Birla Institute of Technology & Science, Pilani
Hyderabad Campus

**ACADEMIC GRADUATE STUDIES AND RESEARCH DIVISION**
**SECOND SEMESTER 2023-24**

**Course Handout (Part-II)**

Date: 10/01/2024

In addition to Part-I (General Handout for all courses appended to the Timetable), this portion gives further specific details regarding the course.

**Course No.** : CE G616
**Course Name** : Bridge Engineering
**Instructor-in-Charge** : Prof. P N Rao

## 1. Course Description

Purpose of bridge; classification of bridges; characteristics of each bridge; loads stresses and combinations; design of RC bridges; steel bridges; pre-stressed bridge; box girders; substructure design for bridges.

## 2. Scope and Objective

Bridges are the key elements of roadways and transportation networks and play an essential role in the sustained economic growth and social development of any country. This course intends to impart skills for planning, analysis & design of different types of bridge structures at basic as well as at advance level.

## 3. Text Books

T1: Johnson Victor, D. (2010), "Essentials of Bridge Engineering", 6th Edition, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

## 4. Reference Books

R1: Krishna Raju, N, (2018) "Design of Bridges". Fifth Edition, Oxford & IBH Publishing Co. Pvt, Ltd, New Delhi.
R2: Ponnuswamy, S, (2017) "Bridge Engineering", 3rd edition, McGraw-Hill Pub., New Delhi.
R3: IRC: 5-2015, "Standard Specifications and code of Practice for road bridges: section I-General features of Design", Indian Road Congress.
R4: IRC: 6-2017, "Standard Specifications and code of Practice for road bridges: section II-Loads and Stresses", Indian Road Congress.
R5: IRC: 22-2015, "Standard Specifications and code of Practice for road bridges: section III-Cement Concrete (Plain and Reinforced)", Indian Road Congress.

R6: IRC:18-2000, "Design criteria for Pre-Stressed Concrete Road Bridges (post-tensioned concrete)", Indian Road Congress.
R7: IRC: 24-2015, "Standard Specifications and code of Practice for road bridges: section V-Steel Road Bridges", Indian Road Congress.
R8: IRC:78-2017, "Standard Specifications and code of Practice for road bridges: section VII-Foundation and Substructures", Indian Road Congress.
R9: IRC:83-2018, "Standard Specifications and code of Practice for road bridges, Section IX Bearings; (Part I): Roller & Rocker Bearings, (Part II): Elastomeric Bearings and (Part III): POT, PIN, Metallic Guide and Plane Sliding Bearings", Indian Road Congress.
R10: IRC:112-2011," Code of Practice for Concrete Road Bridges", Indian Road Congress.
R11: Priestley, M. N., Seible, F., & Calvi, G. M. (1996). Seismic design and retrofit of bridges. John Wiley & Sons.

## 5. Course Plan

| Lecture No. | Learning objectives | Topics to be covered | References |
|---|---|---|---|
| 1-4 | Introduction | Importance of Bridges, Components of bridge, classification of bridges, Failure of bridges | T1, R1 |
| 5-9 | Bridge Loading Standards | IRC design standards, Loads on bridges, Impact factors, Loading for Indian railway bridges, Introduction to international bridge design codes | T1, R1, R4 |
| 10-14 | Culverts | Design of pipe and box culverts | T1,R1 |
| 15-21 | RCC Bridges | Design of culverts, Slabs spanning in two directions using Pigeaud's method, Load distribution in longitudinal girders using Courbon's method, Design of simply supported T-beam bridges | T1, R1 |
| 22-26 | Prestressed Concrete Bridges | Analysis of pre-stressed section, design aspects of prestressed concrete girders | T1, R1 |
| 27-30 | Steel bridges | Analysis and design of steel bridges | T1,R1 |
| 31-33 | Bearings and Expansion Joints | Necessity of bearings, types of bearings, design of steel bearings, designs of elastomeric bearings, necessity and types of expansion joints. | T1, R1 |
| 34-37 | Bridge Substructures | Types of piers and abutments; Loads to be considered on piers and abutments; Stability analysis of pier and abutment, wing walls and approach slabs, features of wing walls | T1, R1 |
| 38-42 | Bridge Foundations | Types of bridge foundations, design aspects of pile and well foundations | T1, R1 |

## 6. Evaluation Scheme

| S. No. | Evaluation Component | Duration (Minutes) | Weightage (%) | Date & Time | Remarks |
|---|---|---|---|---|---|
| 1 | Mid semester Exam | 90 | 25 | 14/03 - 2.00 - 3.30PM | OB |
| 2 | Assignments | - | 20 | Continuous | OB |
| 3 | Term Project | - | 20 | Continuous | OB |
| 4 | Comprehensive Exam | 180 | 35 | 14/05 FN | OB |

## 7. Chamber Consultation Hour

Will be announced in the class.

## 8. Notices

Notices concerning this course will be displayed on CMS and Department Notice Board.

## 9. Make up policies

Make-up would be granted only for genuine cases with **prior permission**.

## 10. Academic Honesty and Integrity Policy

Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

**Instructor-in-charge**
**CE G616**