

Hands-On Engineering Science & Math



In today's competitive and fast-paced world, we don't get enough time to explore. Another aspect of contemporary education is a lot of focus on theoretical concepts. We may prove theorems on equilateral triangles but folding one with simple A4 paper, and then converting it to the largest possible equilateral triangle unravels a lots of mathematical mysteries and cover fundamental concepts.

In this workshop we will explore the magic of hands-on science and math. We will explore:

- Enigma Machine, which resulted in the invention of the first computer in 2nd world war.
 - Made in-house and the only machine in India, it is a beautiful amalgamation of Electronics, Maths, Computer Science and Mechanics.
- Robotic Arm which can do Aarti
- Real hydraulic excavator using syringes and valves
- Car which draws various mathematical shapes (sine wave, triangular wave, cycloid etc)
- Sherlock's Holmes mystery to find the direction of cycle by looking at the tracks using calculus.
- Sprinkler from the straw and figure out at what angles does water go the farthest.
- Levitate the pen in the air and find out the forces acting on it which make it levitate .
- Four real reasons(yes four reasons) behind our days and nights on earth and moon.

And behind each of these interesting stories is very interesting science and math. So this workshop will have a lot of interesting stories of science and hopefully brings forth the inherent creativity and sense of wonder. **The goal of the workshop is to Bring Back the Gleam in the Eyes and Joy of Learning.**

Participants will get exposure to various types of automata especially the one which is based on Chebyshev's 4 bar lambda mechanism! They will make machines, build, cut, stick, pull things apart and put them together. We will make platonic solids, 3D structures, spinners, motors, generators, gliders etc. This hands-on approach to engineering science and maths makes learning joyous and experiential. We will see how seemingly simple looking "toys" can demonstrate complex concepts beautifully.

Brief Bio of Facilitator



Manish Jain

Manish is an IIT Kanpur alumnus. A chance meeting with Padmashree Arvind Gupta triggered him to dive into the space of popular science education full-time. Manish currently heads Creative Learning Initiative (CLI) at IIT Gandhinagar which aims to provide an ideal space and environment to learn and understand concepts joyously. His goal is to ignite interest, inquisitive spirit, and scientific temper to nurture inherent creativity and passion for science and technology among all.

After spending 10 years in Bay Area working in the area of VLSI design CAD I decided to spend all my energies making learning hands-on and joyous.

Tentative list of activities done at Workshop:

- Sine car- a car that draws sine wave when it moves
- Robotic Arm- a minimalistic Arduino-controlled hand that does Aarti and signature
- A hydraulic JCB using syringes and valves
- Robots “Chitti” and “Frog” which can be made by just using one gear motor and no electronics
- PISA test- How would you buy iron- Rs 100/Kg or Rs 100/L
- Training & workshop
- Khichdi
- Why we start division from left side and multiplication from right
- Adding large notes first and in addition start from unit place
- Straw Whistle
- Flute and binary Counting
- 3-in-1

- Bernoulli Bag
- Newton's third law- bendable straw
- Straw Firki
- Balloon Race
- Centre of mass- rotating man
- DC motor
- Homopolar motor
- Generator and Faraday Story
- Levitating pen and story of hamsa ,
- Vertical pen stand
- Pencil spinner
- Graduation cap using newspaper
- Mobius Strips
- The forger – New York Times movie
- A4 Ratio and why children feel more cold than adults
- Fold equilateral triangle from A4 sheet and then biggest equilateral triangle; same with a square
- Triangle, hexagon, pentagon from paper
- Cut out a triangle with a single cut
- 3D shapes with Cucumber
- Ray optics
- Platonic solids
- Topi Shankar with Newspaper
- Educational Books discussion
- Make isosceles triangle which if you cut in two parts results in two isosceles triangle. One obvious answer is 90 45 45. What are others?
- Maryam Mirzakhani story. Gauss story.
- Fritz Haber story.
- Kalashnikov story.
- Why do we have day and night? If earth stopped spinning, would we still have days and nights?
- Why do we have seasons?
- Orbit of moon. Different plane. Why do we see only one side of the moon?
- Archimedes volume of a sphere story.
- Pi as dropping of matchsticks