



SECOND SEMESTER 2020-21
COURSE HANDOUT

Date: 18.01.2021

In addition to Part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No. : CE F420
Course Name : INTRO TO BRIDGE ENGG
Instructor-in-charge : MANOJ KUMAR

1. Course Description:

This course deals with the planning and investigations for bridges, understanding the behaviour of different type of bridge superstructures, economical span and basis for selecting suitable form of superstructure for given location, types of loads considered for highway and railway bridges, design of various culverts and bridges, design of pier and abutments, and design aspects of foundations for abutments and piers.

2. Scope and Objective of the Course:

Bridges are inseparable part of any communication network as they are the key elements in rail and highway network. This course intends to impart skills for planning and analysis & design of different types of highway bridge structures at basic as well as at advance level. This course will introduce the various components of bridges and different type of bridges to the students. Standard loading standards developed by IRC which form a consistent basis for design will be introduced. Moreover, in this course the theory and design of pipe culverts, RC slab culverts, arch culverts, composite bridges and T- Beam Bridges will be discussed in details while the long span bridges will be introduced. Furthermore, this course will cover the theory and design of substructures (piers and abutments), foundations and bearings which is an important part of bridge engineering.

3. Text Book (TB):

1. Krishna Raju, N. (2014) "Design of Bridges", 6th Edition, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

4. Reference Books (RB):

1. Johnson Victor, D. (2010), "Essentials of Bridge Engineering", 6th Edition, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
2. SP 13:2004: Guidelines for Design of Small Bridges and Culverts, Special Publication, Indian Road Congress.
3. SP 20:2002: Rural Roads Manual, Special Publication, Indian Road Congress (Chapter 7)
4. SP 64: 2005: Guidelines for the Analysis and Design of Cast-in-place Voided Slab Superstructures, Indian Road Congress.
5. IRC: 5-2015, "Standard Specifications and code of Practice for road bridges: section I-General features of Design", Indian Road Congress.
6. IRC: 6-2017, "Standard Specifications and code of Practice for road bridges: section II-Loads and Stresses", Indian Road Congress, 5th revision.
7. IRC: 112-2011, "Code of Practice for Concrete Road bridges, Indian Road Congress
8. IRC: 22-2015, "Standard Specifications and code of Practice for Road Bridges: section VI-Composite Construction, Indian Road Congress.



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9. IRC:78-2014, “Standard Specifications and code of Practice for road bridges: section VII-Foundation and Substructures”, Indian Road Congress
10. IRC:83-2002, “Standard Specifications and code of Practice for road bridges: section IX (Part I)- Metallic Bearings, (Part II)- Elastomeric Bearings and (Part III)-Pot, Pot-Cum-PTFE, Pin and metallic guide Bearings, Indian Road Congress.

5. Course Plan:

Module No.	Lecture Session	Reference	Learning outcomes
I: General features of Road bridges Investigations for Bridges	L1-5: Components of bridges and various definitions, Classification and general features of different types of bridges, Planning of bridges, Collection of Data,	IRC 5, RB: Ch. 1-2	General features of various Types of Bridges and selection of Bridge Site
	Effective Linear water way, Economical span, Afflux, Freeboard, vertical clearance, kerbs	IRC 5, RB: Ch.1-2	Planning of Bridge
	L6-7: Choice of bridge type, Width of carriage way, Clearances	IR C5, TB: Ch. 3	Selection of bridge Super structure type
II: Loads on Bridges	L8-10: Different types of loads and their combinations considered for the design of Roadway bridges super structures	IRC 6, TB: Ch.3	Loads to be considered in Design of Highway Bridges
III: General Design considerations	L11: Traffic aspects of highway bridges, aesthetics, relative costs of bridge components	TB: Ch. 5	Deciding no. of Lanes and clearances
IV: Analysis and Design of Culverts	L12-15: Effective width and Effective Length of dispersion of vehicular Loads, Analysis of solid slab, voided slab and skew slab culverts	TB: Art. 4.4, 5.2-5.3, Ch. 6	Design of Slab culverts
	L16-18: Classification of RCC pipes, design principles of Pipe culverts	TB: Ch. 6	Design of Pipe Culverts
	L19-21: Design principles of Box-culverts, determination of design forces	TB: Ch. 7	Design of Box-Culverts
V: Analysis and Design of Reinforced Concrete T-beam Bridges	L22-25: Components of T-beam bridges, Analysis of internal deck slab panels using Pigeaud’s method, analysis of cantilever slabs,	TB: Ch. 8	Design of Deck slab T-beam Bridges
	L26-29: Load distribution among longitudinal girders according to (i) Courbon’s method, (ii) Guyon & Massonet method, and (iii) Hendry-Jaegar method, Analysis of longitudinal girders and cross beams	TB: Art. 4.4, 8.2-8.6	Live Load Distribution in the Longitudinal girders of T-beam Bridges
VI: Design of Steel Bridges	L30-31: Fatigue strength of steel, design plate girders with lateral bracings	TB: Ch. 9, IRC 24	Design of Plate girders
VII: Analysis of composite bridges	L32-35: Design of composite bridges with various types of shear connectors	TB: Ch. 10	Design of Shear Connectors in Composite bridges



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VIII: Design of bearings	L35-37: Types of bearings, design of Elastomeric pad bearings	TB: Ch. 16	Design of Elastomeric bearings
IX: Design of Bridge Piers & Abutments	L38-40: Design of Pier & Abutment Caps, Forces acting on Piers & Abutments, design of piers & Abutments	TB: Ch. 18	Design of Abutments and Piers
X: Bridge Foundations	L41-42: Types of foundations, scour depth, Forces considered on Foundation	TB: Ch. 19	Design of Bridge Foundations

6. Evaluation Scheme:

SN	Evaluation Component	Duration	Weightage (%)	Date & Time	Nature of component (OB/CB)
1.	Mid-Sem Test-I	90 Mints.	35	TBA by AUGSD	OB
2.	Compre. Exam.	3 hours	40	11/05 FN	OB
3.	Class Tests/Quizzes//Assig.	--	25	--	OB

7. Chamber Consultation Hour: To be announced in the class by the Instructor.

8. Notice: Notice if any, concerning this course will be uploaded at Nalanda or communicated through institute e-mail.

9. Make up policy: Make-up will be granted only to genuine cases. For cases related to illness, proper documentary evidence is essential. Prior permission is necessary if student is out of station on the test date.

Instructor-in-charge

CE F420