Transportation Engineering I

BEG 356 CI

Year: III **Semester: I**

Teaching Schedule Hours/week			Examination Scheme						Total Marks
			Final				Internal Assessments		
			Theory		Practical		Theory	Practical	
L	T	P	Duration	Marks	Duration	Marks			
3	3	2/2	3	80	-	-	20	25	125

Course Objective:
After the completion of the course, students will be able to plan, survey and design the road projects. They will attain the knowledge of road development and its planning. They will gain the knowledge based on the Nepalese context.

Course Contents:

1. Introduction to Transportation Planning and engineering (4 hrs)

1.1. Modes of transportation: Highways, railways, waterways and airways
1.2. Comparison between various modes of transportation and constraint on their development in Nepal
1.3. Historical development of roads and road construction in Nepal
1.4. Classification of roads (Nepal Road Standard and Nepal Rural Road Standard)
1.5. Transport planning including objective of road planning, National network planning, urban road network planning and ring roads

2. Highway Alignment and Engineering Survey (3 hrs)

2.1. Highway Alignment
  2.1.1. Introduction
  2.1.2. Requirements of highway alignment
  2.1.3. Factors controlling highway alignment

2.2. Engineering survey and its stages (map study, reconnaissance, preliminary and detailed surveys)

3. Geometric Design of Highway (18 hrs)

3.1. Definition and scope of geometric design
3.2. Basic design controls and criteria for design
3.3. Elements of cross-section
3.4. Elements of horizontal alignments
  3.4.1. Definition and types of horizontal curve
  3.4.2. Design of horizontal curves including night visibility consideration
  3.4.3. Sight distance: Stopping sight distance, Overtaking sight distance, Set-back from obstructions
  3.4.4. Super elevation
  3.4.5. Extra widening
  3.4.6. Transition Curves: Definition and types of transition curve, design of transition curve
3.5. Elements of Vertical Alignment
  3.5.1. Definition and types of gradient
  3.5.2. Momentum grade
  3.5.3. Grade compensation
  3.5.4. Definition and types of vertical curve
  3.5.5. Design of vertical summit curve
  3.5.6. Design of vertical valley curve
  3.5.7. Lowest and highest point of vertical curve

4. Highway Drainage (5 hrs)

4.1. Introduction and importance of highway drainage system
4.2. Causes of moisture variation in sub-grade soil
4.3. Surface drainage system
  4.3.1. Different types of road side drain
  4.3.2. Cross drainage structures
  4.3.3. Different types of energy dissipating structures
4.4. Subsurface Drainage System
  4.4.1. Drainage of infiltrated water
  4.4.2. Control of seepage flow
  4.4.3. Lowering of water table
  4.4.4. Control of capillary rise

5. Hill Roads (7 hrs)

5.1. Introduction
5.2. Special consideration in hill road design
  5.2.1. Alignment of hill road design: General consideration, route location in hills, gradient, design and types of hair pin bends, different types of hill road cross sections
5.3. Special structures in hill road
  5.3.1. Types of retaining structures, river training structures, land slide stabilization structures and gully control structures
5.4. General introduction to bio-engineering

6. Highway Materials (8 hrs)

6.1. Introduction and classification of road materials
6.2. Sub-grade Soil
  6.2.1. General
  6.2.2. Characteristics of sub-grade soil
  6.2.3. Desirable properties of sub-grade soil
6.3. Road Aggregate
  6.3.1. Definition and classification of road aggregates
  6.3.2. Desirable properties of road aggregates
  6.3.3. Tests on road aggregates and their significance
  6.3.4. Comparing gradation specification and method of translating specification
  6.3.5. Combining of the aggregates
6.4. Bituminous Road Binders
  6.4.1. Definition and classification of road binders
  6.4.2. Liquid btumen: Cut-back bitumen and Bitumen emulsion
  6.4.3. Tests on Bituminous binders
6.5. Bituminous Mixes
  6.5.1. Definition and Classification
  6.5.2. Marshal Method of bitumen mix design

Laboratories:

(i) Los Angeles Abrasion value and crushing value of aggregates
(ii) Penetration value; Viscosity; softening point and ductility of bitumen
(iii) Skid resistance test on road surface
(iv) Marshall stability test and asphalt mix design
(v) Extraction of bitumen from mix and gradation of aggregate after extraction

References:

- "A Text-book on highway engineering and airports", S.B.Sehgal and K.I. Bhanot, S. Chand and Co. Publishers Ltd., New Delhi
- "Principles, Practice and Design of Highway Engineering", S.K. Sharma, S. Chand and Co. Publishers Ltd., New Delhi
- "Highway Engineering" Dr. S.K. Khanna and Dr. C.E.G.Justo, Nem Chand & Bros Roorkee (U.P.)