UNIVERSITY OF PERADENIYA
DEPARTMENT OF CIVIL ENGINEERING

POSTGRADUATE PROGRAMME IN HIGHWAY AND TRAFFIC ENGINEERING

YEAR 2022

Applications are invited for the Postgraduate Programme in Highway and Traffic Engineering for the year 2022. Programme will be commenced from **February 2022**.

1. INTRODUCTION

The postgraduate programme in Highway and Traffic Engineering conducted by the Department of Civil Engineering is intended for graduates with engineering background and practicing engineers in the field of highway and transportation engineering. The programme consists of course units conducted through lectures, tutorials, assignments, laboratory classes, field experiments, and research or design projects. These course units have been designed to enhance the capabilities of the students in analyzing, designing, and operate and manage a transportation system.

Department of Civil Engineering, University of Peradeniya has excellent testing facilities in the laboratory and modernized equipment for fieldwork related to Highway and Traffic Engineering. State of art computer software (e.g., PVT VISSIM, Microsoft Civil 3D) is available for analytical and design work. Facilities in the computing centre and engineering library are available for acquire additional knowledge. The course will be taught by a team of highly qualified academic staff.

Dr. AGHJ Edirisinghe,	BScEng MEng, PhD
Dr. IMS Sathyaprasad,	BScEng MEng, DEng
Dr. PBG Dissanayake,	BScEng, PhD, MIEAust, Member PMI, AMIESL
Dr. HK Nandalal,	BScEng, MSc, PhD, CEng, MIESL
Dr. WMVSK Wickramasinghe,	BScEng MEng, PhD, AMIESL
Dr. AMRG Athapaththu,	BScEng, MPhil, DEng, AMIESL
Dr. WRSS Dharmarathna,	BScEng, MPhil, PhD, AMIESL
Dr. Gemunu Gurusinghe	BSc, PhD
Dr. Janaka Kosgolla	BScEng., MSc, PhD
Dr. Dulakshi Karunasinghe	BScEng., PhD
Dr. Kanthi Perera	BSc, MSc, PhD
Dr. C.K. Walgampaya	BScEng, MSc, PhD
Dr. S.B. Wijekoon	BScEng., MPhil, PhD, CEng, MIEAust, MIESL
Dr. M.M.G.V. Shyamalee	BScEng., MSc, PhD
Eng. Ajantha Karunaprema	BScEng., MPhil
Eng. Jeewana Meegaha	BScEng., MEng
Eng. H.N. Prasanga	BScEng., MEng

2. PROGRAM STRUCTURE, DURATION AND COURSES

The proposed time schedule for the program is as follows;

Semester	Period of the year
Term I	February to June (5 months)
Term II	July to November (5 months)
Term III	Term I and Term II and then Continue after November

The taught part of the courses consists of subjects conducted through lectures, tutorials, assignments, laboratory classes, field classes and design classes and an advanced study/ research. The courses will be conducted over 2 semesters on Saturdays and Sundays from 8 am to 5 pm. The research study shall be carried out from the first semester and the progress is continuously evaluated.

In order to obtain minimum 12 credits per term, it is required to conduct classes for at least 4 sessions per week. Accordingly the proposed time allocation for each session is as follows;

Day	Time	Description of work
Saturday	8.00 AM to 12.00 NOON	Core Course I
	1.00 PM to 3.00 PM	Core Course I or Elective Course
	3.00 PM to 5.00 PM	Core Course I or Elective Course
Sunday	8.00 AM to 12.00 NOON	Core Course II
	1.00 PM to 5.00 PM	Core Course II or Elective Course

Examinations of the subjects taught in a semester will be held within the semester, and the progress of the research/design projects are continuously evaluated during and at the end of each semester. The core and elective courses to be offered in the year 2022 are as follows (subject to approval);

	Course Code	Course Title	Credits
Core Courses	CE 662	Basic Soil and Rock Mechanics for Highway Engineering	3
	CE 663	Traffic Engineering	3
	CE 664	Pavement Design	3
	CE 665	Traffic Measurements, Analysis and Design	3
	CE 666	Road Safety and Environment	3
	CE 760	Highway Planning	3
Elective Courses	CE 761	Highway Construction Materials and Methods	2
	CE 762	Evaluation of Pavement Materials and Pavements (Lab Course)	2
	CE 763	Highway Evaluation and Maintenance	2
	CE 764	GIS for Highway and Transportation Engineering	3
	CE 765	Quantitative Methods in Traffic Engineering	3
	CE 766	Traffic Management	2
	CE 767	Traffic Impact Assessment	1
	CE 6101	Research Methods in Civil Engineering	2
	CE 6303	Slope Stability and Earth retaining Structures	3

(Course contents are given on pages 6 - 10)

3. ADMISSION REQUIREMENTS

3.1 Postgraduate Diploma (PGDip in Highway and Traffic Engineering)

The minimum qualifications required of a person for admission to a programme leading to the Postgraduate Diploma:
 (a) A first Degree in Engineering/Science (SLQF L5) acceptable to the Faculty Higher Degrees Committee or
 (b) Such other qualification equivalent to a first Degree in Engineering/Science (SLQF L5) as may be recommended by the Faculty Higher Degrees Committee as suitable for candidature for PG.Dip., in a field related to the programme of study.

3.2 Degree of Master of Engineering (MEngHwy&Traf)

The minimum qualifications required of a person to be considered for direct admission to a programme leading to the Degree of Master of Engineering are as follows:
(a) A first Degree in Engineering of at least 120 credits (SLQF L6) with First or Second Class Honours or
(b) A first Degree in Engineering of at least 120 credits (SLQF L6) with acceptable postgraduate qualifications or a minimum of one year's experience after obtaining the Degree, in a field related to the programme of study or
(c) Such other qualification equivalent to a first Degree in Engineering of at least 120 credits (SLQF L6) as may be recommended by the Faculty Higher Degrees Committee as suitable for candidature for the M.Eng. Degree with a minimum of one year's experience, after obtaining such qualification, in a field related to the programme of study

3.3 Degree of Master of the Science of Engineering (M.Sc.Eng. in Highway and Traffic Engineering)

The minimum qualifications required of a person to be considered for direct admission to a programme leading to the Degree of Master of the Science of Engineering are as follows:
(a) A first Degree in Engineering of at least 120 credits (SLQF L6) with First or Second Class Honours or
(b) A first Degree in Engineering of at least 120 credits (SLQF L6) with acceptable postgraduate qualifications or a minimum of one year's experience after obtaining the Degree, in a field related to the programme of study or
(c) Such other qualification equivalent to a first Degree in Engineering of at least 120 credits (SLQF L6) as may be recommended by the Faculty Higher Degrees Committee as suitable for candidature for the M.Sc.Eng. Degree with a minimum of one year's experience, after obtaining such qualification, in a field related to the programme of study.

4 ELIGIBILITY TO OBTAIN THE DIPLOMA/DEGREE

4.1 Postgraduate Diploma (PG.Dip.)

Course requirement
A total of 25 credits earned with at least 2.75 GPA from prescribed courses including an advanced study of at least 3 credits.
Duration: 10 months (minimum)

4.2 Degree of Master of Engineering (MEng)

Course requirement
In order to be eligible for the award of the Degree of M.Eng., a student shall have earned a total of 30 credits with at least 3.0 GPA from the prescribed courses including an advanced study of at least 5 credits.
Duration: 12 months (minimum)

4.3 Degree of Master of the Science of Engineering (MSc.Eng.)

In order to be eligible for the award of the Degree of M.Sc.Eng, a student shall have earned a total of 30 credits from the prescribed courses with at least 3.0 GPA and successfully completed a research study of 30 credit
Duration: 24 months (minimum)

5 COURSE FEE

- Rs.350,000.00 for PG.Dip.
- Rs.400,000.00 for MEng.
- Rs. 475,000.00 for MSc.Eng.

In addition to above fee a refundable library deposit of Rs. 10,000.00 and Standard Library Deposit of Rs. 4,000.00 should be paid at the time of the registration for the postgraduate programme.

6 APPLICATION PROCEDURE

The applications should be submitted online through http://pgciviladmissions.eng.pdn.ac.lk/login on or before 22nd of November 2021.

The following documents should be uploaded along with the duly completed application:

a) Degree/Diploma/Professional membership certificates and Academic Transcript.
b) Two Referee Reports (Online). At least one should be from the applicant's teacher at the University.
c) Birth certificate and National Identity Card.
d) Letter of consent on granting leave to engage in PG study from the employer (where applicable).
e) Application processing fee - Proof of payment (deposit slip)
f) Recent colour photograph (passport posture)

Originals of documents of which scanned copies are submitted should be produced before admission, on request. Also, applicant should arrange to send the official transcripts directly by the educational institutions concerned to the **Assistant Registrar, Faculty of Engineering, University of Peradeniya, Peradeniya**.

In the event of any discrepancy between the names appearing in the applicant's academic/professional/birth certificates and the name given by the applicant in the application, an affidavit to the effect that the applicant is the one and the same person known by such names should be sent together with the application form.

A payment of Rs. 2,000.00 has to be done to the below account as the non-refundable application processing fee.

Bank : Bank of Ceylon
Branch : Peradeniya
Name of Account : Research and Fund Account
Account Number : 001274688

Documents submitted in support of an application shall become the property of the University.

Application which are received late/or incomplete in any respect are liable to be rejected. **Only shortlisted applicants will be called for an interview.**

The applicants will be informed of their acceptance/non-acceptance to the particular postgraduate programme for which admission has been sought. The University may at its discretion refuse admission to any applicant.

For further details contact Dr.V.S.K.Wickramasinghe
Tel: +94-81-2393517; 070 2566265
Email: vskw@eng.pdn.ac.lk, the Coordinator of the Postgraduate Programme in Highway and Traffic Engineering, Department of Civil Engineering, University of Peradeniya, Peradeniya.

Courses Offered

CE 6101   RESEARCH METHODS IN CIVIL ENGINEERING
                 (Optional)

Fundamentals of Research: Definition and Objectives of Research; Qualitative vs Quantitative Research; The Scientific Research Process; Identification, selection, and formulation of research problems; Characteristics of good research problems; Review of literature. **Data Collection, Analysis and Presentation:** Methods and techniques of data collection; Design of Experiments; Sampling and sampling designs; Statistical modelling and analysis including introduction to statistical package; Probability Distributions; Multivariate methods; Concepts of correlation and regression, error analysis; Effective presentation of information using Tables, illustrations, graphs, etc. **Scientific writing and presentation:** Essential components of abstract, introduction, literature review, materials and methods, results, discussion, and conclusions; Formatting of contents; Methods of referencing and the use of referencing tools, Preparing and presenting a technical presentation.

CE 6303   SLOPE STABILITY AND EARTH RETAINING STRUCTURES
                 (Optional)

Mass movements: Classification, causative factors, instrumentation, preventive, remedial and control measures. **Slope Stability Analysis using EC7:** EC7 guidelines for slope stability analysis, Design of slopes to EC7, Limit equilibrium methods, Bishop and Morgenstern Chart. **Design of rigid and flexible earth retaining structures using EC7:** Lateral earth pressure: Rankine's and Coulomb's theory, Introduction to earth retaining structures, EC7 guidelines for designing earth retaining structures, Design of mass concrete retaining wall and cantilever retaining wall to EC7. Introduction to sheet pile walls (Cantilever and anchored sheet pile walls), EC7 guidelines for sheet pile wall design, Fixed and free earth support methods of design of anchored sheet pile walls. Analyse internally stabilized earth wall (MSE walls), Soil nailing. **Case study on slope and retaining failure:** Case studies on slope and retaining wall failures.

CE 662   BASIC SOIL AND ROCK MECHANICS FOR HIGHWAY
                 ENGINEERING
                 (Compulsory)

Introduction to soil, soil formation and composition, soil types and structure, Field Investigations, compaction, determination of CBR from DCP test, soil improvement, Rock types, geological structures, geological processes and surface features of earth, Engineering classification of rock masses and suitability of sites for engineering projects and road constructions, Engineering properties of rocks and rock as a construction material, Stereonet analysis, Laboratory Tests (Los Angeles Abrasion value test, Rock Identification).

CE 663   TRAFFIC ENGINEERING
                 (Compulsory)

Traffic variables and traffic flow theory, Fundamental parameters and relations of traffic flow (Eg. Speed, density, Volume, Travel Time, Headway, spacing, Time space diagram, Time mean speed, Space mean speed and there relation, relation between speeds, flow, density, Fundamental Diagrams) ; Traffic stream models: Greenshield's model, Greenbeg's logarithmic model, Underwood's exponential model, Pipe's Generalized model, Multi-regime models. Traffic measurement procedures, Measurement at a point: Traffic volume measurement, Equipment for flow measurements, Data analysing, Concepts of ADP, AADT measurement over a short

section: Speed measurements, 15th and 85th percentile speeds, Design speed, Speed distributions Measurement along a length of road: Density measurement, Travel time measurement, Automated traffic measurement: GPS devices, Loop detectors, Video analysis, and other technologies. Highway Capacity Estimation, Capacity and level of service LOS: Definitions, Highway capacity, factors affecting LOS, HCM methods, capacity and LOS calculations on urban street, to lane Highways, Multi lane Highways, freeways. Traffic intersection control Principles of Traffic Control, Traffic signs and road markings, uncontrolled intersection, Channelization, Traffic rotary grade separated intersection. Traffic signal design, Elements of Traffic signal: Design principles of a Traffic signal, Evaluation of a Traffic signal. Specialised traffic studies, Parking studies, accidents studies, fuel consumption and emission studies, congestion studies, toll operation, Pedestrian studies. Intelligent Transport Systems.

CE 664 PAVEMENT DESIGN
(Compulsory)

Introduction and description of Pavements, Important, functions, design and construction, maintenance rehabilitation. **Traffic:** Different types of Highway Traffic, measurement of Traffic loads, Effect of load and tire pressure. **Drainage:** Source and effect of water, Estimating flow, surface drainage system, subsurface drainage system, use of software for design of drainage structures. **Distress and Performance:** Distresses in asphalt pavements, consideration of performance. **Economic Analysis and Cost-Saving Concepts**: Engineering economic, concepts of life cycles cost, probabilistic versus deterministic approach, software for running life cycle cost analysis. **Sustainable Pavement Engineering:** Need for pavements, design of layout of pavements, constructions of pavements, use of waste and Byproducts in pavements, workers, Pavements-Building-Nature-Symbiosis, Regulatory Bodies and Impetus for Sustainability, Human factor. **Structural design of Flexible pavements:** Traffic and load distribution concept, materials and layers, Theoretical Considerations for structural Design: mechanistic and empirical design, Computer methods. **Structural Design of Rigid Pavements:** Theoretical Considerations, Different Methods, Limiting Criteria, Longitudinal Reinforcement Design Procedure, Computer methods for Rigid Pavements.

CE 665 TRAFFIC MEASUREMENTS, ANALYSIS AND DESIGN
(Compulsory)

Traffic parameters (e.g. Speed, Flow, and Density) and Measuring Methods. Traffic Surveys (Turning Movement Counts, Speed Surveys). Transportation Surveys (e.g. Person Trip Surveys, Bus loading, Origin-Destination Surveys, Travel Time Surveys). Parking Surveys, Data analysis, and Parking facility Designs. Accident Data Collection, Black Spot analysis, Safe Designs. Pedestrian Surveys, Pedestrian Data Analysis, Pedestrian Facility Design. Public transport surveys and non-motorized transportation. Traffic System Design Project (Individual).

CE 666 ROAD SAFETY AND ENVIRONMENT
(Compulsory)

Introduction to road safety. Importance of road safety. Local and global statistics of road traffic crashes. **Crash. reporting and collision diagrams.** Different crash reporting systems Concepts of collision diagrams Extracting important data for analysing. **Basics of crash Statistics.** Basic statistics to treat crash data. Data presentations. Predictions, regression analysis. **GIS applications in road** .safety Basics of GIS. GIS applications. **Factors that influence safety and analysis of safety data.** Identify reasons for crashes. Introduce accident blackspots. Introduce spatial distribution, time distribution and mad user group distribution. **Safety**

countermeasures. Introduction to various countermeasures Selection of suitable countermeasures. Effectiveness of safety countermeasures. Implementing safety countermeasures. **Highway geometry and safety** Horizontal and vertical curve designs Access road Junctions. **Road signing and marking.** Standard road signings and marking. Effect of road signing and marking for safety and convenience Modifications necessary to meet local conditions. **Road safety audits.** Basic concepts in road safety auditing Different stages in road safety auditing. **Issues related to pedestrian safety** Introduction to Pedestrian facilities. Knowledge and Attitudes towards pedestrians facilities of different road user groups. Possible improvements to enhance the safety of pedestrians. Road Safety Management.

CE 760 HIGHWAY PLANNING
(Compulsory)

History and finance, and Highway Classification, Transportation and forecasting (Trip generation, trip distribution, modal split, trip assignment)

Driver, vehicle and roadway characteristics, Highway capacity for two lane roads, basic geometric concepts, horizontal curve design, Vertical curve design, Super elevation, Transition curves (spirals), Cross sectional elements, Highway safety and roadside design, Intersection and interchanges

Using International Standards for Highway Design, Traffic control devices, Environmental Mitigation in Transportation Projects, How Transportation Impacts the Environment, Model for Assessing Impacts and Developing Mitigation, Measures, Project Conception, Impact Assessment, Alternatives Analysis, Public Involvement and Review, Enforcement and Post-Project Monitoring, Transportation Planning and Regional Mitigation Approaches.

CE 761 HIGHWAY CONSTRUCTION MATERIALS AND METHODS
(Optional)

Granular material for Pavement Construction. Mass-Volume Relationships, Grain Size Distribution: Gradation, Effect of Water, Stiffness and Strength of Soils, Soil Stabilization Concepts and Methods: Chemical and Mechanical, Parent Rock, and Types, Aggregate Production and Aggregate Tests. **Bitumen:** Cut hack Bitumen, Emulsion, .and Bitumen Testing. **Asphalt:** Asphalt Binder, Safe Delivery, Storage, and Handling of Asphalts, Asphalt Binder Properties, Asphalt Binder Properties and Pavement Distress and Performance, Recovery of Asphalt Binder from Asphalt mix, Asphalt Emulsions. **Concrete:** Concrete, Aggregates, Cement, Water, Hydration and Steel in Concrete. **Construction of Asphalt Pavements.** Production, Transportation and Laydown, Description and Requirements of Components in Hot Mix, Asphalt- Producing Plants, Equipment Used for Transportation, Laydown, and Compaction, Important Factors, Specifications, Quality Control and Quality Assurance **Construction of Concrete Pavements** Concrete Production, Preparation of Subgrade and Base, Presetting Reinforcements such as Dowel Bars, ciebars and Continuous Reinforcement, Paving, Concrete Placement, Finishing, Quality Assurance/ Quality Control {QC/QA).

CE 762 EVALUATION OF PAVEMENT MATERIALS AND PAVEMENTS
(Optional)

Laboratory Soil Testing: Grain size analysis, Shear Tests, CBR. **In-situ Testing:** Determination of filed density of pavement layer, plate bearing test, dynamic cone penetration, Benkelman beam deflection. **Aggregate Testing:** Aggregate Impact Test, Los Angeles abrasion test, polished stone test, Aggregate crushing value test, specific gravity and absorption test, shape test, soundness test. **Bitumen Testing**: Penetration Test, Ductile and elastic recovery test, softening point test, viscosity test, flash and fire point test, water sensitivity test. **Asphalt**

Testing: Specific gravity test on asphalt, Marshall stability test on compacted asphalt. **Concrete testing:** Concrete Mix design (Cube Test), Workability, strength and density testing.

CE 763   HIGHWAY EVALUATION AND MAINTENANCE
     (Optional)

Introduction to Asset Management Systems Introduces the fundamental principles common to other industries (e.g. trucking, rail) that are applicable to a PMS and how they can be applied to pavements. **Pavement Management Systems Overview**. Describes the basic components of a PMS and how the products of can be used as a tool to aid in the development and that system decision-making for the pavement maintenance and construction program for and agency. Relational Databases and Location Referencing Systems Details the principles and concepts behind a relational database including the available technology, such as GIS and GPS. **Inventory and History**, Defines what types of data should be collected, how it should be collected and how it is used in a PMS. **Pavement Condition Surveys**, Describes the use of pavement condition survey data in the PMS, how it can be collected and the state-of-the-art of data collection equipment. **Pavement Condition Indices**. Includes the historic development of pavement distress indices, their basic functions, how they are computed, the different types available along with their advantages and disadvantages, and a discussion of the International Roughness Index (IRI). **ESAL Flow Maps**. Participants will be able to more fully appreciate the use and application of ESALs rather than basic traffic volumes in a PMS. Performance Models. This module will emphasize the importance of predicting the change in level of service in order to estimate futur. rehabilitation needs and introduce the tools used to predict future conditions. Remaining Service Life Participants will gain an understanding of what the remaining service life of a pavement is, how it is used, why it is important, and how it is calculated. **Prioritization,** The focus will be on the priority assessment techniques for prediction models to forecast conditions and prioritization as tools to identify the most cost-effective strategies for various funding levels. **Optimization** Will familiarize the participants with optimization techniques used in a PMS. **Maintenance and Rehabilitation of Asphalt Pavements** Maintenance, Primary Corrective Maintenance Activities, Primary Preventive Maintenance Activities, Recycling. **Maintenance and Rehabilitation of Concrete Pavements**, Joint and Crack Sealing, Slab Stabilization, Diamond Grinding, Load Transfer Devices, Precast Panels for Repair and Rehabilitation, Portland Cement Concrete Overlays, Warranty Projects.

CE 764   GIS FOR HIGHWAY AND TRANSPORTATION ENGINEERING
     (Optional)

Introduction to GIS and software: Raster data, Vector data, Data structures, Data manipulation Exploring the interface and file management system. **Spatial data structures and sources:** Map projections/coordinate system, World and National datum and transformations, Web and other spatial data sources. **GIS analysis functions and operations;** Creating editing and GIS data. Spatial and overlay analysis, Distance analysis, Conversion and re-sampling techniques. **Layouts, reports, graphs and. data interoperability:** Preparing and presenting maps and tables and exporting them to different online formats, Exporting and importing data to and from different formats. **Network modelling and analysis:** Performing network analyses; developing network **connectivity rules;** network validation and editing Road network analysis. **model Builder**. Creating a model for complex analysis. **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. **Introduction to Geographic Positioning Systems.** GNSS for GIS data capture, importing and exporting GPS data.

CE 765   QUANTITATIVE METHODS IN TRAFFIC ENGINEERING
          (Optional)

Introduction: Concepts of probability, Sample space and events, Random variables, Probability distributions, Cumulative distributions , Expected values. **Discrete probability distributions.** Binomial distribution, Poisson distribution. **Continuous probability distributions** Normal distribution, Weibull distribution. Sampling distributions. **Sampling distribution** of sample mean, Central limit cheorem, Sampling distribution of sample variance. **Inferences on mean and variance.** Point estimation, Confidence intervals. **Hypothesis testing**. Hypothesis testing for mean, variance and proportions. Single sample and Two samples tests. **Sampling techniques and analysis.** Sampling methods, questionnaire preparation , data analysis. **Simple and multiple linear regression**. Correlation, simple linear regression, multiple linear regression, polynomial regression ,use of 'Dummy' variables in multiple regression. **Residual Analysis.** outliers, Residual plots, Multicollinearity, Statistical tests for examination of residuals, model validation. **Selecting the 'best' regression model**. Forward selection, backward elimination, stepwise regression,   Akaike Information Criterion and Baysian Information criterion.

CE 766   TRAFFIC MANAGEMENT
          (Optional)

Introduction to traffic   management, Travel Demand   Management   (TDM).   **Urban traffic management techniques,**   local area traffic management. **Managing non- motorizes transport**, bus priority theorem. **Road signs and markings** , traffic calming and speed control, Traffic demand management and road pricing, HOV promotion, junction control. **Parking management and its applications**. User information systems and intelligent traffic management systems.

CE 767   TRAFFIC IMPACT ASSESSMENT
          (Optional)

Introduction to TIA: Major Components of a Traffic impact Study. Traffic Data Collection, Highway Inventory, Parking counts, Bus loading and Pedestrians Counts, Travel time Data collection. Intersection Analysis: Capacity estimation. Traffic forecasting and impact assessment. Parking standards and regulations. TIA case study.

CE 6303   SLOPE STABILITY AND EARTH RETAINING STRUCTURES
          (Optional)

Mass movements: Classification, causative factors, instrumentation, preventive, remedial and control measures. **Slope Stability Analysis using EC7:** EC7 guidelines for slope stability analysis, Design of slopes to EC7, Limit equilibrium methods, Bishop and Morgenstern Chart. **Design of rigid and flexible earth retaining structures using EC7:** Lateral earth pressure: Rankine's and Coulomb's theory, Introduction to earth retaining structures, EC7 guidelines for designing earth retaining structures, Design of mass concrete retaining wall and cantilever retaining wall to EC7. Introduction to sheet pile walls (Cantilever and anchored sheet pile walls), EC7 guidelines for sheet pile wall design, Fixed and free earth support methods of design of anchored sheet pile walls. Analyse internally stabilized earth wall (MSE walls), Soil nailing. **Case study on slope and retaining failure:** Case studies on slope and retaining wall failures.