GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering

Level: Diploma

Branch: Civil Engineering

Subject Code : DI04006071

Subject Name: Railway, Harbour & Tunnel Engineering

w. e. f. Academic Year:	2025-26
Semester:	4th
Category of the Course:	Professional Elective - II

Prerequisite:	Students must have proficiency in Basic Transportation Engineering. Students have a keen interest for infrastructure development.
Rationale:	The development of Railways, Harbours, Metros, and Subways is vital for the growth and prosperity of a country, as they support the increasing movement of goods and people at national and international levels. Metro and subway projects in cities require the construction of long, deep tunnels beneath urban areas, demanding advanced design and construction practices. Globally, new materials, innovative techniques, and modern concepts are being adopted in these infrastructure works. Diploma Civil engineers in the transportation sector must be aware of these developments to ensure effective supervision and maintenance. Their role as technicians is crucial in the creation and management of such facilities. This course provides knowledge and skills related to construction and management of Railways, Harbours, and Tunnels. It equips students with technical abilities required in the transportation sector. By learning new materials and practices, they can perform their jobs effectively. Hence, this course is important for building competent engineers and technicians.

Course Outcome:

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

No	Course Outcomes	RBT Level
01	Explain various aspects related to construction and maintenance of Railway, Harbour and Tunnel structures	R & U
02	Describe various procedures for construction activities related to Railway, Harbour and Tunnel structures.	R, U, & A
03	Supervise Railway, Harbour and Tunnel related maintenance work	R, U, & A
04	Recognize components and layout of railway tracks.	R, U, & A
05	Supervise the construction of berthing structure	R & U
06	Select and test materials on site and laboratory as per IS requirement.	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 Railway and Permanent Way** 1.1 History of railway development in India. 1.2 Typical cross section of B.G.in permanent ways as per IRS. 1.3 Railway track, concept of gauge, Advantages of uniform gauge and loading gauge. 1.4 Design and construction of slab track for high-speed and urban rail systems. 1.5 High Speed Rail Engineering: Bullet train development and civil infrastructure including earthwork, bridges, viaducts and tunnels.	07	20
2	**Track Geometrics and Maintenance** 2.1 Gradient and classification 2.2 Grade compensation on curves 2.3 Relation between radius and versine of a curve 2.4 Function of Super elevation or cant, 2.5 Maximum super elevation, safe speed on Curve, Cant deficiency , examples, negative super elevation and Widening of gauge on curve 2.6 Maintenance of surface levels of track, Alignment, Drainage, track materials	06	16
3	**Stations, Yards, Track components and Signaling Systems** 3.1 Types of station, site selection and requirements for a railway station and yards 3.2 Type of yards, Marshalling yards & its types and platform 3.3 Function and necessity if Points and Crossing 3.4 Types of Point or Switches, High-speed S&C (Switches and Crossings) 3.5 Types of crossing , Merits & demerits, crossing clearance, special fitting with turn outs and combination of points and crossing , Differentiate between Left and Right hand Turn Out	10	16

	3.6 Classification of Signals in details, layout of Signals and control of train movements 3.7 Introduction to modern train control technologies like Automatic Train Control (ATC), and Positive Train Control (PTC). 3.8 Principle and Methods of Interlocking and Devices used for interlocking		
4	**Introduction to Harbours.** 4.1 Growth of ports in India, Requirements of good harbour, Element of harbour and their function. 4.2 Inland water transportation in India. 4.3 Classification and types of Harbours based on their utility and location. 4.4 Ship characteristics, Harbour design, turning basin, Harbour entrances. 4.5 Wind characteristics, Wind rose diagram, Tide, Tide forces and theories, types of currents. 4.6 Hydrographic and Topographic Survey, Site selection for Harbour. 4.7 General aspects of selection for berthing structures, jetties, fenders, piers, wharves, dolphins, trestle, moles, Harbour docks, use of wet docks, repair docks, lift docks, dry docks, keel and bilge blocking, mooring system. 4.8 Classification of Break water and construction method of Break water wall. 4.9 Importance of Navigation Aids, Type of Navigation, Requirements of Signals, Light house, Beacons, Beacon light, Floating Navigation aids, Range light and Radar Reflectors 4.10 Essential features of Transit Sheds, Required Area and Dimension of transit shed, ware house, cold storage 4.11 Types of dredger, Necessary of dredging 4.12 Coastal zone and Beach profile, Causes of beach erosion, coastal protection work (Sea wall, Bulk head, Groynes, Off shore break water, Revetments)	12	24
5	**Introduction to Tunnel, Its Surveying and Construction.** 5.1 Necessity, classification, advantages and disadvantages of Tunnel 5.2 Shape and size of Tunnel 5.3 Surveying work operation for tunnel 5.4 Drill and blast method, Tunnel Boring Machines (TBMs) (types like EPB, Slurry, Hard Rock TBMs, and their components/selection), New Austrian Tunnelling Method (NATM) / Sequential Excavation Method (SEM), Cut-and-Cover,	06	14

	Pipe Jacking, and Microtunneling 5.5 Classification, Location , size, Shape, and construction of Shaft 5.6 Method of Tunnelling in Soft soil , in Rock and contraction Equipment		
6	**Tunnel Support & Lining, Ventilation and Drainage System.** 6.1 Temporary and permanent support systems (e.g., shotcrete, rock bolts, steel arches, lattice girders), pre-support techniques, and installation of segmental and concrete linings. 6.2 Method of tunnel Ventilation for construction and operation, dust control, lighting, and drainage/dewatering systems	04	10
	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	**50**	**30**	**-**	**-**	**-**

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	Road, Railway, Bridge and Tunnel Engineering.	Birdi, Ahuja,	Standard Book House, New Delhi, March 2010, ISBN: 978-8189401337.
2	Road, Railway, Bridge & Tunnel Engineering	B L Gupta	Standard Publishers. Delhi
3	Transportation Engineering Vol. I & II	V N Vazirani& S P Chaondola	Khanna Publishers. Delhi
4	Element of Bridge Tunnel and Railway Engineering	S P Bindra K Bindra	DhanpatRai& Sons Delhi
5	Dock and Harbour Engineering	H P Oza G H Oza	Charotar Publishing House, Anand
6	Harbour, Dock and Tunnel Engineering	R. Shrinivasan	Charotar Publishing House, Anand

(b) Open-source software and website:

1. https://nptel.ac.in/courses/105107463
2. https://nptel.ac.in/courses/114106025
3. https://nptel.ac.in/courses/105105212

Suggested Course Practical List:

Exp No.	List of Practicals	Unit No.	Approx. Hrs. required
1	Draw the dimensional sketches of cross section of railway track (with function of each part of track).	1	2*
2	Draw the sketches of both left, right hand turnout and crossing of railway track showing each part of track.	3	2*
3	Prepare a visit report to a nearby Railway Station to visually observe fixtures, fasteners, track, slippers etc. and Junction/ Yard if any.	1,2 & 3	6*
4	Draw the sketches of Harbour, piers, wharf, quay wall, jetty, types of fenders light house, beacons, beacon light, floating navigation aids, coastal protection work.	4	4*
5	Prepare visit report to a nearby jetty and/or tunnel existing or under construction.	5	6*
6	Draw the sketches of various shape and size of tunnels.	5	2*
7	Seminar on emerging and relevant technologies	1 to 6	6*
		Total	28

Suggested Activities for Students:

(A) Site Visit of Railway Track, Harbour or Tunnel.
(B) Site visit to HSR project (Bullet Train) construction site.
(C) Case study of Indian Rail Traffic Management System (KAVACH).
(D) Case study of Chenab Railway Bridge, Konkan railway projects of India.
(E) Complete a micro-project given.
(F) Deliver a seminar on a relevant topic of your choice.
(G) Internet based assignments
(H) Teacher guided self-learning activities
(I) Course/library/internet/lab based mini-projects etc. (These could be individual or group-based.)

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