GUJARAT TECHNOLOGICAL UNIVERSITY

BE Semester-V
Subject Code: 3150611

Subject Name: TRANSPORTATION ENGINEERING

Type of course: Professional Core Course

Prerequisite:

Rationale:
1. To comprehend basic requirements of Highway, Rail, Water and Air Transportation.
2. To enable the students to apply the basic principles of geometric design, design of highway and traffic engineering in the field.
3. To know the functions and design of water transportation structures.
4. To know basic elements in Airport Engineering.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	**0**	**2**	**4**	**70**	**30**	**30**	**20**	**150**

Content:

Sr. No.	Content	Total Hrs
1	**Introduction:** Importance of Transportation, Different modes of transportation, Overview of Road, Rail, Air and Water Transportation, Comparison of various modes of Transportation. **Organizations and their functions** - Central Road Research Institute (CRRI), Indian Road Congress (IRC), Railway Board (RB), Inland Waterways Authority of India (IWAI), Airport Authority of India (AAI), International Civil Aviation Organization (ICAO), Directorate General of Civil Aviation (DGCA).	**2**
2	**Highway Transportation:** **Introduction:** Highway planning and development in India, Classification of Rural and Urban roads, Highway alignment and surveys, Preparation of Detailed Project Report. **Highway Geometric Design**: Importance, highway cross section elements, sight distance, design of horizontal alignment, design of vertical alignment, design of intersection. **Highway Materials:** Components of highway pavement and materials used. **Soil:** Importance, Desirable properties, Index properties, Compaction, Strength evaluation tests. **Aggregate:** Functions, Desirable properties, Tests on road aggregates and quality control. **Bituminous binders:** Functions, Desirable properties, Tests on bitumen and quality control, Bitumen emulsion functions and classification, Modified bituminous binder	**30**

	functions and classification. **Bituminous Mix:** Desirable properties and requirement of design mix, general approach for design of bituminous mixes and introduction to Marshall Mix Design Method. **Design and Construction of Pavement:** Pavement component functions, factors affecting pavement design and basic pavement design of Flexible and Rigid pavement as per IRC guidelines, Steps for construction of highway on embankment and in cutting. Construction of embankment and subgrade, soil stabilization. **Flexible Pavement:** Construction of Granular Sub-Base/Drainage layer, Construction of Granular Base Course-WBM and WMM, Construction of bituminous pavement layers- base course and surface course, prime coat and tack coat. **Rigid Pavement**: Types of cement concrete pavement, components of cement concrete pavement and its functions, construction of cement concrete pavement, joints in cement concrete pavement-function and construction. **Pavement Maintenance:** Objective and classification of highway maintenance works. Distresses and maintenance measures in flexible and rigid pavements. Concept of pavement evaluation: Functional and Structural **Highway Drainage, Arboriculture and Lighting:** Requirements of drainage system, Surface drainage system, Sub-surface drainage system, Road Arboriculture, Highway lighting: Importance, Design factors and lighting layout. **Traffic Engineering:** Traffic characteristics, Traffic studies: Traffic Volume study, Spot speed studies, Travel time - Delay study, PCU, Origin and Destination studies, Parking studies, Road accident studies. Traffic regulations and control devices. Types of Intersections. Road safety aspect	
3	**Rail Transportation:** Role of Indian Railways in National Development, Basic requirement of railway alignment and functions of Permanent Way, **Types of components and functions:** Gauge, Rail, Fittings, Ballast, Embankments, Subgrade. **Purpose:** Coning of wheel, Super-elevation, points and crossing, signalling and interlocking, yard, junction and terminal.	**4**
4	**Water Transportation:** **Harbour:** Classification, components, site selection. **Definitions:** Harbour, Port, Plimsoll Line, Beam, Draft, Hull, **Structures and functions:** Jetty, Breakwater, Wharf, Dock, Lock, Quay, Mole, Dolphin. Mooring, Dredging. **Natural Phenomenon:** Tides, Waves, Wind, Currents. **Navigational Aids:** Lighthouse, Lightships, Buoys.	**3**
5	**Air Transportation:** **Airport**: Classification, Master plan, Site selection, Zoning laws, imaginary surfaces. Aircraft Component parts, **Importance and Purpose:** Wind rose diagram, Runway Orientation, Taxiway, Apron, terminal building, Marking and lighting on Runway, Taxiway and Apron	**3**

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Course Outcomes: At the end of the course, Student will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Illustrate and demonstrate parameters of highway planning, geometric and pavement design.	20
CO-2	Analyze pavement distresses, failures and suggest prevention measures.	20
CO-3	Describe basics of traffic flow parameters, parking, marking, signal, and signs.	10
CO-4	Solve problems of railway track geometrics and to understand various railway track materials, their properties and use.	20
CO-5	Identify various component parts of dock, harbour and airports and apply ship and aircraft characteristics in planning of harbour and airports.	15
CO-6	Design of pavement for the given for traffic.	15

Suggested Specification table with Marks (Theory): (For BE only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10%	**20%**	**20%**	**20%**	**10%**	**20%**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Huang Y. H., Pavement Analysis and Design. Prentice Hall, Englewood Cliffs, New Jersey, USA, 1993, ISBN-0-13-655275-7
2. Yoder E. J. and Witczak M. W., Principles of Pavement Design, John Wiley and Sons, New York, 1975
3. Tang, Pavement Design
4. Mannering F. L., Kilareski W. P. and S. S. Washburn, Principles of Highway Engineering and Traffic Analysis. Wiley India Pvt. Ltd., New Delhi.
5. Atkins H.N., Highway Construction and Maintenance, Soils, and Concretes, Reston Publishing Company, Reston VA, 1983.
6. Watson J. P., Highway Construction and Maintenance, Longman Scientific and Technical, New York, 1989.
7. Dr. Sharma S. K., Principles, Practice and Design of Highway Engineering (Including Airports), S. Chand & Company Ltd.
8. Chakraborty Partho, Das Animesh, Principles of Transportation Engineering, PHI

9. Khanna S.K., Justo C.E.G., Highway Engineering, Nem Chand & Bros., Roorkee.
10. Bindra S.P., A course in Highway Engineering, Dhanpat Rai Publications
11. Kadiyali L. R. and Lal, N. B., Principles & Practice of Highway Engineering, Khanna Publishers, Delhi.
12. Khanna S. K., Arora M. G. and Jain S.S., Airport Planning and Design, Nem Chand and Bros.
13. IRC:58-2015, Guidelines for the Design of Plain Jointed Rigid Pavement for Highways
14. IRC:37-2018, Guidelines for the Design of Flexible Pavements,
15. Specifications for Road and Bridges, Ministry of Road Transport & Highways (MoRTH)
16. Chandra Satish, Agarwal M.M., Railway Engineering, Oxford University Press,
17. Rangwala S. C., Principles of Railway Engg., Charotar publication
18. Bindra S. P., Docks & Harbour Engineering, Dhanpatrai Sons publication.
19. Srinivasan R., Harbour, Dock and Tunnel Engineering, Charotar Publication,
20. Linzodef Quinn A., Design and Construction of Ports & Marine structures, Mcgraw hill publication
21. Norman J. Ashford, Saleh Mumayiz, Paul H. Wright, Airport Engineering, Wiley publication
22. Saxena Subhash C, Airport Engineering Planning and Design, CBS Publishers & Distributors
23. Rangwala S. C., Airport Engineering, Charotar publication

List of Experiments:

1. Determination of aggregate crushing Value
2. Determination of aggregate impact value
3. Determination of Los Angeles Abrasion value
4. Determination of shape tests on aggregate
5. Determination of California Bearing Ratio values
6. Determination of viscosity of Bitumen
7. Determination of softening point of bitumen
8. Determination of ductility of the bitumen
9. Determination of flash point and fire point of bitumen
10. Determination of Bitumen content
11. Determination of stripping value of road aggregate
12. Determination of Marshall Stability value for Bituminous mix

Major Equipment:

1. Aggregate crushing value test apparatus
2. Aggregate impact value test apparatus
3. Los Angeles test apparatus
4. Flakiness and Elongation index gauge
5. California bearing ratio test apparatus
6. Kinematic viscometer test apparatus
7. Ring and ball test apparatus
8. Ductility test apparatus
9. Flash and fire point test apparatus

10. Marshal test apparatus

List of Open Source learning website:

1. http://www.nptel.iitm.ac.in/courses/

Field Visit :

1. A visit of construction site of Highway and Railway for understanding of construction procedure
2. A visit of an Airport and Harbour / Port site for understanding various components and its function
3. A visit of Ready-Mix Concrete plant for understanding of process of producing concrete