

One Week ISTE Workshop for Coordinators

On

Engineering Mechanics

Under the
National Mission on Education through ICT

(MHRD, Govt. of India)

16th – 20th September, 2013

Conducted by IIT Bombay

Course Coordinators:

Prof. Mandar Inamdar & Prof. Sauvik Banerjee
Department of Civil Engineering



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Introduction to the Workshop

An important initiative has been taken by IIT Bombay and IIT Kharagpur to work with Engineering Colleges in the country to enhance the teaching skills of our faculty colleagues in core Engineering and Science subjects. This is the second phase of Teach One Thousand Teachers programme run successfully earlier by IIT Bombay under the project called 'Empowerment of Students and Teachers through Synchronous and Asynchronous Instruction'. Two-week ISTE workshops are conducted during the vacation periods in summer and winter. Participating teachers attend live lectures delivered by IIT faculty at a remote center close to their own college, and also attend tutorial and lab sessions conducted in the same centers. The lecture transmission and live interaction takes place in distance mode using the AVIEW technology through internet, at selected remote centers across the country. This initiative is part of the 'National Mission on Education through ICT,' which is supported by MHRD. Faculty coordinators are appointed at each remote centre to handle the technology infrastructure and other operational logistics. Additionally, for each workshop there will be a workshop Faculty Coordinator for that subject, who will help in the conduct of labs and tutorials at each center.

We invite expert faculty from various remote centers for a five-day Coordinators' training workshop which is held in IIT Bombay, before the main workshop. These Coordinators then act as Workshop Coordinators during the main workshop, liaising between the participants at their Remote Centers and IIT Bombay from where the workshop is transmitted live. 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 will be 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", "Engineering Thermodynamics" and "Analog Electronics." We have reached more than 35,000 teachers and helped them to enhance their teaching skills at around 324 distinct Remote Centers across the country.

In the backdrop of the success of these workshops, IIT Bombay now announces another two-week ISTE workshop, on **Engineering Mechanics**, to be held in **December 2013**.

One Week Coordinators' Workshop

The proposed Coordinators' Workshop, to support the above, is being organized at IIT Bombay from **16th to 20th September 2013**. This workshop will provide a complete orientation to the prospective Workshop Coordinators, on the methodology to be followed in this project. This will include the delivery of live lectures through the AVIEW mechanism of interaction with participants, and the local conduct of tutorials and labs. Since the final contents are meant to be adopted by most colleges across the country, this workshop will finalize the following for the subject of **Engineering Mechanics**:

- (a) Definition of common syllabus to be covered.
- (b) Graded coverage from simple to difficult levels for each topic and subtopic.
- (c) Nature of tutorials, keeping the above gradation and the typical examination pattern in mind, but leading to the typical advanced levels reached in such subject teaching, at the top institutions of the world.
- (d) Discussion of laboratory environment and the experiments to be conducted, if any.
- (e) Use of the learning management system, audio-visual equipment, editing tools.
- (f) Other logistic details for conducting the main workshop.

Tentative syllabus, proposed for Engineering Mechanics, is given below. The course content for the main workshop will be finalized during the Coordinators' workshop.

Introduction to the Course

Engineering Mechanics (EM) is the most fundamental course in the extensive area of mechanics. The basic concepts that are dealt with in EM form the cornerstone of more advanced topics such as solid mechanics, structural mechanics, geotechnical engineering, and biomechanics, among others. Similarly, the ideas and techniques that are developed in EM are also indispensable in structural design. Due to its crucial importance, EM is a core course in a majority of engineering curriculum both in India and abroad. A rigorous training in both basic concepts and problem solving in EM 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 plays 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.

Teaching Faculty

Prof. Mandar Inamdar, Department of Civil Engineering
<http://www.civil.iitb.ac.in/~minamdar/>

Prof. Sauvik Banerjee, Department of Civil Engineering
<http://www.civil.iitb.ac.in/~sauvik/>

Duration and Venue

The duration of the workshop is one week (**16th- 20th September, 2013**), and it will be conducted in IIT Bombay.

Note

Please note that this workshop is conducted under the eOutreach project of IIT Bombay. Live recording of the course and other created contents would be released under Open Source, through a portal. The recorded CD/DVD of the course lectures would be available for distribution at cost, to any individual/institution. All participants are required to sign a No Objection certificate for such release of contents contributed by them during and after the workshop. All contributors will be acknowledged.

Accommodation & other support

Shared Guest House accommodation with standard boarding will be provided free to the participants depending on availability.

Course Fee

Since the workshop is funded by the National Mission on Education through ICT (MHRD, Government of India), there is no course fee for participation. Travel fare reimbursement will be made for up to A/C 2-tier or lowest return airfare, as per GOI entitlement. Please click [here](#) for the details of Travel Allowance.

Who may benefit

The workshop is likely to benefit faculty colleagues, who are willing to be prospective Workshop coordinators for the larger main workshop to be held on **25th November – 05th December, 2013**. **It is mandatory that the prospective coordinators should have taught a course on Engineering Mechanics or Solid Mechanics or Structural Mechanics at the UG level.** Furthermore, they should be either from Mechanical, Civil, Applied Mechanics or Aerospace engineering departments. He/she should be familiar with the syllabi and examination pattern of their own college or university. It is preferable that they should have at least 3 years of teaching experience with some experience in conduct of ISTE, QIP workshops.

Important Note:

It is mandatory that the participant's Institute is well equipped to conduct the workshop through the NKN/ internet for a minimum of 50 participants. For a remote center a primary requirement is provision of one computer per participant, with Linux (preferable) or Windows as the operating system. This is for the laboratory component of the course.

It is also mandatory that the participants bring a document from the Heads of their institutes to the effect that the participant has been officially nominated by the Institute to be the Workshop Coordinator for this workshop. The format is provided on the Registration page.

The prospective coordinators are expected to read all the relevant material available on moodle before coming to IIT Bombay. They will be given their moodle log-in ids once they are confirmed as participants for the workshop.

How to Apply

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

Confirmation of registration will be sent by email. **Enrollment will be strictly online.**

Multiple registrations from a Remote Center are not allowed. We will consider only the officially nominated participant as the Workshop Coordinator.

LAST DATE FOR ONLINE ENROLLMENT:

31st August, 2013

Address for Communication:

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