

B.E. Semester: V

Department of Civil Engineering

Subject Name: Railway Bridge and Tunnel Engineering (CV506-N)

Course Category: Program Course Core (PCC)

A. Objectives of the Course:

- Railway, Bridge and Tunnel engineering are the three important aspects of civil engineering
- Civil engineer has to play a vital role in the design and construction of railway track and other associated structures for safe and efficient movement of the trains
- All the three aspects have been dealt with extreme care, especially the tunnel engineering on which limited reference is available

B. Teaching & Evaluation Scheme:

Teaching Scheme				Credit	Evaluation Scheme					Total Marks
L hrs	T hrs	P hrs	Total Hrs		Theory		IE	CIA	Pra/Viva	
					Hrs	Marks	Marks	Marks	Marks	
3	1	0	4	4	3	70	30	20	30	150

C. Detailed Syllabus:

Railway

1. Railway Track Gauge:

Different Gauges on Indian Railways, Affecting Factors, Uniformity of Gauge, Loading Gauge, Construction Gauge

2. Alignment of Railway Lines:

Importance, Basic Requirements of an Ideal Alignment, Selection of a Good Alignment, Rack Railways, Survey for Track Alignment

3. Track and Track Stresses:

Components, Requirements, Cross Section of Permanent Way, Track Modulus, Forces Acting on Track, Coning of Wheels

4. Components of Permanent Way:

Rail: Functions, Requirements, Type of Rails, Standard Rail Sections, Causes of Creep, Effects of Creep

Sleeper: Function, Requirements, Types of Sleepers, Sleeper Density and Spacing of Sleepers

Ballast: Function, Requirements, Specification of Track Ballast

Track Fittings: Fittings and Fastenings

5. Geometric Design of Track:

Necessity for Geometric Design, Details of Geometric Design of Track, Track Gradients, Grade Compensation on Curves, Curves and Super Elevation

6. Points and Crossings:

Functions, Turnout, Points of Switches, Crossings, Gauntletted Track, Triangle, Double Junctions, Single Slip, Double Slip

7. Signalling and Interlocking:

Objectives, Classification, Interlocking

Bridge

8. Introduction to Bridge:

Selection of Site, Data Collection, Stages of Investigation, Waterway Calculations, Scours Depth, Afflux, Free Board, Vertical Clearance and Economic Span, Classification of Super Structures, Flooring Joints, Bridge Bearings, Movable Bridges

9. Construction of Simply Supported Super Structure:

Introduction of Bridge Super Structure and Bridge Sub Structure, Construction of Bridge Approach, Construction of RE Wall, IRC SP 102, Installation of Geo Grid, Elements of Super Structure, Sequence Casting of Elements, Introduction IRC 87, Form traveller, Launching Gantry, launching of Precast Girder, Incremental Launching, Types of Expansion Joints, Construction of Expansion Joints, Construction of Prestressed Concrete Girder, Balanced Cantilever Erection

10. Testing and Maintenance of Super Structure:

Introduction to IRC SP 51, IRC SP 37, Introduction to IRC SP 018, IRC SP 52, Mobile Bridge Inspection

Tunnel

11. General:

Necessity/Advantages of Tunnel, Classification of Tunnel, Size and Shape of a Tunnel, Alignment of Tunnel, Portals and Shafts, Problems in Tunnelling

12. Tunnelling in Hard Rock and in Soft Ground:

Sequence of Operation, Faces of Attack, Methods, Types and Factors Affecting the Choice of Method to Soft Ground, Methods

13. Control and Safety Features in Tunnel:

Tunnel Lightning, Ventilation Tunnel, Methods of Ventilation, Dust Control, Drainage of Tunnel, Drainage System, Safety

D. Lesson Planning:

Unit No	Title of the Unit	Minimum Hours	Weightage (%)
1	Railway Track Gauge	02	05
2	Alignment of Railway Lines	02	05
3	Track and Track Stresses	02	05
4	Components of Permanent Way	03	05
5	Geometric Design of Track	02	05
6	Points and Crossings	02	03
7	Signalling and Interlocking	02	02
8	Introduction to Bridge	05	10
9	Construction of Simply Supported Super Structure	10	25
10	Testing and Maintenance of Super Structure	06	05
11	General	02	07
12	Tunnelling in Hard Rock and in Soft Ground	04	15
13	Control and Safety Features in Tunnel	03	08
Total:		45	100

E. List of Practical/Assignments:

- Minimum 5 Theories from each topic
- Major case study on launching of segmental precast super structure
- Major case study on casting of prestressed concrete bridge girder
- Presentations on each Type of Bridge including minor case study
- Presentations on various construction methods of bridge including minor case study
- Presentation of tunnel construction with major and minor case studies
- Drawing Sheets on various railway component

F. Instructional method and pedagogy (Continuous Internal Assessment Scheme CIA):

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lecture may be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures, practical and tutorial which carries 05 marks.
- At regular intervals assignments is given. In all, a student should submit all assignments of 05 marks each.
- Classroom participation and involvement in solving the problems in tutorial rooms carries 05 marks.
- Viva voce will be conducted at the end of the semester of 05 marks.
- One internal exam of 30 marks is conducted as a part of mid semester evaluation.

G. Students Learning Outcomes:

On the successful completion of this course

- The students will gain an experience in the implementation of Railway, Bridge and Tunnel Engineering on engineering concepts which are applied in field of Transportation Engineering.
- The students will get a diverse knowledge of Railway, Bridge and Tunnel engineering practices applied to real life problems.

- The students will learn to understand the theoretical and practical aspects of Railway, Bridge and Tunnel engineering along with the design and management applications

H. Recommended Study Materials:

a. Text book & Reference Books:

1. Satish Chandra and M.M. Agrawal, Railway Engineering, Oxford University Press, New Delhi
2. S.C. Saxena and S.P. Arora, A textbook of Railway Engineering, Dhanapat Rai and sons, New Delhi
3. S.C.Saxena, Tunnel Engineering , Dhanpat Rai and sons, New Delhi
4. S.P.Bindra, Principles and Practice of Bridge Engineering , Dhanpat Rai and sons, New Delhi
5. D.J.Victor, Essential of Bridge Engineering, Oxford and IBH Publication Co.Ltd.Mumbai
6. Construction Handbook for Bridge Temporary Works, 2nd Addition – 2017, American Association of State Highway and Transportation Officials (AASHTO)
7. Bridge Construction Practices Using Incremental Launching, A Report Prepared by HNTB Corporation and Bridge Engineering Centre – Centre for Transportation Research and Education, Iowa State University, 2007

b. Indian Standards:

1. Manual for standards and specifications for railway stations June 2009, ministry of railway, government of India.
2. Indian railway standard specifications, government of India.
3. Track manual volume I and Volume II.
4. IRC SP 102: 2014 Guide Lines for Design and Construction of Reinforced Soil Walls
5. IRC SP 51: 1999 Guide Lines for Load Testing of Bridges
6. IRC SP 37: 2010 Evaluation of Load Carrying Capacity of Bridges
7. IRC SP 018: Manual for Highway Bridge Maintenance Inspection
8. IRC SP 52: Bridge Inspector's Reference Manual
9. IRC 87: Guide Lines for the Design and Erection of Formwork, Falsework and Temporary Structures

10. IS: 5878: 1971 (Part – I), Code of Practice for Construction of Tunnels – Precision Survey and Setting Out (WRD 14: Water Conductor Systems)
11. IS: 5878: 1971 (Part – II – II), Code of Practice for Construction of Tunnels – Underground Excavation in Rock, Section 2: Ventilation, Lighting, Mucking and Dewatering (WRD 14: Water Conductor Systems)
12. IS: 5878: 1971 (Part – II – III), Code of Practice for Construction of Tunnels Conveying Water– Underground Excavation in Rock, Section 3: Tunneling Method for Steeply Inclined Tunnels, Shafts and Underground Power Houses (WRD 14: Water Conductor Systems)
13. IS: 5878: 1972 (Part– III), Code of Practice for Construction of Tunnels Conveying Water– Underground Excavation in Soft Strata (WRD 14: Water Conductor Systems)
14. IS: 5878: 1971 (Part– IV), Code of Practice for Construction of Tunnels Conveying Water– Tunnel (WRD 14: Water Conductor Systems)
15. IS: 5878: 1971 (Part– IV), Code of Practice for Construction of Tunnels Conveying Water– Tunnel Supports (WRD 14: Water Conductor Systems)
16. IS: 5878: 1976 (Part– V), Code of Practice for Construction of Tunnels Conveying Water– Concrete lining (WRD 14: Water Conductor Systems)
17. IS: 5878: 1975 (Part– VI), Code of Practice for Construction of Tunnels Conveying Water– Steel lining (WRD 14: Water Conductor Systems)
18. IS: 5878: 1972 (Part– VII), Code of Practice for Construction of Tunnels Conveying Water– Grouting (WRD 14: Water Conductor Systems)
19. IS: 15026: 2002, Tunnelling Methods in Rock Masses – Guidelines [CED 48: Rock Mechanics]
20. IS: 4756: 1978, Safety Code for Tunnelling Work [CED 29: Construction Management Including Safety in Construction]

c. Web Materials:

1. <http://www.cdeep.iitk.ac.in/nptel>
2. <http://www.nptel.iitm.ac.in>