

Master of Technology
Structural Engineering
Design of Bridge
01ST1113 (PEC)

Objective of the Course: Objectives of introducing this subject at first year level in Masters of civil engineering are:

- To learn the components of bridges, classification of bridges, importance of bridges.
- To familiarize students with various types of bridges such as slab-bridge, T-beam bridge, pre-stressed concrete bridge, continuous bridge, arch bridge, box girder bridge decks.
- To get exposure to evaluation of sub structures, type of foundations, importance of bearings, lessons from bridge failures

Credit Earned: 3

Students learning outcomes:

After successful completion of the course, it is expected that student will be able to:

1. Understand various components of bridges, types of bridges and choice of bridges.
2. Estimate the load acting on the various types of bridges.
3. Analyze and design the bridge superstructure.
4. Analyze and design the bridge substructure.

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	CSE (I)	IA (M)	Viva (V)	Term Work (TW)	
3	0	0	3	50	20	30	25	25	150

Detailed Syllabus

Sr No.	Title of the unit	Number of hours
1	<p>Introduction</p> <p>Components of Bridges, Classification of bridges; Investigations and planning, Criteria for selection of bridge site, economic span, Choice of type of bridges.</p> <p>Specifications of Road Bridges, Loads on bridges-I.R.C. loading standards for Live Loads and Various forces acting on bridges.</p>	4

2	Design of Bridge Super structures Bridge slabs – Effective width method as per I.R.C. – Pigeaud’s method Analysis of girder bridges by Courbon's method and Grillage method. Introduction to other methods of analysis like Finite element, Finite strip method etc. Analysis and design of reinforced concrete slab culverts, tee beam and slab bridges. Design principles of prestressed bridges, continuous bridges, box girder bridges, balanced cantilever bridges. Bearings-Importance of Bearings, Types of Bearings, Bearings for slab bridges, Bearings for girder bridges, Joints-Expansion joints. Construction and Maintenance of bridges, Lessons from bridge failures.	24
3	Design of Bridge Substructure Various parts of substructures, Various types of substructures, Loads acting on substructures, Design of pier and pier cap, Design of different types of foundation –Open, pile & well foundation, its construction aspects & related issues.	14

Suggested Theory Distribution

The suggested theory distribution as per Bloom’s taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
5%	5%	20%	25%	25%	20%

Instructional Method and Pedagogy:

1. Use of Learning Management system like canvas
2. Demonstration through ppt and videos and lectures
3. Brainstorming and group discussion sessions
4. Collaborative learning

List of Experiments/Tutorials:

Recommended Study Material:

Reference Book:

1. N. Krishna Raju, Design of Bridges, 5th edition, Oxford & IBH Publishing.
2. T.R. Jagdeesh and M.A. Jayaram, “Design of Bridge Structures”, 2nd Edition, Prentice Hall of India Pvt. Ltd., 2003.
3. D Johnson Victor, “Essentials of Bridge Engineering”, 6th edition Oxford, 2017.

4. S Ponnuswamy, “Bridge Engineering”, 3rd edition, McGraw Hill Education; 2017.
5. Praveen Nagarajan, Design of Concrete Bridges: As per Latest IRC Codes, Wiley.
6. Swami Saran, “Analysis and Design of Substructures”, Oxford & IBH Publishing Co.,1996.
7. J.E. Long, “Bearings in Structural Engineering”, Newnes Butterworth & Co., 1974.
8. R.E. Rowe, “Concrete Bridge Design”, 1st Edition, Elsevier Science and Technology, 1962.
9. Jaeger & Bakht, “Bridge Analysis by Microcomputer”, Mc Graw Hill, 1989.
10. C.S Surana & R. Agarwal, “Grillage Analogy in Bridge Deck Analysis”, Narosa Publication, 1998.
11. M.S. Troitsky, “Cable Stayed Bridges: An approach to Modern Bridge Design”, 2nd edition, Van Nostrand Reinhold Company, 1988.

Web Resources**MOOC Course:****Reinforced Concrete Road Bridges-NPTEL Course**

<https://nptel.ac.in/courses/105/105/105105165/>
