INDIAN INSTITUTE OF TECHNOLOGY KANPUR

SEMESTER 20017-2018-I

Course **:** MSE 658 Dislocations and Plasticity
Credits **:** (3-0-0-0) 9
Lecture House **:** W, F (10:00 am to 11: 45am)
Venue **:** WL226
Instructor **:** Dr. Shashank Shekhar
Contact **:** WL304A // Ph: 6528 // email: shashank@iitk.ac.in
TA **:** Ms. Sudha (psudha@iitk.ac.in)
Course Webpage **:** home.iitk.ac.in/~shashank/MSE658

Grading Scheme:

Mid-Semester Exam	:	25 Marks
End-Semester Exam	:	40 Marks
Assignments + Project	:	20 Marks
Quizzes	:	15 Marks
Pass Percentage	*:*	*40%*

Attendance:

Attendance is compulsory in the class unless there is health issue or emergency in family. Students with 3 or less absents will receive a bonus 5% marks. If you miss more than 3 classes you will lose all the bonus marks.

Unfair Means:

Any use of unfair means (in project or assignment or exam) would lead to automatic 'F' grade. It is your responsibility to ensure that other students do not copy from you. If unfair means is found, then all parties involved will be penalized. During exam, borrowing or sharing of any material (pen/ pencil/ eraser/ calculator etc.) is strictly not allowed. Bring your own stationaries.

Project:

If project is assigned to more 2 more people as group, there will be peer-review at the end of project to ascertain that each member of the group contributed to the project. Project will be based on MATLAB, where you will be required to simulate dislocations and its effects.

Assignments

Assignments must be done individually and with due diligence. It must be submitted before deadline. Assignments will be checked, but not add to the grade. It will however be used for deciding grades in borderline cases.

Objectives of the course:

At the end of the course, the student should be able to

- ✓ Have a broad understanding of defects in materials and their role in determining properties of materials
- ✓ Have a thorough understanding of the structure of dislocations in various crystals and their elastic fields
- ✓ Have an overview of plastic deformation mechanisms and the role of dislocations in plasticity, fracture, fatigue and creep

Course Contents:

- ❖ Defect Structure
    - o Point defects, Line defects, Area defects, Volume defects
- ❖ Concept of Dislocations
    - o Structural Defects, Dislocations in the lattice, Burger Vector
- ❖ Dislocations in an Elastic Continuum
    - o Energy, Forces on dislocation, Line tension, Interaction, Motion
- ❖ Dislocations in Crystals
    - o Peierls Model, Stress for slip, Glide systems in FCC and other crystal structure
- ❖ Multiplication of Dislocations
    - o Sources, Frank-Read, Dynamic multiplication
- ❖ Geometrically and Structurally necessary dislocations
- ❖ Effect of lattice Defects on the Physical properties of metals

References

1. Introduction to Dislocations, D. Hull and D.J. Bacon **(Main Reference Book)**
2. http://www.tf.uni-kiel.de/matwis/amat/def_en/
3. Mechanical Metallurgy, G.W. Dieter
4. Dislocations and Mechanical Behavior of Materials, M.N. Shetty
5. Ebook by Dr. Anandh Subramaniam and Dr. Kantesh Balani (http://home.iitk.ac.in/~anandh/E-book/)
6. Dislocations and Plastic Deformation, I. Kovacs and L. Zsoldos