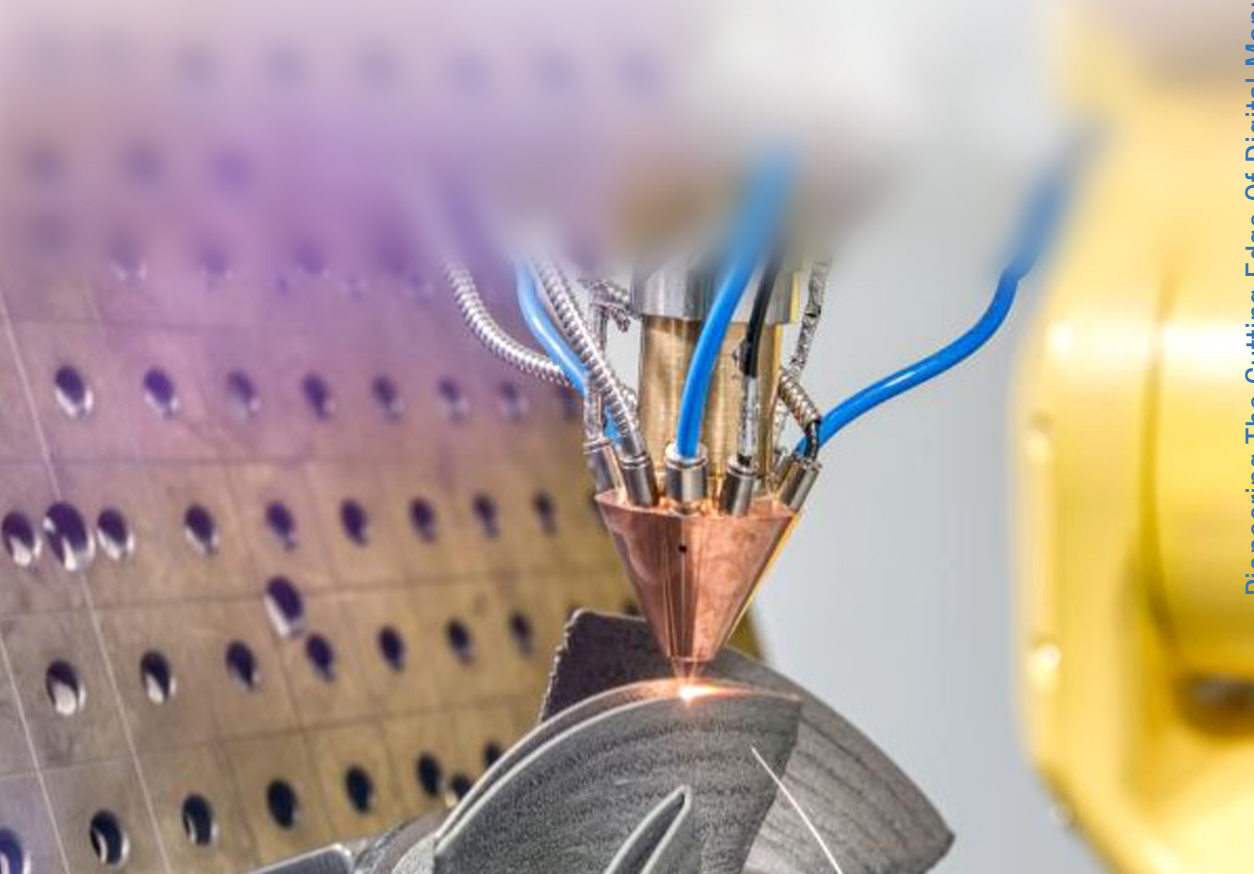
భారతీయ సాంకేతిక విజ్ఞాన సంస్థ హైదరాబాద్
भारतीय प्रौद्योगिकी संस्थान हैदराबाद
Indian Institute of Technology Hyderabad

2023-24 | Admissions Brochure

IIT Hyderabad

ADDITIVE MANUFACTURING

Center for Interdisciplinary Programs



Pioneering The Cutting Edge Of Digital Manufacturing

INTRODUCTION

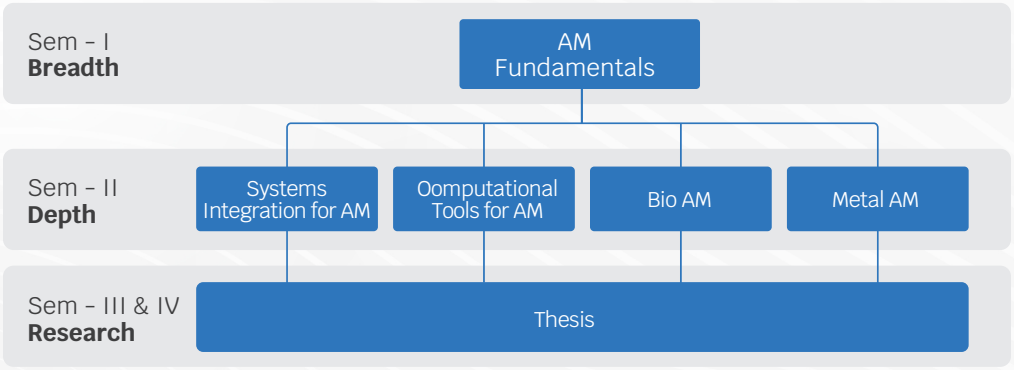
The primary objective of this interdisciplinary MTech program is to generate qualified human resources for taking up challenging careers in Additive Manufacturing (AM) industries.

The course is designed to capture the interdisciplinary nature of AM technologies and equip students with specialized knowledge in the field of AM. The course contents cover both fundamental scientistic principles and applied engineering aspects of AM technologies.

Special emphasis is laid on imparting hands-on skills to the students in designing and building parts various AM technologies.

The course leverages the strong eco-system of AM research at IITH, thus providing the students an opportunity to conduct research at the forefronts of AM technologies.

COURSE OUTLINE

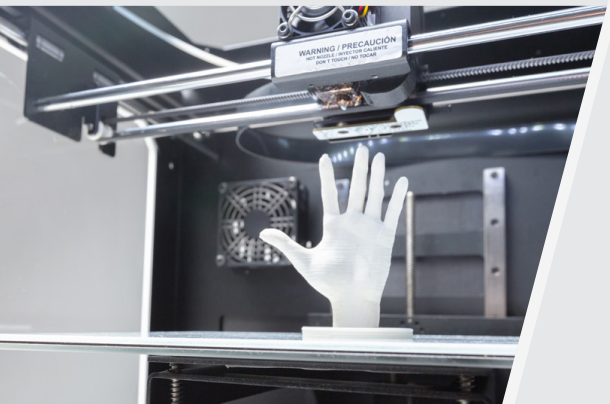


COURSE STRUCTURE

Course Title	Credits
Semester I	
Fundamentals of Additive Manufacturing	3
Product Design and Prototyping	2
Biofabrication	2
Materials for Additive Manufacturing	2
English for Communication	1
Elective course(s) (from any one or more of the four elective baskets)*	3
Sub-total	13
Semester II	
Biofabrication Technology Lab	1
Additive Manufacturing Processes Lab	1
Industrial Lectures	1
Elective courses (from any one or more of the four elective baskets)**	12
Sub-total	15
Semester III and IV	
Thesis	24
Total Credits	52

Elective Courses in Semester I (the list is not exhaustive)

Basket	Course Title
Systems Integration for Additive Manufacturing	Life Cycle Analysis
	Elasticity & Plasticity
	Computational Tools for Geometric Modelling
Computational Techniques for Additive Manufacturing	Finite Element Methods
	Mathematical Methods for Engineers
	Augmented Reality & Virtual Reality
Bio Additive Manufacturing	Biomaterials: Materials in Medicine
	Lab on Chip
	Advanced Fabrionics
	Microfluidic Platform for Cell Culture & Diagnostics
Metal Additive Manufacturing	Metal Additive Manufacturing
	Advanced Physical Metallurgy
	Powder Metallurgy Manufacturing
	Materials Synthesis and Characterization



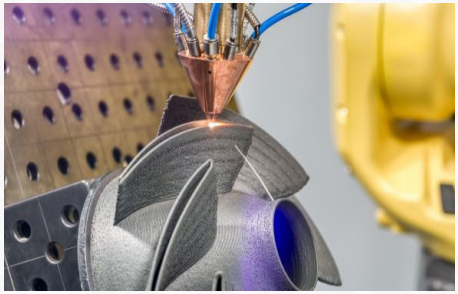
Interdisciplinary PhD

Elective Courses in Semester II (the list is not exhaustive)

Basket	Course Title
Systems Integration for Additive Manufacturing	Computational Fluid Dynamics
	Fluid Mechanics and Heat Transfer
	Industry 4.0
	Design for Additive Manufacturing
	Finite Element Analysis
Computational Techniques for Additive Manufacturing	Introduction to Computational Methods in Materials Science
	Advanced Topics in Mathematical Tools
	Machine Learning and Its Applications
	Topology Optimization with Additive Manufacturing
Additive Manufacturing	Tissue Engineering
	Bio microfluidics
	3D Printing in Medicine
	Biomaterials - Materials in Medicine
	Introduction to Microfluidics and Microreactors
Materials in AM	Metallurgy of Welding and Additive Manufacturing
	Structure and Characterization of Metallic Materials
	Advanced Mechanical Behaviour of Materials
	Microstructure Engineering for Advanced Manufacturing
	Advanced Thermodynamics of Materials
	Thermo-Mechanical Processing of Materials
	Advanced Material Joining Processes
	Composite Materials

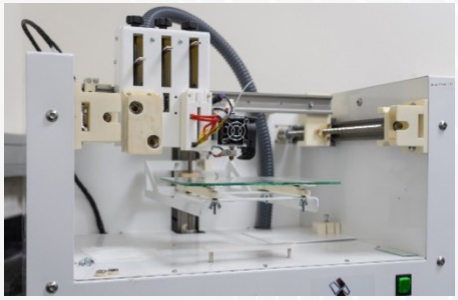
RESEARCH FACILITIES

Extrusion-based 3D Bioplotter



- Make: EnvisionTec
- A liquid, melt, paste or gel is dispensed from a material cartridge through a needle tip from a 3-axis system to create a 3D object
- Individual temperature control of each printing head, both in the parking positions, as well as during printing
- Designed for use in a sterile environment within a biosafety cabinet.

Extrusion-based 3D Bioprinter



- Make: RegeMat
- Nozzle diameter: 0.1 - 0.5mm
- Build volume: 150mm x 150mm x 110m
- Vertical resoultion: 400nm
- Printing platform: Crystal or petri dishes

3D bio-Printer

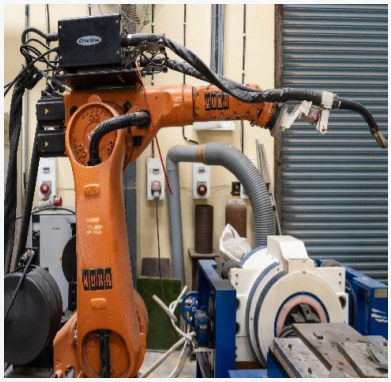
- Model/Make: Biobots
- 3D bio-printer based on Extrusion based technology
- In addition it has blue light based crosslinking capability for bio hydrogels
- Layer Thickness: 0.2mm
- Model material: Hydrogels like alginate, gelatin, collagen, hyaluronic acid.

Wire-Arc Additive Manufacturing (WAAM)

- Wire-Arc Additive Manufacturing setup for large sized components
- Setup developed at IITH by retrofitting a Cold Metal Transfer (CMT) GMAW system with a CNC machine
- Components upto size 600mm x 400mm x 400mm possible.
- Minimum features upto 4mm possible.
- Materials: All weldable materials
- CNC Model: AGNI BMV 45, BFW (along with trunnion table setup)
- Weld-Deposition: CMT, Fronius

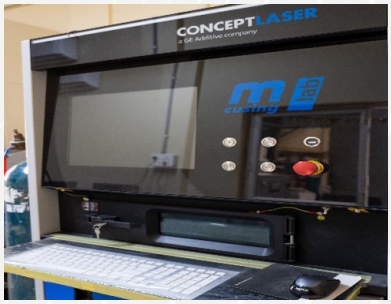
Twin-Wire WAAM

- Twin-wire based WAAM setup for functionally gradient components.
- Setup developed at IITH by integrating a twin-wire welding system with a Kuka robot.
- Components upto size 1200mm x 1200mm x 600mm possible.
- Minimum features upto 6mm possible.
- Materials: All weldable materials
- Robot Model: KR 30-3 Robot, Kuka
- Weld-Deposition: TimeTwin Digital, Fronius

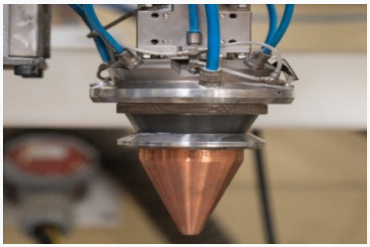


Powder Bed Fusion

- Model/Make: GE, Mlab 200R
- Laser Power: Fibre laser 200 W (cw)
- Build volume: 100 x 100 x 100 mm
- Layer thickness: 15-30 microns
- Scanning speed: max 7 m/s
- Materials: aluminum alloys, tool steels, inconel alloys, titanium alloys.

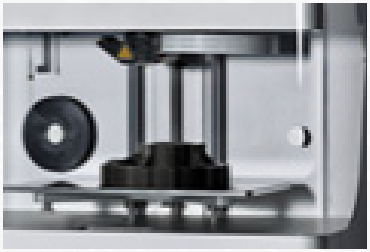


Direct Energy Deposition (DED)



- Laser + Powder based Direct Energy Deposition system.
- Laser: 2kW fiber laser, Coherent
- Cladding: YC 52 Precitec Cladding head
- Kinematic setup capable of 5-axis deposition

Composite (Carbon Fiber & Fiberglass) 3D Printer



- Specifications of a MarkTwo printer are:
- Build Volume 320 mm x 132 mm x 154 mm
- Plastic Materials Onyx
- Fiber Materials, Carbon Fiber, Fiberglass, Kevlar, HSHT (High Strength High Temperature) Fiberglass
- Z Layer Resolution: 100 micron

Multi-Colour Binder Jetting 3D Printer

- HP Jet Fusion 580 Color 3D Printer.
- Binder Jetting technology based 3D printing capable of Multi-Colour components
- Minimum Build Volume: 300mm x 150mm x 200mm
- Layer thickness: 0.1mm
- Resolution: 1200dpi

This machine is available in the i-TIC facility on the IITH premises.

Stereolithography (SLA)

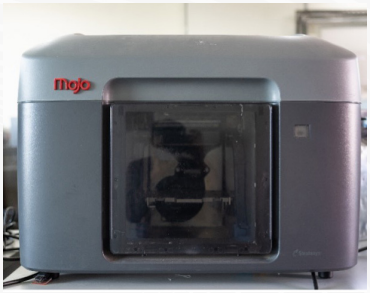
- ProJet6000, 3D Systems, USA.
- Stereolithography (SLA) based 3D printing technology
- Capable of printing transparent designs at 6 micro resolution and 0.2% accuracy
- Resin material is bio-compatible (non-toxic and autoclave-able)

FDM based 3D Printer: Nylon material

- Make: Stratasys
- Model: Fortus 450 MC
- Build Volume: 406 x 355 x 406 mm
- Accuracy: ± 0.127 mm
- Materials: ABS ESD7, ABS M30, Antero800NA,
- FDM Nylon 12, PC-ABS, PC -ISO, ULTEM 9085,
- ULTEM 1010, ST 130.

FDM based 3D Printer: ABS material

- Model/Make: Mojo/Stratasys
- 3D printer based on Fused deposition modelling technology
- Capable of creating complex shapes from a CAD file
- Maximum Build Size: 127x127x127 mm
- Layer Thickness: 0.17mm
- Model material: ABS plastic



FDM based 3D Printer: OpenSource based

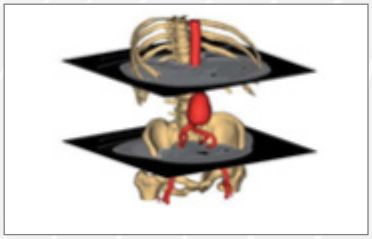
- Creality
- Fused deposition modeling based 3D printer
- Capable of printing PLA and other polymers

Vat Polymerization based 3D Printer

- Make: Formlab
- Capable of printing various biocompatible resins including transparent resin
- Devices can be printed with approximately (300 micron with 2 % accuracy)

Mimics (software for Medical AM)

- Mimics is an acronym for Materialise Interactive Medical Image Control System
- Used to create 3D surface models from stacks of 2D image data (CT/MRI Scan data)
- These 3D models can then be used for a variety of studies including FEA analysis, implant design etc.



FACULTY

Prof. Amritham Rajgopal

Dr Anirban Naskar

Dr Anurup Datta

Prof. Bharath

Dr Falguni Pati

Dr Gopinath

Prof. Janaki Ram

Dr Lopamudra Giri

Dr Prasad Onkar

Dr Rajesh Korla

Prof. Suhash Ranjan Dey

Prof. Surya Kumar

Dr Syed N Khaderi

Prof. Venkat Reddy

Dr Vishwanath

For more information please contact program coordinators

Dr Prasad Onkar
psonkar@des.iith.ac.in

Dr Falguni Pati
falguni@bme.iith.ac.in

Indian Institute of Technology Hyderabad
Kandi, Sangareddy, Telangana – 502284