

## ELEMENTS OF BRIDGE ENGINEERING

<b>II Semester: ST</b>																													
Course Code	Category	Hours / Week			Credits	Maximum Marks																							
<b>BSTC18</b>	<b>Elective</b>	L	T	P	C	CIA	SEE	Total																					
		3	0	0	3	30	70	100																					
<b>Contact Classes: 45</b>		<b>Total Tutorials: Nil</b>		<b>Total Practical Classes: Nil</b>			<b>Total Classes: 45</b>																						
<p><b>I. COURSE OVERVIEW:</b>            To become a specialized person in bridge designs with different types and simplify the design and enhance the safety of structures. We take pride in collaborating in the creation of safer structures through elegant designs. Bridge Design and Engineering Consulting Corporation is an innovator in Bridge Engineering.</p> <p><b>II. COURSE OBJECTIVES:</b>  <b>The student will try to learn:</b></p> <ol style="list-style-type: none"> <li>I. The basic concepts in proportioning and design of bridges in terms of aesthetics, geographical location and functionality.</li> <li>II. The sizing of bridge elements, i.e. Develop a clear understanding of conceptual design.</li> <li>III. The load flow mechanism and identify loads on bridges.</li> <li>IV. The design of bridge starting from conceptual design, selecting suitable bridge, geometry to sizing of its elements.</li> </ol> <p><b>III. COURSE OUTCOMES:</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="3" style="text-align: left; padding: 5px;"><b>After successful completion of the course, students should be able to:</b></th> </tr> </thead> <tbody> <tr> <td style="width: 10%; text-align: center; vertical-align: middle;">CO 1</td> <td style="width: 70%; padding: 5px;">Discuss the IRC standard live loads and design the deck slab type bridges.</td> <td style="width: 20%; text-align: center; vertical-align: middle;">Understand</td> </tr> <tr> <td style="text-align: center; vertical-align: middle;">CO 2</td> <td style="padding: 5px;">Analyze the box culverts for the given loading and detail the box culverts.</td> <td style="text-align: center; vertical-align: middle;">Analyze</td> </tr> <tr> <td style="text-align: center; vertical-align: middle;">CO 3</td> <td style="padding: 5px;">Design and detail of T-Beam bridges.</td> <td style="text-align: center; vertical-align: middle;">Create</td> </tr> <tr> <td style="text-align: center; vertical-align: middle;">CO 4</td> <td style="padding: 5px;">Design and check the stability of piers and abutments.</td> <td style="text-align: center; vertical-align: middle;">Create</td> </tr> <tr> <td style="text-align: center; vertical-align: middle;">CO 5</td> <td style="padding: 5px;">Discuss the bridge foundations and prepare the bar bending schedule</td> <td style="text-align: center; vertical-align: middle;">Understand</td> </tr> <tr> <td style="text-align: center; vertical-align: middle;">CO 6</td> <td style="padding: 5px;">Analyze the bridge decks and substructures for various conditions</td> <td style="text-align: center; vertical-align: middle;">Analyze</td> </tr> </tbody> </table> <p><b>IV. COURSE SYLLABUS:</b></p> <p><b>MODULE-I: CONCRETE BRIDGES (09)</b>            Introduction, types of bridges, economic span length, types of loading, dead load, live load, impact effect, centrifugal force, wind loads, lateral loads, longitudinal forces, seismic loads, frictional resistance of expansion bearings-secondary stresses, temperature effect erection forces and effects, width of roadway and footway, general design requirements.</p> <p><b>MODULE-II: SOLID SLAB, GIRDER BRIDGES &amp; CONTINUOUS BRIDGES (09)</b>            Introduction, method of design. Girder bridges, introduction, method of design, courbon's theory. Continuous bridges, introduction span lengths, analysis of continuous bridges, decking of girders with constant moment of inertia, continuous bridges with variable moment of inertia, method of analysis, girders with parabolic soffit, method of plotting influence lines, girders with straight haunches, design steps for continuous bridges.</p>									<b>After successful completion of the course, students should be able to:</b>			CO 1	Discuss the IRC standard live loads and design the deck slab type bridges.	Understand	CO 2	Analyze the box culverts for the given loading and detail the box culverts.	Analyze	CO 3	Design and detail of T-Beam bridges.	Create	CO 4	Design and check the stability of piers and abutments.	Create	CO 5	Discuss the bridge foundations and prepare the bar bending schedule	Understand	CO 6	Analyze the bridge decks and substructures for various conditions	Analyze
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### **MODULE-III: PRE-STRESSED CONCRETE BRIDGES: FUNDAMENTALS (09)**

Basic principles, method of pre-stressing-pre tensioning and post-tensioning, comparison, freyssinet method, magnel, blanet system-lee-mc call system basic assumptions.

Losses in pre stress-equation based on initial and final stress conditions cable zone, design of selections.

### **MODULE-IV: PRE-STRESSED CONCRETE BRIDGES: DESIGN (09)**

Condition of first crack, ultimate load design, shear, vertical pre stressing, diagonal tension in i- section, end block, magnel's method, empirical method general design requirements, mild steel reinforcement in pre stressed concrete member, concrete cover and spacing of pre-stressing steel, slender beams, composite section, propped, design of propped composite section, un propped composite section, two stage pre stressing, shrinking stresses, general design requirements for road bridges

### **MODULE-V: ANALYSIS OF BRIDGE DECKS AND SUB-STRUCTURES (09)**

Harmonic analysis and folded plate theory, grillage analogy, finite strip method and fem. Substructure, beds block, piers, pier dimensions, design loads for piers, abutments, design loads for abutments.

#### **V. TEXT BOOKS:**

1. E.C. Hambly, "Bridge deck behavior", E & FN SPON Publications, New York, 1991.
2. V.K. Raina, "Concrete bridge practice, analysis, design and economics", Tata McGraw- Hills Publishing Company Limited, New Delhi, India, 1991.
3. M. G. Aswani, V.N.Vazirani, M.M. Ratwani, "Design of Concrete Bridges", Khanna Publishers, New Delhi, 2013.

#### **VI. REFERENCE BOOKS:**

1. Ryall, M.J., Hewson, N., Parke, G.A.R. and Harding, J.E, "The manual of Bridge Engineering" eds., Thomas Telford. 2000.
2. R. Rajagopalan, "Bridge Super Structure", Tata McGraw Hills Publishing Company Limited, 2008.
3. Ponnuswamy , "Bridge engineering", Tata McGraw - Hills Publishing Company Limited, 2008.

#### **VII. WEB REFERENCES:**

1. [http://nptel.ac.in/syllabus/syllabus\\_pdf/105102011.pdf](http://nptel.ac.in/syllabus/syllabus_pdf/105102011.pdf)
2. [http://www.highestbridges.com/wiki/index.php?title=10\\_Great\\_Bridge\\_Books\\_and\\_Web\\_Sites](http://www.highestbridges.com/wiki/index.php?title=10_Great_Bridge_Books_and_Web_Sites)

#### **VIII. E-TEXT BOOKS:**

1. <http://www.highestbridges.com/pdf/Waddell%20-%20Bridge%20Engineering.pdf>
2. <https://accessengineeringlibrary.com/browse/bridge-engineering-second-edition>
3. <https://drive.google.com/file/d/0BwoIGozEq0cMMMy02VVVfMmR2Zad3M/edit>