GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM
COURSE TITLE: RAILWAY, HARBOUR AND TUNNEL ENGINEERING
(COURSE CODE: 3360606)

Diploma Program in which this course is offered	Semester in which offered
Civil Engineering	Sixth

1. RATIONALE

The development of railways and harbours is paramount for prosperity of our country. Developmental works in railway and harbours are taking place at a rapid pace due to increase in volume of material being transported within country as well as internationally. Metro construction projects are being initiated in many cities of our country where large part of the metro would be underground beneath the city; this requires construction of long deep tunnels. Subways, which are being constructed under busy squares of the cities to help pedestrians cross the roads also requires tunnels.

New materials, concepts of design and construction practices are being employed internationally for these civil structures. Diploma civil engineers working in transportation sector should therefore be aware of these materials, concepts and practices so that they can provide effective supervision during construction and maintenance of these structures. The role of technicians in creation and management of such infrastructural facilities is quit important.

This course therefore provides scope and opportunities to the students of civil engineering for acquiring appropriate knowledge, skills and abilities in order to perform their job effectively related to construction and management of railway, harbours and Tunnels infrastructure. Thus this course is an important course for engineers working in transport sector.

2. COMPETENCY:

The course content should be taught and implemented with the aim to develop required skills in the students so that they are able to acquire following competency:

- **Maintain railways (permanent ways), Harbours and Tunnels**

3. COURSE OUTCOMES (COs):

During the course the teaching and learning activities should be carried out in such a manner that students are able to acquire requisite knowledge & specific skills in different domains and demonstrate following learning outcomes:

i. Explain various aspects related to construction and maintenance of Railway, Harbour and Tunnel structures .
ii. Describe various procedures for construction activities related to Railway, Harbour and Tunnel structures.
iii. Supervise Railway, Harbour and Tunnel related maintenance work
iv. Supervise the construction of berthing structure
v. Select and test materials on site and laboratory as per IS requirement.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	
3	0	2	5	70	30	20	30	150

Legends: L - Lecture; **T** -Tutorial/Teacher Guided Student Activity; **P** - Practical; **C** - Credit; **ESE** -End Semester Examination; **PA** - Progressive Assessment

5. COURSE CONTENT DETAILS

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit—I Introduction to Railway and Permanent Way	1a.Describe Indian railway and permanent way 1b.Describe various type of Railway gauge 1c. Illustrate various types cross section of railway track 1d. Describe rails, Sleeper and ballast	1.1 Roll of rail transportation and its limitation, merits and demerits 1.2 Railway track, concept of gauge, Advantages of uniform gauge and loading gauge 1.3 Components of permanent way and its ideal requirement 1.4 Rail ,various type of rail cross section, length of rail, defects in rail and remedies to reduce the defects 1.5 Measure to reduce the wear of rails 1.6 Characteristics of an ideal rail joints 1.7 Rail fastening and fixtures 1.8 Purpose of welding of rail joints 1.9 Type, function and requirement of an ideal sleeper 1.10 Merits and demerits of various sleepers 1.11 Coning of wheels and its purposes 1.12 Various type ofBallast materials its function 1.13 Cross section of ballast and Quantity
Unit—II Track Geometrics and Maintenance	2a.Describe the track geometrics 2b. Describe various type of curves 2c. Describe maintenance of track	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, Maximum super elevation, safe speed on Curve, Cant deficiency , examples, negative super elevation and Widening of gauge on curve 2.5 Maintenance of surface levels of track, Alignment, Drainage, track materials

Unit	**Major Learning Outcomes** (in cognitive domain)	**Topics and Sub-topics**
Unit—III Station, Yards, Points & Crossing, Signalling and Interlocking.	3a Describe the various type s of station and Yards 3b. Explain Points & Crossing, terms used in points & Crossing, with neat sketches 3c. Demonstrate various types of signalling , objects of signalling 3d. Describe the Interlocking	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 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 3.6 Classification of Signals in details , layout of Signals and control of train movements 3.7 Principle and Methods of Interlocking and Devices used for interlocking
Unit—IV Introduction to Harbours.	4a. Describe Harbour Classification and terms used in Harbour 4b. Describe the natural phenomenon and site investigation 4c. Describe various types of berthing structures 4d. Explain Docks Dry dock, Wet dock, Entrances, Entrance lock and size, Break water 4e. Describe Fenders, Mooring and Navigation Aids 4f. Explain Transit Sheds Dredging and Coastal Erosion and Protection	4.1 Growth of ports in India, Requirements of good harbour, Element of harbour and their function 4.2 Classification and types of Harbours based on their utility and location 4.3 Wind characteristics, Wind rose, Tide , Tide forces and theories, types of currents 4.4 Hydro graphic and Topographic Survey , Site selection for Harbour 4.5 General aspects of selection and design for berthing structures, Piers, Wharf, Quay wall, Jetty, Dolphins, trestle, Moles and mooring accessories 4.6 Design and construction of Dock wall, classification of Break water and construction method of Break water wall 4.7 Necessity for Fenders, types of fenders and Mooring system 4.8 Importance of Navigation Aids, Type of Navigation, Requirements of Signals, Light house, Beacons, Beacon light, Floating Navigation aids, Range light and Radar Reflectors 4.9 Essential features of Transit Sheds, Required Area and Dimension of transit shed, Wear house, Cold storage

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
		4.10Types of dredger, Necessary of dredging 4.11 Coastal zone and Beach profile, Causes of beach erosion, coastal protection work (Sea wall, Bulk head, Groynes, Off shore break water, Revetments)
Unit—V Introduction to Tunnel, Its Surveying and Construction.	5.a Explain Tunnel and Its classification, Size, Shape 5.b Describe methods of Surveying 5.c Describe Explosive and its uses 5.d Describe Shaft and its Construction 5.e Explain contraction of Tunnel in Soft and in Rock 5.f List safety precautions to be followed while using explosives.	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 Types of Explosive, Quantity of Explosive, Precaution in handling and transporting, Type of Detonators, Method of blasting 5.5 Classification, Location , size, Shape, and construction of Shaft 5.6 Method of Tunnelling in Soft soil , in Rock and contraction Equipment
Unit—VI Tunnel Lining, Ventilation and Drainage System.	6.a Describe Objective of lining and Formwork 6.b Explain method of Ventilation 6.c Describe Drainage System 6.d List different materials with their properties for lining.	6.1 Objective of lining and Types of lining 6.2 Advantages of concrete lining 6.3 Materials for lining 6.4 Method of tunnel Ventilation 6.5 Source of water, water handling, dewatering and permanent drainage

6. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (Theory)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R	U	A	Total Marks
I	Introduction to Railway and Permanent Way.	4	2	2	2	**6**
II	Track Geometrics and Maintenance.	4	2	2	4	**8**
III	Station, Yards, Points & Crossing, Signaling and Interlocking.	8	4	8	4	**16**
IV	Introduction to Harbour.	10	8	6	2	**16**
V	Introduction to Tunnel, Its Surveying and Construction.	8	2	5	5	**12**
VI	Tunnel Lining, Ventilation and Drainage System.	8	3	5	4	**12**
	Total	**42**	**21**	**28**	**21**	**70**

Legends: R = Remember**; U =** Understand**; A =** Apply and above levels (Bloom's revised 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.

7. SUGGESTED LIST OF EXERCISES/PRACTICAL

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills **(outcomes in psychomotor and affective domain)** so that students are able to acquire the competencies/programme outcomes. Following is the list of practical exercises for guidance.

Note*: Here only outcomes mainly in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of* ***Course Outcomes*** *related to affective domain. Thus over all development of* ***Programme Outcomes (****as given in a common list at the beginning of curriculum document for this programme) would be assured.*

Faculty should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes.

S. No.	Unit No.	Practical/Exercise (outcomes in psychomotor domain)	Approx. Hours Required
1	I	Draw the dimensional sketches of cross section of railway track (with function of each part of track).	2
2	II	Draw the sketches of both left, right hand turnout and crossing of railway track showing each part of track.	2
3	III	Visit to a rail way station and yards for observing various elements of railway and prepare a brief report.	4
4	IV	Draw the sketches of harbour, piers, wharf, quay wall, jetty, types of fenders light house, beacons, beacon light, floating navigation aids, coastal protection work.	6
5	IV/V	Visit to nearby jetty and/or tunnel existing or under construction and prepare a report.	6
6	V	Draw the sketches of various shape and size of tunnels.	4
7	All	Seminar on emerging and relevant technologies	4
		Total	28

8. SUGGESTED LIST OF STUDENT ACTIVITIES

Following is the list of proposed student activities such as:

i. Course/topic based seminars
ii. internet based assignments
iii. teacher guided self-learning activities
iv. course/library/internet/lab based mini-projects etc. (These could be individual or group-based.)

9. SPECIAL INSTRUCTIONAL STRETEGIES (If any)

i. Lecture cum demonstration of various types of equipment used in construction of railway, harbour and tunnel. .
ii. Show video/animation films of construction of railway, harbours and tunnels.
iii. Arrange expert lectures of engineers engaged in construction and maintenance of railways, harbour and tunnels/subways.
iv. Ask students to explore internet and present case studies on different aspects of railways/harbours/tunnels/subways projects by arranging classroom level seminars.
v. Arrange site visits to railway yard, harbour and tunnels/subways

10. SUGGESTED LEARNING RESOURCES

(A) List of Books

S. No.	Title of Books	Author	Publication
1	Road, Railway, Bridge & Tunnel Engineering	B L Gupta	Standard Publishers. Delhi
2	Road, Railway, Bridge & Tunnel Engineering	Ahuja&Birdi	Standard book house 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 Publishers. Anand
6	Harbour , Dock and Tunnel Engineering	R. Shrinivasan	Charotar Publishers. Anand

(B) List of Software/Learning Websites

1. www.amazon.com/Dock-Harbour-Engineering
2. books.google.co.in › Technology & Engineering › Civil › General
3. www.cphbooks.in
4. nptel.iitm.ac.in

11. CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof. N. J. Patel,** L.C.E., Shri K J Polytechnic Bharuch
- **Prof. (Mrs.) R.V.Bhatt,** L.C.E., Govt. polytechnic for girls, A'bad.
- **Prof. (Ms.) M.A.Milisia,** L.C.E., Govt. polytechnic for girls, A'bad.

Coordinator and Faculty Members from NITTTR Bhopal

- **Prof. M. C. Paliwal**, Associate Professor, Department of Civil and Environmental Engineering.
- **Dr Shashi Kant Gupta,** Professor and Coordinator for State of Gujarat**.**