PRAGATI ENGINEERING COLLEGE

(Autonomous)

#1-378, ADB Road, Surampalem – 533 437, Near Peddapuram, E.G.Dist., A.P.
(Approved by AICTE, Permanently Affiliated to JNTUK Kakinada & Accredited by NBA)
(Recognized by UGC Under Sections 2(f) and 12 (b) of UGC act, 1956)
Ph: 08852 – 252233, 252234, 252235 Fax: 08852 – 252232, website:www.pragati.ac.in

Learning is Supreme Deity

DEPARTMENT OF MECHANICAL ENGINEERING

Academic year: 2023-24 Date: 30-09-2023

CIRCULAR

Additive Manufacturing Club of Mechanical Engineering Department in association with Career Guidance Cell is organizing a Workshop to the Mechanical Engineering students on 1st November 2023. The Theme of the Workshop is *"Hands on Experience on Rapid Prototyping using FDM Printer*".

Event	:	Workshop
Date of the Event	:	1st November 2023
Venue	:	CAD Lab

INCHARGE

HOD-ME

PRAGATI ENGINEERING COLLEGE (A) MECH - HOD SURAMPALEM

Copy to:

1. **HOD-ME.**
2. **Departmental file.**
3. **AM Club In-charge – ME.**
4. **Career Guidance Cell In-charge – ME.**

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

INDUSTRY 4.0 CLUBS

Learning is Supreme Deity

ADDITIVE MANUFACTURING CLUB

ORGANISED BY DEPARTMENT OF MECHANICAL ENGINEERING IN ASSOCIATION WITH CARRER GUIDANCE CELL

"HANDS ON EXPERIENCE ON RAPID PROTOTYPING BY USING FDM PRINTER"

SPEAKER :
Mr. M. SUNIL RAJ
Assistant Professor

VENUE: CAD LAB
DATE: 1st November 2023
TIME: 1:00 PM Onwards

AMC
ADDITIVE MANUFACTURING CLUB

FACULTY COORDINATOR

Mr. P. Ram Prasad
Assistant Professor
Mechanical Engineering Department

STUDENT COORDINATOR

Mr. D.Ashish Varma
III Year Mechanical Engineering Department
Contact No. : +91 7095338669

PRAGATI ENGINEERING COLLEGE

(Autonomous)

#1-378, ADB Road, Surampalem – 533 437, Near Peddapuram, E.G.Dist., A.P.
(Approved by AICTE, Permanently Affiliated to JNTUK Kakinada & Accredited by NBA)
(Recognized by UGC Under Sections 2(f) and 12 (b) of UGC act, 1956)
Ph: 08852 – 252233, 252234, 252235 Fax: 08852 – 252232, website www.pragati.ac.in

Learning is Supreme Deity

DEPARTMENT OF MECHANICAL ENGINEERING

Participants List

Name of the Event: Hands on Experience on Rapid Prototyping by using FDM Printer.

Venue : CAD Lab

Date : 01/11/2023

S.No	Roll No	Name	Signature
1	21A31A0372	K. Naga Ramakrishna	K.N.R.Krishna.
2	21A31A0388	S.Abhiram	S.Abhiram
3	21A31A0381	N.Satish	Satish
4	22A35A0319	P. Jagan mohan	P.Jagan
5	21A31A0351	S.Vinay kumar	S.Vinay kumar
6	22A35A0324	S.N.Subramanyam	[illegible]
7	22A35A0317	N.S.V.S.S.L.Royal	N.Royal
8	21A31A0359	Y.chaitanya krishna	[illegible]
9	21A31A0356	T.Durga mani Govind	T.D.M.Govind
10	21A31A0374	K.Praveen Srikanth	Srikanth
11	21A31A0380	N.Manohar	Manohar
12	22A35A0316	L.D.S.V.Sai	L.D.S.V.Sai
13	22A35A0328	U.Pavan sai	U.Pavansai
14	22A35A0322	P.hari shankar	P.harishankar
15	22A35A0321	P.V.Naveen	[illegible]

INCHARGE

PRAGATI ENGINEERING COLLEGE MECH - HOD SURAMPALEM

HOD-ME

PRAGATI ENGINEERING COLLEGE

(Autonomous)

#1-378, ADB Road, Surampalem – 533 437, Near Peddapuram, E.G Dist., A.P.
(Approved by AICTE, Permanently Affiliated to JNTUK Kakinada & Accredited by NBA)
(Recognized by UGC Under Sections 2(f) and 12 (b) of UGC act, 1956)
Ph: 08852 – 252233, 252234, 252235 Fax: 08852 – 252232, website www.pragati.ac.in

Learning is Supreme Duty

DEPARTMENT OF MECHANICAL ENGINEERING

Participants List

Name of the Event: Hands on Experience on Rapid Prototyping by using FDM Printer.

Venue : CAD Lab

Date : 01/11/2023

S.No	Roll No	Name	Signature
1	22A35A0327	U. Bharath Kalyan	U. Bharath
2	22A35A0326	SK. habibul Rehman	[signature]
3	22A35A0330	P. Pavan	[signature]
4	22A35A0301	D V Sukruthi	[signature]
5	21A31A0327	K. Karthik	[signature]
6	21A31A0346	P. Rupesh	Rupesh
7	22A35A0325	K. Sai Varma	Sai Varma
8	22A35A0318	P. Santosh Kumar.	P. Sn
9	22A35A0320	P. Balaji sai Manikanta	P. Balaji
10	22A35A0329	Y. Siva Shankara Veera Prasad	Y. S
11	21A31A0355	P. Dinesh	[signature]
12	21A31A0356	S. Jaswanth Charan	S. Jaswanth Charan
13	21A31A0357	T. Dhanush	T. Dhanush
14	21A31A0350	S. Vijay Kumar	S. Vijay kumar
15	21A31A0391	Y. Sai Venkat Vasu	Y. vasu

INCHARGE

HOD-ME

ENGINEERING COLLEGE MECH - HOD SURAMPALEM

PRAGATI ENGINEERING COLLEGE

(Autonomous)

#1-378, ADB Road, Surampalem – 533 437, Near Peddapuram, E.G.Dist., A.P.
(Approved by AICTE, Permanently Affiliated to JNTUK Kakinada & Accredited by NBA)
(Recognized by UGC Under Sections 2(f) and 12 (b) of UGC act, 1956)
Ph: 08852 – 252233, 252234, 252235 Fax: 08852 – 252232, website:www.pragati.ac.in

Learning is Supreme Deity

DEPARTMENT OF MECHANICAL ENGINEERING

Participants List

Name of the Event: Hands on Experience on Rapid Prototyping by using FDM Printer.

Venue : CAD Lab

Date : 01/11/2023

S.No	Roll No	Name	Signature
1	21A31A0373	K. Murali Krishna	K. Murali
2	21A31A0376	M. Sai NaresH	[illegible]
3	21A31A0358	T. Sri Jairanth Kowshik	[illegible]
4	21A31A0368	D. Dharma Raju	D. Dharma Raju
5	21A31A0389	B. Manikanta	B. Manikanta
6	21A31A0379	H. Bhavannarayana	Bhaaa
7	21F81A0393	K. GaGan	[illegible]
8	21A31A0394	B. Manikanta	B. man
9	21A31A0370	K.V. Subrahmanyam	[illegible]
10	21A31A0365	B. Durga Prasad	[illegible]
11	21A31A0385	Sai Nisith	Nisith
12			
13			
14			
15			

INCHARGE

HOD, ME

PRAGATI ENGINEERING COLLEGE (A) MECH - HOD SURAMPALEM

REPORT

Title of the Event	: Hands on Experience on Rapid Prototyping using FDM Printer.
Date of the Event	: 1st November 2023.
Time of the Event	: 1.00PM Onwards.
Venue	: CAD Lab
No. Students participated	: 41

Additive Manufacturing (AM) involves classes of manufacturing technologies which build 3D components by adding a material layer upon a layer. The material could be a polymer, concrete, metal or even a composite. For a manufacturing process to qualify to be classified as an AM technique, it must involve the following three significant aspects.

- The use of a computer and computer aided design (CAD) to create visual 3D models: There are several CAD tools that are used to generate 3D models some of which include AutoCAD, Inventor®, Solidworks®, CATIA™ and so many others. Some of these software are available open source or closed source. The technologist or engineer involved in the field of additive manufacturing should understand how to use a few or many of the software for effective manufacturing through these technologies. Through these CAD tools, and based on the experience of the user, any form of complex 3D models of the products can be generated. The amount of material to be extruded by the 3D printer and the time it will take to build the 3D model is determined and the information is created in a G-code file, which the printer can easily interpret .
- Slicing and generation of tool paths: The CAD 3D-generated models must be prepared in a format which can be interpreted by the additive manufacturing machine. The slicing software transforms the 3D design into layered models which the machine tool can easily trace. There are so many slicing software in the market and they are provided under different trademark names such as Cura, PrusaSlicer, MatterControl, Simplify3D, Repetier, ideaMaker, Z-SUITE, Slic3r, IceSL, SlicerCrafter, Astroprint, 3DPrinterOS, SelfCAD, KISSlicer, Tinkerine Suite, Netfabb Standard including others and each of the software operates differently to achieve the best slicing .

- Conversion of the 3D model into real product: An additive manufacturing machine such as 3D printer and laser convert the 3D model into an actual product using engineering materials such as plastics, metal powders, composites, among others. The material(s) is melted and then allowed to flow according to the G-code (tool path) from the slicing software to create the 3D component.

There are various additive manufacturing methods, classified according to the material and machine technology used in the production of the components. According to the American Society for Testing and Materials (ASTM F42-) standards of 2010, there are seven categories of AM processes as listed below.

- i.Material extrusion techniques
- ii.Powder bed fusion techniques
- iii.VAT photopolymerization methods
- iv.Material jetting techniques
- v.Binder jetting techniques
- vi.Sheet lamination techniques
- vii.Direct energy deposition techniques.

The above processes utilize different materials and machines to create 3D printed components and have been extensively reviewed in the literature. Additive manufacturing processes are preferred over conventional processes due to the following advantages.

- i.Enhanced material efficiency since no material wastage through cutting or machining.
- ii.There is higher efficiency in resources since these processes do not require auxiliary resources such as tools, jigs, fixtures and so forth.
- iii.Products of high complexity and intricacy can be manufactured since there are no constraints of the tools.
- iv.Additive manufacturing processes enhance production flexibility.

Although these processes are attractive, they are constrained by some limitations such as size of parts that can be manufactured, surface and microstructural imperfections, and high cost of the AM equipmen. The processes are also very slow and therefore they are challenging technologies in mass production.

The reason for singling out FDM from all the many AM manufacturing processes is due to its wide range of applications and adoption by many individuals and industries. The FDM process,

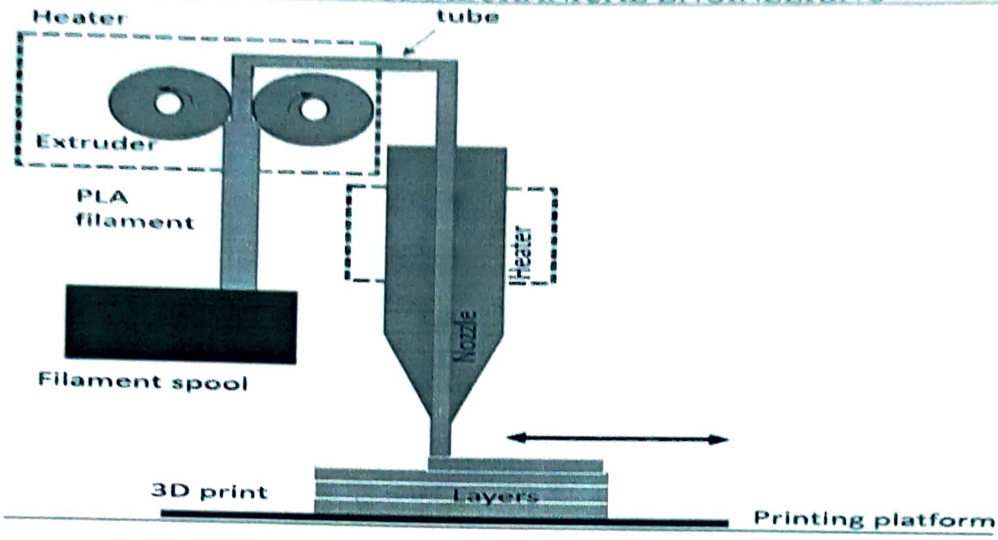


Fig. Principle of fused deposition modelling

There are various materials used in FDM and as stated earlier, PLA is the most adopted material by most 3D printer users at domestic and industrial levels due to the following reasons:

- i.Polylactic acid (PLA) is a bioplastic and therefore eco-friendly and not harmful to human and animal health. PLA is a green material since it is fabricated from fully renewable sources such as corn, sugarcane, wheat or any other high carbohydrate containing resources. As such, it is recommended for use in making cooldrink cups, deli and food take aways, and packaging containers.
- ii.PLA has a glass transition temperature ranging between 50 and 70°C and a melting point temperature ranging between 180 and 220°C. As such, most low-energy and cost-effective 3D printers can extrude it. It is harder than Acrylonitrile butadiene styrene (ABS) although it (PLA) has higher friction when compared to ABS and therefore susceptible to extrusion blockage.
- iii.PLA plastics are compostable and break down quickly upon disposal unlike the other plastics, which have posed serious disposal challenges. Being among the biopolymers, PLA degrades to natural and non-poisonous gases, water, biomass and inorganic salts when it is exposed to natural conditions, hydrolysis or even when incinerated.
- iv.In its semi-crystalline form, PLA has shown to exhibit good flexural modulus, better tensility and flexural strengths.
- v.PLA is preferred by most 3D printer users because it does not always need a heated bed for the adhesion to occur between the print and the platform. Graphene-doped PLA,

however, presents a great challenge for non-heated bed printers and it does not produce quality prints on non-heated build plates.

- vi.PLA is commercially available in the market in a variety of colours and textures. This makes it attractive for users, especially domestic and decorative 3D printer handlers. The availability in various colours and texture has expanded the markets for CAD designers and toy enthusiasts. As such, the designers can develop interesting ideas and post in various databases (such as TurboSquid, CG Trader, Shapeways, Cults3D, 3DSquirrel and Thingsverse) where the toy enthusiasts can purchase, download and print with a variety of colours and texture designs of the PLA filaments.

Other materials used in FDM processing include polycaprolactone (PCL), polypropylene (PP), polyethylene (PE), polybutylene terephthalate (PBT), Acrylonitrile butadiene styrene (ABS), wood, nylon, metals, carbon fibre, graphene-doped PLA, etc.. These materials are available in different commercial brands and trademarks, as filament wires, and can be purchased through various online stores such as Alibaba, Amazon and so forth. However, it is advised that the buyers should be aware of the chemical composition of the filaments they would like to use based on their applications. From the experience of the authors of this book, most of the filament suppliers do not provide reliable information regarding the chemical constituents of the 3D printing filaments and it is therefore recommended for the users, if necessary, to conduct their analyses to confirm the chemistry of these materials. These analyses can be conducted through phase identification on microscopy, X-ray diffraction (XRD) or more advanced chemical analysis facilities at their disposal.

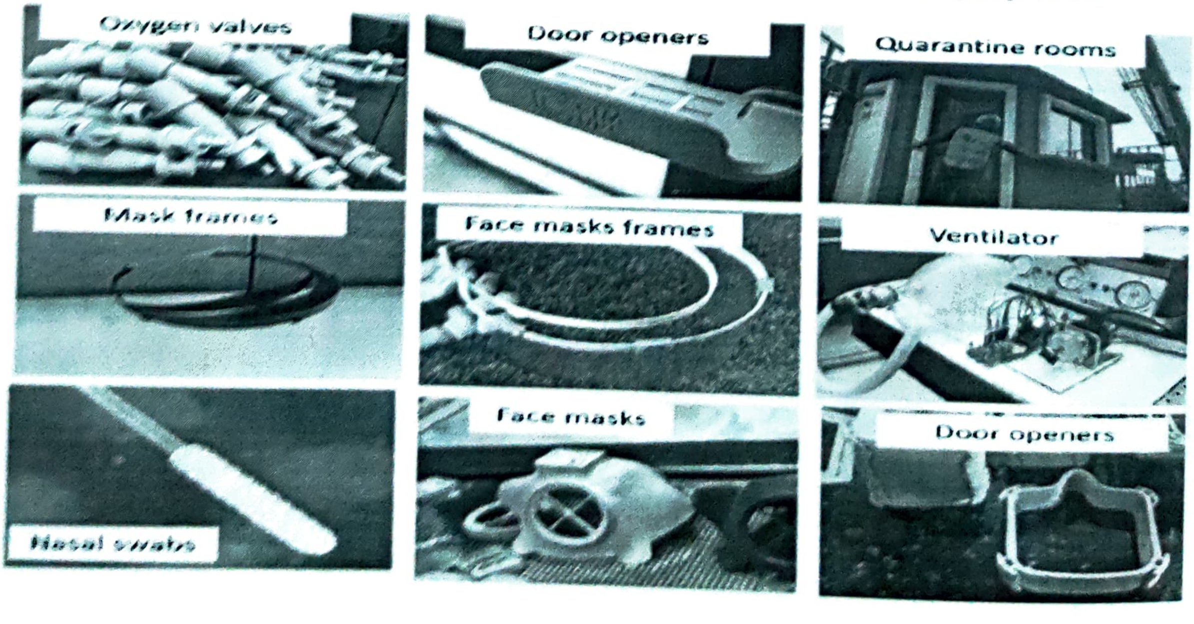
The most common applications of FDM in modern society are listed below.

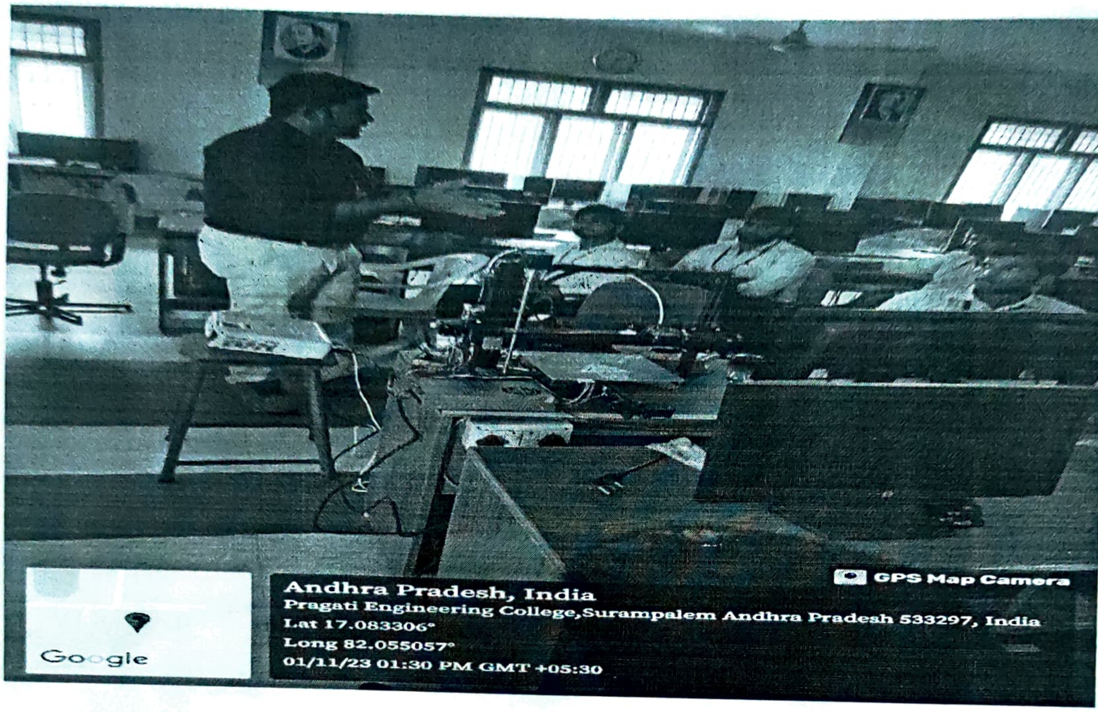
- i.The technology has emerged as one of the most progressive methods for producing prototypes and rapid tooling of complex products in low and medium batches. The research currently is on the development of a larger pool of materials for rapid prototyping applications and a lot of literature is available on this subject.
- ii.There is an increasing adoption of the FDM technique in the toy and other related industries either as a direct manufacturing method or method for producing moulds for injection moulding for such industries.
- iii.The potential of FDM on mass personalization of products cannot be overemphasized. Due to flexibility and capability to produce intricate profiles, FDM finds application in

producing customized products for various applications, for instance, personalized toys, automobile parts, interior design components, implants, beauty products and so forth .

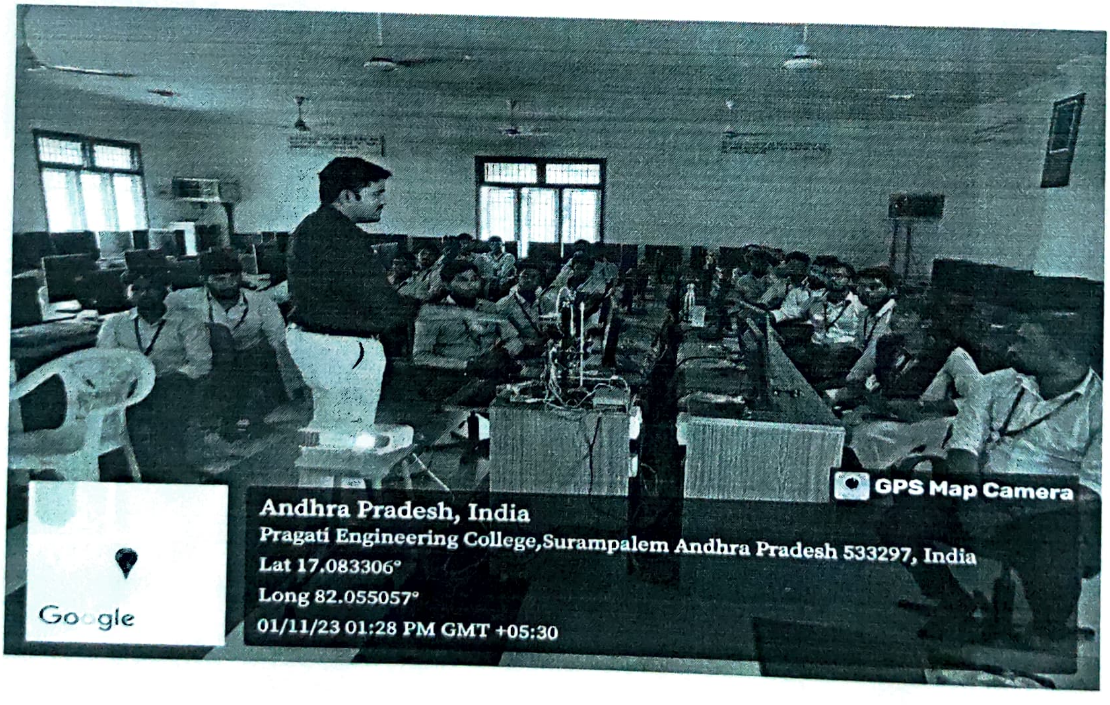
- iv.The FDM is also being applied in the medical field to produce moulds for casting of implants, medical devices and implants. The most exciting application is the 3D printing of moulds for investment casting of medical implants . In traditional investment casting, there is the use of metallic moulds and sacrificial patterns (e.g. wax) to create the complex shapes of any implant. Therefore, using 3D printed moulds eliminates the need of having to use the sacrificial material and hence reduces cost, time and material wastage. However, there are still challenges associated with the integration of FDM into the investment casting process, that is, poor surface quality; as such, as illustrated in the literature herein (for example,and others) a lot of research is currently underway in improving the surface properties of 3D printed parts and castings obtained from FDM moulds.
- v.Other applications of FDM include direct printing of electrochemical cells for energy storage devices, micro-trusses for biomedical scaffolding, drug delivery components in the pharmaceutical industry, direct printing of conductors for electronic industry among others.

Figure shows some of the 3D printed components which have been designed and manufactured, so far, to help in fighting against the spread of the Covid-19 virus as well as assisting its patients.





GPS Map Camera
Andhra Pradesh, India
Pragati Engineering College,Surampalem Andhra Pradesh 533297, India
Lat 17.083306°
Long 82.055057°
01/11/23 01:30 PM GMT +05:30
Google



GPS Map Camera
Andhra Pradesh, India
Pragati Engineering College,Surampalem Andhra Pradesh 533297, India
Lat 17.083306°
Long 82.055057°
01/11/23 01:28 PM GMT +05:30
Google

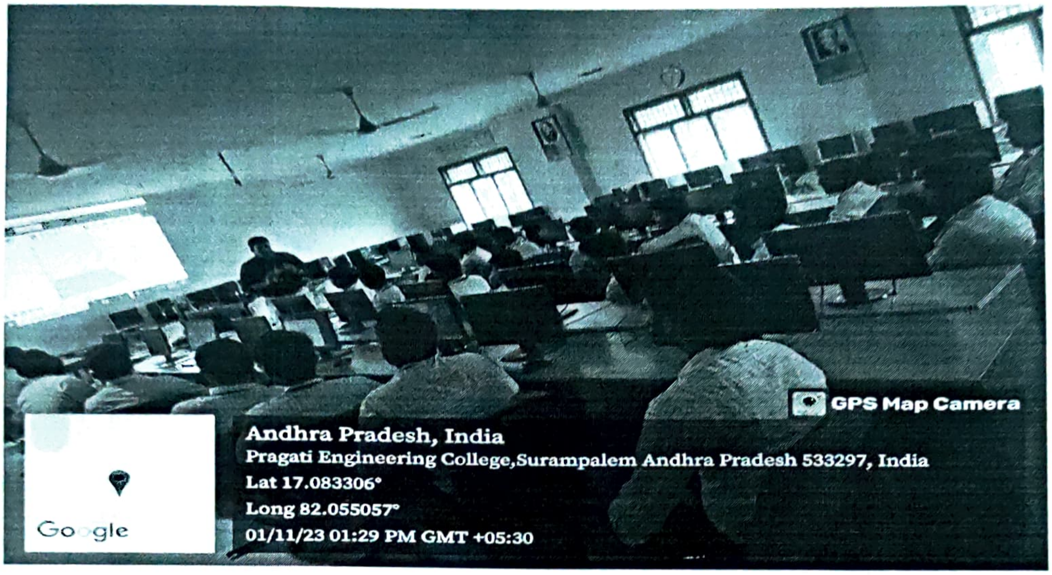
PRAGATI ENGINEERING COLLEGE

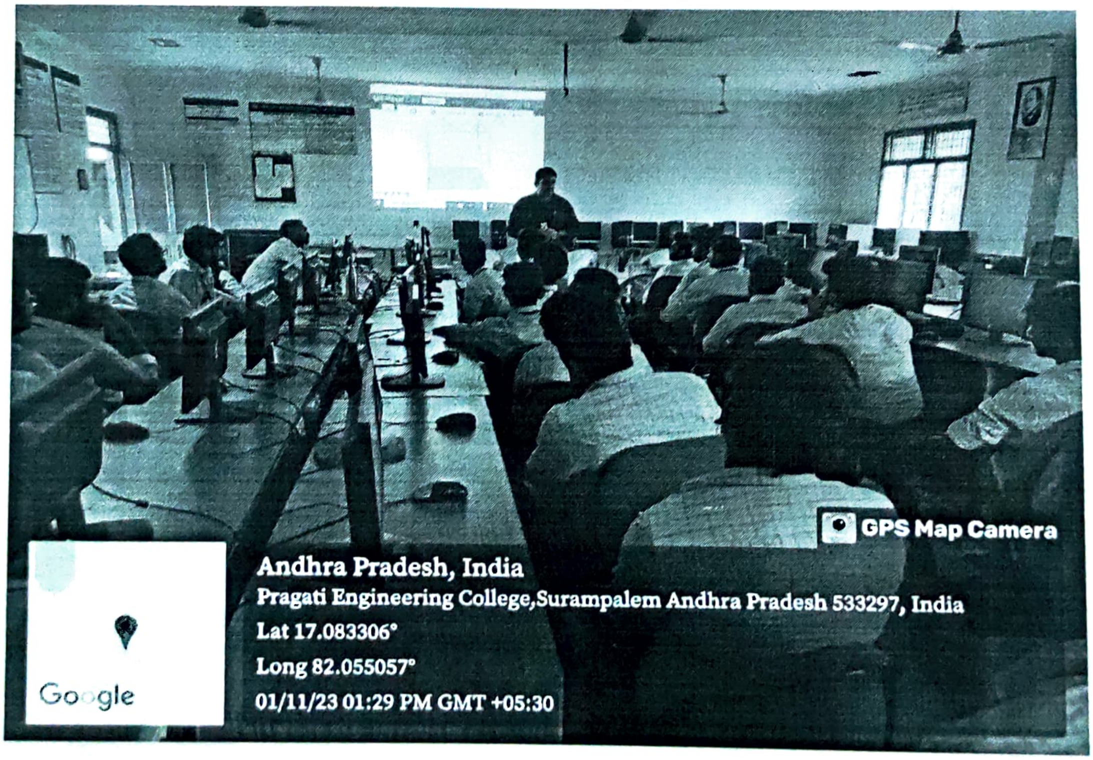
(Autonomous)

#1-378, ADB Road, Surampalem – 533 437, Near Peddapuram, E.G.Dist., A.P.
(Approved by AICTE, Permanently Affiliated to JNTUK Kakinada & Accredited by NBA)
(Recognized by UGC Under Sections 2(f) and 12 (b) of UGC act, 1956)
Ph: 08852 – 252233, 252234, 252235 Fax: 08852 – 252232, website www.pragati.ac.in

Learning is Supreme Deity

DEPARTMENT OF MECHANICAL ENGINEERING





COORDINATOR

HOD-ME

PRAGATI ENGINEERING COLLEGE (A) MECH - HOD

Additive Manufacturing Club

PRAGATI ENGINEERING COLLEGE (Autonomous)

STUDENT SESSION FEED BACK

Additive Manufacturing Club Organized By Department Of Mechanical Engineering In Association With Career Guidance Cell

Topic:	Hands on Experience on Rapid Prototyping using FDM Printer			Date : 01/1/2023	
INSTRUCTION: - Put ☑ mark in the box					
Q1	Indicate the rating of the session as per your Opinion				
	1. Poor ☐	2. Average ☐	3. Good ✓	4. Very Good ☐	5. Excellent ☐
Q.2	Please provide us with ideas and suggestions if any				

THANK YOU for your feedback. Happy Learning!

PRAGATI ENGINEERING COLLEGE (Autonomous)

STUDENT SESSION FEED BACK

Additive Manufacturing Club Organized By Department Of Mechanical Engineering In Association With Career Guidance Cell

Topic:	Hands on Experience on Rapid Prototyping using FDM Printer			Date : 01/11/2023	
INSTRUCTION: - Put ☑ mark in the box					
Q1	Indicate the rating of the session as per your Opinion				
	1. Poor ☐	2. Average ☐	3. Good ☐	4. Very Good ✓	5. Excellent ☐
Q.2	Please provide us with ideas and suggestions if any				

THANK YOU for your feedback. Happy Learning!

PRAGATI ENGINEERING COLLEGE (Autonomous)

STUDENT SESSION FEED BACK

Additive Manufacturing Club Organized By Department Of Mechanical Engineering In Association With Career Guidance Cell

Topic:	Hands on Experience on Rapid Prototyping using FDM Printer			Date : 01/11/2023	
INSTRUCTION: - Put ☑ mark in the box					
Q1	Indicate the rating of the session as per your Opinion				
	1. Poor ☐	2. Average ☐	3. Good ✓	4. Very Good ☐	5. Excellent ☐
Q.2	Please provide us with ideas and suggestions if any				

THANK YOU for your feedback. Happy Learning!

PRAGATI ENGINEERING COLLEGE (Autonomous)

STUDENT SESSION FEED BACK

Additive Manufacturing Club Organized By Department Of Mechanical Engineering In Association With Career Guidance Cell

Topic:	Hands on Experience on Rapid Prototyping using FDM Printer	Date : 01/1/2023

INSTRUCTION: - Put ☑ mark in the box

Q1	Indicate the rating of the session as per your Opinion				
	1. Poor ☐	2. Average ☐	3. Good ☐	4. Very Good ☐	5. Excellent ✓
Q.2	Please provide us with ideas and suggestions if any				

THANK YOU for your feedback. Happy Learning!

PRAGATI ENGINEERING COLLEGE (Autonomous)

STUDENT SESSION FEED BACK

Additive Manufacturing Club Organized By Department Of Mechanical Engineering In Association With Career Guidance Cell

Topic:	Hands on Experience on Rapid Prototyping using FDM Printer	Date : 01/11/2023

INSTRUCTION: - Put ☑ mark in the box

Q1	Indicate the rating of the session as per your Opinion				
	1. Poor ☐	2. Average ☐	3. Good ☐	4. Very Good ✓	5. Excellent ☐
Q.2	Please provide us with ideas and suggestions if any				

THANK YOU for your feedback. Happy Learning!

PRAGATI ENGINEERING COLLEGE (Autonomous)

STUDENT SESSION FEED BACK

Additive Manufacturing Club Organized By Department Of Mechanical Engineering In Association With Career Guidance Cell

Topic:	Hands on Experience on Rapid Prototyping using FDM Printer	Date : 01/11/2023

INSTRUCTION: - Put ☑ mark in the box

Q1	Indicate the rating of the session as per your Opinion				
	1. Poor ☐	2. Average ☐	3. Good ☐	4. Very Good ✓	5. Excellent ☐
Q.2	Please provide us with ideas and suggestions if any				

THANK YOU for your feedback. Happy Learning!

PRAGATI ENGINEERING COLLEGE

(Autonomous)

Certificate of Participation

This is to certify that

S.Abhiram

has participated in a Workshop on ***"Hands on Experience on Rapid Prototyping using FDM Printer"***

under Additive Manufacturing Club

Organized by ***Department of Mechanical Engineering***

in

association with Career Guidance Cell on 1st November 2023.

Mr. P. Ram Prasad
Convener

ADDITIVE MANUFACTURING CLUB
PRAGATI ENGINEERING COLLEGE

Dr. G. Avinash
HOD-ME

PRAGATI ENGINEERING COLLEGE

(Autonomous)

Certificate of Participation

This is to certify that

V.Pavan Sai

*has participated in a Workshop on **"Hands on Experience on Rapid Prototyping using FDM Printer"***

under Additive Manufacturing Club

*Organized by **Department of Mechanical Engineering***

in

association with Career Guidance Cell on 1st November 2023.

P. Ram Prasad

Mr. P. Ram Prasad

Convener

ADDITIVE MANUFACTURING CLUB
PRAGATI ENGINEERING COLLEGE

Dr. G. Avinash

HOD-ME