AICTE sponsored STTP Course on

Mechanics of Impact and Blast : Introduction, Modeling and Prediction (MIB: IMP)

25th March to 30th March 2019

Coordinators

Prof Prasad Patnaik B S V

Dept. of Applied Mechanics,

Prof R Jayaganthan

Dept. of Engineering Design,

and

Prof. R Velmurugan

Dept. of Aerospace Engineering,

Organised by

Indian Institute of Technology Madras

Chennai - 600 036

INTRODUCTION

Extreme loading conditions such as a blast wave and/or ballistic impact are of serious concern to both military and civilian applications. Protecting target structures, vehicles, armored tanks etc is of primary importance and requires a multi-disciplinary understanding. Modeling and prediction of such loads require a holistic study of the basic principles of Mechanics applied to impact, blast waves and their structural/ material response to such loads. With the above background, the course envisages to achieve the following objectives.

COURSE OBJECTIVES

1. Introduce the fundamental principles of impact mechanics, blast waves and material mechanics.
2. Imparting necessary background in Mathematical modeling and experimental characterization for (1) above.
3. Develop modeling and prediction capability for achieving better designs against impact and blast.
4. Acquainting and empowering the learners with a broad spectrum of applications in the field of Impact and Blast.
5. Explore technological solutions for the development of systems and devices for protection against Impact and Blast.

Relevance of the course

The need for understanding impact and blast has become fundamental to the engineering designs for a broad range of defense and civilian applications. This course will find applications in a number of technologies of interest in the disciplines such as, Civil, Mechanical, Aerospace, Applied Mechanics, Engineering Design, Materials Engineering. Teachers/ Scientists/ Engineers working on such technologies need good grasp of the fundamental principles of Mechanics of Solids and Fluids.

COURSE CONTENT

Please see the Appendix A, where the course content is provided. However, applications and case studies will cover beyond what is specified.

RESOURSE FACULTY

The resource faculty are eminent academicians from IITs as well as distinguished Scientists from Defense Laboratories and practicing engineers from reputed Industries.

ELIGIBILITY

Engineering college teachers from AICTE approved colleges are eligible to apply. Eligible teachers are requested to submit the filled in application along with the sponsorship certificate to the coordinator on or before 10th February 2019 (only through the online mode).

https://docs.google.com/forms/d/e/1FAIpQLSeKZJ2ZUYsc6rn3IcK4o9eiDjh9ubzbMEs8PO4MYJUEy7rI5Q/viewform?usp=sf_link

The participants are expected to be motivated Faculty members from disciplines such as, Civil, Mechanical, Aerospace, Applied Mechanics, Engineering Design, Materials Engineering branches. In particular, faculty with teaching/ research interest in Mechanics of Materials (Fluids/ Solids) and/or Defense Technologies are encouraged to apply. Furthermore, young faculty members with the goal of pursuing Ph.D. are particularly encouraged.

Due date for ONLINE REGISTRATION : 10/02/2019

REGISTRATION FEE

There is **no course fee** for the participants from AICTE approved engineering colleges. However, all the short listed candidates after the confirmation from the coordinator, need to pay a refundable deposit of Rs. 500/-. This amount shall be paid through a demand draft drawn in favour of IIT Madras, payable at Chennai (or) an online transfer mode to CCE, IIT Madras account. This deposit will be refunded to the course participants at the end of the course. The payment process will be informed by email (only for the selected candidates).

TRAVEL

The course participants are eligible for 3-Tier AC train fare by the shortest route.

BOARDING AND LODGING

Boarding and lodging facilities will be provided at Taramani Guest House, IIT Madras for all participants from AICTE approved institutions.

COURSE DURATION

The course is of one week duration from **25th March to 30th March 2019**

For further details, please contact:

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APPENDIX A

Course Content for MIB:IMP (25th March to 30th March 2019)

The short-term course will cover the following topics:

Introduction to the Mechanics of Impact and Blast (MIB)

Applications and Engineering relevance to civil and defense; Ballistic Impact, Explosions; Vehicular collisions; Blast waves and their predictions using simple scaling arguments and dimensional analysis; Classification of explosions;

Fundamentals of Solid Mechanics

Principles of rigid body Mechanics; Equations for Impulse-Momentum; Mechanics of collision; Kinetic and energy coefficients of restitution; Mechanics of penetration and perforation; Elastic, plastic, hydrodynamic limit velocities;

Shock Waves and Related Equations of state

Elastic wave propagation in solids; Shock wave formation; Shock wave propagation in solids; Thermo-Mechanics of shock waves; Reiman problems; Rankine-Hugoniot equations; Non-linear equations of state; Material response; Mie-Gruneisen's formalism;

Blast Waves

Acoustic wave, shock wave, blast wave; Euler equations; Rankine-Hugoniot relations; Energy release in blast wave and its propagation; Ideal and non-ideal blast loads; Decay of strong blast, explosion length; Sach's scaling; Cranz-Hopkinson's scaling; Missiles fragments and sharpnels; Incidence and reflection of blast wave interaction with structures;

Material Mechanics subjected to Impact and Blast

Constitutive behavior of materials; The behavior of materials under high strain rates; Experimental tests such as, Pendulum test, drop impact tests, Split Hopkinson Pressure Bar (SHPB) etc. Modeling deformation behavior and failure; Constitute models for material deformation and plasticity; Failure and damage models;

Modeling and Predictions and Technological Applications

Case studies on Ballistic impact, Crash worthiness, Blast wave propagation studies using both numerical and experimental approaches; Development of impact and blast resistant materials;

Introduction and modeling predictions using computational methods such as, Discrete Element Method (DEM), Smooth Particle Hydrodynamics (SPH) etc. Case studies from the aerospace, automotive, defense, forensic sciences will be covered by practitioners, including risk analysis.