

## Introduction to the course

Engineering Mechanics (EM) is the most fundamental course in the extensive area of mechanics. The basic concepts dealt in EM form the cornerstone of advanced topics such as solid mechanics, structural mechanics, geotechnical engineering, and bio-mechanics. Similarly, the ideas and techniques that are developed in EM are also indispensable in structural design. A rigorous training in both basic concept and problem solving is thus essential for a solid foundation in different engineering disciplines such as Civil, Mechanical, Aerospace, Chemical and Metallurgy. However, despite this overwhelming importance of EM in engineering training and its cascading effect on the eventual skills of an engineering professional, there is still a lack of systematic training in this course. This is mainly because the numbers of appropriately trained teachers in EM are not commensurate with the vast population of engineering students that await guidance. The objective of this course is to introduce the fundamentals of EM with special emphasis on problem solving. This will be achieved through working out carefully designed exercise problems that would not only identify various ploys that are commonly used to solve such examples, but also elucidate the thought process that goes behind these methods. The level of the material will be appropriate for a freshman undergraduate student. At the same time, it is hoped that the course will help develop an understanding and passion for this topic that can be carried over by the student to his/her future career.

The course starts with the essentials of Vector Mechanics to build the foundation. This will be followed by a detailed discussion of free body diagrams. These concepts would be sufficiently illustrated with a variety of real life problems. Different topics in 2D and 3D equilibrium will be covered, and a variety of problems in statically determinate trusses and frames will be solved. In addition, a systematic treatment of problems in the relatively difficult subject of dry friction will be done with special emphasis on the logic behind each solution. More advanced topics such as the virtual work method and the principle of minimum potential energy, which is the mainstay of analytical mechanics and approximate numerical methods such as the finite element method, will be discussed. Since problem solving is the backbone of EM, there will be supervised tutorial sessions where the participants will apply the concepts discussed in the lectures and solve a variety of problems.

## Course content

### *Essentials of Engineering Mechanics:*

- **Introduction:** Fundamentals Concepts and Principles, Review of Vector Mechanics
- **Equivalent System of Forces:** Reduction of System of Forces to One Force and One Couple, Resultant of Distributed Force System
- **Equilibrium of Rigid bodies:** Equilibrium in two and three dimensions, reactions at supports and connections, Equilibrium of a two force body and a three force body.
- **Analysis of Structures:** Equilibrium of Trusses: Method of Joints, Method of Sections Compound Truss, Equilibrium of Frames and Machines
- **Friction:** Laws of Dry Friction, Coefficient of Friction, Angle of Friction, Problems Involving Dry Friction, Belt Friction
- **Energy Methods:** Work of a Force, Principle of Virtual Work, Application of Principle of Virtual Work to Real Structures Potential Energy and Equilibrium, Stability of Equilibrium
- **Dynamics and Vibrations:** Free Vibrations of Mass-Spring Systems, Simple Harmonic Motion, Equation of Motion, Natural Frequency of Vibration, Free Vibration of Rigid Bodies

## Remote centers

### **We have remote centers in the following states:**

Andhra Pradesh, Assam, Chhattisgarh, Delhi, Gujarat, Haryana, Himachal Pradesh, Jammu and Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Pondicherry, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal

### **Address for communication:**

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Two-Week  
ISTE WORKSHOP

on

# Engineering Mechanics

Under the  
**National Mission on Education through ICT**  
(MHRD, Govt. of India)

**25<sup>th</sup> November – 05<sup>th</sup> December, 2013**  
Conducted by IIT Bombay



## Course coordinator

Prof. Mandar M. Inamdar  
Prof. Sauvik Banerjee  
Dept. of Civil Engineering

## Project coordinator

Prof. Deepak B. Phatak  
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## Background to the project

IIT Bombay and IIT Kharagpur have taken a significant initiative to work with several Engineering Colleges across the country. It is a part of the National Mission on Education through ICT, supported by MHRD. Under this project called "Empowerment of Students & Teachers through Synchronous & Asynchronous Instruction," IIT Bombay conducts two-week ISTE workshops during vacation periods, both in summer and winter. The participating teachers attend the workshop at a remote center close to their own college, and also attend tutorial and lab sessions conducted at the same center. The lecture transmission and live interaction takes place through distance mode using the AVIEW technology and the internet, at selected remote centers. Faculty Coordinators are appointed at each remote center to handle the technology infrastructure and other operational logistics. Additionally, for each workshop, there is a Workshop Coordinator for that respective subject who will enable a smooth conduct of labs and tutorials

We invite expert faculty from various remote centers for a five-day Coordinators' training workshop, held at IIT Bombay, prior to the main workshop. These Coordinators then act as Workshop Coordinators liaising between the participants from Remote Centers and IIT Bombay. During the main workshop, the Workshop Coordinator at every center supervises the conduct of tutorials and Labs. All the lectures and tutorial sessions are recorded. The final edited audio-visual contents, along with other course material are released under Open Source. These contents can be freely used later by all teachers and students.

Since December 2009, we have conducted two-week ISTE workshops on "Effective teaching/ learning of Computer Programming," "Database Management Systems," "Basic Electronics," "Thermodynamics," "Software Development Techniques for Teachers of Engineering and Science Colleges," "Heat Transfer," "Solar Photovoltaics," "Computational Fluid Dynamics," "Introduction to Research Methodology," and "Engineering Thermodynamics." We have reached out to more than 40,000 teachers and helped them enhance their teaching skills across 324 distinct Remote Centers.

Given the success of such workshops, we now announce a two-week ISTE Workshop on Engineering Mechanics, to be held in November- December, 2013.

## Teaching faculty

### Prof. Mandar M. Inamdar

Department of Civil Engineering, IIT Bombay  
<http://www.civil.iitb.ac.in/~minamdar/>

### Prof. Sauvik Banerjee

Department of Civil Engineering, IIT Bombay  
<http://www.civil.iitb.ac.in/~sauvik/>

## Duration and venue

The duration of the workshop is 2 weeks (10 working days.) It commences on Monday, 25th November, 2013 at 09:00 hrs and ends at 18:00 hrs on Thursday, 05th December, 2013 with a day's break on Sunday, 01st December, 2013. Additional contributions from participants are required to be made within the following two weeks.

The details and the enrolment link are available here:  
<http://www.it.iitb.ac.in/nmeict/>

**223 remote centers would be functioning as venues. The above link contains the list of all remote centers.**

## Who may benefit

The workshop will benefit faculty colleagues who are teaching **Engineering Mechanics or Solid Mechanics or Structural Mechanics at the UG level. The workshop will benefit the faculty from Mechanical, Civil, Applied Mechanics or Aerospace engineering departments.** They should have taught this subject at least once and should be familiar with the syllabi and examination pattern of their own college or university. This workshop is only for Faculty.

### Note

Please note that this workshop is conducted by the eOutreach project of IIT Bombay, under the National Mission on Education through ICT. Live recording of the course and other created contents will be released under Open Source through a portal. The recorded CD/DVD of the course lectures will be available for distribution at cost, to any individual/ institution. All participants are required to sign an authorization for such release of contents contributed by them during and after the workshop. Recognition and citation will naturally be made for all contributors.

## How to apply

Those wishing to attend this course should register online at <http://www.it.iitb.ac.in/nmeict/>

The online form contains a list of remote centers. From this list, please select a center close to your institute, where you wish to attend the workshop. The last date for enrollment and for submission of permission letter is **12th November, 2013**. A list of selected participants will be put up on this website on **15th November, 2013**. The selected participants will also be informed by email.

## Mandatory requirement

It is mandatory that while registering for the workshop, the participant should submit a scanned copy of a permission letter from the principal/Head of the Institute, permitting the participant to attend the workshop for all 10 days. The format of this letter is given in the registration form. Registration without this letter will not be considered.

*Enrollment will be strictly online, and no other mode of application will be entertained.*

## Course fee

Since the workshop is partly funded by the National Mission on Education through ICT (MHRD, Government of India), there is no course fee for participation.

## Accommodation & other support

Remote centers are being partially funded to provide tea/lunch on each day of the workshop, and for accommodation, wherever available\*, for a limited number of outstation participants. Travel reimbursement up to Rs. 1000/- will be paid only to the outstation participants, if the distance travelled from their Institute to the Remote Center is more than 100 kms.

*\*Accommodation is not guaranteed.*

**LAST DATE FOR ONLINE ENROLLMENT:  
12<sup>th</sup> November, 2013**