

MLL 104 Characterization of Materials -I

First Interaction session 5th January 2025.

Introductory course on material characterization techniques. The course will introduce the concept of measurement, observations, qualification and characterization. We will start with fundamental principles behind various material characterization schemes such as X-ray crystallography, optical microscopy, electron microscopy, electrical measurements, optical measurements and thermal measurements. The measurement techniques will involve several fundamental physical properties which every engineer, particular a materials engineer should master. The course has **three hours of lecture and three hours** of lab session per week and has a massive **4.5** credits.

Course Content:

- Fundamental of measurement
- Optical microscopy
- X-ray diffraction and applications
- Scanning electron microscopy
- Optical Spectroscopy Techniques
- Thermal analysis
- Electrical characterization

People:

Instructor: **Prof. Krishna Balasubramanian**

Assistant Professor, Department of Material Science and Engineering

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Course Timing:

- Slot E, Tuesday, Wednesday, and Friday 10 AM – 11 AM LT4, Block 4
- Labs Mondays 2 – 5 PM, TX 120

Prerequisites:

- Well-meaning intentions

Books and Reference:

Multiple references for each topic. Will be announced during the lecture time. General references are as follows:

- B. D. Cullity and S. R. Stock, Elements of X-ray Diffraction, Prentice Hall; 3 ed. 2001R
- R. F. Egerton, Physical Principles of Electron Microscopy: An Introduction to TEM, SEM, and
- AEM, Springer, 2005.
- R. Haynes, Optical Microscopy of Materials, Springer, 1984

- Michael E. Brown and Patrick K. Gallagher, Handbook of Thermal Analysis and Calorimetry, ,
- Elsevier, 2003.
- Peter J. Haines, Thermal methods of Analysis, Principles, Applications and Problems, Springer,
- 2012.
- David B. Williams, Barry Carter, Transmission Electron Microscopy: A Textbook for
- Materials Science, Springer, 2009
- 7. Y. Waseda, E. Matsubara, K. Shinoda, X-Ray Diffraction Crystallography, Springer, 2011

Evaluation:

- Relatively graded course with the following split up:
Lecture part:
35% minor, 45 % major, 10% homework/assignments/quizzes and 10 % in-class interactions

Practical part:
50% - lab sheet evaluations, 40% final viva-voce/term presentation and 10% participation

Final score: 60% Lectures and 40 % Practical
- **Audit Pass is 35%**

Course Organization:

- Course hosting:
 - Lecture notes and other information available on webpage:
<https://web.iitd.ac.in/~bkrishna/MLL104.html>
- Homework to be submitted before the class sessions. Could involve simple coding exercising. Deadlines are razor sharp (its automated).
 - Submissions are binary: either you submit before time or leave without marks. Sorry, no concessions for any amount of delay!
- All evaluation will be off-line. Upload answer sheets and it will be evaluated by TA/myself.
- Dishonesty will be very seriously dealt with. We are a huge team of very experienced professionals. So, any malpractice will be identified, and the student will be given a 'F'. Remember, this is much worse than just dropping the course!

Academic Honesty:

All students registering to this course voluntarily commit to the academic integrity, research and Ethics policy, IIT Delhi

(https://academics.iitd.ac.in/sites/default/files/registration/forms/10_FORM%20H.pdf).

This is an under-graduate level course in the country's most premier institute, and I expect

the students to know their responsibility. If any document submitted to us is plagiarized (copied verbatim either from textbook/ online resources/ fellow students...), the student will be deregistered and promptly handed to institute authorities. Discussion is okay for homework, but the submission needs to reflect the student's work. No discussion/references are allowed in quizzes/ mid-semester/final exams.

Online Compliance:

If any student is having difficulty in accessing the online content/ submitting homework, please inform the instructor at the earliest.