

ME670 Additive Manufacturing

Credits: 3L-0T-0P-0A (9 Credits)

Objectives:

Additive Manufacturing (AM) is a process of joining materials to make objects from 3D model data, usually layer upon layer, as opposed to subtractive manufacturing methodologies, such as traditional machining. The basic principle of AM is that a model, initially generated using a three-dimensional Computer Aided Design (3D CAD) system, can be fabricated directly. AM technologies have significantly evolved over the last decade. Because of their potential to extensively transform the nature of manufacturing processes, e.g., by enabling “Freedom of Design” several industries have been attracted by these technologies. Using AM, manufacturing of highly complex parts can be an economically viable alternative to conventional manufacturing technologies.

AM processes can be categorized by the type of material used, the deposition technique or by the way the material is fused or solidified. Over the years, many AM processes have emerged which have their own advantages and limitations. This course is an elective subject for PG/UG students who intend to study additive manufacturing. The main objective of this course is to acquaint students with the concept of AM, various AM technologies, selection of materials for AM, modeling of AM processes, and their applications in various fields. Towards modelling in AM, relevant case studies have been included to introduce the students to the mathematical models for AM to describe the transport phenomena such as heat/mass transfer and fluid flow. The course will also cover AM process plan including building strategies and post-processing.

Course contents:

Introduction to AM, Reverse engineering, Traditional manufacturing v/s AM.

Various AM technologies and process physics.

Mathematical modeling of AM processes and various case studies.

Materials science involved in AM, CAD, CAM aspects, AM process chain.

Process monitoring and control for AM.

References:

- Ian Gibson, David W. Rosen, Brent Stucker, Additive manufacturing technologies: rapid prototyping to direct digital manufacturing, Springer, 2010.
- Andreas Gebhardt, Understanding additive manufacturing: rapid prototyping, rapid tooling, rapid manufacturing, Hanser Publishers, 2011.
- J.D. Majumdar and I. Manna, Laser-assisted fabrication of materials, Springer Series in Material Science, e-ISBN: 978-3-642- 28359-8.
- L. Lu, J. Fuh and Y.-S. Wong, Laser-induced materials and processes for rapid prototyping, Kluwer Academic Press, 2001.
- C.K. Chua, K.F. Leong and C.S. Lim, Rapid prototyping: principles and applications, 3rd Edition, World Scientific, 2010.