



Design engineering Programme: This program has been consistently attracting bright students, and is one of the most popular M. Tech. programs of the Institute among the students as well as industries. Product design is becoming increasingly interdisciplinary, often requiring the knowledge of electronics, instrumentation etc. in addition to solid mechanics, fluid mechanics and material science. Students do this as part of the design challenge to get the full experience of developing a product.

Main research areas are:

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|-----------------------|--|-----------------------------------|--------------------|
| 1 Design optimization | 2 Finite element analysis and applications | 3 Reliability and maintainability | 4 Product design |
| 5 Advanced Dynamics | 6 Solid Mechanics | 7 Fluid Mechanics | 8 Material Science |
| 9 Fracture Mechanics | | | |

Some of the major research areas students have been focussing at present as part of M.Tech. Projects are

- Smart structures – structural actuation & control
- Low velocity impact of composites –Finite element modeling & experiments
- Reliability analysis and safety assessment of components like, offshore structures, human femur bone, body armor etc.
- Flutter analysis and design optimization for curved panel in supersonic flow
- Energy harvesting using piezo-laminated beams and plates
- Path planning and optimization of robot

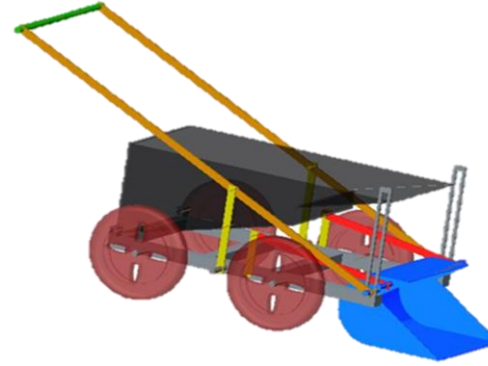
Salient features of few major courses undertaken:

1. Product Design:

This course aims at developing a product which has utility in society or industrial application, students in a team need to perform various stages of product development

- Need analysis and targeting a problem keeping in focus the end users
- Developing alternate designs in CAD modeling softwares such as CATIA, SOLID WORKS
- Kinematic and strength analysis by considering ergonomical factors
- Fabrication and testing

➤ Some of the innovative products made by students during this course were



Material Collecting Vehicle



Automatic Rain Protector

2. Design Optimization:

This course gives major thrust to every other course in terms of optimizing an objective function involving multiple variables and constraints

➤ Students had undertaken projects in team

➤ It focused on formulating objective function of product that had been developed as part of product design course

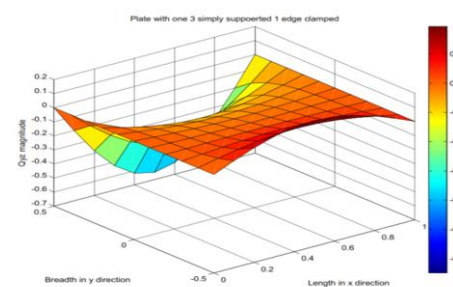
➤ Optimizing the objective functions for various constraints

3. Finite Element Methods:

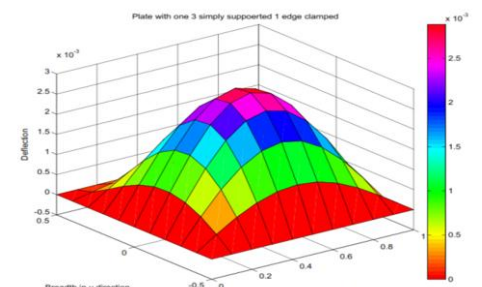
This course focuses on formulation of finite element model

- writing own finite element code in MATLAB
- Automated pre- and post-processing
- Comparing FEM results with analytical results

Plate with three edges simply supported and one edge clamped



Variation of shear force w.r.t. x & y directions



Variation of transverse displacement w.r.t. x & y directions

4. Properties & Selection of Engg. Materials

➤ This course is divided in two parts:

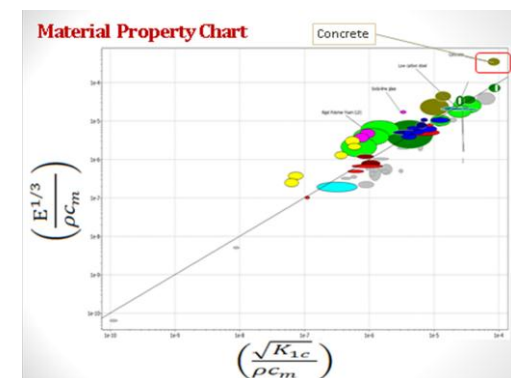
1. Focuses on understanding of material properties
2. Selection of engineering materials for real world applications

Part 2 also consists of group projects

where students in teams of 4 are supposed to choose the most appropriate material for a given practical problem while, depicting the proper problem formulation and its application in CES-Edupack software.

Function	Circular plate
Objective	Minimize the cost of the lid
Constraints	<ol style="list-style-type: none"> It must not deflect by more than 20mm under the application of load of 11.124 KN It must not fail by fast fracture Operating temperature varies from 0 °C to 55 ° C Thermal strain should be not be more than 454.54 μstrain Diameter of circular plate is 400 mm Good corrosion resistance
Free Variable	<ol style="list-style-type: none"> Choice of material Thickness of material

Problem Formulation

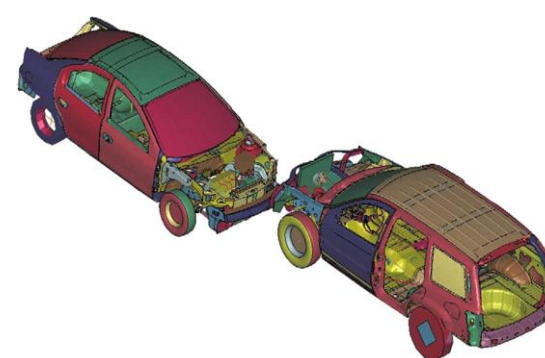


CES-Edupack interface

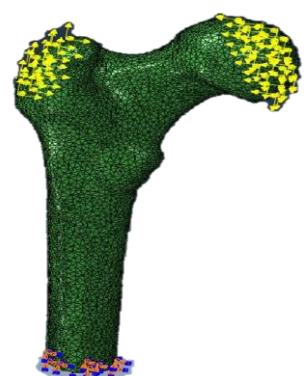
5. Product Reliability and Maintenance

➤ The main objectives of this course are

1. To understand the probabilistic and reliability analysis techniques
2. To understand the importance of quantifying the risk involved in any practical problem.
3. Encouraging students to undertake group projects in which they define the Limit state function, and perform probabilistic analysis while applying various reliability methods like FORM, SORM, AMV etc.
4. To facilitate the decision of most sensitive design parameter which Considerably affects the risk involved in the problem



*Vehicle to Vehicle frontal offset crash simulation model



Risk analysis of human femur bone under static loading conditions