



# MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE

(UGC-AUTONOMOUS INSTITUTION)

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A Report on  
**Six Day Faculty Development Program (FDP)**  
**"Sustainable Machining Tomorrow: Machine Learning Based Approach"**  
Organised by  
**Department of Mechanical Engineering**  
**11<sup>th</sup> – 16<sup>th</sup> December 2023**

Report Submitted By : S Bhaskaran, Associate Professor & HoD, Department of Mechanical Engineering

Report Received on : 05.01.2023

Mode of Conduct: Offline

Resource Person: Dr. Chakradhar D, IIT Palakkad, Dr. Ramesh M R, NIT Karnataka, Dr. M. Ravi Sankar, IIT Tirupati, Mr. Prakash Vinod, CMTI, Bengaluru, Dr. Suresh R, MSRUAS, Bangalore, Dr. Ashok K. Sahoo, KIIT University, Dr. Manas Das, IIT Guwahati, Dr. Sivaiah P, MITS, Madanapalle, Mr. MCV Prasad, Founder, Prakruti Vanam, Dr. S. Baskaran, MITS, Madanapalle

The Department of Mechanical Engineering, MITS conducted a Six-Day FDP program funded by AICTE Training and Learning (ATAL) Academy AICTE, New Delhi, India, titled "Sustainable Machining Tomorrow: Machine Learning Based Approach" from 11.12.23 to 16.12.23 at Madanapalle Institute of Technology & Science, Madanapalle.

The registration and kit distribution started at 8.30 a.m. in the Scaleup room (East block). Dr. Chakradhar D, Associate Professor, IIT Palakkad and Dr. Ramesh MR, Professor, NIT Karnataka was invited as a guest and resource person for the first day of the program. The Inauguration started by 9.00 a.m. at Scaleup room, MITS. The Vice principals, Deans, HoDs, Faculty & Staff members from various departments, External participants from various institutes were participated in inauguration ceremony.



Fig. 1 Inauguration Ceremony

Mr. Azmathullah and Ms. Sravani from third year students have anchored the entire inauguration ceremony. He welcomed the Coordinator, HoD, Vice Principal and Resource person to the Dais. The program started with a prayer song and with lighting of a lamp. **Dr. S. Baskaran, Coordinator** has given the opening remarks about the FDP program and welcomed all the external participants and other dignitaries off the dais. **Dr. P. Ramanathan, Vice Principal**, MITS has delivered a welcome note to the dignitaries and highlighted the institute achievements, facilities and wished all the participants to attend the FDP program and learn new things. Later, Dr. Chakradhar D, and Dr. Ramesh MR delivered a speech on the importance of sustainable machining to the audience.

**Dr. Dhruvajit Sarma, Co-Coordinator** proposed a vote of thanks. Really, we are very thankful to ATAL FDP for providing financial support to the Department of Mechanical Engineering, MITS to conduct FDP program. After the inauguration ceremony, high tea was provided to participants and others then the lectures were started as per the program schedule.

Date: 11.12.23, Session: I, Resource Person: Dr. Chakradhar D, IIT Palakkad.

**Dr. Chakradhar D** from **Indian Institute of Technology, Palakkad** has given the first lecture and delivered the lecture in two parts as mentioned below

#### Part I: Sustainable Machining

- Difficult to cut materials
- Cryogenic machining
- Optimization of cryogenic turning
- Modified tool holder in cryogenic turning.

#### Part II: Artificial Intelligence in Manufacturing

- Industry 4.0
- Fuzzy Logic
- Demonstration of fuzzy logic controller using MATLAB

His lecture was very informative to the participants and given more insights on sustainable machining and AI in manufacturing.

Fig. 2 Session I by Dr. Chakradhar D, IIT Palakkad on 11.12.2023 FN

**Day 1: Article Discussion**

As a part of assessment, the participants were divided into 8 groups with group size 6 to conduct article summary as per the format provided. The following article given to the participants on Day 1 from Elsevier publication related to the theme of FDP, "Ghatge D, Ramanujam R. Sustainable machining: A Review. Materials Today: Proceedings. 2023 Aug 28".

**Date: 11.12.23, Session: II, Resource Person: Dr. Ramesh M R, NIT Karnataka.**

**Dr. Ramesh M R** has delivered talk on "Role of surface coatings in improving machinability of Highly Alloyed Metals". He explained the fundamentals of surface engineering followed by some case studies related to machinability studies and optimization through ANN. The case studies are "Studies on end milling of maraging steel using PVD coated cutting tool, Machinability studies for TiC-C coated Tool".

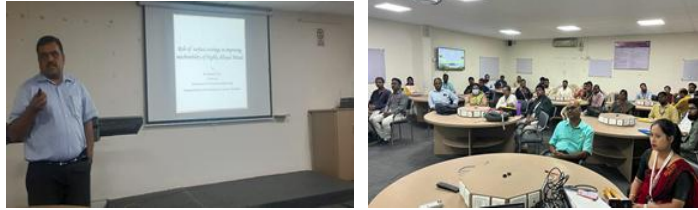


Fig. 3 Session II by Dr. Ramesh M R, NIT Karnataka on 11.12.2023 AN

**Day 1: Practical sessions/ Labs**

**Mr. Prasad**, CNC trainer has conducted the practical session at siemens CNC lab. He explained the fundamentals of CNC programming followed by demonstration in CNC turning and milling.



Fig. 4 Day 1: Practical sessions/ Labs

**Date: 12.12.23, Session: III, Resource Person: Mr. Prakash Vinod, CMTI, Bengaluru**

The second day session started with **Mr. Prakash Vinod** from CMTI, Bengaluru. He delivered his lecture in the topic of "Technology Development in Sustainable Manufacturing with AI/ML". He covered the basics of sustainable manufacturing, Industry 4.0, Smart Manufacturing, Sustainable AI-based Manufacturing and discussed the key benefits of AI-ML in Manufacturing, Generative AI applications in Manufacturing.

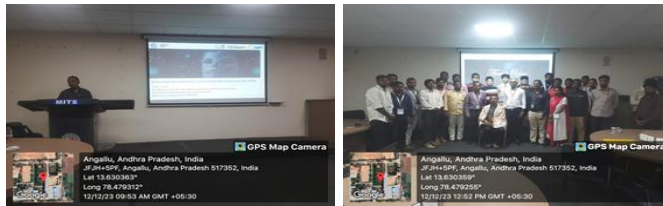


Fig. 5 Session III by Mr. Prakash Vinod, CMTI, Bengaluru on 12.12.2023 FN

**Day 2: Article Discussion**

The following article given to the participants on Day 2 from Hindawi publication related to the theme of FDP, "Rajesh AS, Prabhuswamy MS, Rudra Naik M. Machine Learning Approach: Prediction of Surface Roughness in Dry Turning Inconel 625. Advances in Materials Science and Engineering. 2022 Oct 5;2022".

**Date: 12.12.23, Session: IV, Resource Person: Dr. M. Ravi Sankar, IIT Tirupati**

**Dr. M. Ravi Sankar** has delivered a talk on "Biodegradable rheological abrasive fluids for finishing of 3D printed complex internal and external features". He discussed post processing of additive manufactured complex internal & external features. Post processing is the very important process especially for complex shape products fabricated by metal printing. He explained the complications of the various post processing techniques such as polishing, grinding, abrasive flow machining.

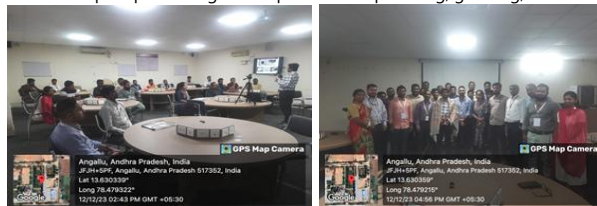


Fig. 6 Session IV by Dr. M. Ravi Sankar, IIT Tirupati on 12.12.2023 AN

**Day 2: Practical sessions/ Labs**

**Mr. Ajith Joshi**, Assistant Professor has conducted the practical session to the participants on MINITAB software about Design of experiments. He explained the fundamentals of followed by demonstration in Taguchi Design.

**Date: 13.12.23, Session: V, Resource Person: Dr. Manas Das, IIT Guwahati**

The third day lecture started with **Dr. Manas Das** from IIT Guwahati. He delivered his lecture on "Nano finishing of prosthetic implants and further tribological characterization". He covered the basics of advanced finishing processes and its applications, Nano finishing of complex shapes later he discussed in details about Abrasive Flow Machining, Magnetorheological Finishing. Also, he shared his own experience in the development of a Magneto Rheological Abrasive Flow Finishing experimental setup at IIT Guwahati.



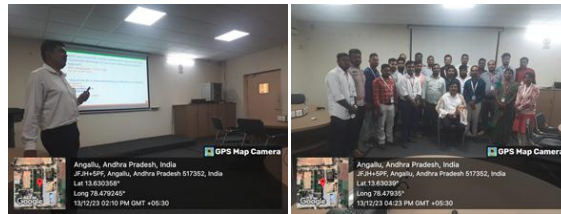
**Fig. 7 Session V by Dr. Manas Das, IIT Guwahati on 13.12.2023 FN**

#### Day 3: Article Discussion

The following article given to the participants on Day 3 from Springer publication related to the theme of FDP, "Ganesan H, Mohankumar G. Optimization of machining techniques in CNC turning centre using genetic algorithm. Arabian Journal for Science and Engineering. 2013 Jun; 38:1529-38."

**Date: 13.12.23, Session VI, Resource Person: Dr. Suresh R, MSRUAS, Bangalore**

**Dr. Suresh R**, Professor from Ramaiah University of Applied Sciences, Bangalore has delivered a talk on "Role of AI & ML in sustainable machining of difficult to cut materials" He explained Role of AI and ML in Machining operations and Difficult-to-cut materials. He discussed the case study, Machining of hardened Steel (EN31) using Artificial neural network (ANN) - Adaptive soft computing modeling technique.



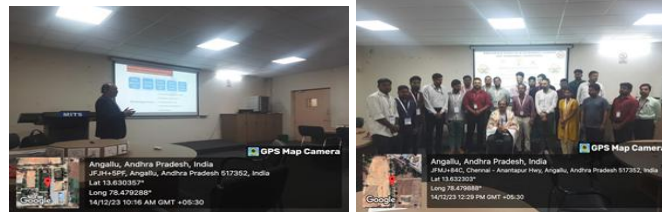
**Fig. 8 Session VI by Dr. Suresh R, MSRUAS, Bangalore on 13.12.2023 AN**

#### Day 3: Practical sessions/ Labs

**Dr. Manish Sharma**, Assistant Professor has conducted the practical session to the participants on TLBO algorithm in MATLAB. He explained the fundamentals of followed by demonstration in MATLAB. The participants practiced the same with data.

**Date: 14.12.23, Session: VII, Resource Person: Dr. Ashok K. Sahoo, KIIT University**

The third day started with **Dr. Ashok K. Sahoo** from KIIT University, Bhubaneswar, Odisha. He delivered a talk on "Sustainable Machining and Machinability Studies under various Cutting Environments". He discussed on a case study, Performance of coated and uncoated carbide inserts in turning D2 Steel, Machinability investigation in hard turning of AISI 4340 steel using PVD and CVD coated tool under dry environment and dual jet nanofluid MQL. His lecture was very informative to the participants.



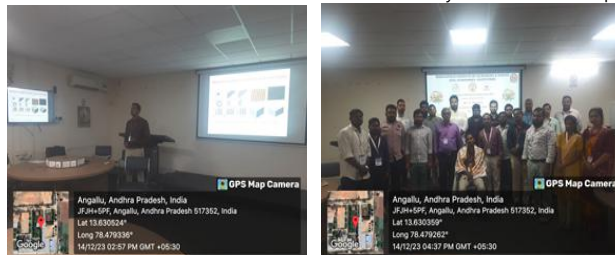
**Fig. 9 Session VII, Dr. Ashok K. Sahoo, KIIT University on 14.12.2023 FN**

#### Day 4: Article Discussion

The following article given to the participants on Day 4 from Taylor & Francis publication related to the theme of FDP, "Varghese V, Ramesh MR, Chakradhar D. Experimental investigation and optimization of machining parameters for sustainable machining. Materials and Manufacturing Processes. 2018 Dec 10;33(16):1782-92."

**Date: 14.12.23, Session VIII, Resource Person: Dr. Sivaiah P, MITS, Madanapalle**

**Dr. Sivaiah P** from MITS, Madanapalle delivered a talk on "Sustainable Machining: Cryogenic, MQL and surface textured tools". He explained various Cryogenic cooling approaches used in machining operations with a case study on Machinability studies on 17-4 PH SS during turning operation under different cooling environments. Also, discussed on Eco friendly machining techniques with different Surface textured tools. The session was very informative to the participants.



**Fig. 10 Session VIII by Dr. Sivaiah P, MITS, Madanapalle on 14.12.2023 AN**

#### Day 4: Practical sessions/ Labs

**Mr. Ajith Joshi**, Assistant Professor has conducted the practical session to the participants on Artificial Neural Network (ANN) in MATLAB software. He explained the fundamentals of followed by demonstration of ANN modeling analysis.



Fig. 11 Day 4: Practical sessions/ Labs

#### Date: 15.12.23, Industrial Visit at Prakruti Vanam, Madanapalle

As per the FDP schedule, an industrial visit was arranged at Prakruti Vanam, Madanapalle. Prakruti Vanam is an organic food processing industry. The products are millets, cold pressed edible oils, dry fruits, Herbals & Hygiene products, cosmetics, spices and pickles etc. <https://prakruthivanam.com>. The participants have enjoyed the visit with an informative visit.



Fig. 12 Industrial visit at Prakruti Vanam, Madanapalle on 15.12.2023 FN

#### Date: 15.12.23, Session: IX, Resource Person: Mr. MCV Prasad, Founder, Prakruti Vanam

Mr. MCV Prasad, Founder, Prakruti Vanam has delivered talk on "Stress Management". He given tips to manage stress and reduce the overall stress of day-to-day activities such as use guided meditation, practice deep breathing, maintain physical exercise and good nutrition, manage social media time and how connect with others. He shared his own experience and the participants were really enjoyed his session.



Fig. 13 Session IX by Mr. MCV Prasad Prakruti Vanam, Madanapalle on 15.12.2023 FN

#### Day 5: Practical sessions/ Labs

**Mr. Ajith Joshi**, Assistant Professor has conducted the practical session to the participants in MINITAB and MATLAB software. He explained the step-by-step procedure to perform regression analysis in MINITAB and Response surface plots in MATLAB. Later, the participants practiced with an experimental data for the same.



Fig. 14 Day 5: Practical sessions/ Labs

#### Date: 16.12.23, Session: X, Resource Person: Dr. S. Baskaran, MITS, Madanapalle

The final day of the FDP program started with **Dr. S. Baskaran** from MITS, Madanapalle and the coordinator of the FDP program. He discussed on the topic on "Sustainable machining for tomorrow: Machine learning based Approach". He explained the basics of various sustainable machining techniques and its benefits, various tool wear mechanisms and finally various machine learning algorithms such as decision tree, kNN in detail with the help of different case studies.

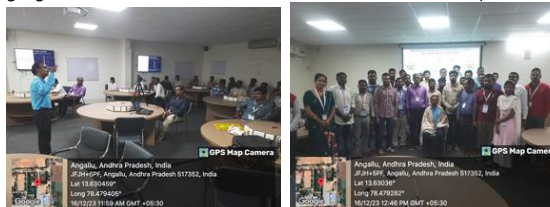


Fig. 15 Session X, Dr. S. Baskaran, MITS, Madanapalle on 16.12.2023 FN

### Day 6: Reflective Journal

As per the guidelines, the Reflective journal session was conducted to the participants as per the format provided, to carry out introspection and reflection on what they have learned during the ATAL FDP with a focus on implementation of new learnings. The participants were actively participated in the session.

### MCQ, Feedback & Interaction Session

The final session was conducted to assess the participants by MCQs later we collected the feedback from each participant on organization of FDP, Facility provided, Resource person selection and overall improvement of the program.



Fig. 16 Day 6, MCQ, Feedback & Interaction Session on 16.12.2023 AN

### Valedictory Ceremony

**Dr. Anantharaman**, Assistant Professor, Dept. of Mechanical Engineering, MITS anchored the valedictory ceremony. The Principal, MITS and Co-coordinator of FDP graced the valedictory ceremony. **Dr. S. Baskaran** briefed about the summary of the FDP program and thanked all the participants for providing support and attending the 6 Day program. **Dr. C. Yuvaraj**, Principal congratulated all the participants on their completion of FDP and thanked AICTE, MITS Management and Principals & Managements of external participants for sending the faculty members to attend the 6 Day FDP program. Later, we took feedback from the participants to get suggestions and improvements for the future events. At the end, the group photo was taken with all the participants.

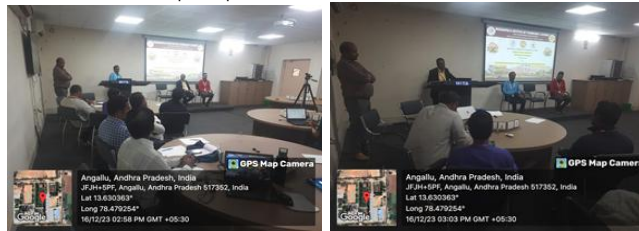


Fig. 17 Valedictory Ceremony



Fig. 18 Group photo of participants with MITS Principal Dr. C. Yuvaraj