**19CE4103 – BRIDGE ENGINEERING**

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| **Course Category**  | Professional Core | **Credits**  | 3 |
| **Course Type**  | Theory | **Lecture - Tutorial - Practical**  | 2-1- 0 |
| **Prerequisite**  | Design of Reinforced Concrete Structures and Structural Analysis-II | **Sessional Evaluation**  | 40 |
| **Semester End Exam Evaluation**  | 60 |
| **Total Marks**  | 100 |

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| **Course Objectives** | 1. Explore various categories of IRC loadings and railway bridge loadings.
2. Carryout analysis and design of deck slab bridge and box culvert.
3. Carryout design of T-beam bridge.
4. Carryout design of plate girder bridges and composite bridges.
5. Carryout stability analysis of piers and abutments.
6. Carryout design of various types of bridge bearings.
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| **Course Outcomes** | CO1 | Classify bridge loading standards and be able to recommend suitable bridge type. |
| CO2 | Analyze and design box culvert and deck slab bridge.  |
| CO3 | Design RC T- beam bridge using Pigeaud’s method. |
| CO4 | Design plate girder bridge and composite bridge. |
| CO5 | Analyze Piers and abutments for stability. |
| CO6 | Design bridge bearings and identify the types and importance joints in bridges. |
| **Course****Content** | **UNIT - I****INTRODUCTION:** General – Classification of bridges – Site selection - Importance of site investigation in Bridge design - Choice of bridge type - Location of piers and abutments - Subsoil exploration – Economical span - Traffic projection – Scour depth. **IRC LOADING STANDARDS:** Various loads on bridges - Highway Bridge loading standards–Impact factor–Railway Bridge loading standards (Broad Gauge Main Line Bridge). **UNIT – II****BOX CULVERT:** General aspects – Design loads, Design of Box culvert subjected to RC class AA tracked vehicle only. **DECK SLAB BRIDGE:** Introduction – Effective width method analysis– Design of deck Slab Bridge (Simply supported) subjected to class AA tracked vehicle only. **UNIT - III****BEAM & SLAB BRIDGE (T-BEAM BRIDGE):** General features – Design of interior panel of slab – Pigeaud’s method – Design of a T-beam bridge subjected to class AA tracked vehicle only. **UNIT - IV****PLATE GIRDER BRIDGE:** Introduction – elements of a plate girder and their design - Design of a deck type welded plate girder – Bridge of single line B.G. **COMPOSITE BRIDGES:** Introduction – Advantages – Design of Composite Bridges consisting of RCC slabs over steel girders including shear connectors **UNIT - V****PIERS & ABUTMENTS:** General features – Bed Block – Materials for Piers & Abutments–Types of piers – Forces acting on piers – Stability analysis of piers – General features of Abutments – Forces acting on abutments – Stability analysis of abutments – Types of wing walls – Approaches – Types of bridge foundations (excluding design). **UNIT - VI****BRIDGE BEARINGS:** General features – Types of bearings – Design principles of steel rocker & roller Bearings – Design of a steel rocker bearing – Design of elastomeric pad bearing – Joints – Expansion joints. |
| **Textbooks****and****References** | **TEXTBOOKS:**1. N. Krishna Raju, *Design of Bridges*, Oxford & IBH Publishing Company Pvt. Ltd., 5th Edition, 2018.
2. N. Raja Gopalan, *Bridge superstructure*, Narosa Publishing House, 2006.
3. S. C. Rangwala, *Bridge engineering*, Charotar Publications, 16th Rev Edition, 2015.

**REFERENCE BOOKS:** 1. D. J. Victor, *Essentials of bridge engineering*, Oxford & IBH Publishing Company Pvt. Ltd., 4th Edition, 1994.
2. T. R. Jagadeesh and M. A. Jayaram, *Design of Bridge structures*, PHI Learning Pvt. Ltd., 2nd Edition, 2014.
3. Ponnu Swamy, *Bridge Engineering*, Tata McGraw Hill Company, 3rd Edition, 2017.
4. Relevant – IRC & Railway bridge Codes.
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**CO-PO Mapping:** 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

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|   | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | 1 | - | 2 | - | 1 | - | 1 | 1 | - | - | 1 | 1 |
| **CO2** | 3 | - | 3 | - | 1 | - | 2 | - | - | - | 1 | - |
| **CO3** | 3 | - | 3 | - | 2 | - | 1 | - | - | - | 1 | - |
| **CO4** | 3 | - | 2 | - | 2 | - | 1 | - | - | - | 1 | - |
| **CO5** | 2 | - | 1 | - | - | - | - | - | - | - | - | 1 |
| **CO6** | 1 | - | 1 | - | 1 | - | - | - | - | - | 1 | - |