

## Indian Institute of Technology Mandi Proposal for a New Course

**Course Number** : CE 509  
**Course Name** : Bridge Engineering  
**Credits** : 3-0-0-3  
**Prerequisites** : Strength of Materials and Structures (CE301) or Equivalent, Design of Reinforced Concrete Structures (CE351) or Equivalent  
**Intended for** : UG (3<sup>rd</sup> and 4<sup>th</sup> year), PG  
**Distribution** : Discipline Elective (UG); Elective (PG)  
**Semester** : Odd/Even

1. **Preamble:** Bridges are one of the lifeline structures in our society. Importance of bridges in hilly region is even more as many times they act as only access point to a whole region. This course is aimed to provide an eloquent discussion on the theoretical and practical considerations for design of bridges. The participants are expected to develop understandings of types of bridges, their functional requirements, and essential details for the analysis and design of different components. Through, course project on analysis and design of full scale bridge, and site visits (whenever feasible), the participants will be exposed to real life bridge design and construction practices.

### 2. Course Modules with Quantitative Lecture Hours:

**Module 1:** (4 lecture hours)  
Introduction: Importance of bridges; Historical development and classification of bridge types; Various structural forms; Materials in bridge construction; Consideration for site selection; Determination of design discharge; Linear waterways and economical span; High flood level (HFL) and vertical clearance; Traffic projection.

**Module 2:** (3 lecture hours)  
Design Loads: Consideration of various forces and their application as per IRC specifications for loadings on road bridges (IRC-6 2014).

**Module 3:** (8 lecture hours)  
Structural Behavior and Concepts for Analysis: Moving load analysis; Grillage analogy; Structural behavior of box-girder bridges, arch bridges, suspension bridges, and cable stayed bridges.

**Module 4:** (17 lecture hours)  
Design of Bridge Superstructure: Analysis and design of reinforced concrete slab bridge deck; Design considerations for skewed slab decks; Pre-tensioning and post-tensioning; Analysis and design of pre-stressed concrete slab deck; Introduction to T-beam bridges; Approximate methods for analysis of T-beam bridges: Courbon's method; Illustrative examples.



**Module 5:** (5 lecture hours)  
Bridge Bearings and Joints: Importance and types of bearings; Design of elastomeric bearings; Seismic considerations for bearing design; Provisions for expansion joints.

**Module 6:** (3 lecture hours)  
Bridge Substructure: Components of substructure; Computation of different forces acting on substructure; Introduction to various bridge foundation types.

**Module 7:** (2 lecture hours)  
Construction and Maintenance: Common bridge construction techniques; overview of segmental construction for long span bridges; Primary functions of bridge maintenance; Categories of bridge inspections and instrumentation.

**3. Text books:**

- (i) D.J. Victor (2007), "Essentials of Bridge Engineering", 6<sup>th</sup> Edition, Oxford and IBH Publishing, New Delhi, India.
- (ii) N.K. Raju (2009), "Design of Bridges", 4<sup>th</sup> Edition, Oxford and IBH Publishing, New Delhi India.

**4. Reference Books:**

- (i) E.C. Hambly (1991), "Bridge Deck Behaviour", 2<sup>nd</sup> Edition CRC Press, Taylor and Francis Group, New York, USA.
- (ii) IRC-112 (2011), "Code of Practice for Concrete Road Bridges", Indian Roads Congress, New Delhi, India.
- (iii) IRC-6 (2014), "Standard Specifications and Code of Practice for Road Bridges, Section: II - Loads and Stresses", Indian Roads Congress, New Delhi, India.
- (iv) N. Rajagopalan (2013), "Bridge Superstructure", Narosa Publishing House, New Delhi, India.
- (v) S. Ponnuswamy (2007), "Bridge Engineering", 2<sup>nd</sup> Edition, Tata McGraw-Hill Education, New Delhi, India.
- (vi) V.K. Raina (2014), "Rainas Concrete Bridge Practice Analysis, Design & Economics", 4<sup>th</sup> Edition, Shroff Publishers and Distributors Pvt. Ltd., Mumbai, India.

**5. Similarity content declaration with existing courses:**

Sl. No.	Course Code	Similarity Content	Approximate % of Content
1.	CE351	Fundamentals of Design of Reinforced Concrete Sections	5%

**6. Justification for new course proposal if cumulative similarity content is > 30%:**

Not Applicable

**Approvals:**

Other faculty interested in teaching this course: Dr. Maheshreddy Gade, Dr. Kaustav Sarkar

Proposed by: Dr. Sandip Kumar Saha

School: School of Engineering (SE)

Signature:

Date:

Recommended / Not Recommended, with comments:

\_\_\_\_\_  
Chairman, CPC

Date: \_\_\_\_\_

Approved / Not Approved:

\_\_\_\_\_  
Chairman, Senate

Date: \_\_\_\_\_

