HIGHWAY BRIDGE STRUCTURES

(Professional Elective-3)

I I Semester

Course Code: 19CE2159

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Prerequisites: Transportation Engineering, Bridge Engineering

Course Outcomes:

At the end of the course, the student will be able to:

CO1 Describe various forms, components and classifications of Bridges.

CO2 Explain about various Culverts adopted in Highways.

CO3 Classify various types of Super-Structures in Bridge Construction.

CO4 Illustrate various forms of sub-structures and foundations supporting bridge Decks.

CO5 Identify the suitability of different bearings, Joints and appurtenances used in bridge SuperStructure.

UNIT-I: (10 Lectures)

INTRODUCTION TO BRIDGES

a)Definition – Basic Bridge forms – Components of Bridge –Classification of Bridges – Indian Roads Congress Bridge code – Loads on Bridge structure – IRC standard Live loads including Impact.

b) Structural Concrete and its Grades and Permissible stresses - Reinforcement and its grades and permissible stresses - Cover to the reinforcement – Minimum reinforcement in slabs and beams – Pre-stressed concrete including pre-stressing steel.

c) Over-passes and under-passes – pedestrian bridges.

Learning outcomes:

1. Classify various Highway Bridges (L1)
2. Identify various materials used in Bridge Construction. (L2)

3. Illustrate different arrangements at Junctions to manage the traffic. (L3)

UNIT-II: (10 Lectures)

CULVERTS

a)Introduction - Reinforced concrete Slab culvert including Skew culvert – Deck slab, Abutments, Wing walls and Approach slabs-Foundations, Kerb and Railing.

b) Pipe Culvert - Pipes - Concrete bedding – Head wall – Wing wall – Foundation.

c) Reinforced Concrete Box Culvert – Barrel – Wing walls

Note:

1) For all the above three types of culverts, design principles are only to be taught and there is no detailed design.

2) General arrangement and Reinforcement drawings of above culverts are to be covered.

Learning outcomes:

1. Illustrate Various Types and its design principles of Culverts (L4)
2. Identification of Suitability of different types of Culverts according to drainage conditions (L2)
3. Illustrate the reinforcement drawings of culverts (L4)

UNIT-III: (10 Lectures)

BRIDGE SUPER STRUCTURE

a) Reinforced Concrete Bridges – Introduction – Types – Slab bridge – Girder and slab bridge (T-beam) – Hollow girder bridge – Rigid frame bridge – Bow String Girder bridge – Continuous bridge.

b) Pre-stressed Concrete Bridges – Types – various Cross sections of Deck of pre-tensioned members and post-tensioned girders – End block.

Note:

1) For all the above Bridge Super-structures, design principles are only to be taught and there is no detailed design.

2) General arrangement and Reinforcement drawings of above Bridge Super-structures are to be covered.

Learning outcomes:

1.Illustrate the purpose about various components of Reinforced Concrete Bridges (L4)

2.Discuss about Types and Elements of Pre-Stressed Concrete Bridges (L2)

3. Explain the cross sections of post-tensioned girders (L2)

UNIT-IV: (10 Lectures)

BRIDGE SUB-STRUCTURE AND FOUNDATIONS

a) Sub-Structure – Definition – Pier and Abutment – Pier and abutment caps – Types of piers and abutments

b) Foundations – Shallow foundations Isolated footings and Raft foundation ; Deep foundations – Pile and Well foundations

Note:

1) For all the above Bridge Super-structures, design principles are only to be taught and there is no detailed design.

2) General arrangement and Reinforcement drawings of above Bridge Super-structures are to be covered.

Learning outcomes:

1. Illustrate various elements of Bridge Sub-Structure (L4)
2. Identify the suitability of various foundations of Bridges (L2)
3. Explain theconcept of deep foundations (L2)

UNIT-V: (10 Lectures)

BRIDGE BEARINGS, JOINTS AND OTHER APPURTENANCES

a) Bearings – General – Bearings for slab bridges – Bearings for girder bridges – Types and its applications – Typical sketches.

b) Expansion Joints – General – Types of expansion joints – suitability – Typical sketches.

c) Appurtenances - General – Handrails – Footpath – Kerb –Median- Drainage – wearing course – Approach slab – Typical sketches.

Learning outcomes:

1. Illustrate Bearings used in Bridges and its Applications (L4)
2. Explain various Expansion Joints and Appurtenances adopted in different Super Structures of Bridges (L2)
3. Discuss about appurtenances for bridges (L2)

Text Books:

1. Jagadeesh,T.,R., and Jayaram,M.,A., Design of Bridge Structures, 2nd edition, PHI Publishers, New Delhi, 2009
2. Johnson,D., Essentials of Bridge Engineering, 6th Edition, S Chand Publishing Company, 2012.

References:

1. Krishna Raju,N, Design of Bridges, fourth edition, Oxford and IBH Publishing Pvt. Ltd., New Delhi, 2010.
2. Ponnuswamy,S., Bridge Engineering, Second edition, McGraw-Hill Education: New York, 2008.
3. Relevant Codes of Practice of both IS and IRC