शिक्षा मंत्रालय
MINISTRY OF
EDUCATION

GLOBAL INITIATIVE OF ACADEMIC NETWORKS

A 5 DAY GIAN COURSE ON

REPAIR AND REMANUFACTURING OF PARTS WITH DIRECTED ENERGY DEPOSITION

COURSE ID: 2700056

JUNE 23-27, 2025

OVERVIEW

Additive Manufacturing (AM) encompasses a class of advanced manufacturing technologies that produce parts directly from computer aided design (CAD) models without the necessity of any part-specific tooling. In the initial stages, AM processes were mainly used for the purpose of rapid prototyping. Recent advances in materials, processes and machines have enabled AM processes to go beyond prototyping applications towards the fabrication of functional parts made of metals and other engineering materials.

Directed Energy Deposition (DED) is an advanced additive manufacturing technique that is increasingly being used for the repair and remanufacturing of parts. DED involves the deposition of material using focused thermal energy, typically from a laser, electron beam, or plasma arc, to fuse the material onto a substrate. T

This process is highly versatile and can work with a variety of materials, including metals, ceramics, and composites. Laser Direct Energy Deposition (LDED) processes, a high-power laser beam is used as an energy source to build a component layer by layer. LDED processes are attractive in various applications because they can substantially reduce both the buy-to-fly ratio and production lead time compared with conventional manufacturing methods. Moreover, LDED processes will potentially enable the direct manufacture of advanced aerospace components made of multiple or functionally graded materials, or "smart" structures containing embedded sensors or electronic components.

This course provides an in-depth exploration of DED as a cutting-edge technique for the repair and remanufacturing of parts. Students will gain comprehensive knowledge of the principles, applications, advantages, and challenges associated with DED, preparing them for roles in industries where maintenance, repair, and sustainability are critical. This course is designed to make students familiar with the Laser Additive Manufacturing processes and demonstrate a scientific understanding of this emerging technology. In line with the current Government of India initiatives on MAKE IN INDIA AND SKILL INDIA, manufacturing industry personnel and researchers working in this area will immensely benefit from the expertise shared by the speaker on Laser Processing of Materials.

COURSE OUTCOMES

At the end of the course, the participants will get insights into the following:

- Understand how Directed Energy Deposition (DED) works and its basic principles.
- Learn about DED applications in industries like aerospace, automotive, and oil and gas.
- Analyze the benefits and challenges of using DED for repairs and remanufacturing.
- Apply DED knowledge to real-world tasks like customizing and remanufacturing parts.
- Use simulation software to model and optimize Laser Additive Manufacturing processes.

REGISTER NOW

LIMITED SEAT

Last Date for Registration: 31/05/2025

Modules

Day 1:

1. Introduction to Additive Manufacturing (AM); Historical Perspectives; Application Sectors
2. Classification of Additive Manufacturing Processes (ISO/ASTM 52900); Introduction to Laser AM Processes; Types of Energy Sources (Laser, Electron, Plasma Arc); Energy Density

Day 2:

1. Service (Mechanical) Properties of DED Parts, Including Repair
2. Cost Model and Studies for DED Parts, Including Repair/Remanufacture
3. Hands-On Workshop: Printing, post processing and Simulating DED Processes using Ansys

Day 3:

1. Metallurgical Aspects of Directed Energy Deposition (DED) Processes; Microstructure; Processing Effects on Microstructure (cooling rate, temperature, residual stress)
2. Microstructural Defects in DED Parts (feedstock porosity, lack of fusion, gas porosity, balling); PV Diagrams; Macrostructural Defects (distortion, cracking, surface finish, oxidation)

Day 4:

1. Case Studies in DED: Aerospace, Energy, Biomedical, Automotive; Reverse Engineering
2. The DED Process Chain (Ideation, Design, Solid Modeling, Build Preparation, Build, Support Removal, Heat Treatment, Finishing)
3. Benefits of Wire vs. Powder Metal 3D Printing
4. Sustainability and Environmental Impacts of AM/DED

Day 5:

1. Hybrid Manufacturing Technologies DED Standards

Future Outlook on AM/DED in Research and Society: Where We Are, and Where We Are Headed

You Should, Attend If...?

Executives, engineers and researchers from manufacturing, service and government organizations including R&D laboratories and industry.
Students at all levels (BTech/MSc/MTech/PhD) or Faculty from academic institutions and technical institutions.

Course FEE

Number of participants for the course will be **limited to fifty.**
The participation fees for taking the course is as follows:

Students: INR 1,000 +GST

Academic Institutions (Faculty): INR 2,000 +GST

Industry/ Research Organizations: INR 5000 +GST

Participants from abroad : US $500

The above fee includes all instructional materials, computer use for tutorials and assignments, laboratory equipment usage charges, 24 hr free internet facility. The participants will be provided with accommodation on payment basis.

Payment Details

Account Name: **DIRECTOR RESEARCH ACCOUNT**
Account No: **62266262236**
Bank: **State Bank of India**
Branch: **REC Warangal (NIT Campus)**
Branch Code: 20149
IFSC: **SBIN0020149**
MICR Code: 506002030
SWIFT Code: SBININBB

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International Faculty

Dr. David Bourell is a Professor Emeritus in the Department of Mechanical and Materials Science Engineering at The University of Texas at Austin. He holds a B.S. in Mechanical Engineering from Texas A&M University and an M.S. and Ph.D. in Materials Science from Stanford University. His research has significantly impacted the field of additive manufacturing, particularly in Laser Sintering (LS) materials. His work focuses on particulate processing, sintering kinetics, and developing new materials specifically for LS, a pivotal additive manufacturing technology. He is credited with holding 14 patents related to LS materials and was the lead author of the original 1990 patent for Laser Sintering materials, which has been cited in 288 subsequent patents.

Throughout his career, Dr. Bourell has authored over 280 published works, contributing extensively to the academic and industrial development of additive manufacturing. His achievements have earned him numerous awards, such as the ASTM Advanced Manufacturing Lifetime Achievement Award in 2023 and the Knight of Laser Technology honor in 2024. Dr. Bourell was inducted as a Fellow of ASM International in 1997 and TMS (The Minerals, Metals & Materials Society) in 2011. He has received prestigious accolades, including the Albert Sargent Award in 2017 and the TMS/MPMD Outstanding Scientist/Engineer Award in 2009. In addition to his research, he is actively involved in the additive manufacturing community, serving on various technical committees and playing a key role as a founding member of the ASTM F42 Technical Committee on Additive Manufacturing.

Indian Faculty

Dr. Manjaiah M is an Assistant Professor in the Department of Mechanical Engineering at the National Institute of Technology, Warangal. His research interests include Additive Manufacturing, Dynamic Deformation of Materials, Surface Engineering, and Bimetallic Joining Technology. He has made significant contributions to the field of Additive Manufacturing and has published 50 highly reputed journal articles and 15 book chapters.

He edited 2 books on Additive Manufacturing and Welding and joining Technologies published in Elsevier and Taylor & Francis Group. He organized the International Conference on Additive Manufacturing (ICAM2024) from March 4-6, 2024. Additionally, he has conducted over 12 training programs in Additive Manufacturing including GIAN on Sustainability of AM, sharing his expertise with professionals and students alike.

For **Registration** SCAN QR code or Use the following link

https://tinyurl.com/yub9xef7

Prof. David Bourell

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The University of Texas, Austin.

Course Coordinator

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How to reach NITW?

Nearby airport: Rajiv Gandhi International airport (3hours journey from Warangal)
Nearby railway station:
Kazipet (KZJ) 3 km from NIT, Warangal
Warangal (WL) 12 km from NIT, Warangal