MADAN BHANDARI UNIVERSITY OF SCIENCE AND TECHNOLOGY

Sustainable and Resilient Infrastructure Program

An Introduction

The **Sustainable and Resilient Infrastructure (SRI) Program** at Madan Bhandari University of Science and Technology (MBUST), offering **PhD and Master in Applied Science (MAS)** programs, is designed to address growing challenges such as disaster risk, climate change, rapid urbanization, and environmental degradation. The program equips students with the skills to plan, design, and maintain infrastructure systems that are both environmentally sustainable and resilient to natural and human-induced hazards.

Why Study Sustainable and Resilient Infrastructure?

Sustainable and resilient infrastructure is essential for the rapid socio-economic development. As global challenges intensify, ranging from climatic and non-climatic disasters, climate change impacts, man-made environmental degradation and social inequity, the need for research in developing inclusive, adaptive, and environment friendly infrastructure is more urgent than ever. The SRI program cultivates interdisciplinary expertise that integrates engineering, science, planning, and policy making. Graduates gain competencies in:

- Climate/disaster-resilient infrastructure design
- Sustainable construction materials and environment friendly practices
- Risk assessment and disaster risk mitigation
- Life cycle-based and systems-oriented project planning
- Integration of economic, social, ecological, and cultural dimensions
- Community-based infrastructure and land use planning

Addressing Nepal's Unique Infrastructure Challenges

Nepal is among the world's most disaster-prone countries, shaped by complex topography, active tectonics, and fragile ecosystems. The country faces a combination of seismic risks such as the devastating 2015 Gorkha Earthquake, and growing climate-related hazards including floods and landslides. Unplanned urbanization, poor construction practices, and aging infrastructure further exacerbate these risks. Past disasters have revealed critical vulnerabilities in key sectors such as housing, transportation, healthcare, and education. In this context, resilient and sustainable infrastructure is not a luxury but a necessity to protect lives, reduce economic losses, and to create conducive environment for sustained development.

Infrastructure Planning and Development Approach

Every sector of the economy, to name a few – tourism, water supply, roads, housing and irrigation – needs sustainable and resilient infrastructure. Because of the practice of the design of the infrastructure by experts of specific disciplines who are usually not familiar with the sectoral context very often infrastructure design fails to meet the requirements of the particular sector optimally. To bridge this gap the program facilitates students to plan, design, operate and maintain the infrastructure within the context of sectoral needs. This approach is being started with the tourism sector, which will later expand to other sectors.

Economic Growth and Rural Tourism Development

Investment in SRI is not only a strategy for risk reduction but a driver of inclusive economic growth. For Nepal, the benefits include:

- Reduced disaster-related losses and reconstruction costs
- Increased local capacity for recovery and self-reliance
- Job creation in sustainable construction and renewable energy
- Cost savings from efficient, low-maintenance infrastructure
- Improved access to services and markets across rural regions

SRI also plays a key role in unlocking **rural tourism potential**, especially in remote, culturally rich but infrastructure-deficient regions. With improved roads, clean energy, safe water, and eco-friendly accommodations, tourism can become a sustainable livelihood source for rural communities. MBUST's SRI program supports initiatives to:

- Develop resilient guesthouses and trails using local, safe materials
- Build access routes resistant to landslides and flooding
- Conserve cultural heritage through restoration of vernacular architecture
- Implement sustainable energy and waste management systems
- Promote nature-based and heritage tourism as a means of economic resilience

By linking infrastructure with rural tourism development, the SRI program helps turn vulnerability into opportunity.

Research-Based Degree

The MAS degree is a research-based degree. While graduates of a course-based degree are trained to use available of-the-shelve knowledge and technology to solve technological problems, graduates of a research-based degree are trained to solve technological problems, which cannot be solved using available of-the-shelve knowledge and technology, using their research skills. These skills should enable graduates to work in sectors other than one they have chosen for their thesis.

Research Focus

The SRI program at MBUST is grounded in applied, community-relevant research that supports sustainable and disaster-resilient development in Nepal. Key areas of research include:

- **Stone Masonry Structures**: Optimization of mortar through experimental and numerical studies, material characterization, and advanced 3D simulation methods for seismic performance.
- **Sustainable Materials**: Mechanical testing and AI-based assessment of Nepali bamboo and timber species, development of laminated bamboo boards, evaluation of prefabricated bamboo-timber wall panels, and life cycle assessment of bamboo-based structures.
- **Digital Technologies & AI**: Post-earthquake damage detection using AI and imagery, structural health monitoring of heritage structures using LiDAR and vibration analysis, and integration of indigenous knowledge with digital tools for resilient rural tourism planning.
- **Risk-Informed Planning & Community Resilience**: Risk-sensitive land use planning in traditional settlements, socio-economic studies of rural tourism impacts, and strategies for local self-recovery using sustainable infrastructure practices.

This diverse portfolio reflects MBUST's focus on local materials, digital innovation, heritage protection, and inclusive infrastructure solutions tailored to Nepal's unique challenges.

Specializations

The MAS program is designed to enable students to develop their own unique specialization through the choice of thesis topics. The elective courses are designed to support research related to the chosen thesis topic. Students completing this program depending upon the choice of their thesis may specialize in the following areas, among others: structural engineering, construction materials, settlement planning and building design.

Faculty and Facilities at MBUST

The SRI at MBUST is supported by distinguished faculty members, including both in-house experts and renowned visiting scholars. The program offers state-of-the-art laboratory and research facilities, ensuring a low student-to-equipment ratio that promotes hands-on learning, innovation, and high-quality experimental work.

Prof. Sudarshan Raj Tiwari
Board Member
MBUST, Nepal

Prof. Dr. Sangeeta Singh
Board Member
MBUST, Nepal

Prof. Netra Chhetri
Arizona State University
Arizona, USA

Rabi Jung Pandey
Tourism Expert
Nepal

Jitendra Bothara
Earthquake Expert
New Zealand

Dr. Kirti K. Joshi
Director, Institute of Applied Sciences
MBUST, Nepal

Dr. Kishor Timsina
Assistant Professor
MBUST, Nepal

Dr. Chaitanya Krishna G.
Assistant Professor, Asian Institute of Technology, Thailand

For further information, visit www.mbust.edu.np or email Dr. Kishor Timsina, SRI Program Coordinator at kishor.timsina@mbust.edu.np.