GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: Diploma

Branch: Civil Engineering

Course / Subject Code : DI03006031

Course / Subject Name: Basic Transportation Engineering

w. e. f. Academic Year:	2024-25
Semester:	3rd
Category of the Course:	PCC

Prerequisite:	Students must have proficiency in Mathematics. Students have a keen interest in problem-solving skills.
Rationale:	Transportation forms the backbone of a developing nation by enabling smooth movement of goods and people. With India's growing population and increasing infrastructure needs, engineers must understand efficient, safe, and sustainable transport systems. This subject introduces students to the fundamentals of transportation engineering — particularly road transport, which is the most accessible and commonly used mode. It also includes essential topics like drainage systems, bridges, permanent ways in railways, and an overview of water and air transport systems. Therefore, this course is designed to enrich students with knowledge about all the modes of transportation with the emphasis to road construction and maintenance with practical knowledge to confidently execute construction, operation and maintenance as a part of their jobs in field.

Course Outcome:

After Completion of the Course, the Student will able to:

No	Course Outcomes	RBT Level
01	Explain the significance and types of transportation systems in terms of economy.	R & U
02	Apply geometric design principles as per IRC recommendations and Identify road materials and describe construction techniques.	R, U, & A
03	Maintain different types of drainage, bridges and its components.	R, U, & A
04	Recognize components and layout of railway tracks.	R, U, & A
05	Explain the function of harbours, docks and airways.	R & U
06	Perform material tests and analyze site observations for road and rail infrastructure.	R, U, & A

**Revised Bloom's Taxonomy (RBT)*

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Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	ESE (E)	PA (M)	PA (I)	ESE (V)	
03	00	02	04	70	30	20	30	**150**

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1	**Introduction to Transportation Engineering** 1.1 History of road development in India. 1.2 Importance of roads, railway, harbor and airport. 1.3 Modes of transportation: Road, Rail, Water, Air – comparison applications and its advantages. 1.4 Classification and types of road, Railway, harbor and airport based on their utility.	06	14
2	**Road geometries and its construction:** 2.1 Road alignment, Factors affecting the alignment, their types & its Importance. 2.2 Road geometry: ➢ Standard cross-sections of urban &Rural highway. ➢ Types camber, kerbs, right of way ➢ Design speed and influencing factors (IRC guidelines) ➢ Gradient: types and IRC Standards ➢ Sight distance – SSD, OSD ➢ Curves: horizontal and vertical, superelevation, extra widening 2.3 Materials used in road Construction. 2.4 Various tests on aggregate and Bitumen. 2.5 Brief introduction of Flexible and Rigid Pavement. 2.6 Maintenance of roads.	14	30
3	**Road Drainage system and Bridges** 3.1 Importance of drainage. 3.2 Methods of Surface and Sub-surface drainage. 3.3 Maintenance of drainage system. 3.4 Component of Bridge, classification and its type.	08	18

	3.5 Factor affecting the selection of Bridge site and Scour, Afflux, Runoff, Economic Span, Clearance, Freeboard etc.		
4	**Railway engineering:** 4.1 History of railway development in India. 4.2 Typical cross section of B.G.in permanent ways as per IRS. 4.3 Function of Various Components. 4.4 Method of fixing the rails with slipper. 4.5 Railway gauge, its types and uniformity of gauge. 4.6 Function of Rail joints and point and crossing. 4.7 Factors affecting point and crossing. 4.8 Classification yards and function of various yards. 4.9 Requirement of Track Maintenance, Daily and periodical maintenance.	11	24
5	**Water transportation and airway:** 5.1 Classification and types of Harbours based on their utility and location. 5.2 Growth of ports in India, Requirements of good harbour, Element of harbour and their function. 5.3 Wind characteristics, Wind rose diagram, Tide, Tide forces and theories, types of currents. 5.4 Hydrographic and Topographic Survey, Site selection for Harbour 5.5 General aspects of selection for berthing structures, Piers, Wharf, Quay wall, Jetty, Dolphins, trestle, Moles and mooring accessories. 5.6 Construction of Dock wall, classification of Break water and construction method of Break water wall. 5.7 Necessity for Fenders, types of fenders, mooring system and types of dredger. 5.8 Ideal airport layout. 5.9 Location and planning aspects of various airport elements. 5.10 Aircraft components and their functions.	06	14
	Total	**45**	**100**

Suggested Specification Table with Marks (Theory): (in %)

Distribution of Theory Marks (in %)					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
20	**30**	**50**	-	-	-

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

S. No.	Title of Book	Author	Publication with place, year, and ISBN
1	Highway Engineering	Khanna S.K, Justo, C.E G and Veeraragavan,A.	New Chand and Brothers, Roorkee, 2010. ISBN 978-8185240800.
2	Road, Railway, Bridge and Tunnel Engineering.	Birdi, Ahuja,	Standard Book House, New Delhi, March 2010, ISBN: 978-8189401337.
3	Road, Railway, Bridge & Tunnel Engineering	B L Gupta	Standard Publishers. Delhi
4	Traffic Engineering and Transport Planning	Kadiyali,L.R	Khanna Publishers, New Delhi, 2008, ISBN:978-8174092205
5	Principles, Practice and Design of Highway Engineering	Sharma, S.K	S. Chand Publication, New Delhi, 2012, ISBN: 9788121901314
6	Laboratory Manual in Highway Engineering	Duggal, Ajay K. and Puri, V.P	New Age International (P) Limited, Publishers, New Delhi, 2010, ISBN: 9788122403107.
7	Transportation Engineering Vol. I & II	V N Vazirani& S P Chaondola	Khanna Publishers. Delhi
8	Element of Bridge Tunnel and Railway Engineering	S P Bindra K Bindra	DhanpatRai& Sons Delhi
9	Dock and Harbour Engineering	H P Oza G H Oza	Charotar Publishing House, Anand
10	Harbour, Dock and Tunnel Engineering	R. Shrinivasan	Charotar Publishing House, Anand
11	Airport Engineering: Planning and Design	Subhash C. Saxena	CBS Publisher
12	Airport Engineering	Rangwala	Charotar Publishing House, Anand

(b) Open-source software and website:

1. www.nptel.iitm.ac.in.
2. https://www.vlab.co.in/broad-area-civil-engineering.

Suggested Course Practical List:

Exp. No.	List of Practicals	Unit No.	Approx. Hrs. required	Click here for Virtual experimen
1	• Draw the sketches showing standard cross section of NH/ SH, MDR/ ODR in embankment and cutting also draw road junction, Road curve and widening. • Draw neat sketches of Diamond crossing, Double slip crossing. • Draw sketches of layout of airport with brief description.	**1,4,5**	**HOME work**	-
2	Conduct Flakiness index test and Elongation index test on the aggregate.	**2**	**2***	click here
3	Conduct aggregate crushing test.	**2**	**2***	click here
4	Conduct aggregate Impact test.	**2**	**2***	click here
5	Conduct Softening Point test on Bitumen.	**2**	**2***	click here
6	Conduct Penetration test on Bitumen.	**2**	**2***	click here
7	Conduct Flash and Fire Point test on Bitumen.	**2**	**2***	-
8	Conduct Ductility test on Bitumen.	**2**	**4***	click here
9	Conduct California Bearing Ratio Test	**2**	**2**	click here
10	Visit the site at which construction of flexible/ Rigid pavement is undergoing to have the knowhow of construction of sub-base and / or base and / or surfacing coat as well as provision of drainage and prepare a report of it.	**2,3**	**4***	-
11	Prepare a visit report to a nearby Railway Station to visually observe fixtures, fasteners, track, slippers etc. and Junction/ Yard if any.	**4**	**4***	-
12	Visit the constructed road for visual inspection to identify defects and suggest remedial measures.	**2**	**4***	-
13	Visit to nearby airport and prepare a report on types of runway and taxiway.	**5**	**4**	-
		Total	**28**	-

List of Laboratory/Learning Resources Required:

S. No.	Equipment Name	Experiment No.
1	-Thickness gauge containing openings for aggregate sizes 63, 50, 40,31.5, 25,20,16,12.5,10 & 6.3mm as per IS:2386(Part I)-1963. -Length gauge containing openings for aggregate sizes 63, 50,	2

S. No.	Equipment Name	Experiment No.
	40,31.5, 25.20,16,12.5,10 & 6.3mm as per IS:2386(Part I)-1963.	
2	Compression testing machine-2000 kN capacity	**4**
3	IS sieve set (sizes- 80 mm, 40 mm, 20 mm, 12.5mm,10 mm, 4.75 mm, 2.36 mm,1.18 mm, 600 µ, 300 µ. 150 µ and pan), sieve shaker 04,05,06 with adaptors.	**2,3,4,5**
4	Los Angeles abrasion testing machine.	**3**
5	Crushing mould, measuring cylinder with plunger.	**4**
6	Impact testing machine.	**5**
7	California Bearing Ratio Test Apparatus.	**6**
8	Ring and Ball test apparatus (Hot plate 160mm dia. with magnetic stirrer, brass ring, steel ball and glass vessel 600ml and glass thermometer +80°c. Standard Penetrometer with penetration needle 100gm weight, container 55mm dia. and 53mm ht. as per IS:1203.	**7**
9	Standard Penetrometer with penetration needle 100gm weight, Container 55mm dia and 53mm ht. as per IS 1203.Water bath maintain (25°±0.1 °C), Thermometer range 0-44 °C.	**8**
10	Pensky Marten's Flash and Fire Point test apparatus 100x200x240mm with measurement range 0-95 as per IS:1209 1953. Thermometer range 0-200 °C.	**9**
11	Ductility Testing Machine with ductility mould and base plate.	**10**
12	Weighing Balance.	**FOR ALL**

Note: It is recommended that the standards specified in the relevant I.S. Codes should be met by equipment to ensure accuracy and reliability.

Suggested Project List: As per the Suggested Course Practical List

Suggested Activities for Students:

(A) Visit the site at which construction of flexible/ Rigid pavement is undergoing.

(B) Complete a micro-project given.

(C) Deliver a seminar on a relevant topic of your choice.

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