



Tribhuvan University  
Institute of Engineering  
Pulchowk Campus

Course Outline  
(Draft)  
M. Sc. in  
Transportation Engineering

September, 2010

## **1. Introduction**

The era of overall development for any nation starts from the national priority on infrastructure. Transportation takes most significant attention from the state mechanism. Therefore, the state investment in this sector is always at high level. Issues on Planning, Design, construction, operation and maintenance of transportation infrastructure are very perceptive in terms of economic development, environmental concern and social aspect of our context.

In this light, national demand on transportation professionals remains very high. Institute of Engineering (IOE), the pioneer in serving the nation by producing technical workforce is always leading the country in this aspect. Assessing the present need in consultation with stakeholders in this sector, IOE is launching M. Sc. in Transportation Engineering. Need based curriculum meeting national demand and opening the horizon for further research career in new technological advancement, are core of this program.

## **2. Title and course duration**

M. Sc. in Transportation Engineering. The duration of the course is two years. The course is two years and four semesters. The last semester is dedicated for thesis work.

## **3. Objective of the Program**

The main objective of the program is to produce highly competent professional in the field of transportation engineering. Graduates from this course will be familiar with the planning methods, design techniques, and maintenance of the different modes of transportation. The students will be able to work as the professional in any sector of transport. This could be achieved by the provision of diversified elective courses in this sector. Students after the completion of the course could join in any study and research projects in the Transportation Engineering, The last semester thesis work will develop the skill and patience to study in depth and find out some research output in the topic.

## **4. Entry Requirements and admission test**

The candidate pursuing the admission must hold the Bachelor's Degree in Civil Engineering or its equivalent from recognized institutions. The candidate shall appear in the admission tests.

## **5. Credit System**

The course curriculum is organized in the overall frame work of credit system. Each course has a certain number of credits which describes its weightage. The number of credits depends upon the contact hours for the course and its work load. Generally, a course is designed for a four credits hours (i.e. four lecture hours, one tutorial or assignment per week). This is denoted as by label 4-1-0 indicating '0' contact hour for laboratory work.

## **6. Course codes:**

Each course offered by the Institute of Engineering is identified by two letters, engineering 'EG' followed by three digits. The first digit '6' or '7' denotes the first and second year respectively of Master's level course. The second digit from '0' to '4' is used to denote the courses offered in first semester and '5' to '9' is used for second semester of each year. The third digit is used to identify the particular course. The last two letters denote the department offering the course e.g. CE – Civil Engineering.

## 5. Course Structure

Semester	Code	Subjects	Credit hours	Remarks
I	EG 611 CE	Transportation Engineering	4	
	EG 612 CE	Applied Research Methodology & Statistics	4	
	EG 613 CE	Traffic Engineering	3	
	EG 614 CE	Road Construction Materials & Technology	4	
	<b>Sub Total</b>		<b>16</b>	
II	EG 655 CE	Operation Research in Transportation System	4	
	EG 656 CE	Pavement Engineering	4	
	EG 657 CE	Transport Planning & Management	3	
	EG 658 CE	Transportation Economics	2	
		Elective I	4	
<b>Sub Total</b>		<b>16</b>		
III	EG 709 CE	Advanced Geotechnical Engineering	4	
		Elective II	4	
		Elective III	4	
	<b>Sub Total</b>		<b>12</b>	
IV	EG 750 CE	M. Sc. Thesis	16	
<b>Total Credit</b>			<b>60</b>	

## 6. Elective Courses:

Elective courses will be offered as per the availability of resource persons. The elective course credit hour will be the same as mentioned in the table above. The elective courses mentioned in the table below have been identified as the relevant courses presently. However, new courses could be offered after the official approval from the IOE, TU. Total elective courses Elective courses Course Code for elective courses will be:

Code	Courses	Remarks
EG661CE	GIS and Remote Sensing	
EG662CE	Project Management	
EG663CE	Transport Safety	
EG721CE	Urban Transportation	
EG722CE	Airport Engineering and Operations	
EG723CE	Railway Engineering	
EG724CE	Design of RCC Bridges	
EG725CE	Tunnel Engineering	
EG726CE	Ropeway Engineering	
EG727CE	Pavement Management System	
EG 728 CE	Computer simulation applications in Transportation Engineering	

Note: Courses offered as elective sub

## 7. Course Details

### Semester I, Core courses

Code	Subject/course objectives	Outline (Contact hours)
EG 601 CE	<p><b>Transportation Engineering(4-1-0)</b></p> <ul style="list-style-type: none"> <li>To introduce the continuum of transportation system</li> <li>To develop the skill in planning, design, construction and maintenance of different modes of transportation.</li> <li>To introduce new technology in the field of transportation engineering.</li> </ul>	<ol style="list-style-type: none"> <li>Introduction to transportation system (2)</li> <li>Operation and control of transportation vehicles (3)</li> <li>Design of Transportation facilities               <ol style="list-style-type: none"> <li>Highway Engineering: Planning, alignment survey, Geometric design, drainage system (15)</li> <li>Railway Engineering: Geometric design, crossings and turnout, terminal facilities (15)</li> <li>Airport Engineering: Airport planning, geometric design of runway and taxiway, airport terminal facilities. (15)</li> <li>Rope ways: types, components, Design considerations,(5)</li> </ol> </li> <li>Express ways, LRT, BRT, high speed trains (5)</li> </ol>
EG 612 CE	<p><b>Applied Research Methodology and Statistics (4-1-0)</b></p> <ul style="list-style-type: none"> <li>To introduce the culture of understanding the research</li> <li>To develop the skill in qualitative and quantitative research methods in Engineering.</li> <li>To develop the skill for collecting, processing the transportation data</li> <li>To strengthen the writing skill for proposals and research papers.</li> <li>To strengthen the basic concepts on random variable, probability distribution functions, hypothesis testing, estimation theory and curve fittings</li> </ul>	<ol style="list-style-type: none"> <li>Basic of Research methodology (10)</li> <li>Source of Transportation data (2)</li> <li>Transport data in developing countries (3)</li> <li>Data Analysis (5)</li> <li>Writing the Research Proposal (8)</li> <li>Writing the Research Report (7)</li> <li>Special Probability distributions (5)</li> <li>Sampling Theory and distribution (5)</li> <li>Estimation theory (3)</li> <li>Hypothesis testing (2)</li> <li>Curve Fitting &amp; statistical tools (10)</li> </ol>
EG 613 CE	<p><b>Traffic Engineering (3-0-1)</b></p> <ul style="list-style-type: none"> <li>Strengthen the knowledge and concepts on traffic studies</li> <li>To apply the traffic consideration for transportation projects</li> <li>To enable the students in identification, analysis and solution of traffic problems in urban areas.</li> </ul>	<ol style="list-style-type: none"> <li>Road User and Vehicles (2)</li> <li>Traffic studies (10)</li> <li>Traffic controls (5)</li> <li>Traffic regulations (5)</li> <li>Street lighting &amp; Intersection design (8)</li> <li>Highway and intersection Capacity and level of service analysis(10)</li> <li>Introduction to 'Traffic flow theory' (5)</li> <li>Laboratory works in Traffic Engineering (15)</li> </ol>
EG 614 CE	<p><b>Road Construction Materials and Technology (4-0-1)</b></p> <ul style="list-style-type: none"> <li>To impart the knowledge on material testing</li> <li>To develop the knowledge on new technologies in the road construction</li> </ul>	<ol style="list-style-type: none"> <li>Introduction (2)</li> <li>Pavement Materials for Road and Airport Construction: (20)               <ol style="list-style-type: none"> <li>Mineral materials</li> <li>Binding materials</li> </ol> </li> <li>Tools, equipments and plants for road construction (5)</li> <li>Earthworks (4)</li> <li>Pavement works(10)</li> <li>Road maintenance (8)</li> <li>Construction of Roadside structures (6)</li> <li>Site visit &amp; field report (5)</li> <li>Laboratory works on material Aggregates and bitumen testing (15)</li> </ol>

Semester II, Core courses

Code	Subject	Outline
EG 655 CE	<p><b>Operation Research in Transportation System (4-1-0)</b></p> <ul style="list-style-type: none"> <li>• To introduce the basic concepts on optimization and linear programming.</li> <li>• To develop the skill in application of operation research in transportation Engineering.</li> </ul>	<ol style="list-style-type: none"> <li>1. Mathematical Programming (5)</li> <li>2. Discrete Optimization (10)</li> <li>3. Transportation oriented optimization (10)</li> <li>4. Optimization under uncertainty (10)</li> <li>5. Optimal control (5)</li> <li>6. Optimization in Strategic planning and operations management (10)</li> <li>7. Mathematical concepts and notation used for formulating and solving optimization (10)</li> </ol>
EG 656 CE	<p><b>Pavement Engineering (4-0-1)</b></p> <ul style="list-style-type: none"> <li>• To develop more specific knowledge on pavement structure</li> <li>• To develop skill in designing different pavement system.</li> </ul>	<ol style="list-style-type: none"> <li>1. Introduction (4)</li> <li>2. Stresses and strains in flexible pavements (4)</li> <li>3. Stresses and deflections in rigid pavements (4)</li> <li>4. Traffic loading and volume (2)</li> <li>5. Material characterization (2)</li> <li>6. Drainage design (2)</li> <li>7. Pavement performance (2)</li> <li>8. Reliability (3)</li> <li>9. Flexible pavement design(10)</li> <li>10. Rigid pavement Design (5)</li> <li>11. Design of overlays (5)</li> <li>12. Theory of viscoelasticity (2)</li> <li>13. Laboratory work on bituminous mixes (15)</li> </ol>
EG 657 CE	<p><b>Transport Planning &amp; Management (3-1-0)</b></p>	<ol style="list-style-type: none"> <li>1. Transportation Planning definition and context (2)</li> <li>2. Transportation Planning and decision making (5)</li> <li>3. Transportation system characteristics and survey (5)</li> <li>4. Data management (5)</li> <li>5. Demand analysis (5)</li> <li>6. Supply analysis (5)</li> <li>7. Transportation system and project evaluation (8)</li> <li>8. Program and project implementation (5)</li> <li>9. Transport System management (5)</li> </ol>
EG 658 CE	<p><b>Transportation Economics (2-0-0)</b></p> <ul style="list-style-type: none"> <li>• To ensure the understanding of principles of micro and macro economics</li> <li>• To impart the knowledge on transportation cost &amp; benefits</li> <li>• To develop the concepts on budgeting in transportation sector</li> <li>• To develop the knowledge in multi-criteria decision making</li> </ul>	<ol style="list-style-type: none"> <li>1. Foundation of Micro Economics (2)</li> <li>2. Principles of Macro Economics (4)</li> <li>3. Travel Demand (4)</li> <li>4. Supply of Transport (4)</li> <li>5. Cost Functions in Transport (2)</li> <li>6. Pricing of Transport (2)</li> <li>7. Investment Criteria (6) <ol style="list-style-type: none"> <li>7.1. Cost Benefit Analysis)</li> <li>7.2. Vehicle Operating Cost</li> <li>7.3. Travel time</li> <li>7.4. Safety</li> <li>7.5. Social cost and benefits of transport projects</li> </ol> </li> <li>8. Capital budgeting, risk and uncertainty (2)</li> <li>9. Multi-criteria analysis in transport. (4)</li> </ol>

Semester III, core courses

Code	Subject	Outline
EG 709 CE	<p style="text-align: center;"><b>Advanced Geotechnical Engineering (4-1-0)</b></p> <ul style="list-style-type: none"> <li>• Student will able to use the knowledge of advanced knowledge of geotechnical engineering for designing different transportation structures.</li> <li>• To strengthen the knowledge of soil mechanics and foundation Engineering</li> </ul>	<ol style="list-style-type: none"> <li>1. Review of engineering properties of soils (5)</li> <li>2. Exploration (5)</li> <li>3. In-situ tests (5)</li> <li>4. Bearing capacity of soils (5)</li> <li>5. Settlement (5)</li> <li>6. Types of foundation (5)</li> <li>7. Earth pressures (5)</li> <li>8. Retaining walls (5)</li> <li>9. Piles (5)</li> <li>10. Well foundation (5)</li> <li>11. Ground improvement methods (2)</li> <li>12. Slope stability analysis (4)</li> <li>13. Soil structure interaction (4)</li> </ol>

**Elective Courses** (Course outline for elective subjective are subjected to the detail worked out by course coordinator)

code	Courses	Course Outline
EG 661 CE	<b>GIS and Remote Sensing</b>	<ol style="list-style-type: none"> <li>1. Introduction to GIS principles</li> <li>2. Raster and vector based GIS and data Structures</li> <li>3. Spatial data sources</li> <li>4. Generation of thematic maps, Georeferencing, Digitization, Data Editing, Edge Matching and Mosaic Preparation</li> <li>5. Linking Spatial and Non Spatial Data</li> <li>6. Errors and Quality Control, Data Storage, Data formats, Geo databases, Database Concepts</li> <li>7. Database Management in GIS –Introduction to Visual Basic for applications, Data Manipulations: attribute operations, area/distance calculations, ovelays analyses</li> <li>8. Map Projections: Global Positioning Systems</li> <li>9. Remote Sensing</li> </ol>
EG 662 CE	<b>Project Management</b>	<ol style="list-style-type: none"> <li>1. Introduction</li> <li>2. Project procurement</li> <li>3. Project planning and Control</li> <li>4. Resource allocation and leveling</li> <li>5. Material management</li> <li>6. Human resource management and Communication</li> <li>7. Project risk and management</li> <li>8. Project management softwares</li> <li>9. Monitoring and evaluation of projects</li> </ol>
EG 663CE	<b>Transport Safety</b>	<ol style="list-style-type: none"> <li>1. Safety issues in Road, Air, Rail and Water transport</li> <li>2. International accident patterns,</li> <li>3. Safety data sources, their use and misuse</li> <li>4. Identification of hazard and diagnosis of safety problems</li> <li>5. Problem diagnosis using traffic ehavior data; number versus rates – Interpretation of safety information;</li> <li>6. Human factors in road accidents</li> <li>7. Alcohol and speed – effects on safety; human factors and new technology</li> <li>8. Vehicle factors in accidents and injury prevention measures</li> <li>9. Infrastructure problems and solutions</li> <li>10. System safety and safety audit;</li> <li>11. Safety education;</li> <li>12. Safety modeling</li> <li>13. Vulnerable road users</li> </ol>
EG 721 CE	<b>Urban Transportation</b>	<ol style="list-style-type: none"> <li>1. Urban transportation issues in developed and developing countries</li> <li>2. Transport system management in urban area</li> <li>3. Public transportation,</li> <li>4. Land use planning, CBD space management</li> <li>5. Intelligent Transport System: ITS</li> <li>6. Urban transport network and street design</li> <li>7. Assignment on urban transport management if the cities of Nepal</li> <li>8. Non-motorized transport for urban area</li> <li>9. Barrier free transport in urban area</li> </ol>
EG 722 CE	<b>Airport Engineering and Operations</b>	<ol style="list-style-type: none"> <li>1. Airport System and Planning</li> <li>2. Aerodrome Design and construction</li> <li>3. Aerodrome maintenance</li> <li>4. Aerodrome Certification and Operation</li> <li>5. Aerodrome Safety Management System</li> </ol>

EG 723 CE	<b>Railway Engineering</b>	<ol style="list-style-type: none"> <li>1. Introduction</li> <li>2. Basic elements of railway system and their function</li> <li>3. Geometric design of railway track</li> <li>4. Drainage system of railway system</li> <li>5. Survey of railway development</li> <li>6. Electro-mechanical requirement and safety</li> <li>7. Economics of railways</li> <li>8. Maintenance of Railways</li> </ol>
EG 724 CE	<b>Design of RCC Bridges</b>	<ol style="list-style-type: none"> <li>1. introduction to bridge Structures</li> <li>2. Fundamental for Design and Analysis of Bridge superstructures</li> <li>3. Analysis and design of bridge sub-structures</li> <li>4. Bridge foundations</li> <li>5. Bridge bearing and expansion joints</li> </ol>
EG 725 CE	<b>Tunnel Engineering</b>	<ol style="list-style-type: none"> <li>1. Planning and project identification of tunnels in different civil engineering projects</li> <li>2. Survey of tunnel alignment</li> <li>3. Methods of tunneling in different geological conditions</li> <li>4. Drainage in tunnels</li> <li>5. Lighting in tunnels</li> <li>6. Ventilation in tunnels</li> <li>7. Methods of tunnel lining</li> </ol>
EG 726 CE	<b>Ropeway Engineering</b>	<ol style="list-style-type: none"> <li>1. Ropeway in the context of Nepal</li> <li>2. Ropeway classification</li> <li>3. Components parts of ropeway system</li> <li>4. Feasibility study of ropeway</li> <li>5. Alignment survey and detail geotechnical study</li> <li>6. Electromechanical requirements and specifications of ropeway system</li> <li>7. Design of ropeway system: main cable, hauling cables, driving station, returning stations</li> <li>8. Power supply management for ropeway</li> </ol>
EG 727 CE	<b>Pavement Management System</b>	<ol style="list-style-type: none"> <li>1. Principles of Pavement Management System</li> <li>2. Pavement Performance Indicators and Their Relation to Traffic Safety</li> <li>3. Pavement evaluation procedure <ol style="list-style-type: none"> <li>a. Skid resistance</li> <li>b. Roughness</li> <li>c. Structural capacity of pavement</li> </ol> </li> </ol>
EG 728 CE	<b>Computer simulation Applications in Transportation Engineering</b>	<ol style="list-style-type: none"> <li>1. Introduction to system approach, transportation system, mathematical models,</li> <li>2. Fundamentals of simulation: Monte Carlo method, Analog and digital simulation, continuous and discrete models, simulation languages.</li> <li>3. Probability concepts - Random numbers - Pseudo random generators - Arrival patterns - Service time distributions, Queue discipline – Manual simulation of simple queuing system</li> <li>4. Creating and moving transactions - Queues and facilities - Event scheduling</li> <li>5. Priority - Preemption - Functions – Parameters and save values – Standard numerical attributes</li> <li>6. Analysis of simulation results: Model validation - Replication of random conditions - Time series analysis</li> </ol>