TEAM ISTE PRESENTS

PRODYOGIKI

NIT HAMIRPUR

SPAGHETTI BRIDGE CHALLENGE

What enables mankind to easily traverse through valleys and through rivers? Our friends wondered when they faced the same problem. Aha a bridge!

Objective:
Design and construct a model of a single span truss bridge with the help of **spaghetti noodles** satisfying the constraints stated below.

Team Size:
Each team should have 4 members.

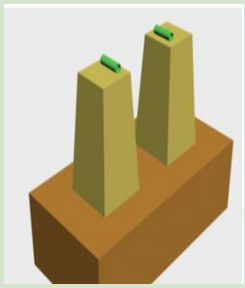
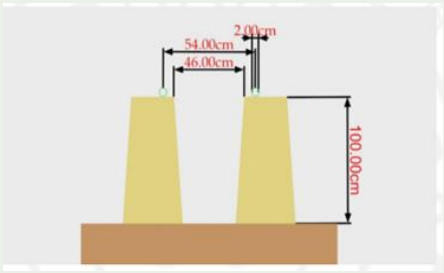
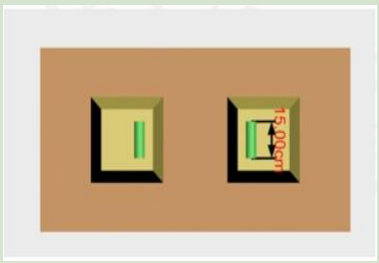
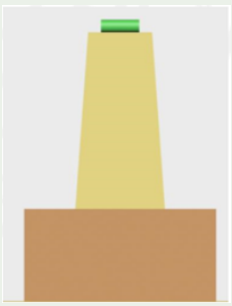
Dimension specifications:

- The dimensions of the bridge model must be within the following limits: **Length: 56-60 cm; Width : 10-11 cm; Height: 12-16 cm**
- There should be a proper clearance for a **10cm X 8cm X 8cm** box to pass through the span of the bridge.
- The members of the bridge can be built by grouping a maximum of 8 sticks of spaghetti noodles together.

Weight specification:
The bridge model should weigh 350 grams or less

Arena specifications:
- The arena has two wooden columns representing the landmass on the sides of a river.
- The distance between the inner edges of these columns is **46 cm.**
- One cylindrical support of **diameter 2cm and length 15cm** is placed on each of the wooden column.
- One of the cylindrical support is fixed to the column and the other is free to act as a roller.

The arena is as shown below:

Isometric View	
Front View	
Top View	
Side View	

A sample spaghetti bridge placed on cylindrical supports is shown below:

Materials:
The teams shall be provided the construction materials. The teams can bring required tools to build the structure.
The following materials will be provided:

1. Spaghetti noodles
2. Cutter
3. Pencils
4. Ruler
5. A3 size sheet
6. Glue

Some properties of spaghetti (dry):
Ultimate tensile strength ~ 2000 psi
Stiffness (Young's modulus) E ~ 10,000,000 psi

Testing of the structures:

- The dimensions and weight of each structure will be measured. Structures violating the dimensional and weight specifications will be penalized according to the rules.
- Each structure will be mounted on the arena over the two cylindrical supports shown in the arena.
- A 20 cmX8 cm wide plate will be placed symmetrically on the base of the structure.
- The centre of the plate will be bolted to a screw-jack which will apply load on the structure. The screw-jack will be connected to a load cell to measure the load being applied.
- An LVDT will be placed on the top of the plate to measure the deflection of the bridge.
- The structure will then be loaded and a continuous monitoring of its deflection and load will be done until it fails. The maximum load taken by the structure will be noted.

Evaluation of the structures:

- The structures will be evaluated on the basis of their performance under loading as well as on the basis of aesthetics.
- The efficiency of each structure will be calculated according to the following formula:

$$e = MaximumLoadWeightofStructure$$

- Evaluation on the basis of aesthetics will be done by judges and will include criteria like: Innovation in design, Cleanliness of work and Overall look of the structure

Scoring:

The final score of each structure will be calculated according to the following rules:

- **70% weightage** - Efficiency Maximum efficiency by any structure will be taken as the constant 'E' and points will be calculated according to the formula: $X = eE*70$
- **30% weightage** - Aesthetics Each structure will be graded by the judges on a scale of 0-30.

Penalties:

Penalties as mentioned below will be imposed if the structure violates the dimensional or weight specifications.

- **Weight exceeds the limit** -Penalty of 15% of the total score
- **Dimensional specifications are not met** -Penalty of 10% of the total score
- **Use of any material other than that provided** -Penalty of 50% of the total score or can lead to disqualification as decided by the judges

In case of any discrepancies, the decision taken by the judges and the coordinators will be final and bounding