimates using Building Schedule of Rates (BSR) as per Standard Method of Measurement (SMM).
6. Carry out a complete building planning exercise independently including architectural drawings, building services plans, building schedules, bill of quantities and a planning report.

Time Allocation (Hours): Lectures: 38 Tutorials: 1 Project Work: 12

Course Content/Course Description:

1. **Features of building construction projects:** Stages of a building project – from conceptual to maintenance; roles of client, architect, consulting engineer, quantity surveyor, contractor and their inter-relations; introduction to Building Information Modeling (BIM), organizational structures at

construction site and design office, Sri Lankan construction industry

2. **Building planning and principles of architecture:** Conceptual and architectural plan, matching architectural styles; design brief, Functional and aesthetic requirements – activity spaces, bubble diagram, anthropometrics and ergonomics, space usage, accessibility, circulation and movement, building regulations, sustainability concepts, lighting and ventilation, thermal comfort, acoustics, optimizing a building plan for space; building specifications and drawings
3. **Construction materials and techniques:** Materials and techniques by building element type – foundations, superstructure, floor, walls, doors and windows, facades, roof, and rain water disposal system, ceiling; relative costs, advantages and disadvantages of alternative materials and methods
4. **Building services:** Water supply – estimating demand, water from public supply, pumping from well, overhead tanks, plumbing and fittings; Waste water and sewerage – discharge to public sewers, other feasible disposal methods for Sri Lanka (septic tanks, soakage pits), municipal regulations, plumbing, Other building services – electrical wiring and fittings, service lines for telephone, television etc., air conditioning and heating, gas, fire protection, noise insulation, security alarm systems, Building maintenance –provision for routine maintenance during design stage, maintenance schedules
5. **Estimation and quantity surveying:** Introduction to SMM, quantity take off, preparing a BOQ , work norms, BSR
6. **Introduction to other Civil Engineering Projects:** hydropower projects, road projects etc.
7. **Group project:** Planning a dwelling unit which will include the preparation of architectural drawings, detailed drawings on water supply and sewerage, detailed drawings on electrical wiring and installations, detailed BOQ inclusive of water supply and sewerage and electrical installations, necessary schedules to make the pricing, procuring of materials and construction easier, final estimate for the residential facility. The report should

explain and provide details such as access to the building, the internal circulation plan, lighting, ventilation, thermal comfort, landscaping around the building and reasons for the selection of suggested material/ finishes/ fittings etc.	
Recommended Texts: 1. Chudley, R. and Greeno R 2012, *Building Construction Handbook*, 10th edn, Routledge, Taylor and Francis Group, London and New York. 2. Royal Institution of Chartered Surveyors, 1988, *Standard Method of Measurement SMM7*, 7th edn.	
Assessment	**Percentage Marks**
In-Course Assignments/Quizzes/Group Project Mid Semester Examination	 20 30
End-semester	50

Course Code	CE210
Course Title	Engineering Surveying
No. of Credits	3
Pre-requisites	-
Compulsory/Optional	Compulsory

Aim(s): To introduce basic concepts used in performing an engineering survey, identify errors on observations, calculation based on field data, and prepare maps, impart knowledge on surveying on special conditions and advanced surveying techniques.

Intended Learning Outcomes:

On successful completion of the course, the students should be able to;

1. Plan and perform land and levelling surveys.
2. Interpret survey maps and calculate areas, volumes, and setting out details for engineering applications.
3. Perform engineering surveys in special conditions such as hydrographic surveys, underground surveys etc.
4. Apply advanced surveying techniques such as GPS, remote sensing for engineering purposes.

Time Allocation (Hours): Lectures: 28 Tutorials: 2 Fieldwork: 30

Course Content/Course Description:

1. **Plane Surveying:** Chain surveying, traversing, use of total station for measurements
2. **Levelling:** Control levelling, detailed levelling, contouring, trigonometrically levelling, stadia hair (tacheometry) levelling, cross sections, longitudinal sections, area and volume calculations
3. **Setting Out:** Horizontal control, vertical control, field information, checking and precision of measurements
4. **Surveying in Special Conditions:** Hydrographic surveys, introduction to underground surveys
5. **Geodetic Surveying:** Triangulation, triangulation adjustments (theory of errors), control surveys, explaining applications of geodetic surveying
6. **Advanced Surveying Techniques and applications**

Photogrammetry, interpretation of GIS maps and satellite images, use of imagery for surveying, use of GPS data for surveying and its

applications

Recommended Texts (if Any):

Bannister, A, Raymond, S & Baker R 1992, *Surveying*, Longman Scientific & Technical.

Schofield, W & Breach, M 2007, *Engineering Surveying*, 6th edn, Technology & Engineering.

Assessment	**Percentage Marks**
In-Course	
Tutorials/Fieldwork/Quizzes	30
Mid Semester Examination	20
End-semester	50

Course Code	CE219
Course Title	Civil Engineering Laboratory I
No. of Credits	1
Pre-requisites	CE201, CE202
Compulsory/Optional	Compulsory

Aim(s): To give understanding of engineering principles through experimentation and to develop the ability to perform tests used in Civil Engineering using standards.

Intended Learning Outcomes:
On successful completion of the course, the students should be able to;

1. Perform tests in Civil Engineering and relate underlying engineering principles involved.
2. Perform laboratory tests in Civil Engineering using standards in practice and to interpret the results.
3. Write a report on the findings of experiments.
4. Work effectively as a member of a team to accomplish a given task.

Time Allocation (Hours): Lectures: Tutorials: Practical: 30 Assignments:

Course content/Course description:
Development of experimental skills; Use of experimental procedures in material testing and in mechanics of fluids, performance of standard tests used in Civil Engineering and interpretation of their results

Recommended Texts:

1. Gere, JM and Timoshenko, SP 1997, *Mechanics of Materials*, 4th edn, PWS Publishing Company, Boston.
2. Ashby, MF & Jones, DRH 1998, *Engineering Materials 2*, 2nd edn, Butterworth Heinemann.
3. Douglas, JF, Gasiorek, J, Swaffield, J & Jack, L 1992, *Fluid Mechanics*, Pearson Education Ltd, England.

Assessment	**Percentage Mark**
In-course	
Coursework	60
Mid Semester Examination	-
End-semester	40

Course Code	CE302
Course Title	Environmental Engineering
No. of Credits	3
Pre-requisites	-
Compulsory/Optional	Compulsory

Aim(s): To impart knowledge on local and global pollution issues, environmental sustainability and to provide basic skills for planning, design and control of environmental pollution.

Intended Learning Outcomes:

On successful completion of the course, the students should be able to;

1. Describe modes of water pollution, their effects on the water environment and to identify suitable options for their control.
2. Describe the concepts of environmental sustainability through understanding the global and local environmental issues, their impacts and options for mitigation.
3. Explain the concepts of potable water treatment and ability to plan a conceptual design of a conventional potable water treatment facility.
4. Explain the concepts of wastewater management and plan and design a wastewater collection system and conventional wastewater treatment units.
5. Compare available alternatives for urban waste management: municipal solid waste collection, treatment and disposal options and sanitary waste disposal.

Time Allocation (Hours): Lectures: 33 Tutorials: 3 Practical/Design: 16 Assignments: 2

Course Content/Course Description:

1. **Environmental Sustainability:** Concepts of environmental sustainability; overview of global and local environmental issues; environmental standards and laws in Sri Lanka, Environmental impacts: identification, assessment and mitigation
2. **Water Resources Management:** Introduction to integrated water resource management (IWRM), water quality management and pollution control: Types of pollution sources and their control
3. **Water Supply:** Water quality standards, water demands, principles of water treatment, unit operations, introduction to water distribution
4. **Waste water treatment:** Waste water characteristics, waste water collection systems; conventional sewage systems; conventional wastewater treatment, residual management
5. **Urban waste management:** Municipal solid waste management (MSW); MSW planning, collection treatment and disposal options, sanitary waste management systems
6. **Design of wastewater management systems:** Wastewater collection system and treatment unit, human/sanitary waste treatment system (sanitation design)

Recommended Texts:

1. Tchobanoglous, G & Burton, FL 2002, 4th edn, *Wastewater Engineering: Treatment and Reuse*, McGraw Hill, New York.
2. Crittenden, JC, Trussell, RR, David, WH, Kerry, JH & Tchobanoglous, G 2012, *MWH's Water Treatment: Principles and Design,* 3rd edn, John Wiley & Sons, Inc. New Jersey.
3. Raju, BSN 1995, *Water Supply and Wastewater Engineering*, Tata McGraw-Hill, New Delhi.

Assessment	Percentage Marks
In-Course	
Tutorials/Assignments/Course Work/Quizzes	30
Mid Semester Examination	20
End-semester	50

Course Code	CE305
Course Title	Hydraulics
No. of Credits	3
Pre-requisites	-
Compulsory/Optional	Compulsory

Aim(s): To provide knowledge on analysis of open channel flows, transient pipe flows and boundary layer flows with their applications in practice.

Intended Learning Outcomes:

On successful completion of the course, the students should be able to;

1. Solve simple viscous fluid flows using Navier-Stokes equations, explain approach to solve turbulent boundary layers flows and estimate drag forces.
2. Compute transient pressure fluctuations in pipelines (water hammer), mass oscillations in surge tanks caused by sudden changes of discharges and to introduce appropriate surge control devices.
3. Apply mathematical principles for the analysis of steady, non-uniform flows in open channels using energy and momentum considerations and to analyse flow profiles for steady, non-uniform open channel flows.
4. Analysis and design unlined channels on erodible beds.
5. Apply simple computational models for free surface flow computations.

Time Allocation (Hours): Lectures: 37 Tutorials: 6 Practical: Assignments: 4

Course Content/Course Description:

1. **Viscous flow:** Navier-Stokes equation; some solutions; flow past solid boundaries; boundary and turbulent boundary layers, flow separation, drag, Reynolds-averaged Navier-Stokes equation
2. **Hydraulic transients in pipes:** Governing equations of unsteady flow, rigid column theory, mass oscillation in surge tanks, elastic theory, water hammer, cavitation, Surge control

3. **Frictionless flow in open channel:** Specific energy and flow force
   hydraulic jump, flow transients, flow measurements
4. **Resistance in open channel flow:** Uniform flow; Chezy's equation, Manning's equation, gradually varied flow, flow profiles
5. **Sediment transport in open channels:** Initiation of sediment motion, stable channel design, transport formulae, erosion and deposition
6. **Free surface flow computations:** Unsteady flows, Saint Venant equation, numerical modeling concepts, introduction to software applications

Recommended Texts (if Any) :

1. Henderson, FM 1966, *Open Channel Flow*, MacMillan Publishing Co INC, New York.
2. French, RH 1986, *Open Channel Hydraulics*, McGraw Hill, New York.
3. White, FM 1994, *Fluid Mechanics*, McGraw Hill, New York.
4. Massey, BS 1994, *Mechanics of Fluids*, Taylor& Francis, London and New York.
5. Douglas, FM, Gasoriek, JM, Swaffield, JA & Jack, LB 2011, *Fluid Mechanics*, 6th edn, Prentice Hall.

Assessment	Percentage Marks
In-Course	
Tutorials/Quizzes/Assignments/Course work	30
Mid Semester Examination	20
End-semester	50

Course Code	CE306
Course Title	Design of Structures I
No. of Credits	3
Pre-requisites	CE208
Compulsory/Optional	Compulsory

Aim(s): To develop a sound knowledge on the design of steel structures and design of pre-stressed concrete (PC) structures.

Intended Learning Outcomes:

On successful completion of the course, the students should be able to;

1. Explain the basic behaviour of steel structures.
2. Design steel members loaded in tension, compression, flexure, shear and combinations.
3. Design different types of connections in steel structures.
4. Discuss the attributes of PC structures, construction methods and prestressing techniques.
5. Design PC beams conforming to a standard code of practice.

Time Allocation (Hours): Lectures 28 Tutorials 02 Practical Assignments 30

Course Content/Course Description:

1. Design concepts: permissible stress, load factor, limit state
2. Limit state concept: probabilistic approach, characteristic loads, characteristic strength, and partial factors of safety
3. Safety, serviceability, durability, fire resistance and other considerations
4. Physical and mechanical properties of structural steel and their classifications
5. Behaviour of structural elements, modes of failure, application of codes of practice, standards and specifications
6. Design of elements in steel structures: ties, struts, beams, columns, design of connections
7. Robustness of structures
8. Design of a steel building using a code of practices
9. Introduction to design software
10. Basic principles of pre-stressed concrete

11. Preliminary design of pre-stressed concrete beams
12. Analysis of pre-stressed concrete members for the serviceability limit state and plotting of the Magnel diagram
13. Design of tendon profile and identification of debonding locations
14. Computation of pre-stress losses
15. Analysis of pre-stressed concrete for the ultimate limit state

Recommended Texts (if Any):

1. Trahair, EA, Bradford MA, Nethercot DA, Gardner, L 2008, *The Behaviour and Design of Steel Structures to EC3*, 4th edn, Taylor & Francis, Oxon.
2. Mosley, B, Bungey, J and Hulse R 2007, *Reinforced Concrete Design to Eurocode 2*, 6th edn, Palgrave Macmillan.
3. EN 1993-1-1:2005, *Design of Steel Structures – Part 1-1: General Rules and Rules for Buildings.*
4. EN 1992-1-1:2004, *Design of Concrete Structures – Part 1-1: General Rules and Rules for Buildings.*
5. Brettle, ME and Brown, DG 2009, *Steel Building Design: Concise Eurocodes*, SCI Publication.

Assessment	**Percentage Marks**
In-Course	
Assignments/Quizzes	20
Mid Semester Examination	20
End-semester	60

Course Code **Course Title** **No. of Credits** **Pre-requisites** **Compulsory/Optional**	CE307 Finite Element Methods in Solid Mechanics 3 CE201 Compulsory

Aim(s): To introduce approximate methods used in analysing Civil Engineering problems.

Intended Learning Outcomes:

On successful completion of the course, the students should be able to;

1. Explain the different approximate methods and their limitations for analysis of Civil Engineering problems.
2. Analyse basic 1D and 2D Civil Engineering problems by developing a computer program based on finite element method.
3. Model and analyse engineering problems by using commercially available Finite Element (FE) software.

Time Allocation (Hours): Lectures 36 Tutorials 04 Practical Assignments 10

Course content/Course description:

1. **Introduction to approximate methods to solve basic engineering problems:** Variational methods: Rayleigh-Ritz; finite difference method; finite element method
2. **Displacement based finite element formulation for truss structures:** Derivation of element stiffness matrix for a spring/bar element referring local coordinate system; shape (interpolation) functions; 2D transformation of element stiffness matrix from local to global coordinate system; assembly of element stiffness matrices into global stiffness matrix; boundary conditions; solution techniques; evaluation of member forces; computer implementation using a computer program
3. **Displacement based finite element formulation for frame structures:** Review of beam theory, derivation of stiffness matrix for frame element, shape (interpolation) functions, equivalent nodal forces, evaluation of stress resultants,

computer implementation using a computer program

4. **Finite element formulation for 2D plane stress/strain problem:** Basic equations; derivation of stiffness matrix for a 2D plane stress/strain elements: constant strain triangular (CST) element, bi-linear rectangular element, isoperimetric formulation and 4-node quadrilateral element, and higher-order elements; equivalent nodal forces; Gauss quadrature numerical integration and Gauss points, convergence criteria, discretization error and convergence rate
5. **Introduction to general purpose finite element programs:** Pre-processor, input data, graphic interfaces, mesh generation, renumbering for efficiency, processors, storage schemes, post-processors, output devices, graphic support, refining the solution, use of finite element methods in CAD/CAE, applications of general purpose finite element programs

Recommended Texts :

1. Logan, D 2007, *First Course in Finite Element Method*, 4th edn, Nelson Engineering.
2. Desai, C 2005, *Introduction to the Finite Element Method*, 1st edn, CBS Publisher.
3. Weaver, W and Gere, JM 2004, *Matrix Analysis of Framed Structures*, 2nd edn, Springer.

Assessment	**Percentage Mark**
In-course	
Assignments/Quizzes	20
Mid Semester Examination	30
End-semester	50

Course Code	CE308
Course Title	Geotechnical Design
No. of Credits	2
Pre-requisites	CE310
Compulsory/Optional	Compulsory

Aim(s): To impart knowledge and skills to perform design of geotechnical structures using design codes (Eurocode 7).

Intended Learning Outcomes:

On successful completion of the course, the students should be able to;

1. Analyse the stability of a slope according to Eurocode 7 (EC7) using slope stability analysis software.
2. Design earth retaining structures conforming to EC7.
3. Design shallow and deep foundations conforming to EC7 using numerical software.
4. Identify and recognise geological structures and geohazards and relate them to geotechnical design.

Time Allocation (Hours): Lectures: 15 Tutorials: Practical: 30 Assignments:

Course Content/Course Description:

1. **Geotechnical design using Eurocode 7:** Eurocode 7: geotechnical considerations, design of an earth retaining structure, slope stability analysis, design of shallow foundations, design of deep foundations
2. **Design for geohazards:** Considerations for landslides, earthquakes, floods and landfills
3. **Geological maps and plans:** Interpretation and description of geological maps, description of geological condition of a terrain

Recommended Texts :

1. Barnes, G 2010, *Soil Mechanics-Principles and Practice*, 3rd edn, Publisher-Palgrave Macmillan.
2. Bowles, JE 1997, *Foundation analysis and design*, 5th edn, McGraw Hill.
3. Brinkgreve, RBJ 2002, *PLAXIS 3D manual*, Version 8.
4. John, K 2004, *Stability modeling with slope/W*, 1st edn, GEO-

SLOPE International Ltd.

5. Smith, I 2014, *Smith's Element of Soil Mechanics (Design to Eurocode)*, 9th edn, Blackwell publishing.
6. Tomlinson, MJ 2001, *Foundation design and construction*, 7th edn, Pearson.

Assessment	**Percentage Marks**
In-Course	
Assignments/Course Work/Quizzes	40
Mid Semester Examination	-
End-semester	60

Course Code	CE310
Course Title	Geotechnical Engineering
No. of Credits	3
Pre-requisites	CE204
Compulsory/Optional	Compulsory

Aim(s): To provide knowledge of how to conduct geotechnical investigations and analyse geotechnical structures such as slopes, retaining structures and foundations.

Intended Learning Outcomes:

On successful completion of the course, the students should be able to;

1. Analyse stability problems of natural and man-made slopes using limit equilibrium and earth pressure theories and propose appropriate remedial measures including internally or externally stabilised retaining structures.
2. Analyse isolated or combined shallow foundations in cohesive and cohesionless soils.
3. Analyse deep foundations in cohesive and cohesionless soils
4. Organize and perform a site investigation programme to select sites suitable for geotechnical construction and to obtain material profile and parameters required for design.

Time Allocation (Hours): Lectures: 40 Tutorials: 04 Practical: 02 Assignments:

Course Content/Course Description:

1. **Stability of slopes:** Failure surfaces, total & effective stress analyses
2. **Lateral earth pressure & retaining walls:** Active and passive earth pressure, Rankine theory, Coulomb theory, retaining structures & stability, internally stabilised walls
3. **Shallow foundations:** Foundation types, bearing capacity, allowable bearing capacity, settlement calculation
4. **Deep foundations:** Pile types, single pile, pile groups, settlement calculation
5. **Rocks:** Engineering classification of rocks, engineering

properties of rocks, rock failure criteria

6. **Site selection and site investigation:** Site selection for engineering projects, Introduction to geohazards, direct and indirect methods of site investigation, sampling and sampling methods, site investigation report
7. **Ground improvement, sheet piles, braced excavations**

Recommended Texts :

1. Abramson, LW 2002, *Slope stability and stabilization methods*, 2nd edn, John Wiley & Sons.
2. Coduto, DP 2011, *Geotechnical Engineering: principles and practices*.2nd edn, Pearson.
3. Das, BM 2008, *Fundamentals of geotechnical engineering*, 4th edn, Nelson.
4. Robert, WD 1999, *Geotechnical and foundation engineering: design & constructions*, McGraw-Hill.
5. Robert, MK 2012, *Designing with geosynthetics*, 6th edn, Prentice hall.
6. Bowles, JE 1997, *Foundation analysis and design*, 5th edn, McGraw Hill.
7. Tomlinson, MJ 2001, *Foundation design and construction*, 7th edn, Pearson.

Assessment	Percentage Marks
In-Course	
Tutorial/Quizzes	20
Mid Semester Examination	20
End-semester	60

Course Code	CE311
Course Title	Hydraulic Engineering and Design
No. of Credits	3
Pre-requisites	-
Compulsory/Optional	Compulsory

Aim(s): To provide basic principles and knowledge needed for planning and design of water treatment plants, irrigation development projects and coastal structures.

Intended Learning Outcomes:
On successful completion of the course, the students should be able to;

1. Analyse coastal processes that need to be considered in coastal engineering design projects.
2. Design breakwaters giving due considerations to functional, structural, construction and operational aspects.
3. Evaluate and plan effective use of irrigation water in irrigation development projects.
4. Apply scientific knowledge on water treatment processes to design conventional water treatment plants.
5. Apply basic principles of hydrology and hydraulics to design reservoirs and spillways.

Time Allocation (Hours): Lectures: 26 Tutorials: 03
Practical/Designs: 32 Assignments: -

Course Content/Course Description:

1. **Coastal Engineering:** Coastal environment and near-shore process; application of wave theory; design of coastal structures; coastal zone management
2. **Irrigation Engineering :** Water requirement and irrigation planning; irrigation scheduling; irrigation scheme design
3. **Hydraulic structures:** Water treatment plant; pipe network; reservoir design; spillway design

Recommended Texts :

1. Sorensen R 2005, *Basic Coastal Hydraulics*, Springer-Verlag Inc., New York.

2. Wijetunge, JJ 2013, *An Introduction to Coastal Engineering – Processes, Theory, Hazards and Design Practice*, S. Godage Publishers, Colombo.
3. Singh, B 2005, *Fundamentals of Irrigation Engineering*, Nem Chand & Bros., India.
4. Majumdar, DK 2004, *Irrigation Water Management – Principles and Practice*, Prentice-Hall, India.
5. Varshney, DV& Varshney, M 1987, *Design of Hydraulic Structures*, Khanna Publishers, Delhi.
6. Garg SK & Garg N (eds), 2010, *Water Supply Engineering: Environmental Engineering* Vol.1, Khanna Publishers, Delhi.

Assessment	**Percentage Marks**
In-Course	
Tutorials/Quizzes/Designs	40
Mid Semester Examination	20
End-semester	40

Course Code	CE312
Course Title	Design of Structures II
No. of Credits	3
Pre-requisites	CE208
Compulsory/Optional	Compulsory

Aim(s): To teach basics of reinforced concrete design so that the students use this knowledge when they design low-rise reinforced concrete frame buildings.

Intended Learning Outcomes:
On successful completion of the course, the students should be able to;

1. Discuss the limit state design principles
2. Explain the behaviour of reinforced concrete material.
3. Analyse sub-frames for vertical and lateral loading.
4. Design reinforced concrete beams, slabs, columns and foundations conforming to a standard code of practice.
5. Produce design information in the form of detailed drawings and specifications.
6. Design water-retaining structures conforming to a standard code of practice.

Time Allocation (Hours): Lectures 29 Tutorials 01 Practical Assignments 30

Course content/Course description:

1. Mechanical properties of concrete and reinforcement: strength, constitutive relationships
2. Limit states, durability, fire resistance and other prime considerations; partial factors of safety; loading, load transfer paths, critical loading arrangements
3. Elastic behaviour of uncracked and cracked reinforced concrete beams, tension stiffening; serviceability considerations such as deflection and crack width
4. Collapse of reinforced concrete structural elements: modes of collapse
5. Unbraced frames and braced frames; analysis of sub-frames, redistribution of moments

6. Design of reinforced concrete structural elements: slab, beam, column, and footing; application of codes of practice; robustness of structures
7. Design of a reinforced concrete multi-storey building
8. Application of draughting software for reinforced concrete structural drawings
9. Extension of reinforced concrete design and detailing concepts for water-retaining structure applications; codes of practice
10. Design of a reinforced concrete water-retaining structure

Recommended Texts :

1. Beeby, AW and Narayanan, RS 1995, *Designers's Handbook to Eurocode 2, Part 1.1: Design of Concrete Structures*, Thomas Telford.
2. Mosley, B Bungey, J and Hulse, R 2007, *Reinforced Concrete Design to Eurocode 2*, 6th edn, Palgrave Macmillan.
3. EN 1992-1-1:2004, *Design of Concrete Structures – Part 1-1: General Rules and Rules for Buildings.*

Assessment	**Percentage Mark**
In-course	
Assignments/Quizzes	20
Mid Semester Examination	20
End-semester	60

Course Code	CE316
Course Title	Advanced Mechanics of Materials
No. of Credits	2
Pre-requisites	CE201
Compulsory/Optional	Compulsory

Aim(s): To introduce the concepts of mechanics of materials for analysis of three dimensional (3D) deformable solids subjected to external static loadings.

Intended Learning Outcomes:
On successful completion of the course, the students should be able to;

1. Explain the concepts of mechanics of materials of 3D deformable solids.
2. Apply the fundamental of equilibrium, compatibility and constitutive laws to analyse solid bodies subjected to external static loadings for internal stresses and strains.
3. Determine the state of stress at a point in any given coordinate system and hence evaluate the principal stresses and their directions.

Time Allocation (Hours): Lectures 27 Tutorials 03 Practical Assignments

Course content/Course description:

1. Basics of general 3D elastostatic problem, governing equations and general principles
2. Analysis of stress and strain in 3D, constitutive relations, introduction to 2D approximations of 3D problem
3. Theory of plates and shells

Recommended Texts :

1. Timoshenko, SP & Goodier, JN 1970, *Theory of Elasticity*, 3rd edn, McGraw-Hill.
2. Timoshenko, SP & Woinowsky-Krieger, S 1970, *Theory of Plates and Shells*, McGraw-Hill.
3. Timoshenko, SP 1970, *Strength of Materials part I & II*, 3rd edn, McGraw-Hill.

Assessment	Percentage Mark
In-course Tutorials/Quizzes Mid Semester Examination	 20 30
End-semester	50

Course Code	CE317
Course Title	Civil Engineering Fieldwork
No. of Credits	3
Pre-requisites	CE210
Compulsory/Optional	Compulsory

Aim(s): To apply knowledge acquired in Engineering Surveying for a practical engineering situation, and to expose the students to the real world engineering applications/situations in irrigation engineering, environmental engineering, construction equipment and engineering geology.

Intended Learning Outcomes:

On successful completion of the course, the students should be able to;

1. Apply surveying methods to suit the land formation and gather required information of ground features to implement an engineering project.
2. Process field survey data and prepare maps and plans and setout intended engineering structures.
3. Identify different types of structures used in water distribution for irrigation purposes.
4. Observe the field techniques used in Environmental Engineering for treatment of water, wastewater, and solid waste management.
5. Identify different geological features, rock types and explain their importance in Civil Engineering.
6. Select appropriate construction equipment to perform different Civil Engineering tasks and explain their basic operational and management principles.

Time Allocation (Hours): Lectures: Tutorials: Fieldwork: 90

Course Content/Course Description:

1. **Survey Field camp:** The survey field camp which is usually held outside the university for a period of 10 consecutive days consists of a number of discussions followed by daily survey field exercises. Students work in a group of 6-8 students to produce drawings and other

information required for a given engineering project. Each exercise involves planning and execution of fieldwork followed by calculations, tabulation, presentation and reporting of the survey information through maps and plans, and setting out of an engineering structure on ground

2. **Field exercises in irrigation engineering:** Visit to a major irrigation project and identify field structures, applications and their limitations
3. **Field exercises in environmental engineering:** Visit to a treatment plant and identify the methods used to treat water/waste water and manage solid waste
4. **Geological field visit:** Visit to sites with different geological formations
5. **Construction equipment Training:** One day training at heavy equipment training site/ institute

Recommended Texts:

Cuomo PA 2003, *Surveying Principles for Civil Engineers*, Professional Publications

Assessment	**Percentage Marks**
In-Course	
Surveying field camp	75
Irrigation field visit	05
Environmental field visit	05
Geological field visit	05
Construction Equipment	10
End-semester	-

Course Code	CE318
Course Title	Transportation and Highway
No. of Credits	Engineering
Pre-requisites	3
Compulsory/Optional	-
	Compulsory

Aim(s): To impart knowledge on transportation planning, traffic engineering and management and to provide with design methods and maintenance techniques of highways using suitable materials.

Intended Learning Outcomes:

On successful completion of the course, the students should be able to;

1. Describe transportation systems and different methods of transportation planning
2. Design a flexible pavement selecting appropriate highway construction materials
3. Design highway drainage and plan highway maintenance procedures
4. Measure and interpret traffic data and plan suitable traffic management systems

Time Allocation (Hours): Lectures: 38 Tutorial: 2 Fieldwork: 10

Course Content/Course Description:

1. **Introduction to Transportation Engineering**
2. **Basic Transportation Planning and Demand Estimation**
3. **Highway construction materials:** Introduction to soil, compaction tests, field compaction procedures, CBR test, production and testing of aggregates, production and testing of bitumen
4. **Highway Designs:** Introduction to geometric designs, vertical and horizontal curves, compound curves, setting out of curves, main highway pavement types, empirical methods of flexible pavement designs, design charts, mechanistic methods of flexible pavement designs, and introduction to rigid pavement, importance of drainage in highways, types of drains and culverts
5. **Highway maintenance:** Introduction to highway evaluation and maintenance, basic maintenance categories and activities,

economic aspects of highway maintenance

6. **Traffic Engineering:** Fundamentals of traffic flow, traffic flow theory, speed-flow-density relationships, highway capacity and level of service, traffic surveys
7. **Traffic Management:** Introduction to traffic management and travel demand management

Recommended Texts :

1. Garber, NJ & Hoel, LA 2014, *Traffic & Highway Engineering*. 5th edn. USA.
2. Fricker, JD & Whitford, R 2004, *Fundamentals of Transportation Engineering*, 1st edn, USA.

Assessment	**Percentage Marks**
In-Course	
Tutorials/Fieldwork/Quizzes	20
Mid Semester Examination	20
End-semester	60

Course Code	CE319
Course Title	Civil Engineering Laboratory II
No. of Credits	1
Pre-requisites	CE202, CE204
Compulsory/Optional	Compulsory

Aim(s): To give understanding of engineering principles through experimentation and to develop the ability to perform tests used in Civil Engineering using standards.

Intended Learning Outcomes:
On successful completion of the course, the students should be able to;

1. Perform tests in Civil Engineering and relate underlying engineering principles involved.
2. Perform laboratory tests in Civil Engineering using standards in practice and to interpret the results.
3. Write a report on the findings of experiments.
4. Work effectively as a member of a team to accomplish a given task.

Time Allocation (Hours): Lectures: Tutorials: Practical: 30 Assignments:

Course content/Course description:
Development of experimental skills; Use of experimental procedures in mechanics of materials, geotechnical and transportation engineering, hydraulic engineering; performance of standard tests used in Civil Engineering and interpretation of their results

Recommended Texts :

1. Gere, JM & Timoshenko, SP 1997, *Mechanics of Materials*, 4th edn, PWS Publishing Company, Boston.
2. Ashby, MF & Jones, DRH 1998, *Engineering Materials 2*, 2nd edn, Butterworth Heinemann.
3. Head, KH, 1994, *Manual of Soil Laboratory Testing*, Vol.1,2,3, 3rd edn, John Wiley & Sons.
4. Douglas, FM, Gasoriek, JM, Swaffield, JA & Jack, LB 2011, *Fluid Mechanics*, 6th edn, Prentice Hall.
5. Rice, EW, Baird, RB (eds), Eaton, AD & Clesceri, LS 2012, *Standard Methods for the Examination of Water and Wastewater*, 22nd edn, American Public

Health Association, American Water Works Association, Water Environment Federation	
Assessment	**Percentage Mark**
In-course Coursework Mid Semester Examination	 60 -
End-semester	40

Course Code	CE320
Course Title	Civil Engineering Laboratory III
No. of Credits	1
Pre-requisites	CE219, CE319
Compulsory/Optional	Compulsory

Aim(s): To identify the tests required for Civil Engineering design/ construction and perform the required tests and analyze their results for quality control purposes or to obtain material parameters for design.

Intended Learning Outcomes:

On successful completion of the course, the students should be able to;

1. Select material parameters required for a given Civil Engineering design and choose the required tests to obtain them.
2. Perform laboratory tests in Civil Engineering using standards and to analyze the results to obtain material parameters.
3. Demonstrate the principles of optimum design by testing the model engineering component constructed according to specifications.
4. Work effectively as a member of a team to accomplish a given task.

Time Allocation (Hours): Lectures: Tutorials: Practical: 30 Assignments:

Course content/Course description:

Application of laboratory tests and experimental procedures in the solution of engineering problems

Recommended Texts :

1. Head KH, 1994, *Manual of Soil Laboratory Testing*, Vol.1,2,3, 3rd edn, John Wiley & Sons.

Assessment	**Percentage Mark**
In-course	
Coursework	60
Mid Semester Examination	-
End-semester	40

Course Code	CE402
Course Title	Multi-Disciplinary Design Project
No. of Credits	3
Pre-requisites	-
Compulsory/Optional	Compulsory

Aim(s): To consider alternative solutions to a multi-faceted real-life engineering problem involving society, resources, and environment, by applying a holistic approach to arrive at and produce a conceptual design for the optimal solution.

Intended Learning Outcomes:

On successful completion of the course, the students should be able to;

1. Discuss the various aspects of a project in particular, the life of a project, project financing and approval process for a multi-disciplinary project.
2. Describe the EIA, TIA and social assessment processes for a multi-disciplinary project considering safety, sustainability and ethical conduct.
3. Identify and estimate the costs and benefits of alternatives for a multi- disciplinary project and perform economic and financial analyses to arrive at the optimal solution.
4. Prepare a conceptual design for the optimal solution proposed.

Time Allocation (Hours): Lectures: 14 Tutorial: 01 Project/Assignments: 60

Course content/Course description:

1. Life of an Infrastructure Project
2. Project Appraisal Process - Identification and estimation of costs and benefits of projects, economic and financial analysis
3. EIA and TIA Processes, safety and sustainability considerations, Social Assessment of projects
4. Professional Ethics
5. Project Financing (short-term / long-term)
6. Multi-Disciplinary Design Project

Recommended Texts (if any):

1. Department of National Planning, 2001, *Assessing Public*

Investment in the Transport Sector, Colombo.	
Assessment	**Percentage Mark**
In-course	
Assignments/Quizzes	5
Project Presentations	25
End-semester	
Examination	20
Final Project Presentation and Viva-voce	20
Final Project Report	30

Course Code	CE403
Course Title	Construction Management
No. of Credits	3
Pre-requisites	MA201
Compulsory/Optional	Compulsory

Aim(s): To introduce construction management aspects to carryout management tasks at a construction site and provide an understanding of legal aspects related to the construction industry of Sri Lanka, in particular industrial law as applied to Civil Engineering contracts.

Intended Learning Outcomes:

On successful completion of the course, the students should be able to;

1. Describe the functional elements of project management and to identify the role of client, consultant and contractor during the project life cycle.
2. Explain the time, cost, quality, safety / health, risk management, disputes and dispute resolution, industrial relations issues and marketing aspects in the construction industry.
3. Explain the procurement process, bidding and award of contracts.
4. Describe the Site Management aspects in particular site layout planning, documents and records, meetings, progress monitoring and control, site supervision.
5. Analyse cash flow, recognize basic material and construction equipment management concepts for a construction project.
6. Illustrate how industrial law and other acts and laws pertaining to construction industry in Sri Lanka, is applied to a Civil Engineering contract.

Time Allocation (Hours): Lectures: 42 Tutorial: 03 Practical

Course content/Course description:

1. **Project management:** Functional elements of project management
2. **Construction management:** Construction projects, project life cycle, methods in project management, cost engineering, value engineering, quality management, safety and health in

construction, risk management, disputes and dispute resolution, industrial relations

3. Marketing aspects of construction industry
4. Industrial law and Civil Engineering contracts, acts and laws pertaining to construction industry in Sri Lanka
5. Procurement process, bidding and award of contracts
6. **Site Layout planning:** Space planning, access to site, office and storage facilities, utility services, site safety and security, fencing and lighting, parking, circulation and vertical transport
7. **Site management:** Roles of consultant and contractor at site, documents and records, meetings, progress monitoring and control, site supervision, cash flow management, introduction to material and construction equipment management

Recommended Texts:

1. McCaffer, HR, Edum-Fotwe, F 2013, *Modern Construction Management*, Wiley-Blackwell
2. Schexnayder, CJ, Mayo, R 2003, *Construction Management Fundamentals* 2003, McGraw-Hill.
3. Arulanantham, J *Contract of Employment : cases and commentaries*

Assessment	**Percentage Mark**
In-course	
Assignment/Quizzes	20
Mid Semester	20
End-semester	60

Course Code	CE405
Course Title	Civil Engineering Project I
No. of Credits	3
Pre-requisites	-
Compulsory/Optional	Compulsory

Aim(s): To plan a research project of Civil Engineering relevance by learning how to conduct a literature review, to develop a research methodology, to write a research proposal, and to report and present the work.

Intended Learning Outcomes:

On successful completion of the course, the students should be able to;

1. Plan a research work of Civil Engineering relevance.
2. Search and review literature for the relevant problem.
3. Formulate the scope of the project and develop the methodology.
4. Identify the materials and resources required.
5. Prepare a research budget and a schedule for the project.
6. Write and present the research proposal.

Time Allocation (Hours): Lectures: 6 Tutorial: Practical: 78

Course content/Course description:

Problem identification; literature survey and review; technical feasibility, environmental and social impact study; safety and ethical considerations; detailed project formulation; technical report writing and oral presentation

Recommended Texts:

1. Lebrun JL 2007, *Scientific writing: A reader and writers guide*, World Scientific Publishing, Singapore.
2. Ying LW, Ho L, Tzu MNE 2009, *Research writing: A workbook for graduate students*, Prentice Hall, Singapore.
3. Weissberg R, Buker S 1990, Writing up research: *Experimental research report writing for students of English,* Prentice Hall, USA.

Assessment	**Percentage Mark**

In-course Continuous Assessment Oral Presentation	 30 30
End-semester Report	 40

Course Code	CE406
Course Title	Civil Engineering Project II
No. of Credits	3
Pre-requisites	CE405
Compulsory/Optional	Compulsory

Aim(s): To implement the research proposal made in CE405 and to analyse the results, and to report and disseminate the findings through oral presentations, a formal report, a poster and technical paper/s.

Intended Learning Outcomes:

On successful completion of the course, the students should be able to;

1. Design and build necessary experimental setups and /or analytical programs.
2. Collect, analyse and interpret data/observations to reach logical conclusions.
3. Write a formal report and make an oral presentation to defend the outcome.
4. Disseminate technical information/findings through posters, technical paper/s.

Time Allocation (Hours): Lectures: Tutorial: Practical: 90

Course content/Course description:

Continuation of CE 405 –Project I: design of experimental rigs and/or development of analysis programs, execution of investigations, analysis of results, drawing logical conclusions, oral presentation and preparation of a formal report, posters, and technical paper/s

Recommended Texts:

1. Lebrun JL 2007, *Scientific writing: A reader and writers guide*, World Scientific Publishing, Singapore.
2. Ying LW, Ho L, Tzu MNE 2009, *Research writing: A workbook for graduate students*, Prentice Hall, Singapore.
3. Weissberg R, Buker S 1990, Writing up research: *Experimental research report writing for students of English,* Prentice Hall, USA.

Assessment	Percentage Mark
In-course	
Continuous Assessment	30
Oral Presentation	30
End-semester	
Report	40

Course Code	CE514
Course Title	Ground Improvement and Geosynthetics
No. of Credits	2
Pre-requisites	-
Compulsory/Optional	Optional

Aim(s): To impart knowledge on appropriate use of geosynthetics and on design of a suitable method of ground improvement.

Intended Learning Outcomes:

On successful completion of the course, the students should be able to;

1. Describe methods of ground improvement and to select the most suitable ground improvement technique for a given situation.
2. Recognise different types of geosynthetic materials and to evaluate their engineering properties.
3. Design a suitable ground improvement system using appropriate geosynthetic materials where required.
4. Evaluate the performance of soil stabilization, stone columns, jet grouting and deep mixing methods of ground improvement.

Time Allocation (Hours): Lectures: 25 Tutorial: 3 Practical: Assignments: 4

Course content/Course description:

1. Introduction to ground improvement and geosynthetics
2. Geosynthetics (materials, testing, applications and design)
3. Preloading (PVD/vacuum)
4. Soil stabilization (lime, cement, flyash)
5. Stone columns, jet grouting, deep mixing
6. Other techniques of ground improvement (dynamic compaction, vibroflotation, blasting, vegetation, osmosis, ground freezing)

Recommended Texts:

1. Bergado, DT, Anderson, LR, Miura, N & Balasubramaniam, AS 1996, *Soft ground improvement in lowland and other*

environments, American Society of Civil Engineers Press.
2. Das, BM 2011, *Principles of foundation Engineering*, 7th edn, Global Engineering.
3. Robert, MK 1997, *Designing with geosynthetics*, 5th edn, Prentice Hall.

Assessment	**Percentage Mark**
In-course Assignment/Quizzes/Design	40
End-semester	60

Course Code	CE515
Course Title	Geohazard Management
No. of Credits	2
Pre-requisites	-
Compulsory/Optional	Optional

Aim(s): To impart knowledge on hazards, hazard management and mitigation with special reference to landslides, earthquakes, ground subsidence and salt water intrusion.

Intended Learning Outcomes:

On successful completion of the course, the students should be able to;

1. Describe principles of hazard management and apply them to find ways to mitigate geohazards.
2. Identify landslide hazard and propose structural and non-structural measures to mitigate the same.
3. Describe the seismic hazard with particular reference to Sri Lanka and determine necessary parameters for earthquake resistant design.
4. Identify and propose solutions to problems of ground subsidence, salt water intrusion and man-made hazards.

Time Allocation (Hours): Lectures: 24 Tutorial: 3 Practical: Assignments: 6

Course content/Course description:

1. Hazard management (hazards, control/prevention, mitigation)
2. Landslides (types, causes, remedial actions, mitigation, instrumentation)
3. Earthquakes (occurrence, impact, analysis and mitigation)
4. Ground subsidence (sinkholes, dewatering), salt water intrusion
5. Manmade hazards (vibrations, contaminants)

Recommended Texts :

1. Laming, DJC, Mccall, GJH & Scott, SC 1992*, Geohazards: natural & man-made*, Springer.

2. Mccall, GJH, Laming, DJC & Scott, SC 1990, *Geohazards: natural & man-made*, Journal of the geological society, 147: 879-881.
3. Abramson, LW 2002, *Slope stability and stabilization methods*, 2nd edn, John Wiley & Sons.
4. Seed, HB 1967, *Soil stability problems caused by earthquake,* Soil Mechanics and Bituminous Materials Laboratory, University of California.
5. Gupta, HK 1976, *Dams and earthquakes*, Elsevier.

Assessment	**Percentage Mark**
In-course Project Report/Presentation/Assignment/Quizzes	50
End-semester	50

Course Code	CE521
Course Title	Advanced Geomechanics
No. of Credits	2
Pre-requisites	CE 204
Compulsory/Optional	Optional

Aim(s): To impart knowledge and understanding of stress-strain and failure behaviour of soils and rocks under static and dynamic conditions.

Intended Learning Outcomes:
On successful completion of the course, the students should be able to;

1. Describe different stress-strain models of soils and apply them to interpret real soil behaviour under static and dynamic conditions.
2. Evaluate failure conditions of soil structures using limit theorems of plasticity.
3. Interpret the behaviour of soils using critical state framework.
4. Explain stress-strain behaviour of rocks and analyse geological structures

Time Allocation (Hours): Lectures: 25 Tutorials: 5 Practical: Assignments:

Course content/Course description:

1. Stress-strain models of elasticity, non-linear, anisotropic and visco-elastic models
2. Theory of plasticity, elasto-plastic models
3. Limit analysis :bound theorems of plasticity and applications
4. Critical state soil mechanics, Cam-clay models of soil behaviour
5. Dynamic behaviour of soils and rocks
6. Stress-strain behavior of rocks by mechanical and ultrasonic wave velocity methods
7. Analysis of geological structures

Recommended Texts:

1. Atkinson, JH & Bransby, PL 1978, *The Mechanics of Soils: An Introduction to Critical State Soil Mechanics*, Mc.Graw Hill, New York.

2. Atkinson, JH 1993, *An introduction to The Mechanics of Soils and Foundations, through critical state soil mechanics*, McGraw-Hill, New York.
3. Blyth, FGH & De Freitas, MH 1974, *Geology for Engineers*, Hodder Arnold, London.
4. Cooray, PG 1967, *An Introduction to the Geology of Sri Lanka*, National Museum of Sri Lanka.
5. Cooray, PG 1984, *An Introduction to the Geology of Sri Lanka*, National Museum of Sri Lanka.
6. Scott, CR 1994, *An introduction to soil mechanics and foundations*, 3rd edn, Applied Science Publishers.
7. Wood, DM 1990, *Soil Behaviour and Critical State Soil Mechanics*, Cambridge University Press.

Assessment	**Percentage Mark**
In-course Tutorials/Assignment/Quizzes	40
End-semester	60

Course Code	CE522
Course Title	Foundation Engineering
No. of Credits	2
Pre-requisites	CE 310
Compulsory/Optional	Optional

Aim(s): To impart knowledge and understanding of bearing capacity theory, analysis and design of foundations, foundations subjected to lateral loads and under difficult ground conditions, foundations subjected to dynamic loads and special considerations in the construction of foundations.

Intended Learning Outcomes:
On successful completion of the course, the students should be able to;

1. Analyse and design a suitable shallow foundation under different ground and loading conditions including dynamic loading.
2. Analyse and design a deep foundation under various ground and loading conditions.
3. Recognise and characterize engineering properties of problematic soils and design an appropriate foundation accordingly.
4. Improve existing foundations to suit new situations.

Time Allocation (Hours): Lectures: 26 Tutorials: 4 Practical: Assignments:

Course content/Course description:

1. Special foundations, shallow foundations under inclined loads, foundations on slopes
2. Flexible design of foundations
3. Deep foundations, pile groups, laterally loaded piles, negative skin friction, piles in tension
4. Machine foundations
5. Foundations under difficult ground conditions (collapsible, expansive, peat, sanitary landfills)
6. Improvement of existing foundations

Recommended Texts:

1. Bell, FG 2013, *Foundation engineering in difficult ground*, Elsevier.
2. Bowles, JE 1997, *Foundation analysis and design*, 5th edn, McGraw-Hill, Singapore.
3. Das, BM 2011, *Principles of foundation engineering*, 7th edn, Cengage-Learning, USA.
4. Gunarathna, M 2013, *The foundation engineering handbook*, *CRC Press.*
5. Malcolm, S 1998, *Geomembranes and the control of expansive soils in construction,* McGraw-Hill.
6. Winterkorn, HF 1975, *Foundation engineering handbook*, Van Nostrand Reinhold.

Assessment	**Percentage Mark**
In-course Tutorials/Assignment/Quizzes	40
End-semester	60

Course Code	CE523
Course Title	Geotechnical Design and Construction
No. of Credits	2
Pre-requisites	CE 310
Compulsory/Optional	Optional

Aim(s): To impart knowledge of how to plan and execute a geotechnical engineering project selecting the best option considering the holistic nature.

Intended Learning Outcomes:
On successful completion of the course, the students should be able to;

1. Organise and perform a site investigation programme for a selected geotechnical project including field surveys and shallow and deep investigations, locating suitable geotechnical structures where necessary.
2. Perform and analyse laboratory tests and select the optimum geotechnical engineering solution for the project.
3. Analyse and design in concept the geotechnical structures proposed considering the holistic nature, constructability and suitable equipment.
4. Prepare a cost estimate for the project and produce a final report for the project.

Time Allocation (Hours): Lectures 5 Tutorials: Practical: Assignments: 50

Course content/Course description:

1. Planning site investigation
2. Desk study and report
3. Site visit
4. Conceptual design
5. Detailed site investigation and report
6. Selection of optimal design (considering natural hazards, constructability and value engineering)
7. Design of foundations, retaining structures and slopes using computer software, Construction sequence, cost estimation

Recommended Texts:

1. Abramson, LW 2002, *Slope stability and stabilization method, John Wiley & Sons.*

2. Kulhawy, FH 1989, *Foundation Engineering Current Principles and Practices, ASCE.*
3. Robert, WD 1999, *Geotechnical and foundation engineering: design & constructions, McGraw-Hill Professionals.*
4. Robb, AD 1982, *Site investigation*. *Telford, London.*
5. Tomlinson, MJ 2001, *Foundation design and construction*, 7th edn, Pearson.

Assessment	**Percentage Mark**
In-course	
Report/Quizzes	30
Presentation	30
Final Report	40
End-semester	-

Course Code	CE532
Course Title	Highway Engineering and Design
No. of Credits	2
Pre-requisites	CE318
Compulsory/Optional	Optional

Aim(s): To introduce functions and types of highways, highway planning, design criteria, highway construction materials and techniques, and highway evaluation and maintenance and computer application of highways. Design component aims at designing a comprehensive highway section with given parameters.

Intended Learning Outcomes:

At the end of the course the student should be able to;

1. Predict traffic loading for the design life using standard methods.
2. Design flexible and rigid pavements.
3. Choose basic physical properties of highway materials for proper design and construction.
4. Select appropriate construction materials for flexible and rigid pavements based on environmental factors.
5. Determine the appropriate maintenance and rehabilitation techniques.

Time Allocation (Hours): Lectures: 22 Tutorials: 2 Design: 12

Course Content/Course Description:

1. Introduction to highway planning and route planning
2. Pavement design (flexible and rigid using mechanistic approach)
3. Highway construction material improvements
4. Highway construction techniques
5. Basic introduction to highway structures (culverts, bridges, tunnels, interchanges, toll gates, ramps, viaducts, etc.)
6. Highway evaluation and maintenance
7. Introduction to computer applications in highway engineering (e.g. HDM 4)
8. Highway design exercise

Recommended Texts : 1. Huang, YH 2003, *Pavement Analysis and Design*, 2nd edn, Prentice Hall.	
Assessment	**Percentage Marks**
In-Course Tutorials/Quizzes/Design Exercise	40
End-semester	60

Course Code	CE533
Course Title	Traffic Engineering
No. of Credits	2
Pre-requisites	CE318
Compulsory/Optional	Optional

Aim(s): To impart knowledge on the design of intersections and other roadway facilities using traffic and transportation theories.

Intended Learning Outcomes:

On successful completion of the course, the students should be able to;

1. Apply traffic flow theory to find solutions for traffic flow problems.
2. Estimate the congestion and delays due to traffic incidents using theory of shock waves and calculate the queuing length.
3. Design intersections, roundabouts, and signal timing.
4. Identify accident black spots and suggest mitigatory measures.
5. Design pedestrian and parking facilities.

Time Allocation (Hours): Lectures: 22 Tutorials: 2 Design: 12

Course Content/Course Description:

1. Traffic flow characteristics and traffic flow theory
2. Theory of shock waves, queuing theory
3. Design of intersections, roundabouts and signalised intersections
4. Accident analysis and road safety
5. Design of pedestrian facilities
6. Parking analysis and facility design
7. Computer applications in traffic engineering

Recommended Texts:

1. Garber, NJ & Hoel, LA 2014, *Traffic & Highway Engineering*. 5th edn, USA.
2. Fricker, JD & Whitford, RK 2004, *Fundamentals of Transportation Engineering*, Prentice Hall.
3. Kadiyali, LR 1997, *Traffic Engineering and Transportation Planning*, 6th edn, Khanna Publishers, Delhi.

4. McShane WR & Roess RP 1990, *Traffic Engineering*, Prentice Hall, New Jersey.	
Assessment	**Percentage Marks**
In-Course Tutorial/Quizzes/Design Exercises	40
End-semester	60

Course Code	CE534
Course Title	Traffic Management
No. of Credits	2
Pre-requisites	CE318
Compulsory/Optional	Optional

Aim(s): To introduce travel demand management (TDM) and traffic management techniques so that students will be able to design appropriate TDM measures and traffic management techniques for a given situation.

Intended Learning Outcomes:

On successful completion of the course, the students should be able to;

1. Demonstrate how TDM measures are used to manage travel demand.
2. Design suitable traffic management systems for urban and local environments.
3. Apply knowledge of TDM and traffic management techniques to manage traffic in a given locality.

Time Allocation (Hours): Lectures: 22 Tutorials: 2 Case Study: 12

Course Content/Course Description:

1. Causes of urban traffic congestion: Congestion costing
2. Introduction to travel demand management: TDM techniques, peak spreading, flexible work schedules, telecommuting
3. Traffic management: Traffic management techniques, traffic restraints, area-wide traffic control
4. Electronic road pricing, ITS applications in traffic management
5. Parking management: Parking restraints
6. Traffic safety: Traffic calming, school zones, accessibility for elderly and disabled
7. Case studies in travel demand management and urban traffic management

Recommended Texts :

Assessment	**Percentage Marks**
In-Course Tutorial/Quizzes/Case Study	40
End-semester	60

Course Code	CE535
Course Title	Transportation Planning
No. of Credits	2
Pre-requisites	CE318
Compulsory/Optional	Optional

Aim(s): To plan sustainable transportation systems or components considering future demand as well as social, environmental, engineering and economic aspects.

Intended Learning Outcomes:

On successful completion of the course, the students should be able to;

1. Apply conventional four-step approach to plan city transportation
2. Assess the performance of public mass transport, air and maritime transport, freight transport and non-motorised transport
3. Analyse economic feasibility of a transportation system

Time Allocation (Hours): Lectures: 20 Tutorials: 4
Planning Exercise: 12

Course Content/Course Description:

1. Transport surveys: O-D surveys, land-use surveys, public transport surveys, freight transport survey
2. Transportation planning process: four-step approach (trip generation, trip distribution, modal choice, traffic assignment)
3. Public mass transport
4. Air and maritime transport
5. Freight transport
6. Transport economics
7. Sustainability in transport
1. Energy and environment in urban transport
2. Non-motorised transport, planning of pedestrian and bicycle facilities
3. Transport and land use: urban form, urban sprawl, smart cities

Recommended Texts:

1. Fricker, JD &Whitford, RK 2004, *Fundamentals of Transportation Engineering,* Prentice Hall.
2. Ortuzar, JD & Willumsen LG 1994, *Modelling Transport*, 2nd edn, John Wiley, England.

Assessment	**Percentage Marks**
In-Course Tutorial/Quizzes/Planning Exercise	40
End-semester	60

Course Code	CE542
Course Title	Hydraulic Structures
No. of Credits	2
Pre-requisites	CE311
Compulsory/Optional	Optional

Aim(s): To introduce hydraulic structures used in water resources development and management, coastal zone management and harbours, and to provide knowledge on their selection and design.

Intended Learning Outcomes:
On successful completion of the course, the students should be able to;

1. Explain the purposes of different types of hydraulic structures and to select appropriate structures for given application based on technical, economic and environmental feasibility.
2. Carry out hydraulic analysis and to provide conceptual designs of appropriate structural components of hydraulic structures.
3. Plan and monitor safety aspects of hydraulic structures.

Time Allocation (Hours): Lectures: 27 Tutorials: 02 Practical: Assignments: 02

Course Content/Course Description:

1. **Dams and Outlet Works:** Loads, types, site selection, design flood, sluices, spillways, intakes, fish passes, energy dissipaters, gates and valves, instrumentation on monitoring and safety
2. **Diversion and water conveyance structures:** Weirs and barrages, tunnels, canals, flumes, cross drainage, measuring structures, transitions, siphons, aqueducts, drop structures, irrigation distribution systems; turn-outs, distribution canals
3. **Storm water drainage:** Urban storm water drainage systems, modeling of storm water networks, culverts
4. **Coastal and Harbor Structures:** Groynes, revetments, sea walls, off-shore breakwaters, harbour structures

Recommended Texts:

1. Novak, P, Moffat, AIB, Nalluri, C & Narayanan, R 2006, *Hydraulic Structures*, 4th edn, CRC Press.
2. Garg, SK 2005, *Irrigation Engineering and Hydraulic Structures*, 19th edn, Khanna Publishers.
3. Tanchev, L 2014, *Dams and Appurtenant Hydraulic Structures*, 2nd edn, CRC Press.

Assessment	**Percentage Marks**
In-Course Tutorials/Quizzes/Assignments	40
End-semester	60

Course Code	CE545
Course Title	Coastal Engineering and Coastal Zone Management
No. of Credits	2
Pre-requisites	CE311
Compulsory/Optional	Optional

Aim(s): To provide an in-depth analysis of coastal hydrodynamic and wave processes and to introduce application of engineering principles to solve problems in coastal environment giving due consideration to coastal zone management programme.

Intended Learning Outcomes:
On successful completion of the course, the students should be able to;

1. Explain wave generation, propagation, forecasting, measurements and wave analysis.
2. Apply wave theories to analyse coastal hydrodynamic processes.
3. Analysis of coastal processes that need to be considered in coastal engineering design projects, such as coastal protection structures and harbour structures.
4. Calculate scales for hydraulic modelling and be aware of scale effects.
5. Describe and plan coastal zone management programme.

Time Allocation (Hours): Lectures: 27 Tutorials: 02 Practical: - Assignments: 02

Course Content/Course Description:

1. **Coastal Environment:** Coastal features, tides, wave generation by wind, wave propagation and forecasting, wave measurements, wave analysis
2. **Coastal and Estuarine Hydraulics:** Wave theories, estuarine environment, sediment transport in estuaries
3. **Nearshore Coastal Processes:** Nearshore currents, wave breaking, longshore sediment transport, onshore-offshore sediment transport
4. **Coastal and Harbor Structures:** Coast protection structures, port and harbor structures, hydraulic and structural responses,

introduction to physical modeling

5. **Coastal Zone Management in Sri Lanka:** Environmental problems of Sri Lankan coast, coastal hazards, development of coastal zone management program.

Recommended Texts:

1. Sorensen, R, 2005, *Basic Coastal Hydraulics*, Springer-Verlag, New York.
2. Wijetunge, JJ 2013, *An Introduction to Coastal Engineering – Processes, Theory, Hazards and Design Practice*, Colombo, S. Godage Publishers.
3. Kamphuis, JW 2010, *Introduction to Coastal Engineering and Management*, Singapore, World Scientific.
4. Dean, RG & Dalrymple, RA 2004, *Coastal Processes with Engineering Applications*, Cambridge, Cambridge University Press.

Assessment	**Percentage Marks**
In-Course Tutorials/Quizzes/Assignments	40
End-semester	60

Course Code	CE553
Course Title	Irrigation and Drainage Engineering
No. of Credits	2
Pre-requisites	CE311
Compulsory/Optional	Optional

Aim(s): To provide a sound knowledge on engineering concepts in the field of irrigation and drainage engineering.

Intended Learning Outcomes:
On successful completion of the course, the students should be able to;

1. Describe principles and processes necessary to effectively manage water resources through well designed drainage and irrigation systems.
2. Apply appropriate techniques and analyses for the selection of low cost irrigation methods.
3. Evaluate and choose water delivery system including the preparation of irrigation water schedules.
4. Carry out preliminary designs for both irrigation and drainage systems in agricultural fields.

Time Allocation (Hours): Lectures: 25 Tutorials: 4 Practical: Assignments: 2

Course Content/Course Description:

1. **Planning of Irrigation and Drainage Development:** Project identification, feasibility studies, implementation and operation, intensification of existing irrigation systems, participatory development, sustainability
2. **Water Requirements/Delivery Systems:** Crop water requirements, irrigation water requirement, leaching requirements, land preparation
3. Continuous system, Rotational system, Supply and demand
4. **Methods of Irrigation:** Surface irrigation, sub-surface irrigation, overhead and drip irrigation
5. **Irrigation Structures:** Design, operational and maintenance aspects of irrigation structures
6. **Irrigation Water Management:** Yield response to water, irrigation scheduling techniques

7. **Introduction to computer applications:** Cropwat, WEAP
8. **Drainage Requirements and Systems:** Factors affecting drainage, Surface and sub-surface drainage systems

Recommended Texts :

1. Michael, AM 1978, *Irrigation Theory & Practices*, Amazing Books International, India.
2. Kumar, S 1987, *Irrigation Engineering and Hydraulic Structures*, Khanna Publishers, India.
3. Sharma, RK & Sharma, TK 1991, *Irrigation and Drainage Engineering*, Oxford & IBH Publishing Co Pvt. Ltd, India.

Assessment	Percentage Marks
In-Course Tutorials/Quizzes/Assignments/Course Work	40
End-semester	60

Course Code	CE561
Course Title	Integrated River Basin Management
No. of Credits	2
Pre-requisites	CE205
Compulsory/Optional	Optional

Aim(s): To introduce watershed planning and management approaches, specifically in terms of soil and water management.

Intended Learning Outcomes:
On successful completion of the course, the students should be able to;

1. Appraise and use of water management modelling concepts and integrated water management principles.
2. Formulate and analyse a management problem in a given water management system.
3. Implement catchment conservation practices.

Time Allocation (Hours): Lectures: 22 Tutorials: 05 Practicals: Assignments: 06

Course Content/Course Description:

1. **Basics of Integrated River Basin Management:** IRBM Principles, concept of integration, socio-economic and environmental consideration, institutional arrangement, participatory approach and decentralization
2. **Status of Water Resources:** Surface water and groundwater supplies, catchments management, climate/hydrological changes, water pollution and health
3. **Management of Water Resources:** Demand forecasting and management, water use efficiency, water conservation, treatment and reuse, risk management
4. **Decision Support for Planning and Management:** Water resources systems analysis, linear programming, dynamic programming, simulation in resource allocation and management
5. **Policies and Goals:** Water policy and national goals, water law, water rights and ownership, public awareness and education
6. **Catchment Conservation:** Soil conservation, sediment yield,

sediment modeling, pollution in catchments, water quality control	
Recommended Texts : 1. Loucks, DP and Van Beek, E 2005, *Water Resources Systems Planning and Management: An Introduction to Methods, Models and Applications*, UNESO, France.	
Assessment	**Percentage Marks**
In-Course Tutorials/Quizzes/Assignments/ Course Work	40
End-semester	60

Course Code	CE568
Course Title	Industrial Pollution Control
No. of Credits	2
Pre-requisites	CE302
Compulsory/Optional	Optional

Aim(s): To make students familiarize with industrial pollution control concepts and techniques by introducing industrial waste management options, and legal & policy aspects.

Intended Learning Outcomes:
On successful completion of the course, the students should be able to;

1. Distinguish industrial waste management from municipal waste management.
2. Explain waste monitoring, reporting and control in relation to national, regional and international policy and legal aspects.
3. Recognize importance of in-plant waste management, waste & wastewater treatment systems and application of environmental management systems.
4. Evaluate options available for planning, designing and execution of industrial waste management programs.
5. Design industrial waste management programs with consideration of operation and maintenance of such systems, with the use of Best Available Technologies (BAT).

Time Allocation (Hours): Lectures: 24 Tutorials: 01 Practical: 04 Assignments: 06

Course Content/Course Description:

1. **Introduction to industrial waste:** Industrial waste characterization/testing and basic industrial waste management concepts
2. **Legal and policy aspects:** National, regional and international rules and agreements
3. **In-plant waste management:** (Waste Minimization, Cleaner Production, Reclamation and Reuse), Environmental Management Systems and related case studies

4. **Industrial wastewater management:** primary, secondary and tertiary treatment unit processes for industrial wastewater treatment (specialized physical, chemical and biological treatment options)
5. **Industrial solid waste management**

Recommended Texts:

1. Tchobanoglous, G,Stensel, D, Tsuchihashi, R, Burton, F, and Metcalf & Eddy Inc., 2013, 5th ed., *Wastewater Engineering: Treatment and Reuse*, McGraw-Hill Education; New York.
2. Ranade, VV & Bhandari, VM 2014, *Industrial Wastewater Treatment, Recycling and Reuse*.1st edn.
3. Water Environment Federation, 2008. *Industrial Wastewater Management, Treatment, and Disposal -WEF Manual of Practice* 3rd edn.
4. Tchobanoglous, G 2015. *Integrated Solid Waste Management Engineering Principles and Management Issues*.

Assessment	Percentage Marks
In-Course Tutorials/Quizzes/Assignments/Course work	40
End-semester	60

Course Code	CE570
Course Title	Water Supply and Wastewater Engineering
No. of Credits	2
Pre-requisites	CE302
Compulsory/Optional	Optional

Aim(s): To introduce advanced concepts in water treatment and wastewater treatment to design suitable advanced treatment processes.

Intended Learning Outcomes:
On successful completion of the course, the students should be able to;

1. Recognise the need for environment, health, aesthetic and legislative needs for treatment of water and wastewater
2. Discuss technological trends and their drivers and emerging technologies focussing on Climate Change impacts, Footprints, Green technology, Zero emissions, etc.
3. Design and integrate appropriate water and wastewater treatment plant unit processes
4. Evaluate and identify operational and maintenance problems in existing water treatment and wastewater treatment systems and suggest suitable remedial measures.

Time Allocation (Hours): Lectures: 24 Tutorials: 02 Assignments: 08

Course Content/Course Description:

1. **Water supply:** Quantitative and quality needs and need for treatment, Non revenue water; Water supply intakes; Water demand; Drinking water distribution; Reuse of water; Rainwater harvesting, Climate Change impacts
2. **Advanced water treatment:** Desalination, Adsorption, Ion Exchange, Reverse Osmosis and Membrane Technology; Disinfection, Upgrading existing treatment plants; Climate Change impacts, Technological trends,
3. **Need for wastewater treatment:** Quantities and qualities of wastewater, Need for treatment, Reactor types and designs;

4. **Advanced wastewater treatment processes:** Physical processes, Biological processes; Suspended and attached growth Systems - conventional, on-site and high-efficiency/high rate and chemical coagulation, oxidation etc
5. **Energy optimization, Resources recovery and reuse:** Residuals management, Centralized vs decentralized systems., Energy optimization in treatment plants. Operation and Maintenance aspects

Recommended Texts:

1. Tchobanoglous, G,Stensel, D, Tsuchihashi, R, Burton, F, and Metcalf & Eddy Inc., 2013, 5th ed., *Wastewater Engineering: Treatment and Reuse*, McGraw-Hill Education; New York.
2. Crittenden, JC, Trussell, RR, Hand, DW, Howe, KJ & Tchobanoglous, G 2012, 3rd edn, *MWH's Water Treatment: Principles and Design*, Wiley, New Jersey.

Assessment	**Percentage Marks**
In-Course Tutorials/Quizzes/Assignments/Course Work	40
End-semester	60

Course Code	CE571
Course Title	Environmental Health and Sanitation
No. of Credits	2
Pre-requisites	CE302
Compulsory/Optional	Optional

Aim(s): Familiarizing students with water related health issues and appropriate engineering control measures by introducing basic water microbiology, microbial risk assessments and sanitary waste treatment techniques.

Intended Learning Outcomes:
On successful completion of the course, the students should be able to;

1. Explain the sanitation related public health and assess the associated risk of environmental health issues for any related microbiological or chemical hazards in water.
2. Devise control measures against microbiological hazards to minimize impacts on public health, using tools like Quantitative microbial risk assessment (QMRA)
3. Plan appropriate water management systems by identifying relevant engineering control measures to combat against a given level of health risk

Time Allocation (Hours): Lectures: 26 Tutorials: 02 Practical: 02 Assignments: 02

Course Content/Course Description:

1. **Introduction to water supply and sanitation:** Global Health, Global burden of disease
2. **Disease outbreaks:** Public health and hygiene, history of waterborne diseases, microbiology of drinking water, transmission routes of waterborne pathogens
3. **Identify hazards and hazardous events and assess the risks:** Microbiological risk, quantitative microbiological risk assessment, predictive microbiology
4. **Onsite and offsite sanitary treatment methods:** Special emphasis on low cost and appropriate technologies suited to developing world, risk tradeoffs
5. **Microbial source tracking:** Coliform bacteria detection

techniques in water

6. **Water Safety Plans (WSP) and Sanitation Safety Planning (SSP)**

Recommended Texts:

1. Asano, T, Urton, F, Leverenz, H, Tsuchihashi, R. & Tchobnoglous, G 2006, *Water Reuse: Issues, Technologies, and Applications* : Metcalf & Eddy, Inc. and AECOM.
2. Haas, CN, Rose JB & Gerba, CP 2014, *Quantitative Microbial Risk Assessment*, 2nd edn.
3. Batram J, Corrales L, Davison A, Deere D, Drury D, Gordon B, Howard G, Rinehold A & Steven M 2009, *Water safety plan manual: Step by step risk management for drinking water suppliers*, World Health Organization, Geneva.
4. WHO 2015, *Sanitation safety planning, Manual for safe use and disposal of wastewater, grey water and excreta*, World Health Organization, Geneva.

Assessment	**Percentage Marks**
In-Course Tutorials/Quizzes/Assignments/Course Work	40
End-semester	60

Course Code	CE586
Course Title	Dynamics of Structures
No. of Credits	2
Pre-requisites	-
Compulsory/Optional	Optional

Aim(s): To provide fundamental knowledge on theory of structural dynamics.

Intended Learning Outcomes:
On successful completion of the course, the students should be able to;

1. Describe the equations of motion of a dynamic system.
2. Analyse a system for dynamic loading in frequency and time domain.
3. Demonstrate vibration control measures of structures.

Time Allocation (Hours): Lectures 20 Tutorials 5 Practical Assignments 10

Course content/Course description:

1. **Role of dynamic analysis in structural engineering**
2. **Single degree of freedom system:** Equations of motion, free vibration; un-damped and damped; under damped, critical damped and over damped systems, Forced vibration; response to periodic and transient loadings
3. **Multi degree of freedom system:** Un-damped free vibration response, modal analysis, frequency domain response analysis, time domain response analysis
4. **Vibration Control of structures**

Recommended Texts :

1. Clough, R & Penzien, J 1975, *Dynamics of Structures*, 4th edn, McGraw-Hill.
2. Chopra, AK 2011, *Dynamics of Structures*, 4th edn, Prentice Hall.

Assessment	**Percentage Mark**
In-course Tutorials/Assignments/Quizzes	40
End-semester	60

Course Code	CE587
Course Title	Design of Structures III
No. of Credits	2
Pre-requisites	CE 306 & CE 312
Compulsory/Optional	Optional

Aim(s): To impart knowledge in advanced pre-stressed concrete (PC) design concepts and basics of design of water retaining, masonry and timber structures.

Intended Learning Outcomes:

On successful completion of the course, the students should be able to:

1. Design continuous pre-stressed concrete beams.
2. Design pre-stressed concrete slabs.
3. Design reinforced concrete water retaining structures.
4. Design masonry structures and timber structures.

Time Allocation (Hours): Lectures: 15 Tutorials: 4 Practical: 2 Assignments: 20

Course content/Course description:

1. Bridge load assessment
2. Design of simply supported /continuous PC beam
3. Composite PC beam design
4. End block design
5. Design of prestressed concrete slabs
6. Design of water retaining structures
7. Design of masonry structures
8. Structural timber design including glued-laminated members and composite sections

Recommended Texts:

1. EN 1991-2:2003, *Actions on Structures – Part 2: Traffic Loads on Bridge.*
2. EN 1992-1-1:2004, *Design of Concrete Structures – Part 1-1: General rules and rules for buildings.*
3. EN 1992-2:2005, *Design of Concrete Structures – Part 2: Concrete Bridges – Design and Detailing Rules.*
4. EN 1992-3:2006, *Design of Concrete Structures – Part 3:*

Liquid Retaining and containment structures.

5. Lin, TY & Burns, NH 1982, *Design of Prestressed Concrete Structures*, 3rd edn, John Wiley & Sons.
6. Porteous, J & Kermany, A 2013, *Structural Timber Design to Eurocode 5*, 2nd edn, Wiley Blackwell.
7. Morton, J 2012, *Designer's Guide to Eurocode 6: Design of Masonry Structures*, ICE Publishing.

Assessment	**Percentage Mark**
In-course Tutorials/Assignments/Coursework/Quizzes	40
End-semester	60

Course Code **Course Title** **No. of Credits** **Pre-requisites** **Compulsory/Optional**	CE588 Construction Equipment and Material Management 2 CE403 Optional

Aim(s): To introduce material management principles, construction equipment management principles and various construction methods and processes used in construction industry.

Intended Learning Outcomes:

On successful completion of the course, the students should be able to;

1. Plan material supply to a construction project.
2. Manage construction equipment for a Civil Engineering project.
3. Discuss various construction methods and processes used in construction projects.
4. Prepare site layout plan, select equipment and plan material supplies for a real-life construction project.

Time Allocation (Hours): Lectures: 20 Tutorials: 04 Assignments: 12

Course content/Course description:

1. **Material management:** Material requirements at construction sites, basics of inventory control and terminology, economic order quantity theory, finding optimum order quantities for fixed demand, variable demand and under quantity discounts as applied to construction projects
2. **Construction equipment management:** Types of construction equipment, selection of construction equipment, acquisition options of construction equipment, owning and operating costs of equipment, output estimation using cycle time approach, output estimation using formulae, complex operations involving multiple equipment, fleet matching, basic maintenance practices
3. **Construction technology:** Construction methods in earthwork operations, concreting processes, special construction processes

4. **Case study:** Case study involving site layout planning, equipment selection and material management as applied to a real-life construction project

Recommended Texts:

1. Taylor, J 2007, *Project Scheduling and Cost Control: Planning, Monitoring and Controlling - Planning Monitoring and Controlling the Baseline*, J. Ross Publishing.
2. Douglas & Gransberg, 2012, *Construction Equipment Management for Engineers, Estimators, and Owners (Civil and Environmental Engineering)*, CRC Press.

Assessment	**Percentage Mark**
In-course Assignments/Quizzes/Case Study	40
End-semester	60

Course Code	CE591
Course Title	Design of High-rise Buildings
No. of Credits	2
Pre-requisites	CE 306 & CE 312
Compulsory/Optional	Optional

Aim(s): To provide knowledge on different aspects of high-rise buildings and how to design high-rise buildings.

Intended Learning Outcomes:
On successful completion of the course, the students should be able to;

1. Explain the basic structural configurations for vertical and lateral load resistance system of high-rise buildings.
2. Describe building services for high-rise buildings.
3. Evaluate the behaviour of high-rise buildings against wind and earthquakes.
4. Analyse and design structural systems of high-rise buildings.

Time Allocation (Hours): Lectures: 17 Tutorials: 3
Assignments/Project: 20

Course content/Course description:

1. Configurations and behaviour of high-rise buildings
2. Review of design of gravity load resisting systems
3. Lateral load resisting systems
4. Building services applicable to high-rise buildings
5. Lateral load analysis; wind and earthquakes, codes of practice
6. Comprehensive structural analysis and design
7. Use of computer software for modelling and analysis

Recommended Texts:

1. Smith, BS and Coull, A 1991, *Tall Building Structures*, John Wiley.

Assessment	**Percentage Mark**
In-course Assignments/Quizzes	40
End-semester	60

Course Code	CE592
Course Title	Concrete Technology
No. of Credits	2
Pre-requisites	CE312
Compulsory/Optional	Optional

Aim(s): To impart knowledge in the properties of concrete and its ingredients in specifying, producing, using and caring of high-performance concrete for structures.

Time Allocation (Hours): Lectures: 28 Tutorials: Practical: Assignments: 4

Intended Learning Outcomes:

On successful completion of the course, the students should be able to;

1. Identify different types of cement based on their composition and performance.
2. Select most appropriate ingredients, based on their properties, for the production of concrete to suit the application.
3. Specify concrete with different characteristics for diverse conditions and applications.
4. Design concrete mixes to achieve specified performance requirements.
5. Evaluate the properties of concrete, working life, and judge compliance.
6. Propose suitable procedures for making, delivery, placing, finishing and caring of concrete, giving due consideration for the application.

Course content/Course description:

1. **Concrete as a composite:** Miscellaneous binders and matrices; historical progression; sustainability concepts; safety and health issues
2. **Types of cement:** Composition; properties; hydration and associated effects; cement testing; selection criteria
3. **Chemical and mineral admixtures:** Properties; selection criteria; application.
4. **Aggregate:** Types; normal and lightweight; recycled and reclaimed; properties; compliance criteria; testing; handling
5. **Water:** Supply-source based classification, compliance

criteria

6. **Concept of high-performance concrete:** Methods of specifying concrete; composition and property relationships
7. **Proportioning of concrete mixes**
8. **Properties of fresh and hardened concrete:** Testing methods of concrete
9. **Compliance criteria**
10. **Production of concrete:** Ready-mixed concrete; forming, placing, finishing and curing methods
11. **Durability of concrete:** Alkali-aggregate reaction (AAR), sulphate attack, carbonation; leaching; abrasion and erosion; ingress of chlorides; corrosion of metals in concrete; fire resistance
12. **Assessment of working life:** Application of quantitative methods, introduction to software
13. **Special types of concrete and their applications**: Polymer concrete; polymer-modified concrete; reactive-powder concrete (RPC), roller-compacted concrete (RCC); self-compacted concrete (SCC), pervious concrete, fibre-reinforced concrete; geopolymer concrete
14. **Testing of concrete in structures:** Non-destructive and semi-destructive testing

Recommended Texts:

1. Neville, AM 2012, *Properties of concrete*, 5th edn, Pearson, London.

Assessment	**Percentage Mark**
In-course Assignments/Quizzes	40
End-semester	60

Course Code	CE593
Course Title	Construction Planning
No. of Credits	2
Pre-requisites	MA201
Compulsory/Optional	Optional

Aims: To introduce project planning principles needed to carryout project planning and resource allocation / resource leveling in the preparation project schedules for a construction project.

Intended Learning Outcomes:
On successful completion of the course, the students should be able to;

1. Apply critical path method for a construction project.
2. Plan resources allocation, resource leveling, network crashing for a Civil Engineering project.
3. Prepare a project schedule for a real-life building construction project manually and using project planning software.
4. Apply optimization techniques in construction projects manually and using computer software.

Time Allocation (Hours): Lectures: 17 Tutorials: 3
Assignments/Project: 20

Course content/Course description:

1. **Advanced Planning Techniques and resource analysis:** Principals of project planning and scheduling, critical path analysis, precedence diagrams, program evaluation and review technique, linear scheduling techniques, allocation of resources and resource leveling, network crashing, construction planning process, project progress and monitoring and cost control, carryout a critical path analysis manually for a real-life building project
2. **Optimization Techniques:** Application of optimization techniques in construction projects, linear programming, solving linear programming problems by graphical and computer methods, simplex method, transportation problem, assignment problems, computer applications in optimization

3. Computer applications in project planning
4. Introduction to project planning software, prepare the project schedule using a project planning software for the real-life project

Recommended Texts:

1. Taylor, J 2007, *Project Scheduling and Cost Control: Planning, Monitoring and Controlling - Planning Monitoring and Controlling the Baseline*, J. Ross Publishing

Assessment	**Percentage Mark**
In-course Assignments/Quizzes/Planning Project	40
End-semester	60

Course Code **Course Title** **No. of Credits** **Pre-requisites** **Compulsory/Optional**	CE594 Computer Aided Structural Analysis and Design 2 CE307 Optional

Aim(s): To introduce advanced finite element formulation and their usage for solving engineering problems with the aid of commercial finite element programs.

Intended Learning Outcomes:
On successful completion of the course, the students should be able to;

1. Explain the finite element formulation for three dimensional (3D) problems in Civil Engineering.
2. Model engineering structures using finite element software.
3. Analyse structures for external static and dynamic loading and interpret results.
4. Develop the practical skills to apply a range of software tools for the design of structural elements.

Time Allocation (Hours): Lectures 20 Tutorials Practical Assignments 20

Course content/Course description:

1. **Review of basis of finite element method**
2. **Finite element formulation of plates and shells:** Derivation of stiffness matrix for 4-node quadrilateral element, and higher-order elements; equivalent nodal forces; discretization error and convergence rate
3. **Finite element formulation of solid element:** Derivation of stiffness matrix for 8-node solid element, and higher-order elements; equivalent nodal forces; discretization error and convergence rate
4. **Modelling of structures using a commercial finite element programs:** Geometric modelling, mesh generation, selection of materials and element types for different structural members
5. **Analysis of finite element models for different loading**

conditions using a commercial finite element programs: Modal analysis, steady state response analysis, response spectrum analysis and time history analysis	
Recommended Texts : 1. Holzer, SH 1985, *Computer Analysis of Structures*, Elsevier. 2. Computers and Structures Inc., 2015, *SAP 2000 Structural Analysis Program Manual*.	
Assessment	**Percentage Mark**
In-course Assignments/Quizzes	40
End-semester	60

Course Code	CE598
Course Title	GIS and RS for Civil Engineers
No. of Credits	2
Prerequisites	-
Compulsory/Optional	Optional

Aim(s): To introduce the functionality and potential applications of Geographic Information Systems (GIS) and Remote Sensing (RS) in Civil Engineering.

Intended Learning Outcomes (ILOs):

On successful completion of the course, the students should be able to;

1. Explain the basic principles and procedures associated with GIS.
2. Demonstrate practical skills such as understanding data format, data collection, data entry and modification, projection systems, basic spatial and 3D analysis and finally concept of visualization in the use of GIS software.
3. Describe the physical principles of remote sensing.
4. Describe the operation of available Global Navigation Satellite Systems (GNSS) and the error sources.

Time Allocation (Hours): Lectures: 14 Tutorials: 1
Practical: 26 Assignments: 4

Course content/Course description:

1. **Introduction to GIS and software:** Raster data, vector data, data structures, data manipulation, exploring the interface and file management system
2. **Spatial data structures and sources:** Map projections/coordinate system, world and national datum and transformations, web and other spatial data sources
3. **GIS analysis functions and operations :** Creating and editing GIS data, spatial and overlay analysis, distance analysis, conversion and re-sampling techniques
4. **Layouts, reports, graphs and data interoperability:** Preparing and presenting maps and tables and exporting them to different online formats, exporting and importing data from other graphic formats

5. **Remote Sensed Data and Image processing techniques:** Use of elector magnetic spectrum in RS, active and passive remote sensing, SAR data, supervised and unsupervised classification
6. **Introduction to Geographic Positioning Systems:** GNSS for GIS data capture, importing and exporting GPS data

Recommended Texts:

1. Campbell, JB & Wynne, RH 2011. *Introduction to Remote Sensing*. 5th edn, Guilford Pres, NewYork.
2. Longley, PA, Goodchild, MF, Maguire, DJ & Rhind, DW 2005. *Geographic Information Systems and Science*, John Wiley & Sons, Chichester.

Assessment	Percentage Mark
In-course	
Practical Assignments/Quizzes	30
Project Poster / Report	30
End-semester	40

Course Code	CE599
Course Title	Disaster Management
No. of Credits	2
Pre-requisites	-
Compulsory/Optional	Optional

Aim(s): To impart knowledge on fundamentals of disaster risk management including the origin, occurrence, and mitigation of natural and man-made hazards, and to emphasize the importance of sustainable development.

Intended Learning Outcomes:
On successful completion of the course, the students should be able to:

1. Describe the origin, occurrence and mitigation of natural and man-made hazards.
2. Explain elements of disaster management, the disaster management cycle and the importance of sustainable development.
3. Describe methods of hazard, vulnerability and risk assessment.
4. Develop an emergency management plan.
5. Use basic GIS and RS tools in disaster risk analysis and management.

Time Allocation (Hours): Lectures: 26 Tutorials: Practical: Assignments: 8

Course Content/Course Description:

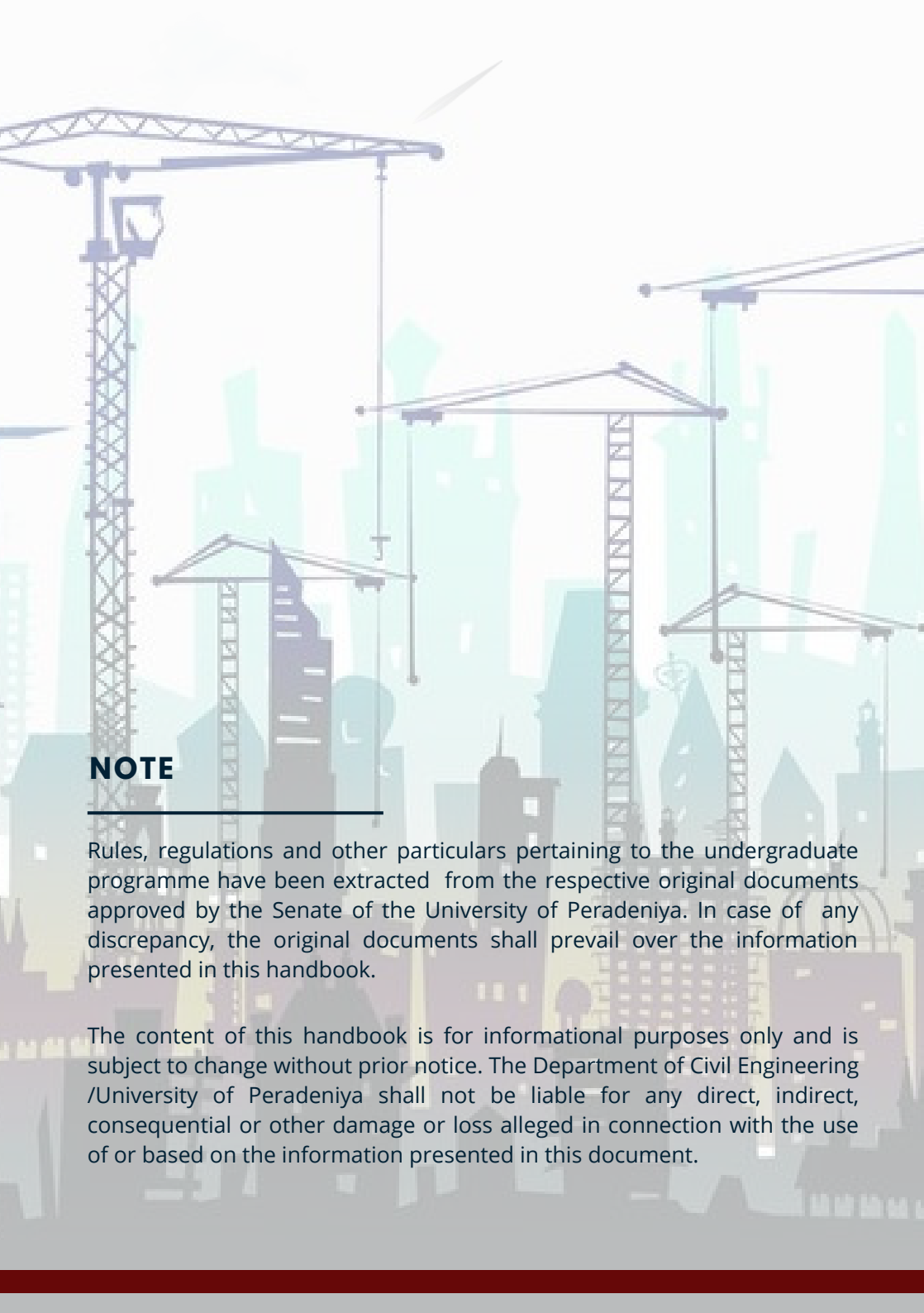
1. Elements of disaster management
2. Risk assessment and management
3. **Geological hazards:** Landslides, earthquakes, volcanic eruptions - origin, occurrence, and mitigation
4. **Coastal hazards:** Tsunamis, storm surges, erosion & sedimentation - origin, occurrence, and mitigation
5. **Hydrological and meteorological hazards:** Floods, droughts, cyclones, tornadoes, tropical storms, lightning - origin, occurrence and mitigation
6. **Anthropogenic hazards:** Nuclear hazards, oil and toxic material spills and
other industrial hazards, pollution, climate change/global

warming, terror, over-population

7. Fire hazards
8. Application of GIS & RS in disaster management
9. Emergency management

Recommended Texts (if any) :

Assessment	**Percentage Marks**
In-Course Tutorials/Quizzes/Assignments/Course Work	40
End-semester	60



NOTE

Rules, regulations and other particulars pertaining to the undergraduate programme have been extracted from the respective original documents approved by the Senate of the University of Peradeniya. In case of any discrepancy, the original documents shall prevail over the information presented in this handbook.

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DEPARTMENT OF CIVIL ENGINEERING

FACULTY OF ENGINEERING

UNIVERSITY OF PERADENIYA

SRI LANKA

Pioneers in Civil Engineering Education in Sri Lanka