AMALTHEA '25

AN AMALTHEA '25 EVENT

# OVERARCH

## OFFICIAL RULEBOOK

**VENUE:** AB11/101

**DATE:** 9th November

**TIME:** 10 AM onwards

**FEEL FREE TO CONTACT:** Manavi (78778 80021)

# INTRODUCTION

OverArch is a case study competition that challenges participants to design a theoretical arch bridge for high-altitude Himalayan terrain, focusing on disaster resilience and innovative engineering solutions.

# PROBLEM STATEMENT

**Title:** Engineering at Extreme Altitudes

The Indo-China border has been a flashpoint in global geopolitics for decades. With rapid industrialisation in both nations, the construction of high-altitude bridges in the Himalayas has accelerated. These bridges must not only connect remote regions but also withstand extreme altitude challenges, seismic activity, avalanches, high wind speeds, and temperature fluctuations.

**Your Task:** Design a disaster-resilient arch bridge for a high-altitude Himalayan pass, ensuring:
Structural integrity at elevations above 3,000 meters.
Resistance to earthquakes, avalanches, and wind loads.

Inspiration: Draw from real-world examples like the Baily Bridge (Ladakh), Chenab Bridge (J&K), or international high-altitude bridges.

# ELIGIBILITY & TEAM FORMATION

- Eligibility: Open to all students.
- Team Size: 2-4 members per team.

# SUBMISSION GUIDELINES

## Registration

- Teams must register via the official Google Form or Unstop.
- Registration details: Team name, member names, institution, and a brief concept note (max 200 words)

## Submission Components

All submissions must be in PDF format and uploaded via the official Google Form by 7th November 2025.

Bridge Design (.ipt)

- The bridge must be an arch bridge.
- The bridge must be modelled in Autodesk Inventor or another application that outputs an .ipt model.
- Must include:
  - Front, side, and top views.
  - Annotated disaster-resilient features (e.g., seismic dampers, avalanche deflectors, wind-resistant trusses).
  - Scale and material specifications (theoretical).

**Case Study Report (5-6 pages, PDF)**

- **Introduction:** Overview of high-altitude bridge challenges in the Himalayas.
- **Design Description:** Detailed explanation of your bridge design.
- **Disaster Resilience:** How the design addresses altitude, seismic activity, wind and temperature changes.
- **Case Study Analysis:** Comparison with at least one real-world high-altitude bridge, highlighting successes and lessons.
- **Feasibility & Practicality:** Analysis of construction logistics.
- **Conclusion & References.**

## Submission Deadline

7th November 2025, 11:59 PM IST.

## Plagiarism Policy

- All submissions must be original. Plagiarism will result in disqualification.
- Teams may be asked to present their work or answer questions to verify originality.

# JUDGING CRITERIA & PROCESS

## Evaluation Parameters

- Disaster Resilience–35%
- Innovation & Creativity–10%
- Feasibility & Practicality–25%
- Case Study Analysis–15%
- Problem Statement Response–10%
- Presentation & Clarity–5%

## Judging Process

- Initial Screening: All submissions are reviewed for completeness and adherence to guidelines.
- Final Evaluation: Shortlisted teams will be invited for a brief offline presentation and Q&A.

## Step-by-Step: Simulating and testing the Bridge in Autodesk Inventor

### Step 1: Open Your Model

- Open your bridge file (either a part file .ipt or an assembly .iam).
- Ensure all components are fully constrained and properly connected—no loose or floating parts

**Step 2: Switch to the Stress Analysis Environment**

- Navigate to the "Environments" tab.
- Select "Stress Analysis" and then "Create Simulation."
- Choose "Static Analysis" to test how your bridge responds to loads and deformations.

**Step 3: Define Material Properties**

- Right-click each component and select "Assign Material."
- Assign realistic materials based on your design intent, such as:
    - Steel
    - Aluminum
    - Balsa wood
    - Carbon fiber
- Material properties like *Young's* modulus, density, and Poisson's ratio will affect the strength and deflection results.

**Step 4: Apply Constraints (Supports)**

- Define where the bridge is fixed to the ground.
- Typically, apply pin or fixed supports at the two abutments (ends of the bridge).
- Use the "Constraints" menu to set these up.

**Step 5: Apply Loads**

- Go to the "Loads" menu and select "Force" or "Pressure."
- Apply the following loads to simulate real-world conditions:
  - Vertical loads at midspan (to simulate traffic or pedestrian weight).
  - Wind loads as lateral pressure on the sides.
  - Optional: Seismic load as horizontal base acceleration.
- You can apply multiple load cases to compare different scenarios.

**Step 6: Mesh the Model**

- Go to "Mesh Settings" and generate the mesh.
- The mesh divides your model into finite elements for analysis. A finer mesh yields more accurate results but takes longer to compute.

**Step 7: Run the Simulation**

- Click "Run" to start the solver.
- Inventor will calculate:
  - Stress distribution (von Mises stress).
  - Deflection (bending).
  - Safety factor (based on yield strength).

**Step 8: View Result**

- After the simulation completes, use the following plots to analyse your design:
  - Stress Plot: Visualise high-stress areas (red zones indicate potential failure points).
  - Deformation Plot: See how much your bridge bends (exaggerated for clarity).
  - Safety Factor Plot: Identify the weakest parts of your design.

## IMPORTANT DATES

- Registration starts – 1st November 2025
- Submission Deadline – 7th November 2025
- Main Event (Showcase) – 9th November 2025

## AWARDS AND RECOGNITION

- Special Recognition: Certificate for Most Innovative Design.
- Certificates: All participants receive digital certificates

# PRIZES WORTH

# 5000/-