

# **‘Garage One 2011’**

## **Workshop on Automobile & Engine Design**

METAWING comes up with a short term professional workshops program me designed for young engineering minds on Automotive and Engine Design. The students will learn the basics concepts and will gain the practical experience while unfolding every part of the engine. The training sessions are being designed and developed by Team METAWING.

This workshop has been designed to provide an insight view in the field of automotive and engine design to the engineering graduates and technocrats. It aims at bridging the gap between the college curriculum and the industry environment. METAWING are the pioneers in conducting an interactive workshop in INDIA in which moulds will be showcased so that the students can enhance there knowledge and experimentation skills. The course content has been designed and developed under the guidance of our faculty advisors and highly experienced individuals from industrial background. Our team has worked on many national and international projects. To mention some, they have developed a prototype for a Gyro Car (a self balancing 2wheel car) which is made to run by a water engine, Project on All Terrain Vehicle, Solaris, Super mileage car, amphibian vehicle and many more.

All the concepts will be explained in detail with the Help of Theory and with Specially Designed Animations which would help the students to visualize things before actually practically working on it.

**‘Four Stroke Open Engine will be Transported at the Venue with Videos of our latest FSAE Car developed for Supra 2011’**

### **Highlights of the Course**

- ◆ 16 hours of certified practical training accompanied with industrial projects to give you a glimpse of different areas in the Automotive and Engine Design.

- ◆ 16 hours of certified workshop accompanied with practical implementation to give you a glimpse of different areas in the automotive industry.
- ◆ Study Materials to be given so that the students are able to keep an idea of what he/she has studied hitherto.
- ◆ Further help in industrial projects
- ◆ Competition at the end of the workshop. Winners get a certificate of Merit & Prizes worth Rs 1500.

## Course Catalog

### DAY 1

#### Introduction

Automotive  
 Engine design  
 History of research projects undertaken in the subject  
 Upcoming projects and Future of Automotive engineering  
 Industry perspective  
 Companies in India and job opportunities

#### Section 1: Chassis: Backbone structure

- need for chassis
- types of chassis
- arriving at a chassis type and design according to the need
- chassis materials and manufacturing processes involved
- material characteristics
- post manufacture analysis
- different testing procedures and standards for a chassis

#### Section 2: Virtual world of design

- need for computer aided design
- benefits of a virtual prototype
- design planning and component isolation
- introduction to cad software (Solidworks)
  - o 2D and 3D sketching
  - o transforming sketches into 3D parts
  - o applications of different features to the parts
  - o walk through of the different software features
  - o parts and assemblies

- virtual analysis
  - o defining material properties
  - o types of material testing
  - o FEA- finite element analysis

### Section 3: CAD in SAE competitions

- modeling car parts in CAD (Solidworks)
- chassis designing
  - o 3D sketching of the chassis
  - o transforming the sketch to weld-ment model
  - o analysis of the chassis model
- FEA -impact
- FEA - torsion
- design optimization
- analysis of other car parts
  - o torsion test on spindle upright
  - o fatigue testing of suspension
- CAD in manufacturing
  - o bill of materials
  - o part drawing sheets
- design reports

### Section 4: Aerodynamics and Bodyworks

- aerodynamics fundamentals
- assembling car parts into a rolling chassis
  - o overview of all parts interacting with each other
  - o step by step insight on how car will be assembled
- designing bodyworks in CAD( Solidworks)
  - o familiarizing with surface feature in Solidworks
  - o designing bodyworks around car model
- aerodynamic analysis of bodywork
  - o basic aerodynamic analysis in Solid works
  - o setting goals for optimization of the aerodynamics of the car

- lift
- drag
- position of spoiler wings
- virtual wind tunnel analysis

## Section 5: Suspension Unit

Spring Rate

Mathematics of the spring rate

Wheel rate

Roll couple percentage

Weight transfer

Jacking forces

Travel

Damping

Camber control

Roll center height

Instant center

Anti-dive and anti-squat

Flexibility and vibration modes of the suspension elements

Isolation from high frequency shock

Contribution to unsprung weight and total weight

Space occupied

Force distribution

Air resistance (drag)

Springs and dampers

Conventional passive, semi-active/active, and interconnected suspensions

Springs

Dampers or shock absorbers

### Type Of Suspension

Front suspension Dependent System

Front Suspension – Independent system

Mac Pherson Strut

Double wishbone suspension system

Coil Spring –type1

Coil spring-type2

Multi link type

Trailing arm suspension

I beam suspension

### Rear suspension –dependent type

Solid axle –leaf spring

Solid axle– coil spring

Beam

Hydroelastic suspension

Hydro gas suspension  
Hydro Pneumatic

## **Section 6: Safety: Brakes and Impact Attenuators/ Crush-boxes**

Brakes: Overview and Classification

- Construction
- Performance upgrade: Balance bars
- Power brakes and ABS

Impact Attenuators or Crash-boxes

- Impact and its associated dangers
- Impact Attenuation: Principles and working
- Impact Attenuators: classification and basis of selection
- Case Study: Design, Development and testing of a Impact attenuator for a Formula SAE car

## **Section 7: Transmission System**

### **Types of Transmission system**

Manual transmission

Automatic transmission

Semi automatic Transmission

Continuously variable transmission

### **Tires and Traction Control**

Types of Tires

Over steer

Under steer

Steering column

## **Section 8: Engine Design**

Types of Engines

Working of Engine (All process involved)

Engine Balancing

### **Interactive sessions**

We will be discussing about the making of the following vehicles (with videos’):

Super Mileage car

Solaris

Formula 1

Amphibian vehicle

ATV