



AICTE Training And Learning (ATAL)

Academy FDP

On

**Manufacturing and Characterization of 3D
Printed Materials (MC3DPM-2021)
(December 13-17, 2021)**



Course Coordinator

**Dr. Anuj Bansal
Dr. Anil Kumar Singla**

Organized by

Department of Mechanical Engineering
**Sant Longowal Institute of Engineering
and Technology,**
(Deemed to be University under MOE, Govt. of India)
Longowal, Dist. -Sangrur-148106 (Punjab)

www.sliet.ac.in

About ATAL Academy:

The primary objective of the ATAL Academy is to plan and help in imparting quality technical education in the country and to support technical institutions in fostering research, innovation and entrepreneurship through training. The online FDP of 2020-21 has been recognized as a world record by World Book of Record, London. This is also important that FDP sessions are recorded and available on portal so that anyone can learn in the future.

About the Institute:

Sant Longowal Institute of Engineering & Technology (SLIET), Deemed to be University, has been established and funded by MHRD (now MoE), Government of India in 1991 to provide technical education in emerging areas of Engineering and Technology. Accepting the new challenge of new education policy, the institute has the new concept of flexible, modular and multi-point entry/exit system and aims to provide technical manpower requirements of all levels to the industries. The institute offers Integrated Certificate-Diploma, B.E., M. Tech., and Ph.D. in various disciplines of Engineering and Technology, Science and Management. The 451 acres campus presents a spectacle of harmony and natural beauty.

About the Department:

The Department of Mechanical Engineering offers Bachelor of Engineering programme, two Master of Technology programme, and Ph.D. programme. Five Integrated Certificate-Diploma (ICD) courses are also being offered covering major areas of mechanical engineering to produce skilled manpower for shop floor in industry. At present, there are 40 highly qualified and motivated faculty members in the department, who are actively involved in different sponsored projects funded by DST, MHRD, AICTE etc. The department has produced approximately 45 PhDs and 30 scholars are currently working in different research areas. Patents are also to the credit of the faculty of the department. The department regularly organizes conferences and AICTE sponsored STTP courses.

Introduction:

3D Printing or Additive manufacturing is a novel method of manufacturing parts directly from digital model by using layer by layer material build-up approach. This tool-less manufacturing method can produce fully dense metallic parts or components with desired porosity values in small duration, with high accuracy. Some of the unique features of additive manufacturing like freedom of part design, desired complexity, controlling the component weight, and design for required functionality make it one of the best suitable option to manufacture components for various industries such as aerospace, oil & gas, marine and automobile. Before commercialization of these 3D printed components, the in-depth characterization of the components should be done to insure the desired life span.

Course Contents:

The programme is focused to discuss the process of manufacturing a component using 3D printing and its characterization. Few important aspects that will be covered in this programme are -

- ❖ History and importance of 3D printing technology in industrial sector.
- ❖ Biomedical application of 3D printed components.
- ❖ Mechanical properties of 3D printed components.
- ❖ Defects in 3D printing
- ❖ Demonstration of component manufacturing using 3D printer: various practical sessions.
- ❖ Post processing of 3D printed component.

Resource Persons:

Faculty from reputed Academic Institutions/ Industries/ R&D labs across the globe who are broadly working in the field of 3D printing at research and application level will conduct the online sessions in the programme.

Who can participate?

The faculty members of the AICTE approved institutions, Research scholars, PG Scholars, participants from Government, Industry (Bureaucrats/ Technicians/ Participants from Industry etc.)/ School Teachers and staff of host institutions.

Important Dates:

Last date for applying 10 December 2021
Intimation of selection 11 December 2021
Mode of Intimation Through email/ATAL portal

Registration Fee:

There is **no registration fee** for eligible participants of AICTE approved institute.

How to Apply:

- The interested candidates are required to register for the FDP through following link on or before the last date by following the given steps
<https://www.aicte-india.org/atal>

Step 1: Register as a participant on ATAL portal.
Step 2: Select workshop tab on left side
Step 3: Select State-Punjab, Month-December,
Step 4: Select thrust area – Thrust Areas
Step 5: Apply by clicking on the + sign in the workshop MC3DPM-2021 (1614678143)

- The number of participants is limited to 200 and will be selected based on first come first serve basis. For any clarification, contact the FDP coordinator.

Certificate:

The certificates shall be issued to the participants who have attended the program with minimum 80% attendance and scored minimum 60% marks in the test. The participants also have to provide compulsory online Feed-back on the last day of FDP.

Expected Outcomes:

At the end of the program the participants shall be able to understand the following key factors in the field of 3D printing.

- Fundamental design aspects and parameters involved in 3D printing.
- Mechanical properties of 3D printed components.
- Metallurgical properties like porosity and defects in 3D printed components
- Simulation and post processing of 3D printed components

Organizing Committee:

Chief Patron: Prof. Shailendra Jain, Director
Patron: Prof. J. S. Dhillon, Dean (Acad.)
Chairman: Prof. A. S. Shahi, HOD (ME)
Coordinator: Dr. Anuj Bansal
Dr. Anil Kumar Singla
Co-coordinators: Mrs. Ankita Omer
Mr. Jonny Singla

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Additive Manufacturing and Characterization Facilities in SLIET:



Wire Arc Additive Manufacturing



Single Screw Extruder (Felfil evo)



Polymer/Ceramic FDM/LDM Printer (Delta Wasp 2040)



FE-Scanning Electron Microscope (FESEM) (JSM-7610Fplus, JEOL)



Polymer-Metal/Composite FDM Printer (Ultimaker S5)



X-ray diffractometer (Bruker D-8 Advance)



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Report

of



AICTE Training And Learning (ATAL) Academy

sponsored

Online Faculty Development Programme (FDP)

on

**Manufacturing and Characterization of 3D Printed
Materials (MC3DPM-2021)**

(13th December to 17th December 2021)

Date: 13th to 17th December 2021

Mode: Online

Organized by

**Department of Mechanical Engineering
SLIET Longowal**



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Manufacturing and Characterization of 3D Printed Materials (MC3DPM-2021) (December 13-17, 2021)

Sant Longowal Institute of Engineering and Technology Longowal (Deemed-to-be-University under MOE, Govt. of India)

FDP Schedule

Dates & Timing	Session 1 (09:30 AM-11:30 AM)	Session 2 (11:45 AM-1:45 PM)	Session 3 (2:30 PM- 04:30 PM)
Day 1 13-12-2021	Inauguration (10:30 AM to 11:30 AM)	Introduction to 3D printing and its applications Prof. Neeraj Bala, NITTTR Chandigarh	Solid, liquid & powder based material addition processes Dr. Deepak Kumar Goyal, IKGPTU, Jalandhar
Day 2 14-12-2021	Powder bed fusion based additive manufacturing processes: materials, mechanism, and parameters Dr. Anupam Agrawal, IIT Ropar	Rheological, mechanical, thermal, and morphological characterization for in-house preparation of feedstock filaments for open source 3D printers Prof. Rupinder Singh, NITTTR Chandigarh	Wire arc additive manufacturing ¹ (WAAM)-introduction, scope & practical demonstration Prof. Amandeep Singh Shahi, SLIET Longowal
Day 3 15-12-2021	3D printing of high strength lightweight novel structures inspired from nature Dr. Navin Kumar, IIT Ropar	Development of multi-material 3D printed functional prototypes for 4D applications Prof. Rupinder Singh, NITTTR Chandigarh	Practicing of metal 3D printing using FDM technology and its challenges Prof. Pardeep Gupta, SLIET Longowal
Day 4 16-12-2021	Polymer-based 3D printing Dr. Sanat Agrawal, NIT Uttarakhand	Cold Spray Technology for 3D printing Prof. Harpreet Singh, IIT Ropar	Hands-on 3D printing (FDM) of polymers Prof. Rajesh Kumar, SLIET Longowal
Day 5 17-12-2021	Need Value Education for a Happier Society Dr Jagmeet Bawa, Central University of Himachal Pradesh, Dharamshala	Postprocessing machining for additively manufactured nickel and titanium alloys Dr. Navneet Khanna, IITRAM Ahmedabad	Design for additive manufacturing Dr. Sagar Nikam, Ulster University, United Kingdom (UK)
	Valediction: 04:30 PM to 05:30 PM		Online Test: 05:30 PM to 06:30 PM



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List of experts along with their topics

S. No.	Expert Name and affiliations	Topic of expert talk
1	Dr. Sagar Nikam School of Computing, Engineering and Intelligent Systems, Ulster University, United Kingdom Email: s.nikam@ulster.ac.uk	Pre-processing in Additive Manufacturing
2	Prof. Rupinder Singh Department of Mechanical Engineering, NITTTR, Chandigarh Email: rupindersingh@nitttrchd.ac.in	Rheological, mechanical, thermal, and morphological characterization for in-house preparation of feedstock filaments for open source 3D printers
3	Prof. Neeraj Bala Ent. Devel. & Industrial Coordination, NITTTR, Chandigarh Email: nirajbala@nitttrchd.ac.in	Introduction to 3D printing and its applications
4	Dr. Anupam Agrawal Department of Mechanical Engineering, IIT Ropar, Punjab Email: anupam@iitrpr.ac.in	Powder bed fusion based additive manufacturing processes: Materials, Mechanism, Parameters
5	Dr. Navin Kumar Department of Mechanical Engineering, IIT Ropar, Punjab Email: nkumar@iitrpr.ac.in	3D printing of high strength lightweight novel structures inspired from nature
6	Prof. Harpreet Singh Department of Mechanical Engineering, IIT Ropar, Punjab Email: harpreetsingh@iitrpr.ac.in	Cold spray and its applications for Additive Manufacturing
7	Dr. Navneet Khanna Mechanical and Aero-Space Engineering, IITRAM, Ahmedabad, Gujarat Email: navneetkhanna@iitram.ac.in	Postprocessing machining for additively manufactured nickel and titanium alloys
8	Prof. Rupinder Singh Department of Mechanical Engineering, NITTTR, Chandigarh Email: rupindersingh@nitttrchd.ac.in	Development of multi-material 3D printed functional prototypes for 4D applications
9	Dr. Sanat Agrawal Department of Mechanical Engineering, NIT, Uttarakhand Email: sanata@nituk.ac.in	Polymer-based 3D Printing
10	Dr. Deepak Kumar Goyal Department of Mechanical Engineering I. K. Gujral Punjab Technical University, Jalandhar, Punjab Email: dr.deepakgoyal@ptu.ac.in	Introduction to rapid prototyping and selective laser melting of Ti6Al4V alloy: process parameters, defects and post treatments
11	Dr Jagmeet Bawa Department of Political Science Central University of Himachal Pradesh, Dharamshala, Himachal Pradesh Email: jagmeet.bawa@hpcu.ac.in	Value education for a prosperous society
12	Prof. Amandeep Singh Shahi Department of Mechanical Engineering, SLIET Longowal, Sangrur, Punjab Email: ashahisliet@yahoo.co.in	Wire arc additive manufacturing' (WAAM)-Introduction, Scope & practical demonstration
13	Prof. Pardeep Gupta Department of Mechanical Engineering, SLIET Longowal, Sangrur, Punjab Email: pardeepmech24@gmail.com	Metal Additive manufacturing and Practice 3D Metal Printing using Fluid Filament Fabrication (FFF) Technology
14	Prof. Rajesh Kumar Department of Mechanical Engineering, SLIET Longowal, Sangrur, Punjab Email: rajesh_krs@rediffmail.com	Hands-on 3D printing (FDM) of Polymers



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FDP Poster



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Prof. Neeraj Bala
NITTR, Chandigarh

Introduction to 3D printing and its applications



Dr. Sanat Agrawal
NIT Uttarakhand

Polymer-based 3D printing



Prof. Rupinder Singh
NITTR Chandigarh

Characterization for in-house preparation of feedstock filaments for open-source 3D printers.



Prof. Harpreet Singh
IIT Ropar

Cold Spray Technology for 3D printing



Dr. Anupam Agrawal
IIT Ropar

Powder bed fusion based additive manufacturing processes: materials, mechanism, and parameters.



Prof. Rajesh Kumar
SLIET Longowal

Hands-on 3D printing (FDM) of polymers



Dr. Deepak Kumar Goyal
IKGPTU, Jalandhar

Solid, liquid & powder-based material addition processes



Dr. Jagmeet Bawa
CUHP, Dharamshala

Need Value Education for a Happier Society



Prof. A. S. Shahi
SLIET Longowal

Wire arc additive manufacturing (WAAM)-introduction, scope & practical demonstration



Dr. Navneet Khanna
IITRAM Ahmedabad

Postprocessing machining for additively manufactured nickel and titanium alloys.



Dr. Navin Kumar
IIT Ropar

3D printing of high strength lightweight novel structures inspired from nature.



Dr. Sagar Nikam
Ulster University, UK

Design for additive manufacturing



Prof. Pardeep Gupta
SLIET Longowal

Practicing of metal 3D printing using FDM technology and its challenges.



Prof. Rupinder Singh
NITTR Chandigarh

Development of multi-material 3D printed functional prototypes for 4D applications



Chief Patron
Prof. Shailendra Jain, Director (SLIET)



Patron
Prof. J. S. Dhillon, Dean (Acad.)



Chairman
Prof. A. S. Shahi, HOD (ME)



Coordinator
Dr. Anuj Bansal



Coordinator
Dr. Anil Singla



Co-Coordinator
Mr. Jonny Singla



Co-Coordinator
Mrs. Ankita Omer



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Manufacturing and Characterization of 3D Printed Materials
(MC3DPM-2021)
(13th to 17th December 2021)

Resource Persons
Faculty from IIT's, NIT's, CFTI's, and foreign institutes working in the field of 3D printing at research and application level

Course Content

- 3D printing and its types
- Properties of 3D printed components and their post processing
- Demonstration of WAAM and 3D printing machines

Organised by
Mechanical Engineering Department
Sant Longowal Institute of Engineering and Technology Longowal
(Deemed-to-be-University under MoE, Govt. of India)

Department of Mechanical Engineering, SLIET Longowal, Sangrur, Punjab has inaugurated a one-week online Faculty Development Program (FDP) on “Manufacturing and Characterization of 3D Printed Materials (MC3DPM-2021)” sponsored by AICTE Training and Learning (ATAL) Academy Programme, New Delhi on 13th December 2021. The course has been inaugurated by Prof. Shailendra Jain, Director SLIET Longowal as Chief guest. The chief guest urged the participants to take maximum benefits from the FDP and appreciated the efforts of the organising team. In addition, Prof. J. S. Dhillon, Dean (Acad.) and Prof. A. S. Shahi, HOD (ME) have also shared their valuable views about the 3D printing technique. Approx. 90 participants from various institutes have registered for the FDP. Dr. Anuj Bansal and Dr. Anil Kumar Singla, Coordinators of FDP have welcomed the participants and gave brief introduction about the sessions and resource persons. In this course, different Faculty from reputed Academic Institutions across the globe, who are broadly working in the field of 3D printing at research and application level will conduct 14 online sessions.



AICTE Training And Learning (ATAL) Academy
Sponsored
Online Faculty Development Programme (FDP)
On



Manufacturing and Characterization of 3D Printed Materials (MC3DPM-2021) (December 13-17, 2021)
Sant Longowal Institute of Engineering and Technology Longowal (Deemed-to-be-University under MOE, Govt. of India)

Some key outlines of the ATAL FDP course

The course consisted of 13 technical sessions and 1 ethical session, which were successfully conducted in the last 5 days.

The FDP started with a session from Prof Neeraj Bala, NITTTR Chandigarh, who introduced the participants with the basics of 3D printing process and Industry 4.0. Professor Bala also discussed the various types of 3D printing processes in detail. In the second session, Dr. Deepak Goyal from IKGPT, Jalandhar, discussed the process of converting a CAD file into a .stl and shed light on the topics like Droplet deposition manufacturing and also discussed some points about defects and post processing of SLM manufactured Ti alloys.

MC3DPM-2021 FDP @ SLIET Live Stream

National Institute of Technical Teachers Training and Research, Chandigarh
(Ministry of Human Resource Development, Government of India)
राष्ट्रीय तकनीकी शिक्षक परिशिक्षण एवं अनुसंधान संस्थान चंडीगढ़
(मानव संसाधन विकास मंत्रालय, भारत सरकार)

INTRODUCTION TO 3D PRINTING AND ITS APPLICATIONS

PRESENTED BY
DR. NIRAJ BALA
PROFESSOR
ENTREPRENEURSHIP DEVELOPMENT AND INDUSTRIAL COORDINATION DEPARTMENT
NATIONAL INSTITUTE OF TECHNICAL TEACHERS TRAINING AND RESEARCH (NITTTR)
CHANDIGARH

1:50 AM | MC3DPM-2021

3:45 / 1:58:45

MC3DPM-2021 FDP @ SLIET Session 2

Deepak Goyal is presenting

Introduction to Rapid Prototyping and
Selective laser melting of Ti6Al4V alloy: Process
parameters, defects and post-treatments

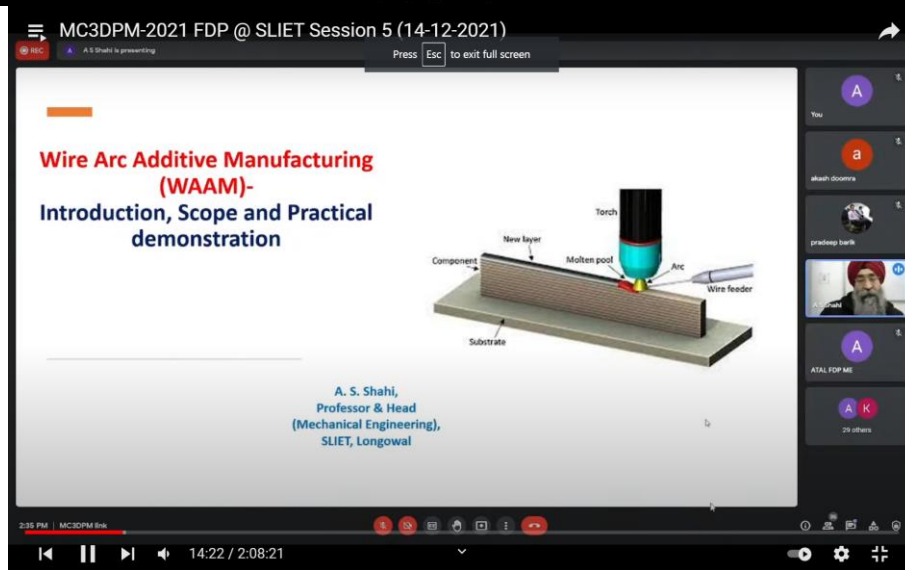
by
Dr. Deepak K. Goyal
(Assistant Professor)

Department of Mechanical Engineering
I.K.G. Punjab Technical University, Kapurthala

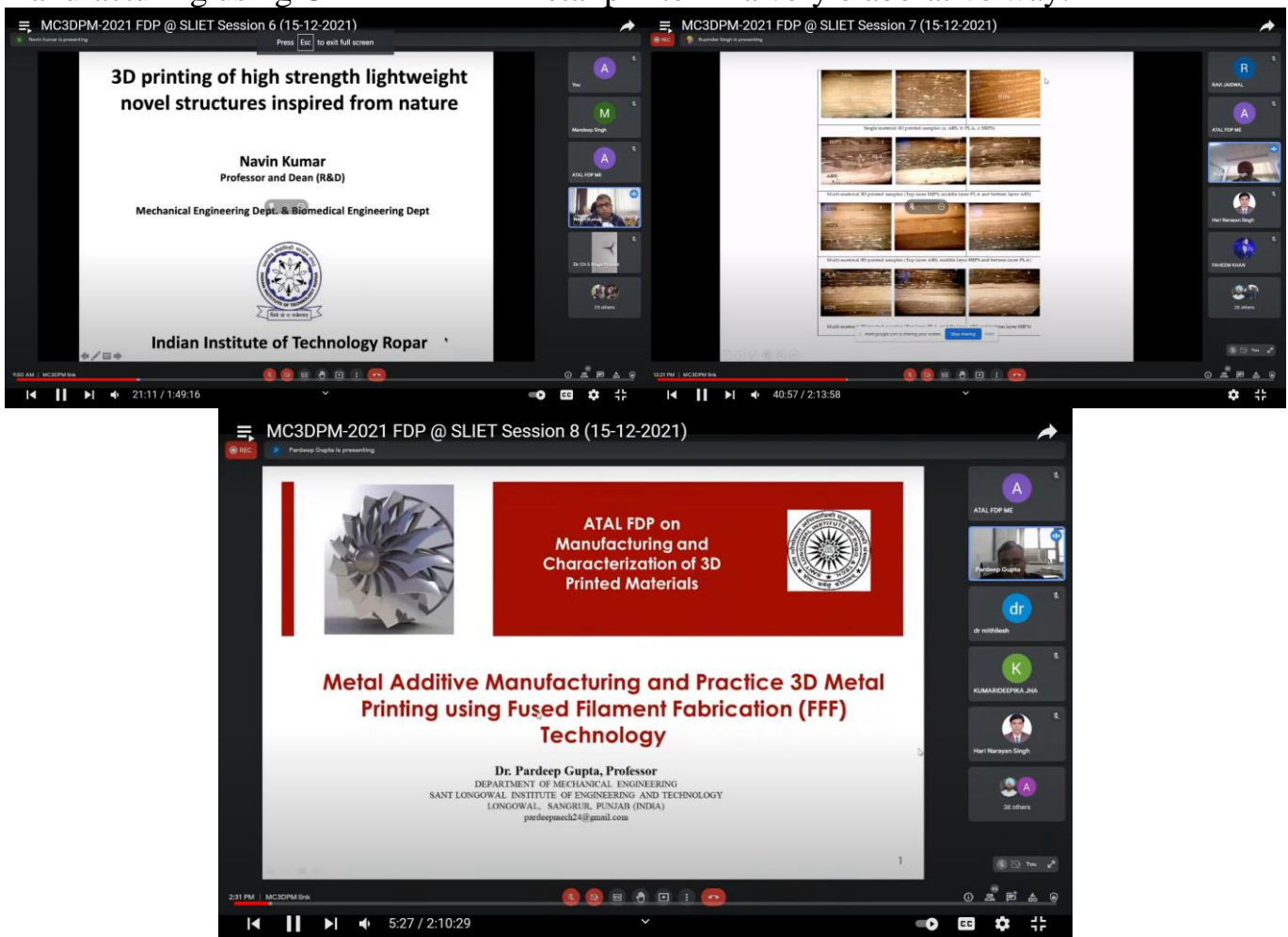
2:42 PM | MC3DPM-2021

4:44 / 1:42:14

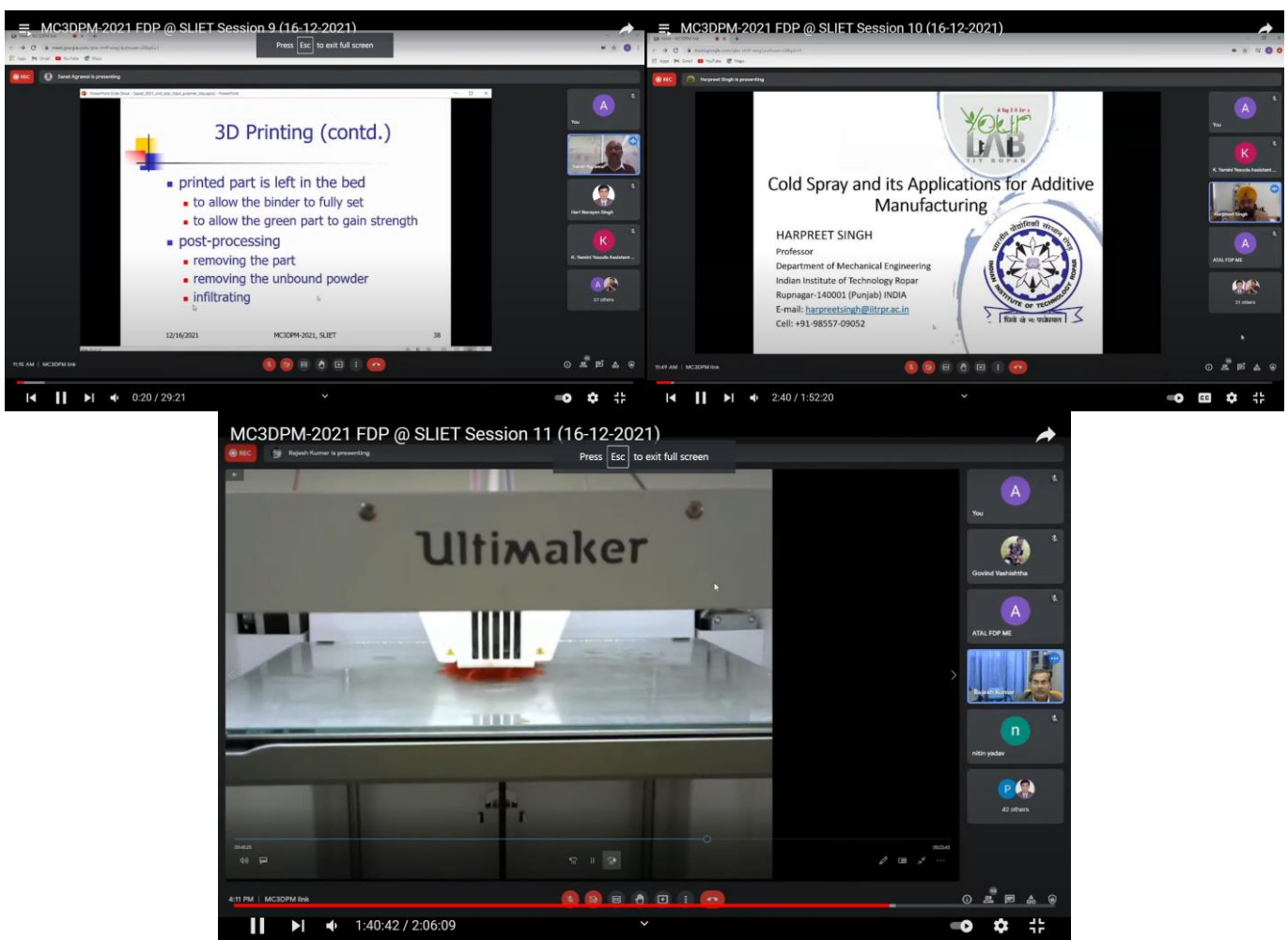
The second day of the FDP started with an informative session by Dr. Anupam Agarwal from IIT Ropar. Dr. Agarwal explained in detail the powder bed fusion (PBF) based Additive manufacturing process and gave a step by step procedure for the same. Professor Rupinder Singh from NITTTR Chandigarh, led the fourth session by sharing with us a few case studies. The first case that he discussed was affect of banana fibre reinforcement on mechanical and thermal properties of ABS and PA6. The next three case studies were on treatment of veterinary subjects with the help of Additive manufacturing. He discussed how AM can be used in treatment of hernia in cows, developing new teeth for canine, and bone joints etc. In the last session of day 2 of the FDP, Prof. A.S. Shahi, Head of Mechanical Department, SLIET Longowal, shared with us basics of WAAM, its applications and advantages over other AM techniques. Shedding light on the transforming characteristics of the process, he also shared with the participants a practical demonstration of working of WAAM available in the department.



Dr. Naveen Kumar, IIT Ropar began the third day with his enlightening discussion on how the modern medicine is learning from the natural examples and transforming itself with the help of AM. The first case study he discussed was on the efficient working of a honeybee stinger in injecting its venom to its target. He supplemented the listeners with another case study on mosquito bite, and discussed how it is possible to make drug administration process more painless and accommodating for the patients with the help of AM. In the next lecture, Professor Rupinder Singh from NITTTR Chandigarh, elucidated 4D printing technique. He discussed about the various types of materials that can be 4D printed and the techniques used for the same. Last session of the day was conducted by Prof. Pradeep Gupta, SLIET Longowal. After a brief introduction to the basics of 3D printing of metals, he demonstrated a practical session to the participants on 3D part development on a software and its manufacturing using ULTIMAKER metal printer in a very elaborative way.



First session on day four was by Dr. Sanat Agrawal from NIT Uttrakhand. Dr. Agrawal discussed in brief basics of 3D printing and continued with elaborating direct printing technique. He shared his knowledge on 3 types of direct printing processes. Further, Dr. Agrawal delineated sheet lamination type AM process with polymers and detailed the process of Laminated object manufacturing to the participants. Next session was an informative session by Prof. Harpreet Singh, IIT Ropar. Prof. Singh discussed in detail about the cold spray technology for 3D printing. Further, he compared cold spray technique with thermal spray coating. He highlighted the lacking points in laser based AM process and how these problems can be overcome by cold spray technique. Last session of the day was conducted by Prof. Rajesh Kumar, Dean (SFW), SLIET Longowal. After a brief introduction to the basics of 3D printing of polymers he gave a practical session to the participants on 3D part development on Cura software and demonstrated the practical formation of components live from the Additive manufacturing lab in department of mechanical engineering SLIET Longowal.



After that, fifth day of FDP starts with the ethical session emphasizing on the need of value education to pursue in the modern society by Dr. Jagmeet Bawa from Central university of Himachal Pradesh, Dharamshala. He emphasized that how a small satisfaction of a person can be transformed to permanent happiness. After that Dr. Navneet Khanna from IITRAM Ahmedabad has shared his technical expertise about post processing of Additively manufactured components. He emphasized how the difficult machining can be done easily by using tools like minimum quantity lubrication and using coolants like liquid nitrogen and CO₂. At last Dr. Sagar Nikam from Ulster University, UK enlightened us about the pre-processing requirements for Additively manufacturing of components. He showed different case studies on simulation technique of multi layer deposition and SLM processes.

