

## Course syllabus

Department of Civil Engineering, Indian Institute of Technology Madras

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### CE5030W - Design of Concrete Bridges

**Credit Distribution:** C:10 L:3 T:1 P:0 E:0 O:6 TH:0

**Course Type:** Theory

**Description:** To provide students with understanding of behaviour and design of reinforced and prestressed concrete bridges.

**Course Content:** Basis of Design Actions on structural members and their combinations; Serviceability Limit State Checks; Strength Limit State Design; Design Standards Properties of Materials Stress-strain curves; Creep and Shrinkage of Concrete; Corrosion Resistance and Ductility of Reinforcing Steel; Relaxation of Prestressing Steel Superstructure Slab Decks - Response based on plate theory, response of voided, skewed and curved decks, design and detailing; Girder and Slab Decks - load distribution on girders, moment-curvature behaviour of girder sections, ductility, design of RC and PSC girders for flexure and shear; internal and external prestressing; losses of prestress; transmission length and anchorage for prestressing tendons; precast segmental construction and prestressing; launching sequence and concept of design of launching girder Box Girder Decks - torsion, distortion and warping; design of RC and PSC box girders for flexure and shear; diaphragm design; detailing Substructure Confinement of concrete; moment-curvature behaviour of piers for combined axial load and flexure; ductile detailing for earthquake effects; structural design of abutments Foundation Structural design pile and well foundations Strut-and-Tie Models Design for local effects in deep beams, corbels, pier caps, pile caps, well caps, articulations, anchorage blisters, anchorage of external prestress in diaphragms, temporary anchorage blocks in box girders, stay cable anchorage on deck slabs, steel piles with concrete pile caps Special Design Considerations Construction stage design; design considering creep, shrinkage and secondary effects

#### Text Books

- None

#### Reference Books

- Parke,G., and Hewson,N., Eds., (2008), ICE Manual of Bridge Engineering, 2nd Edition, 2008
- Benaim,R., (2008), The Design of Prestressed Concrete Bridges - Concepts and Principles, Taylor & Francis
- Hambly,E.C., (1991), Bridge Deck Behaviour, CRC Press, 2nd Ed.
- Hewson, N., (2012), Prestressed Concrete Bridges Design and Construction, ICE Publishing, 2nd Ed.
- Park,R., and Paulay,T., (1975), Reinforced Concrete Structures, John Wiley & Sons
- Podolny,W. and Muller,J.M., (1982), Construction and Design of Prestressed Concrete Segmental Bridges, John Wiley & Sons
- Priestley,M.J.N., Seible,F., and Calvi, G.M., (1996), Seismic Design and Retrofit of Bridges, Wiley Interscience

**Prerequisite:** NIL