A Concept Note

On

M.Tech. in Bridge Engineering



DEPARTMENT OF CIVIL AND INFRASTRUCTRE ENGINEERING INDIAN INSTITUTE OF TECHNOLOGY JODHPUR

Introduction

Upscaling and modernization of built infrastructure in India are taking place at an unprecedented scale in line with its Viksit Bharat 2047 vision. India has about 1,73,000 bridges, and they are one of the vital arteries of the transportation infrastructure. Bridges in their service life are susceptible to extreme events, such as earthquakes, wind, fire, and flood. They are also prone to environmental conditions such as scouring and corrosion, and these environmental conditions often deteriorate the service life. The design and maintenance of bridges are governed by numerous factors, for instance, assessment of loads, choice of materials, analysis tools, codal provisions, connection detailing, and maintenance manual. A well-designed bridge often requires less maintenance and should have enough resistance against previously mentioned durability concerns. In recent decades, there has been a noticeable growth in the scale and complexity of bridge structures in India and abroad. For example, the high-speed rail (HSR) project is one of the lofty visions of the Government of India, which aims to develop a rail transport network with operating speeds as high as 350 km/hr. In HSR, the viaduct bridge structures are one of the critical components. At the same time, several bridges in India are aged and require frequent maintenance and assessment of their health. Therefore, in the coming decades, manpower training, skill development, and upgradation, as well as indigenous technology developments, are vital in the area of bridge engineering.

The bridge engineering academic curriculum in India is insufficient for the current civil engineering industry requirements. It lacks the required rigor compared to the wellestablished civil engineering courses (e.g., earthquake engineering, construction technology, etc.). For instance, in undergraduate (UG) civil engineering programs, students are usually given a perspective on bridge structures in structural analysis and design courses without much attention to aforementioned critical factors. The emphasis on codal provisions and construction practices is not on par with buildings and other critical structures. It should be mentioned that postgraduate (PG) civil engineering programs of institutes of repute, such as IITs and NITs offer a few electives on bridge engineering. However, elective courses are subject to the availability of expert faculties. Consequently, designers and civil engineering practitioners rely on computational software without proper understanding of bridge engineering. This is an inappropriate practice, and recently, there have been many instances of bridge collapse during construction. Therefore, a rigorous curriculum aiming at developing graduate engineers in the domain of bridge engineering is the need of the hour. This concept note presents the brief outline of an M.Tech. program in bridge engineering.

Program Structure

The program structure will be as per the Institute's M.Tech. program norms. The coursework will include foundational courses and a list of electives. The foundational courses focus on topics in mathematics, solid and fluid mechanics, analysis and design,

that are relevant to bridge engineering. The elective courses focus on various themes in bridge engineering, viz., bridge construction, foundation, finite element analysis, monitoring and condition assessment, durability and repair, etc. The tentative core and elective courses are outlined below, subject to the approval of the institute's senate.

Category	Program Core (PC)	Electives	M.Tech. Project (MP)	Non-Graded Courses
Credits	12	12	32	2

Program Core Courses (PC)

- Mathematics for Civil Engineering
- Advanced Solid and Fluid Mechanics
- Analysis of Bridge Structures
- Design of Bridge Structures

Elective Courses

- Bridge Site Selection and Foundation Safety
- Bridge Materials, Construction and Assessment
- Finite Element Method
- Structural Dynamics
- Advanced Concrete Technology
- Prestressed Concrete Structures
- Cable-Supported Bridges
- Bridge Foundation
- Introduction to Structural Health Monitoring