

## Nanotechnology Workshop

Techfest is the annual science and technology festival of IIT Bombay. Following is the basic outline of the workshop that would be happening at **Techfest, IIT Bombay**.

### **DAY 1:**

#### **Session 1: 2 Hours:**

Design & Manufacturing Fundamentals with convergence to Nano-Technology

Concepts like ideality, most useful function(s), harmful effects, expansion, convolution, need for invention, s-shaped curve in innovative design. Trimming, miniaturization, etc. while retaining functional performance of technical systems, viz. products and processes. Working Unit identified as the most 'wanted' part of a Technical System. Laws of evolution of technical systems, including idealization towards smart materials at nano-scale. Examples displayed from all areas of engineering systematically. Handling and assembling in Nano-Lab, conceptual and embodiment design methodologies such as Function-Cost-Analysis, use of tools, safety precautions, creative innovation enhancers like Miniaturized Model Dwarfs (MMD), Space-Time-Cost Operator and of course, all-rounder brainstorming. Invention procedures at different levels; jumping to higher levels.

#### **Session 2: 3 Hours:**

Nano-LED embedded screwdriver

Design & prototyping of Nano-LED lighted, preset torque generating screwdriver for night repair. Assembly using 3D Printed or precisely machined parts, nano LED, coin batteries, reflectors, wires, switches, etc. Transparency, translucency of parts pivotal in determining (partial or total) internal reflection and hence efficiency. Demonstration of final product in working condition. Variations in choice of parts, subsystems, etc.

#### **Session 3: 1 hour:**

**Doubts' Clearing and Assignment given for assessment Day 2:**

**Session 4:** 3 hours:

Portable, focus-able, pocket-microscope

Design & prototyping of portable, low cost, (almost) two dimensional microscope with buckling-based-focusing. Acrylic mirror, balsa wood (non-isotropic), nano-LED, coin batteries, switches, borosilicate glass balls of different radii in millimeters, etc. are used to assemble the optical instrument which resembles a sandwich (three layers). With Mass of about 10gms or so, Dimensions about 5cm x 3cm x 1cm in closed configuration & Energy consumed about 0.2W,  $\Sigma$ MDE is remarkably low.

Biological slides are prepared simultaneously using pollen grains, onion peels, etc. Instead of using brittle and dangerous standard glass slides and coverslips, we use slides made of transparent, safe acrylic. Arrangement for a nano-cover slip that is electrically conductive and/or nano-layer of a silver (based) conductive solution also done and demonstrated. Electrical current is passed through a slide to unfreeze or modify organic specimens - thermal effect of current. By a special technique, a mobile phone camera picks up a microscope image and displays it to you online, live during the workshop. It is identical to viewing directly through the microscope, rather better.

**Session 5:** 30 minutes:

Guest Talk by Co-Trainer, Dr Vijeta Jha on 'Protecting your Valued Invention

**Session 6:** 2 and 1/2 hours:

Questions and Answers. Extra material discussed. Evaluation of Assignment and Results. Origin, present and future of nano science and engineering discussed from technical systems' and material science points' of view, with convergence.