

## Department of Civil Engineering University of Moratuwa

# MSc. / Masters/ PG Dip. in TRANSPORTATION ENGINERING 2023/2024

The transportation industry is currently undergoing an unprecedented expansion fuelled by worldwide economic growth. There is an expanding need for highly skilled transportation engineering professionals. The programme in Transportation Engineering is a highly valued qualification and graduates can expect to pursue careers in a range of organisations in the world.

The programme intends to provide students from a wide range of backgrounds, a firm grounding in the principles, techniques, issues and practice of transportation Engineering, thus equipping them for a professional career. The programme is hosted by the Transport Engineering Division (TED) of the Department of Civil Engineering, University of Moratuwa.

TED is reaching another milestone by offering this program to offshore students (Sri Lankan citizens in foreign countries as well as all foreign students), especially providing an opportunity to students who are working overseas. This creates a platform for global level knowledge sharing and discussions in the class, leading to more knowledgeable graduates.

All lectures, assignments, evaluations, etc. will be carried out using online (hybrid) platforms.

### MSc. / Masters/ PG Dip. in Transportation Engineering 2023



# Department of Civil Engineering University of Moratuwa



#### TITLE OF AWARD

Master of Science in Transportation Engineering Master of Transportation Engineering Postgraduate Diploma in Transportation Engineering

#### ELIGIBILITY REQUIREMENTS

a). B.Sc. Eng. degree Honours in Civil Engineering from the University of Moratuwa, or any other equivalent degree in Civil Engineering from a recognized University as judged by the faculty and approved by the Senate.

or

b). Any other four-year engineering degree from a recognised University with at least one-year post qualifying experience in relevant field judged by the faculty and approved by the Senate.

or

c). At least the Associate Membership of a recognized professional engineering institution with a minimum of two years post qualifying experience in a relevant filed as judged by the Faculty and approved by the Senate.

#### DURATION OF COURSE

#### 2 years (Part Time)

All Lectures, assignments, seminars, field trips etc., will be conducted on Fridays(afternoon) and Saturdays via online(hybrid).

#### COURSE FEES

| MSc.                                               | - | RS. 350,000.00 |  |  |  |
|----------------------------------------------------|---|----------------|--|--|--|
| Master                                             | - | RS. 300,000.00 |  |  |  |
| PG Dip.                                            | - | RS. 225,000.00 |  |  |  |
| (Sri Lankan citizens only)                         |   |                |  |  |  |
| Foreign students please contact course coordinator |   |                |  |  |  |
|                                                    |   |                |  |  |  |

Rs. 1500/= Registration fees

- Rs. 4500/= Library deposit (Rs. 2000/= non refundable) (Rs. 2500/= per book - refundable) and
- Rs. 500/= Exam Fees payable at registration

#### TENTATIVE START DATE

First week of December 2023

#### APPLICATION

Application forms can be downloaded from the website : https://uom.lk/civil/divisions/transportation/pg-course

Application closing date: 14<sup>th</sup> August, 2023

Completed application forms should be sent to: pg-ted@uom.lk

For more information, contact the course coordinator on loshakap@uom.lk or on extension 2219.

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#### ■ PROGRAMME STRUCTURE

| Course<br>Unit or<br>Module<br>Code | Course Unit<br>or Module<br>Name or<br>Other                             | Module Outline                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Credit<br>Value | Status<br>(Compul-<br>sory<br>/Optional) |
|-------------------------------------|--------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|------------------------------------------|
| CE 6601                             | Highway<br>Construction<br>& Maintenance<br>Techniques                   | History of road construction, Pavement types, load distribution, elements of cross sections, cross sections at cut/fill and transition, right of way, drainage Elements of Cross section, Engineering prop-<br>erties of soil and road aggregates, Material selection, construction and quality control: Subgrade, Subbase: and Bases, Gravel and Earth Roads, Use of appropriate material. Engineering properties of<br>Asphalt and Emulsions, Review of specifications, Requirement of mixture design, Marshall and Superpave. Dimonstration of Marshall and Superpave mix designs, Blending and Segregation, Asphalt<br>production, delivery, placement, and compaction. Asphalt Pavement Construction, Concrete slab behaviour, Types of concrete pavement, joint construction, load transfer efficiency, Placement dowed<br>bars, tie bars, Construction techniques, curing of concrete, Type of distress, Road Condition Evaluation, Reflection crack control in overlays, Maintenance technique (fogseal, slurry seal, SBST, DBST,<br>micro surfacing, thin asphalt surfacing, white topping)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 3               | Core A                                   |
| CE 6602                             | Traffic Engi-<br>neering                                                 | Basic car following models, different traffic flow models, use of traffic flow models, one-way roads, lane reversal, bus only lanes, Types of control and selection criteria, overpasses vs. underpasses, different ramp arrangements, basic interchange types, Identification of priority movements, capacity analysis of TWSC, Delay & LOS calculation, queue length calculation. Signal technology, warrants for traffic signals, phasing arrangements, signal timing calculations, signal coordination, Design of roundabouts, capacity, LOS, Understand the shock wave theory and application, Understand the principles of vehicle queuing, mathematical representation and application                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 3               | Core A                                   |
| CE 6603                             | Highway Infra-<br>structure Design                                       | Highway functional classification, principle of highway location, factors influencing highway design, sight distance, Design controls: vehicles and drivers, Design controls: speed, volume and access Route layout, environmental considerations, and context sensitive solutions, Introduce and develop principles and theories used in the design of horizontal, alignments. Introduce and develop principles and theories used in the design vertical alignments, Introduce the national standards and guidelines in highway geometric, Design. Use of software tool Civil 3D in Geometric Design, Types of pavements, structural components of flexible pavements, ising loads, Stresses and strains in pavement, introducion of design guidelines : Road Note 31, AASHTO (1993) ME Design, Introduce the national standards and guidelines in highway geometric , Design. Use of Software tool CIRCLY in Pavement Design                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 3               | Core A                                   |
| CE 5619                             | Research Methods                                                         | Introduction to research methods, process, and types of research , Literature review and referencing, Methods of data collection, Questionnaire preparation, Data analysis, reliability and validity of data & interpretation of results, Development of a research proposal, Academic writing for reports & making presentation, Report formatting                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1               | Core A                                   |
| CE 5601                             | Quantitative<br>Methods for<br>Transport<br>Analysis                     | Data types and data collection, Descriptive Statistics, Probability theory, Random variables and Expected values, Discrete probability distributions, Continuous probability distributions, Sampling techniques, Sampling distributions, Hypothesis testing, Regression models & Trend analysis, Use of spreadsheet software other statistical software for advance statistical analysis                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 3               | Core B                                   |
| CE 5602                             | Systems and<br>Operational<br>Research Methods<br>in Transport           | Systems methods, Optimization techniques, Non-linear models, Methods of calculus, Linear models, Linear programming, transportation problem ,Bellman's approach, additive & multiplicative models, Capacity constrained networks, Minimum spanning tree, Minimum path problem ,Decision under uncertainty & risk, Decision tree, Multi-criteria decision analysis, Game theory, Queuing models and reliability models                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 3               | Core B                                   |
| CE 5603                             | Road Safety,<br>Social &<br>Environmental<br>Evaluations                 | EIA process in Sri Lanka & environment issues related to transport projects , EIA methods & introduction of case study, EIA methods & evaluation, Air & water pollution, Noise, Vibrations, Ecological impacts, Social impacts due to transport projects, Regulatory framework to incorporate social impacts assessment in transport project appraisal, Case studies in social impact assessments, Overview of road safety in Sri Lanka, Key issues in road safety in the global context, Vulnerable road user safety, Accident data collection and analysis, Conflict studies, Road safety performance analysis tools, Road safety audit, Road safety management                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 3               | Core B                                   |
| CE 6638                             | Advanced<br>Bituminous Ma-<br>terials and Paving<br>Technologies         | Applications and properties of asphalt binder, aggregates for bituminous mixtures, asphalt cement production, rheology, chemistry, and mixture design and characterization. asphalt mixture produc-<br>tion, construction, and recycling, sustainable pavements, recycled materials, Basic concept of characterization of pavement materials, Modification of bitumen and the properties. The course will cover<br>a wide range of advanced knowledge of sustainable pavements and material, Introduction to warm mix asphalt, benefits and drawbacks, characterization arm mix asphalt technology. Properties<br>of warm mix asphalt, Production, and application of warm mix asphalt, Introduction to OGFC pavements, Characteristics of OGFC, Selection of materials and aggregate gradations, compaction,<br>evaluating durability and permeability of OGFC mixtures, Asphalt emulsion production, applications and properties, quality control Introduction to non-structural surface dressings and materials,<br>micro surfacing, Fog seal, slurry seal, chip seal technologies, Thin asphalt surfacing, Store Mastic Asphalt technology                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 3               | Core B                                   |
| CE 6604                             | Geotechniques<br>and Pavement<br>Analysis                                | Improvement of soft clays and peaty clays by preloading with and without vertical drains, stone columns, deep mixing, electro osmosis and field monitoring. Analysis of the stability of cut and fills lopes involved in the construction of highways, rain induced slope failures, methods of stabilization of slopes, Design of different types of externally and internally stabilized earth retaining systems in the construction of highways. Boussinesq Theory for Pavement analysis; One layer system; Two Layer system and Multilayer elastic analysis. Flexible pavement Analysis: Three layer systems, Worked example for three layer analysis, Curling stresses in finite slab, Closed-Form Formulas, Stresses and deflections in rigid pavement, Rigid pavement load transfer analysis. Use of CIRCLY software for Mechanistic Pavement Analysis                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 3               | Core C                                   |
| CE 5605                             | Traffic Manage-<br>ment & Intelligent<br>Transport Systems               | Need for Traffic Management, Traffic Demand Management, Road Signs and Markings, Traffic Calming & Speed control, managing non-motorized transport, TIA regulations, steps involved in TIA, Parking management systems, Pedestrian Facilities, Walskbility measures, bicycle facilities, ITS systems & technology, Advanced user information systems, Advanced driver assistance systems (ADAS), Introduction to autonamous vehicle technology, Introduction to automated vehicle technology, v2v/v2x communication, Real time traffic motiviring and adaptive traffic signals, Use of crowdsource data & vehicle priority systems, Microscopic traffic modelling & demand estimation, Transport data bases, Tolling systems' congestion pricing.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 3               | Elective A                               |
| CE 5606                             | Highway<br>Planning &<br>Management                                      | Elements of highway planning and feasibility studies, Functions of a road (Mobility, Accessibility, Safety) and its design considerations, Access management of highways, Concepts of highway capacity analysis, Highway capacity analysis methodologies, Planning and preliminary engineering applications of highway capacity analysis methods, Concepts of asset management, pavement management systems, asset management tools, Highway financing mechanisms, Case studies in PPP projects                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 3               | Elective A                               |
| CE 5607                             | Transport Project<br>Planning and<br>Appraisal                           | Attributes of transport policy, Best practices in transport sector policy development, Transport policy of Sri Lanka, Sustainable development goals relevant to transport infrastructure development, Sustainability in transportation, Incorporating socio-environmental factors in transport project planning and appraisal, Objectives of planning: inputs into policies, strategies, short/medium/long term planning, urban/regional/national plans, development plans, The planning process: stages (problem, data, analysis, forecasting, generation of alternatives, evaluation, programming, Process of project appraisal: appraisal path, methodology, procedures and documentation. Project implementation, Monitoring and evaluation of projects, Economic analysis, Risk assessment in transport project fastility. Multi-criteria analysis techniques, Issues in project budgeting and forecasting                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 3               | Elective A                               |
| CE 6611                             | Urban & Regional<br>Transport Plan-<br>ning                              | Transport systems, Transport Planning in Regional Centres, Urban Centres and Local Areas, Transport Service Management, Urban & Regional Planning Process, TIA/EIA, Techniques and Tools (Land use and Transportation), Transport System Model Selection, Practical Spatial Economic Modelling Using PECAS, Technologies in Urban Transit Systems Planning and Operations, Planning of Transport Intermodal Systems                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 3               | Elective B                               |
| CE 6631                             | GIS and Geomat-<br>ics in Transport<br>Planning                          | General overview: what is GIS, spatial data, non-spatial data, geoprocessing, topology, coordinate systems, modelling in GIS, Site suitability analysis using simple spatial data analysis techniques and through models. (The examples will be selected related to the transport engineering). Overview of geocoding and network analysis, sample exercises related to transport engineering with geocoding and network analysis, sample exercises related to transport engineering with geocoding with ehelp of GIS, General overview: Open-Source GIS, Citizen Science, Open Data, General overview of network centrality, tools for network centrality analysis, application related to transport engineering with the help of GIS, General overview of land use analysis techniques, open-source GIS, Citizen Science, Open Data, General overview of network centrality, tools for network centrality analysis, application related to transport engineering with the help of GIS, General overview of land use analysis techniques, open-source GIS, General overview of Location-based Services (LBS), LBS applications related to transport engineering with the help of GIS, General overview of Location-based Services (LBS), LBS applications related to transport engineering with the help of GIS, General overview of Location-based Services (LBS), LBS applications related to transport engineering with the help of GIS, General overview of Location-based Services (LBS), LBS applications related to transport engineering with the help of GIS, General overview of Location-based Services (LBS), LBS applications for land use analysis techniques, open-source GIS applications for land use analysis and modelling. | 3               | Elective A                               |
| CE 6632                             | Railway & Airport<br>Infrastructure                                      | Elements of rail infrastructure and operations, Tracks & amp; yards, Stations and related facilities, Scheduling and signalling communication, Security and passenger services, Railway freight operation, Alternate and advanced rail systems – LRT/MRT/Monorail, Concepts of railway design, Railway design methodology, Airport master plan development, Passenger demand forecasting, Terminal operations, Terminal level of service analysis: curb side, check-in, gates etc., Ground access at airports, Airside layout planning: runway, taxiway, apron, Runway geometric design Runway capacity analysis.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 3               | Elective A                               |
| CE 6633                             | Freight Transport<br>& Logistics                                         | Basic logistics management, Supply chain concept & SCM tools, Networks & Hubs, Collection-distribution systems, Vehicle routing, ITS for distribution, Inventory control, Warehousing, Location theory, Road, Rail , Air, Sea, Marketing of transport services                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 3               | Elective B                               |
| CE 6634                             | Advanced Methods<br>in Road and Air-<br>field Infrastruc-<br>ture Design | Aesthetics of bridges, Types of bridges, Bridge construction and maintenance, Bridge inspection and management systems, Bridge loading analysis, Bridge design criteria, Selection of super structure and sub structure, Aspects of hydrology, Surface and subsurface drainage design, cross drainage design, Fundamentals of airfield pavement design, Runway pavement design – empirical and mechanistic approaches, Runway pavement management, Runway friction.,                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 3               | Elective B                               |
| CE 6636                             | Monitoring &<br>Evaluation of<br>Transport Projects<br>& Programs        | Role of M&E, Steps in M&E process, Global Trends, Utilization of M&E, Results orientation in programming cycle, Results Frameworks & their, Construction, Building up a M&E System, Selecting outcomes and Performance Indicators, Baseline values of indicators, Monitoring for Results and Quality Assurance, Evaluation Designing – stages / processes, Evaluation Methods and their use, Cur-<br>rent Approaches, Methods and Design in M&E, Data source, data collection method, cost of collection, data analysis and reporting, Basic Principles and Guidelines of M&E (ethics, standards, norms,<br>values, etc.), Contextual Conformities; Culture, Norms, Compliance to National / International Standards & Norms, Commissioning M&E Processes; Facilitation, Information Collection, etc., Resource<br>Allocation in M&E Managing a M&E unit / team, Advocacy, Communication and Promotion of Utilization of M&E Outcomes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 3               | Elective B                               |
| CE 6637                             | Concrete Pave-<br>ment Technology                                        | Sulfate attack and carbonation, Effect of organic materials, Problems in sulfate soils stabilized with lime/cement, Soil-lime-sulphate reactions, Evaluate the conventional weight batching process. Analyse the behavior of concrete (Durability, strength, workability, etc.) under different additives (manufactured sand, internal curing aggregates, recycled products etc.), Evaluation of stress and behaviour of concrete pavements under different conditions (Loading, temperature variation, etc.) which causes pavement distresses. Analyse the factors that can lead to concrete pavement distresses. Jdentification and evaluation of maintenance processes in freshly placed and hardened concrete pavement. Analyse the effect of curing which affects to the properties of freshly placed and hardened concrete pavement. Analyse the effect of curing which affects to the properties of freshly placed and hardened concrete pavement. Analyse the effect of curing which affects to the properties of the concrete pavement construction processes. Roller compacted concrete technology, Concrete Block Paving technology, Semi Rigid Pavements. Internal curing concrete. fibre-reinforced concrete. Reinforced concrete Pavement.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 3               | Elective B                               |

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### MSc. / Masters/ PG Dip. in Transportation Engineering 2023



# Department of Civil Engineering University of Moratuwa



#### GRADUATION REQUIREMENT

1. MSc in Transportation Engineering Students are required to complete 25 credits from core (A/B/C) modules, 15 credits from electives (A/B) and 20 credit MSc Dissertation.

2. Master of Transportation Engineering Students are required to complete all core A modules (10 credits), minimum 6 credits from core B modules, minimum 6 credits from elective A and a Research Project (independent study) worth 5 credits.

3. PG Diploma in Transportation Engineering Students are required to complete all core A modules (10 credits), minimum 6 credits from core B modules and minimum 6 credits from elective A.

#### CONTACT INFORMATION

For more information, contact the course coordinator on loshakap@uom.lk or on extension 2219.

#### TRANSPORTATION ENGINEERING DIVISION ACADEMIC STAFF

Professor J.M.S.J. Bandara B.Sc.(Eng) , Ph.D. (Calgary), FCILT, CEng., MIE (SL)

Professor W.K.Mampearachchi B.Sc.(Eng) , MSCE (S.Florida), Ph.D.(Florida), CMILT, CEng, MIE (SL)

Professor H.R. Pasindu B.Sc. Eng (Hons), Ph.D.(NUS), CMILT, CEng, MIE (SL)

Dr. G.L.D.I.De Silva B.Sc (Eng), Ph.D (Calgary), P.Eng (Alberta)

Dr.H.L.K Perera(Course Coordinator) B.Sc. Eng (Hons), M.Sc. (K-State,USA),Ph.D.(Uni Melb), A. Dip. in MA (CIMA-UK), CEng., MIE(SL), CMILT, EIT (USA)