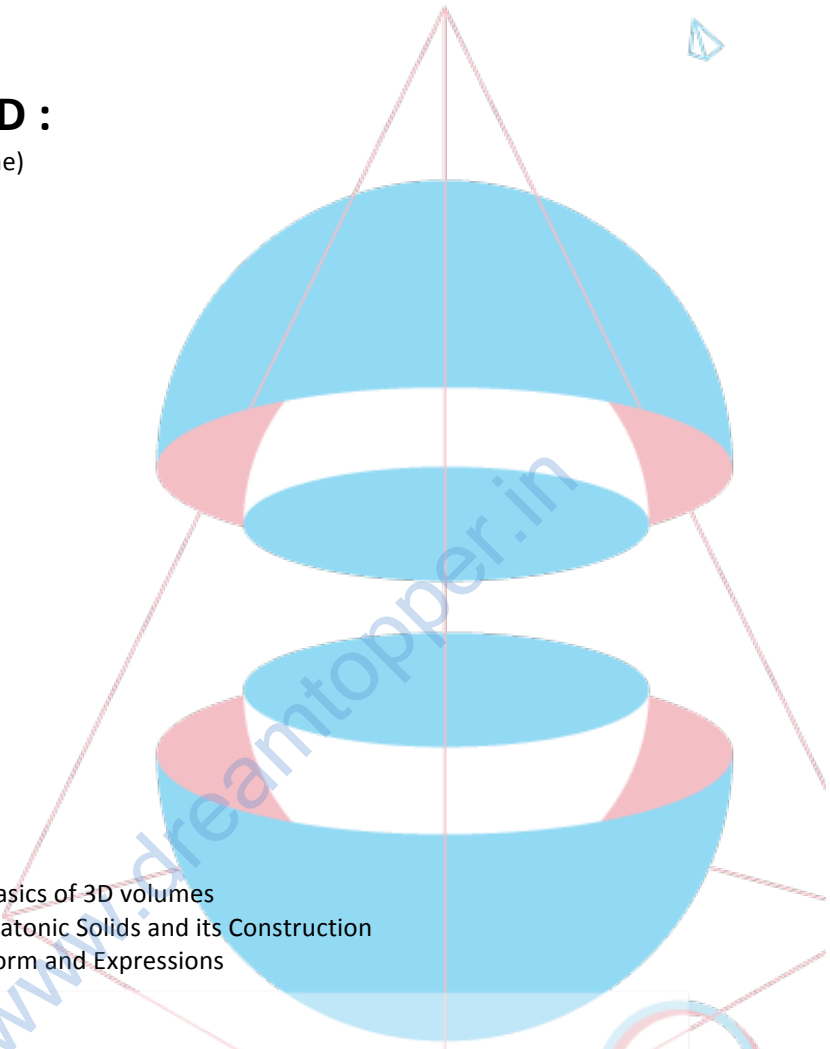
6.0 **Module 6**

Fundamentals of 3D :

18 hours (12 in school and 6 at home)



Design Skills

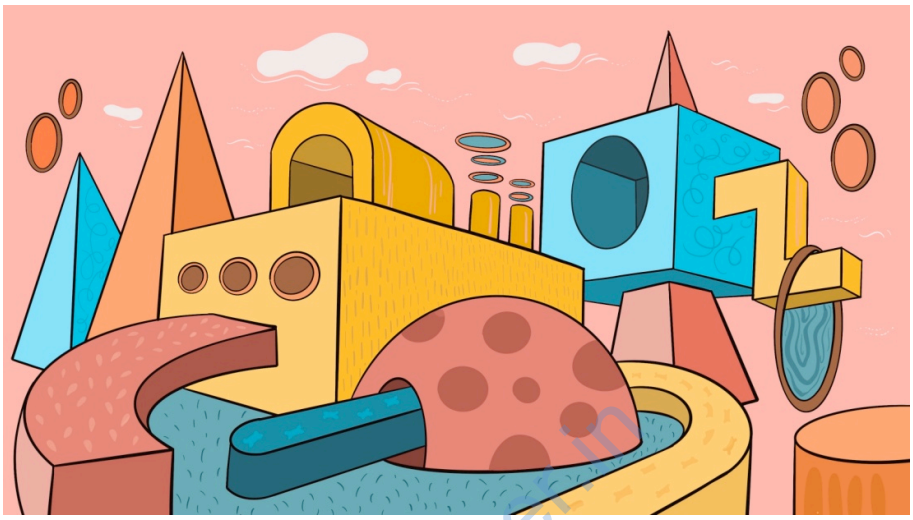
Design Sensitivity

Exposure 1	- Basics of 3D volumes
Exposure 2	- Platonic Solids and its Construction
Exposure 3	- Form and Expressions
Task 6.1 (at Home)	- Observation and Analysis of Objects around Home
Task 6.2 (at School + Home)	- Rectilinear Forms and its Proportion
Task 6.3 (at School + Home)	- Curvilinear Volumes
Task 6.4 (at School + Home)	- Platonic Solids
Task 6.5 (at School + Home)	- Form and Expression
Final Output	- Make a presentation of all your Form Explorations
	+ Reflections, Self Assessment and References

6.0 **Module 6**

Fundamentals of 3D

(12 hours at school + 6 hours at home)



Introduction

Understanding the fundamentals of forms in three dimensions are essential for design of objects that we hold and carry, objects that we sit and move, objects at home and objects that we live in.
Form has expression and gives meaning to the object and have a relation to the function of the object. The form can indicate how we interact with the object. Forms give shape to the man-made world.

Aim of Course

Aim of the course:
To expose school students (Grade 9) to basic fundamentals of 3D Volumes, proportions and Surface development for the understanding of spatial relationships. It will help to create an interest in the field of 3D Culture, proportions and sensitivity towards 3D Objects constructions by using daily used materials. It will enhance the culture of exploring and making with three dimensions.

Place:

Place: Task 5.1, 5.2, 5.3 and 5.4 done at School and at home

Grouping:

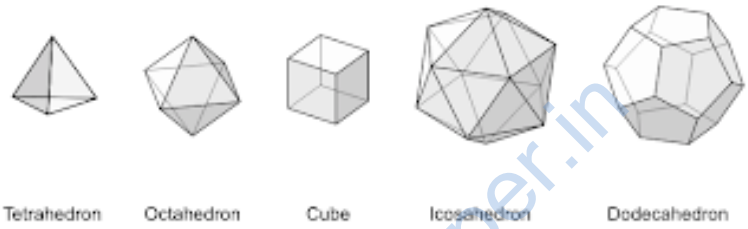
Grouping: Class tasks are done in groups of 3-4 and Home tasks are individually

Equipment:

Equipment: Sketchbooks for sketching, Stationary (Pencils, Pens, Colours, Tracing paper, Black Ink and brush or brush pen, colour pens),
Chart papers (three colors), cutter, steel ruler, stick (match stick) Rubber band (cycle tube valves), PVA Glue (Fevicol), Scotch Tape, Clay, Chalk and Sand paper (60 grades)

Exposures:

Exposure1: Basics of Volumes – Rectilinear Volumes and Curvilinear Volumes (Rectilinear volumes such as, Cube, Rectangular Cuboid (V= W x L X H), understanding Proportion by varying W, L and H. Curvilinear Volume such as Cylinder, Sphere, Cone, Ellipsoid, Hemisphere and Paraboloid.)
Exposure 2: Platonic Solids and its construction by using Sticks and Rubberband and paper by developing surfaces as shown in figure below.



Exposure 3: Form and Expressions
Exploration of expressions and meaning in 3D.

Design Thinking & Innovation Process involvement:

This Module involves the following phases of the DT&I Process:
Phase 1. Observe/Empathise/Research (Sketching Observations of 3D)
Phase 2. Understand/Analyse/Define (Understanding 3D)
Phase 3. Ideate/Alternate/Create (3D Explorations)
Phase 4. Build/Prototype/Detail (Making 3D forms)
Phase 5. Evaluate/Reflect/Implement (Presentation of Models)

Mapping SDG Goals:

The following SDG goals need to be considered while solving this task. While documenting elements and expressions, do think of gender equality and reduced inequalities and concern for life on our planet.

Task 6

Task 6 = 6.1 + 6.2 + 6.3
School Hours: 12, Home hours: 6

Task 6.1
(done at Home)

Task 6.1:
Home hours: 2, done individually

Topic Title:

Observation and analysis of 3D objects at home:

1. Select 6 different 3D objects of daily use at home (these could range from mobile phones, to watches, to mixers to a fridge)
2. Study these 3D objects and look at its visible visual features and other properties: shape/form, colours, textures, symmetry, softness/hardness, usefulness, expression, material, recyclability, cost, etc.
3. Make a chart (A4 size) with the 6 objects on one axis and their features and its properties on the other axis
4. Mark the ones that you like the most for each of the properties/features
5. Can you simplify and draw the simplified form? (optional)

Output 6.1: Submission of the Chart with analysis of the observed objects

Task 6.2
(done in Home)

Task 6.2:
Home hours: 4, done individually

Topic Title:

Rectilinear Volumes and its proportion:

Construct a rectangular cuboid of size 10cm length X 5 cm depth x 5 cm height by using a single sheet of chart paper. Incorporate a slanting roof so as to make a house. Optional: integrate doors and windows that are openable.
(cutting is allowed)
The above tasks would involve the following:
1. Development of the plan of the cuboid of dimension 10x5x5 cm when it is flattened out on a 2d surface of the chart paper
2. You could draw the outlines or make a crease in the paper by folding
3. Exploration of joining two flat surfaces
4. Explore Joining three surfaces
6. Discussion on the sticking flaps that go inside the cube
7. Application of Glue and managing the flaps
8. Construct the 3D object with clean edges (as much as possible)
9. YouTube video would be useful to understand the making of cuboid or you could explore your own version
https://www.youtube.com/watch?v=boCTmO71-Qs

Output 6.2: Model of the Cube or Rectangular cuboid with a slanting top

Task 6.3

Done at School

Task 6.3:

School Hours: 4, done individually

Topic Title:

Curvilinear Volume:

Demonstrate and construct a curvilinear volume viz. Cylinder, cone and sphere by using either (A) chalk as basic material or (B) Clay as the material

(A) Chalk as basic material

Size: for Cone and Cylinder 10mm diameter and 20 to 30 mm length.

For Sphere, hemisphere or Diameter = 10

For Ellipsoids Major axis =15 mm and minor axis=10 mm.

1. Planning with dimensions by drawing the volume in front, top and isometric views
2. Carving on chalk by using cutters/knife
3. Exploration working with chalk to achieve the goal as per planning.
4. Surface smoothening by using sandpaper

or

(B) Clay as the material:

Size: for Cone and Cylinder 20mm diameter and 40 to 50 mm length.

For Sphere, hemisphere or Diameter = 20

For Ellipsoids Major axis =30 mm and minor axis=20 mm.

1. Planning with dimensions by drawing the volume in front, top and isometric views
2. Shaping clay by using fingers
3. Exploration working with clay to achieve the goal as per planning.
4. Smoothen the surface as much as possible

Output 6.3: Models of the three curvilinear volumes

Task 6.4

Done at School

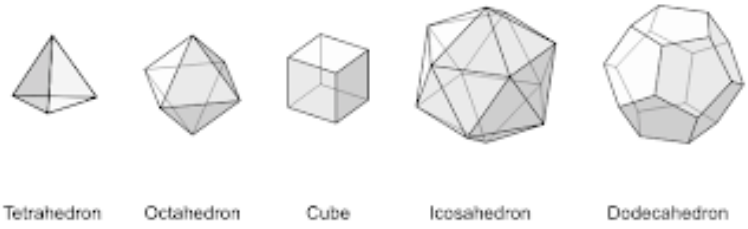
Task 6.4:

School Hours: 4, done in groups of 3-4

Topic Title:

Platonic Solids:

Platonic Solids: the cube, the octahedron, the tetrahedron, the icosahedron, and the dodecahedron



Understanding the relationship between 5 platonic solids in terms of Faces, edges and vertices and its representation with 5 elements.

Understanding the development drawing of each platonic solids

Construction any one of them

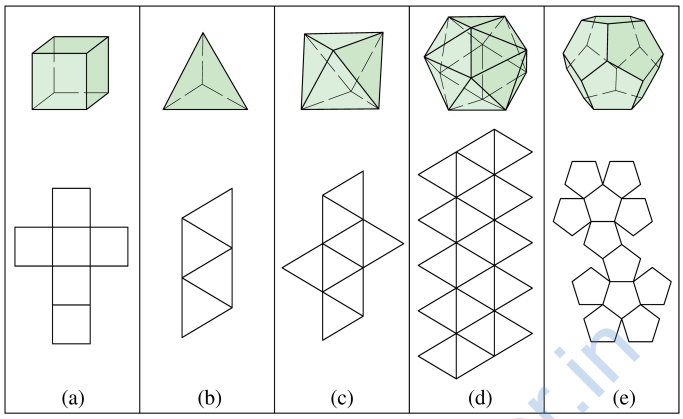
A. Construction of an Open Platonic solid :

1. Selection of material such as bamboo/match-stick/straws/broom sticks/used pencils/used ballpen refill and Cycle-tube valves/rubber band
2. Cutting of sticks as per size by using cutter

3. Cutting of rubber valves
4. Construct a volume by joining sticks at the corner using rubber valve/band.
5. The overall size of the volume is as such that it will fit to the 6x6x6 cm cube
or

Construction of a closed Platonic Solid:

1. Selection of Material – Chart paper of any color and PVA Glue.
2. Draw a development drawings on the paper and cut accordingly



3. Construct the solid by folding and sticking the open edges.

Output 6.4: Construction of either Open or Closed Platonic Solids

Task 6.5

Done at School

Task 6.5:

School Hours: 4, Done individually

Task Title:

Form and Expression:

In this task you will explore change of form with its ability to express a meaning. For example, curvilinear forms could express softness, sharp forms could express dynamism, solid rectangular forms could express sturdiness, etc.

Examples:  Dynamic Form,  Transforming form

1. Choose 2 opposing expressions that you would like to explore – could be comfort and discomfort, love and hate, light and heavy, fast and slow, progress and regress, natural and machine-made, organic and synthetic, etc.
2. On A4 size paper sketch forms to represent the chosen expressions
3. Take 2 sets of clay of roughly the size 5cm x 5 cm x 5 cm)
4. Taking the sketches as reference, transform clay to represent the meaning of the chosen two expressions in 3 dimensions
5. Show it to others and get feedback on whether they are able to make out the expression

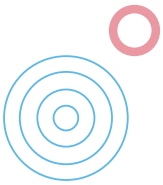
Output 6.5: Two sets of opposing expressions represented in 3 Dimensions using clay

Reflection:

Questions to ponder:

- Do you feel you can try visualizing artifacts in 3 dimension?
- Can you apply what you learnt of understanding 3D principles to select artifacts for your home?
- Will you make a list of the most interesting 3D objects?

Self Assessment:



Assessment Criteria (Task 6.1 + 6.2 + 6.3 + 6.4 + 6.5) - Assess yourself:

- Observation and Analysis of the objects at home were done well. (Individual task 6.1)

☐ *Beginning* ☐ *Developing* ☐ *Promising* ☐ *Proficient* ☐ *Excellent*

- Construction of the model of the Cube or Rectangular Cuboid with a slanting top was done well. (Individual task 6.2)

☐ *Beginning* ☐ *Developing* ☐ *Promising* ☐ *Proficient* ☐ *Excellent*

- Models of curvilinear volume viz. Cylinder, cone and sphere were done well (Individual task 6.3)

☐ *Beginning* ☐ *Developing* ☐ *Promising* ☐ *Proficient* ☐ *Excellent*

- The construction of either Open or Closed Platonic Solids were done well (Group task 6.4)

☐ *Beginning* ☐ *Developing* ☐ *Promising* ☐ *Proficient* ☐ *Excellent*

- The two sets of opposing expressions represented in 3 Dimensions using clay were done well (Individual task 6.5)

☐ *Beginning* ☐ *Developing* ☐ *Promising* ☐ *Proficient* ☐ *Excellent*

Other References:

Other suggested References:

1. Film featuring the Frank Lloyd Wright architectural masterpiece 'Fallingwater', by Cristóbal Vila:
http://www.youtube.com/watch?v=9CVKU3ErrGM
2. Design Thinking Framework - a short video:
https://www.youtube.com/watch?v=LhQWrHQwYTk

7.0 Module 7