

**QIP Training program on**

## **Vibro-acoustics**

**December 4-8, 2017**

**Venue: IIT Bombay**

### **Coordinator and faculty**

Prof. Dhanesh N. Manik



Continuing Education Program  
Indian Institute of Technology, Bombay,  
Powai, Mumbai, 400 076

#### **Introduction**

Concerted efforts to reduce noise in machines started in the 1950s. Preventing noise induced hearing loss of factory workers was the main concern of these efforts. Due to the pioneering efforts of Paul Sabine in quantifying the acoustic absorption properties of materials used in auditoria during the beginning of 20<sup>th</sup> century, acoustic materials were extensively used to reduce noise in machinery. It resulted in band-aid measures like providing enclosures. Although enclosures were effective in reducing noise in machines, they presented difficulties in heat dissipation and maintenance, thus limiting their application to only certain machines. In addition, the enclosures were expensive and sometimes more expensive than the machines themselves!

The first launching of the manmade satellite, Sputnik, in 1957, sparked competition between many countries to build satellite launch vehicle structures. The electronics of the guidance systems used in these launch vehicles

failed many times due to the acoustic and boundary layer noise generated at the time of launching. The traditional structural design techniques based on normal modes using natural frequencies and the corresponding modeshapes of structures was not useful in designing such space structures. Thus began extensive research into vibro-acoustics and random vibration that explained many phenomena of noise generation and its reduction at the source.

Now vibro-acoustics is extensively used to reduce noise in aerospace vehicles, ships, submarines, automobiles and machinery to reduce noise at the source, which is very effective in reducing noise at a nominal cost. Customer demands for quiet machines and stiff competition among manufacturers to produce such machines at a lesser cost have made vibro-acoustics an important body of knowledge that engineers need to be aware of.

## **Objectives**

The course begins with the fundamentals of vibration and noise. The concept of wave propagation is introduced that is a very important viewpoint in vibro-acoustics. This is followed by extensive discussion on random vibration, which is not only required for understanding the basics of vibration and noise measurement techniques but has applications in statistical energy analysis (SEA). Since most noise in machines is produced due to vibration by continuous systems, they are discussed next; important continuous systems discussed are: beams, plates and shells. Important noise sources like monopoles and dipoles are discussed, followed by room acoustics that relates sound pressure levels generated by machines within an enclosed space. Although noise can be produced by vibration, all vibration will not produce noise. This is a key element in preventing noise in machines by understanding the conditions under which vibration results in noise; this is discussed in the session on sound-structure interaction. Statistical energy analysis (SEA), which is an important vibro-acoustic technique in the high frequency range, is discussed in detail. Many practical examples are provided in the final sessions.

## **Who can attend?**

This is a Level 2 course that is meant for scientists and engineers who already have some knowledge of vibration and noise and have some exposure to its basics and, are already working on reducing vibration and noise. Those participants who attend the course must have a graduate degree in engineering with basic knowledge of mechanics, circuit theory, fluid mechanics and mathematics. This course is mainly useful to those who are interested in mathematical modeling of machines to reduce noise at the design stage.

## **Reference textbook**

The reference textbook for this course is:

Vibro-acoustics: Fundamentals and applications, Dhanesh N. Manik, CRC Press, 2017

<https://www.crcpress.com/Vibro-Acoustics-Fundamentals-and-Applications/Manik/p/book/9781466580930>

## **ELIGIBILITY**

Faculty members of engineering colleges recognized by AICTE, working in mechanical and electrical departments engineering, who have relevant teaching/research experience in any of the related areas of vibro-acoustics can attend this course.

## TRANSPORTATION, BOARDING & LODGING

Participants are entitled for II class (Sleeper Class) or III AC railway to and fro fare by the shortest route from their college / institute to IIT Bombay. All participants will be given auto rickshaw fare from Kanjurmarg / Andheri Rly. Station to IIT on the dates of arrival and departure. Local participants (from Mumbai, Navi Mumbai, or up to Karjat / Kasara / Khopoli) will be paid 2<sup>nd</sup> class railway fare or BEST Bus fare.

Boarding and lodging will also be provided free of cost. Accommodation will be provided in the students Hostel or Guest House on sharing basis. Since on-campus accommodation is limited, family members of the participants cannot be given accommodation by the QIP office.

## REGISTRATION

There is no registration fee for this QIP course. Participants will be selected based on the information provided in their application. All the selected candidates are then required to confirm their participation by sending a Demand Draft of ₹ 2000/- drawn in favour of "Registrar IIT Bombay". This amount will be refunded to the participants who attend the course.

## IMPORTANT DATES

Last date for receipt of registration forms: September 10, 2017

Notification of Selection: September 25, 2017

## TEACHING FACULTY

The teaching faculty consists of expert professors from IIT Bombay.

## Venue for Classes

Classes will be held in the Seminar Hall of Vanvihar Guest House, IIT Bombay from 9 a.m. to 5 p.m.

	Monday December 4	Tuesday December 5	Wednesday December 6	Thursday December 7	Friday December 8
09:00 to 10:30	Single degree of freedom systems	Airborne sound	Flexural vibration of beams	Sound sources	Sound-structure interaction
10:30 to 11:00	Tea	Tea	Tea	Tea	Tea
11:00 to 12:30	Single degree of freedom systems	Airborne sound	Flexural vibration of beams	Sound sources	Sound-structure interaction
12:30 to 13:30	Lunch	Lunch	Lunch	Lunch	Lunch
13:30 to 15:00	Multi-degree of freedom systems	Random vibration	Flexural vibration of plates	Room acoustics	Statistical energy analysis (SEA)
15:00 to 15:30	Tea	Tea	Tea	Tea	Tea
15:30 to 17:00	Longitudinal vibration	Random vibration	Flexural vibration of shells	Room acoustics	Statistical energy analysis (SEA)

## HOW TO APPLY?

Fill up the following registration form using any word processing software, and take a print out. Paste a passport size photograph, get the registration form signed by your head of institution, and send a **scanned copy** (pdf file only) of the same to [dnmanik@iitb.ac.in](mailto:dnmanik@iitb.ac.in). Keep the original copy with you and bring it when you come to IIT Bombay to attend the course, if selected.

40 candidates will be selected based on information provided in the registration form.

**Application form for attending the QIP course on Vibro-acoustics conducted at IIT Bombay from Dec 4-8, 2017**

Name

Date of birth

Gender

Designation

Name of the Institution

Department

e-mail:

Mobile:

City

Pin code

State

Paste a passport size photograph in this space

**Type of Institute:** state government/central government/aided/private

**University affiliation**

**\*Recognized by AICTE**

**Yes/No**

**\* AICTE Permanent ID** \_\_\_\_\_

**Details of education**

No	Name of the college	University	Degree	Specialization	Year	Marks/Grade obtained

**Details of employment**

No	Designation	Name of the organization	Date of joining	Date of leaving

**Details of courses taught related to vibration or acoustics only**

No.	Name of the course	Number of students	Year	Semester	Sole teacher or shared

Areas of research

List of refereed journal publications

Approximate distance from the nearest railway station to Mumbai

Signature of the participant

Date:

Head of Institution

**(IMPORTANT: BY SIGNING ABOVE HEAD OF THE COLLEGE/INSTITUTE CERTIFIES THAT APPLICANT IS A FACULTY MEMBER OF DEGREE LEVEL ENGINEERING COLLEGE RECOGNIZED BY AICTE AND AICTE PERMANENT ID WRITTEN ABOVE IS CURRENTLY VALID).**

\* Required fields otherwise application will be rejected.