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DEPARTMENT OF MECHANICAL ENGINEERING

Academic year: 2023-24

Date: 13-12-2023

CIRCULAR

Additive Manufacturing Club of Mechanical Engineering Department in association with Career Guidance Cell is organizing a Seminar to the Engineering students on 15th December 2023. The Theme of the Seminar is "*Overview on the 3D printing Technology*".

Event : Seminar
Date of the Event : 15th December 2023
Venue : S-17.

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ADDITIVE MANUFACTURING CLUB

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

"OVERVIEW ON THE 3D PRINTING TECHNOLOGY"

SPEAKER :

Mr. P. Ram Prasad
Assistant Professor

FACULTY COORDINATOR

Mr. P. Ram Prasad
Assistant Professor
Mechanical Engineering Department

VENUE: S-17

DATE: 15th December 2023

TIME: 11:00 AM Onwards



STUDENT COORDINATOR

Mr. D. Ashish Varma
III Year Mechanical Engineering Department
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2nd International Conference on Sustainable Materials Processing and Manufacturing
(SMPM 2019)

An Overview on 3D Printing Technology: Technological, Materials, and Applications

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Abstract

Digital fabrication technology, also referred to as 3D printing or additive manufacturing, creates physical objects from a geometrical representation by successive addition of materials. 3D printing technology is a fast-emerging technology nowadays. 3D printing is widely used in the world. 3D printing technology increasingly used for the mass customization, production of any types of open source designs in the field of agriculture, in healthcare, automotive industry, locomotive industry and aviation industries. 3D printing technology can print an object layer by layer deposition of material directly from a computer aided design (CAD) model. This paper presents the overview of the types of 3D printing technologies, the application of 3D printing technology and finally, the materials used for 3D printing technology in manufacturing industry.

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Keywords: Additive manufacturing, 3D Printing, manufacturing industry

1. Introduction

3D printing can create physical objects from a geometrical representation by successive addition of material [1]. This 3D process had many experienced a phenomenal expansion in recent years. First commercialised of the 3D printing processes in year 1980 by Charles Hull [2]. Currently, 3D printing primarily used for producing artificial heart pump [3], jewelry collections [4], 3D printed cornea [5], PGA rocket engine [6], steel bridges in Amsterdam [7] and other products related to the aviation industry as well as the food industry.

3D printing technology has originated from the layer by layer fabrication technology of three-dimensional (3D) structures directly from computer-aided design (CAD) drawing [8]. 3D printing technology is a truly innovative and has emerged as a versatile technology stage. It opens new opportunities and gives hope to many possibilities for

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companies looking to improve manufacturing efficiency. Conventional thermoplastics, ceramics, graphene-based materials, and metal are the materials that can be printed now by using 3D printing technology [9]. 3D printing technology has the potential to revolutionize industries and change the production line. The adoption of 3D printing technology will increase the production speed while reducing costs. At the same time, the demand of the consumer will have more influence over production. Consumers have greater input in the final product and can request to have it produced to fit their specifications. At the meantime, the facilities of 3D printing technology will be located closer to the consumer, allowing for a more flexible and responsive manufacturing process, as well as greater quality control. Furthermore, when using 3D printing technology, the need for global transportation is significantly decreased. This is because, when manufacturing sites located nearer to the end destination, all distribution could be done with fleet tracking technology that saves energy and time. Lastly, the adoption of 3D printing technology can change the logistics of the company. The logistics of the companies can manage the entire process, offer more comprehensive and start-to-finish services [10].

Nowadays, 3D printing is widely used in the world. 3D printing technology increasingly used for the mass customization, production of any types of open source designs in the field of agriculture, in healthcare, automotive industry, and aerospace industries [11].

At the same time, there are several disadvantages the adoption of 3D printing technology in manufacturing industry. For instance, the effect of the use of 3D printing technology is will reduce the use of manufacturing labour so automatically will greatly affect the economy of countries that rely on a large number of low skill jobs. Furthermore, by using 3D printing technology, users can print many different types of objects such as knives, guns and dangerous items. Therefore, the use of 3D printing should be limited to only certain people to prevent terrorists and criminals bring guns without detected. At the same time, the people who get a hold of a blueprint will be able to counterfeit products easily. This is because, the use of 3D printing technology is simple, just sketching, and set the data in the machine-printed so 3D objects can generate [12].

To sum up, 3D printing technology has emerged during recent years as a flexible and powerful technique in advance manufacturing industry. This technology has been widespread used in many countries, especially in the manufacturing industry. Therefore, this paper presents the overview of the types of 3D printing technologies, the application of 3D printing technology and lastly, the materials used for 3D printing technology in manufacturing industry.

2. Types of 3D Printing

Varieties of 3D printing technologies have been developed with the different function. According to ASTM Standard F2792 [13], ASTM catalogued 3D printing technologies into seven groups, including the binding jetting, directed energy deposition, material extrusion, material jetting, powder bed fusion, sheet lamination and vat photopolymerization. There are no debates about which machine or technology function better because each of them has its targeted applications. Nowadays, 3D printing technologies are no longer limited to prototyping usage but are increasingly also being used for making variety of products [14].

2.1. Binder jetting

Binder jetting is a rapid prototyping and 3D printing process in which a liquid binding agent is selectively deposited to join powder particles. The binder jetting technology uses jet chemical binder onto the spread powder to form the layer [9]. The application of the binder jetting is would be producing the casting patterns, raw sintered products or similar large-volume products from sand. Binder jetting can print a variety of materials including metals, sands, polymers, hybrid and ceramics. Some materials like sand not required additional processing. Moreover, the process of binder jetting is simple, fast and cheap as powder particles are glued together. Lastly, binder jetting also has the ability to print very large products.

2.2. Directed energy deposition

Directed energy deposition is a more complex printing process commonly used to repair or add additional material to existing components [8]. Directed energy deposition has the high degree control of grain structure and

3.6. Specials materials

The examples of special materials are:

- Food

3D printing technology can process and produce the desired shape and geometry by using food materials like the chocolate, meat, candy, pizza, spaghetti, sauce and so on [49]. 3D-food printing can produce healthy food because this process allows customers to adjust the ingredients of materials without reducing the nutrients and taste of the ingredients [50].

- Lunar dust

3D printing process has the capability to directly produce multi-layered parts out of lunar dust, which has potential applicability to future moon colonization [51].

- Textile

With 3D printing technology, jewellery and clothing industry will be shine with the development on 3D-textile printing. Some advantage of 3D printing technology in fashion industry are short processing time to make the product, reduced costs related with the packaging and reduce supply chain cost [16].

4. The Applications of 3D Printing in Manufacturing Technology

4.1. Aerospace industry

3D printing technology provides unparalleled freedom design in component and production. In aerospace industry, 3D printing technology has potential to make lightweight parts, improved and complex geometries, which can reduce energy requirement and resources [52]. At the same time, by using 3D printing technology, it can lead to fuel savings because it can reduce the material used to produce aerospace's parts. Furthermore, 3D printing technology has been widely applied to produce the spare parts of some aerospace components such as engines. The engine's part is easily damaged, which require regular replacement. Therefore, 3D printing technology is a good solution to the procurement of such spare parts [53]. In aerospace industry, nickel-based alloys is more preferred due to the tensile properties, oxidation/corrosion resistance and damage tolerance [54].

4.2. Automotive industry

Nowadays, 3D printing technology have rapidly changed our industry to design, develop and manufacture new things. In the automotive industry, 3D Printing technique have made phenomena to bring new shines, allowing for lighter and more complex structures in the fast time. For instance, Local Motor had printed the first 3D-printed electric car in 2014. Not only cars, Local Motors also extended the wide range application of 3D printing technology by manufacturer a 3D-printed bus called OLLI. OLLI is a driverless, electric, recyclable and extremely smart 3D printed bus. Furthermore, Ford is the leader in the use of 3D printing technology also apply 3D printing technology to produce prototype and engine parts [55]. In addition, BMW uses 3D printing technology to produce hand-tools for automotive testing and assembly. Meanwhile, in 2017, AUDI was collaborated with SLM Solution Group AG to produce spare parts and prototypes [56].

Consequently, by using 3D printing technology in automotive industry enable company to try various alternatives and emphasize right in the improvement stages, prompting ideal and effective automotive design. At the same time, 3D printing technology can reduce the wastage and consumption of the materials. Moreover, 3D printing technology can reduce costs and time, therefore, it allows to test new designs in a very fast time [57].

4.3. Food industry

3D printing technology open the doors not only for aerospace industry, but also for food industry. At present,

enabling more innovative designs created in just one process [37]. The development of a green electronic device with low-manufacturing cost, good safety, high reliability and rapid production, is urgently in demand to address environment pollutions in today's society [75].

5. Summary

In this review, there are rich landscape of 3D printing in manufacturing industry. At present, 3D printing technology is beginning in the manufacturing industries, it offers many benefits to the people, company and government. Therefore, more information is needed to progress on ways to enhance the adoption of 3D printing technology. The more information about 3D printing technology will help the company and government to upgrade and improve the infrastructure of 3D printing technology. Thus, this paper is to overview the types of 3D printing technologies, materials used for 3D printing technology in manufacturing industry and lastly, the applications of 3D printing technology. In the future, researchers can do some study on the type of 3D printing machines and the suitable materials to be used by every type of machine.

6. Acknowledgements

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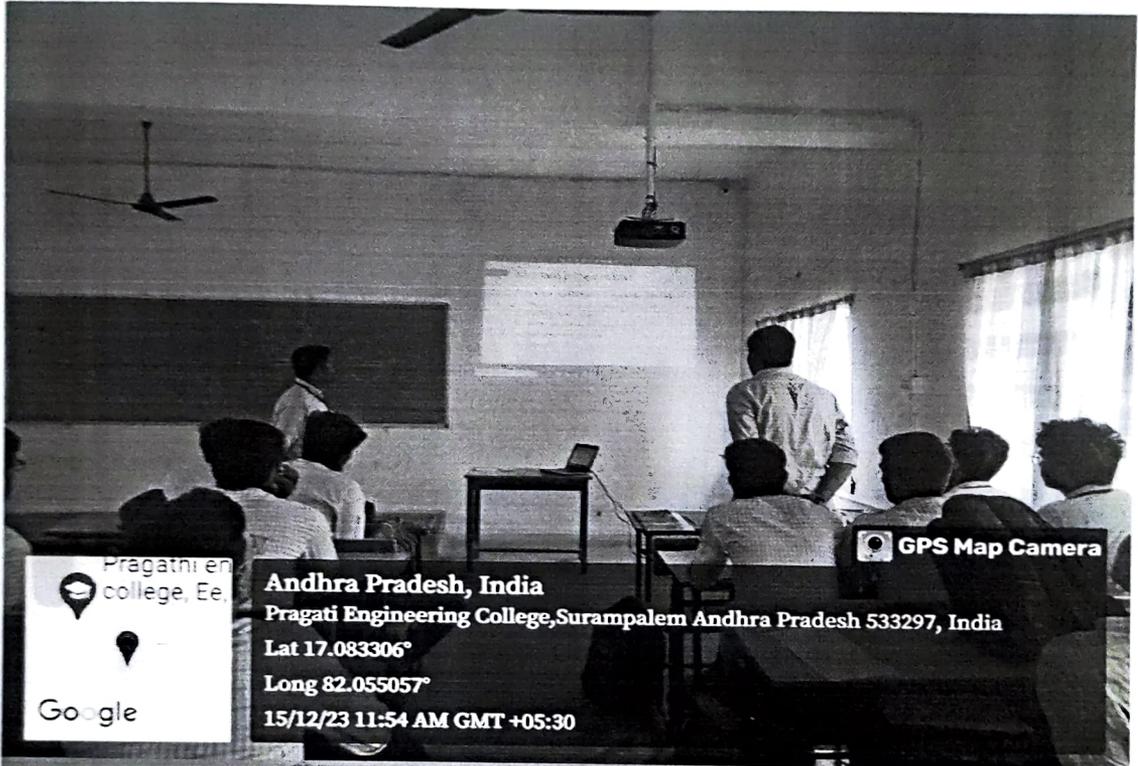


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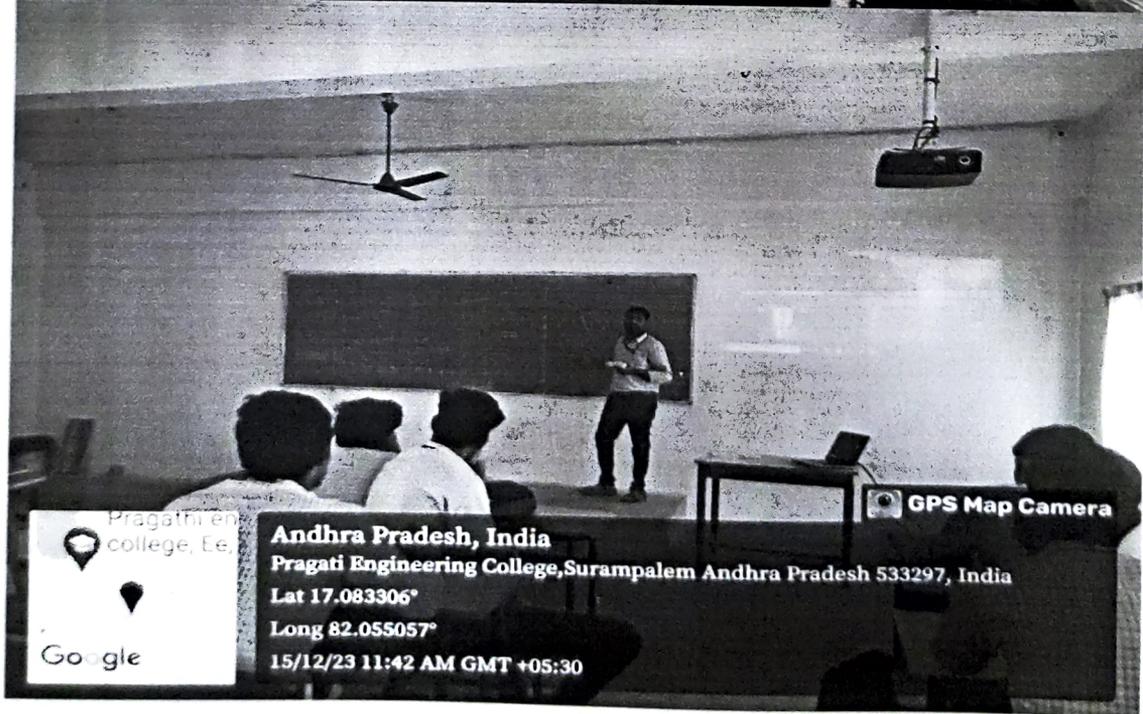
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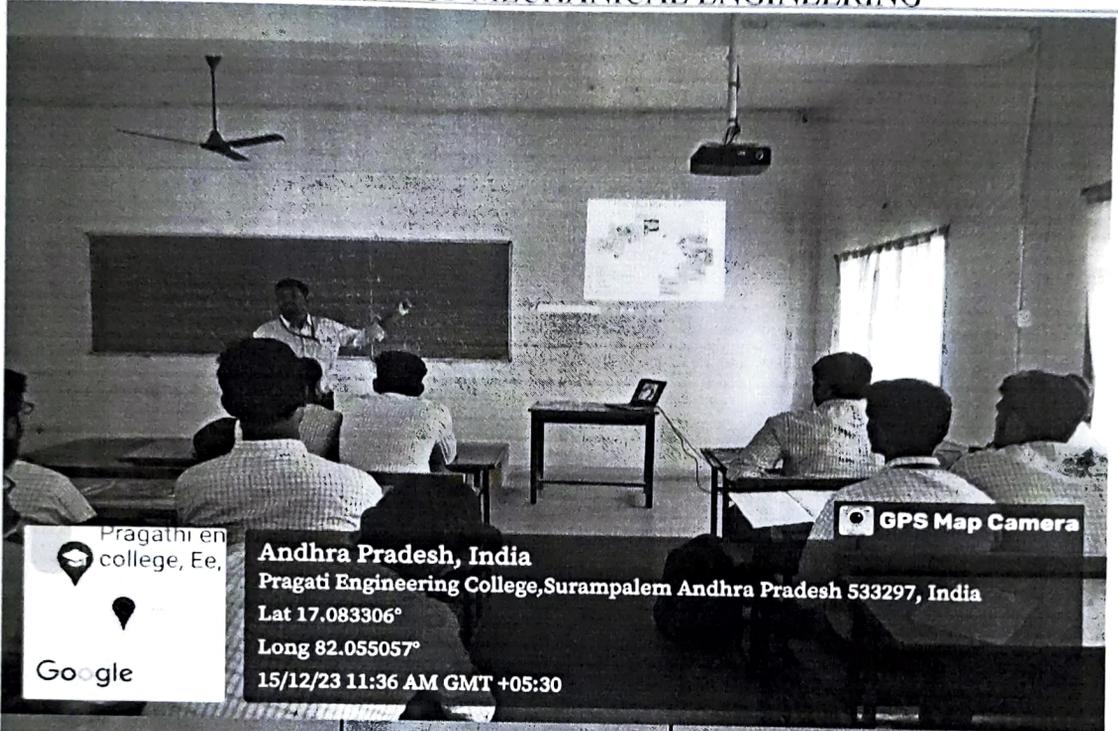
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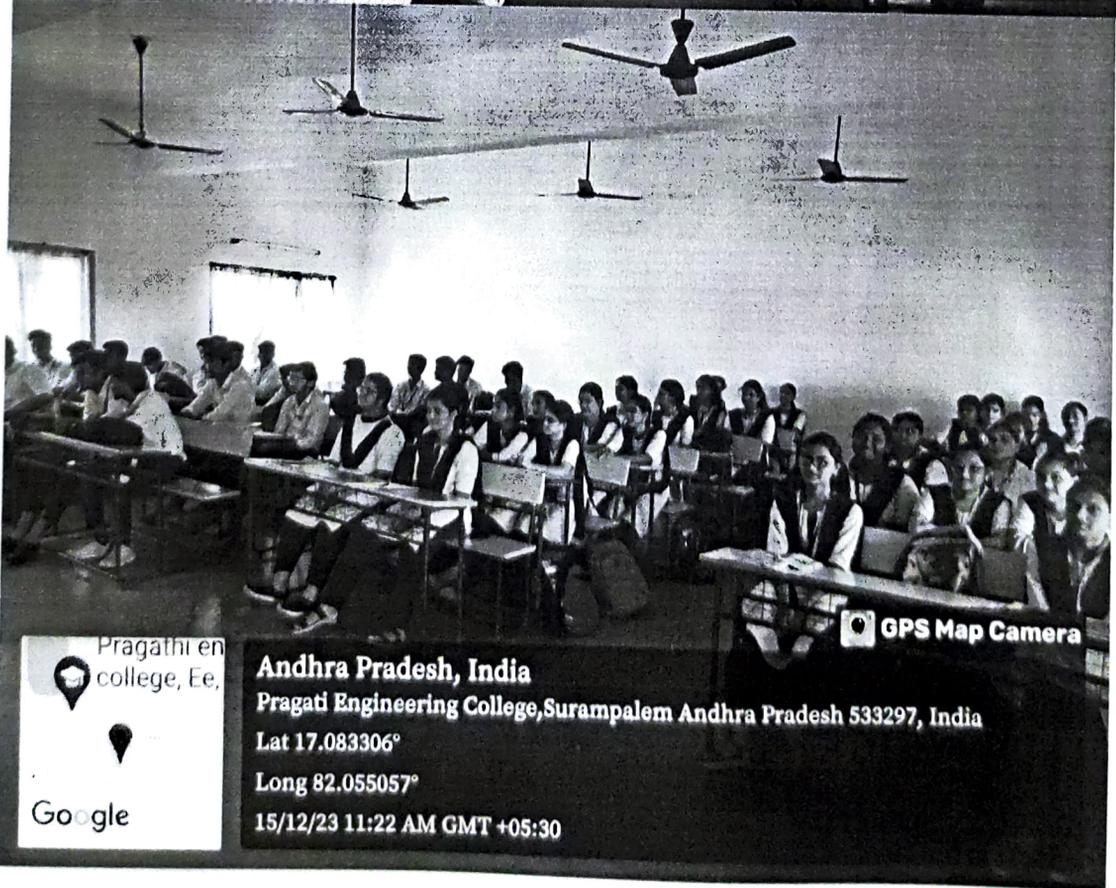
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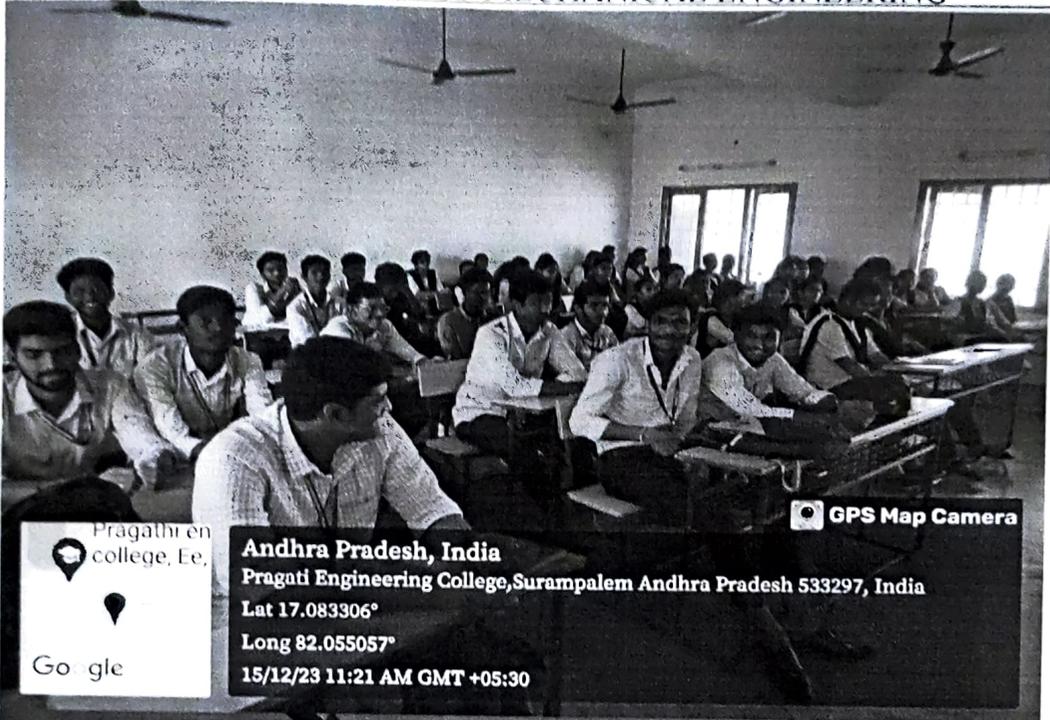
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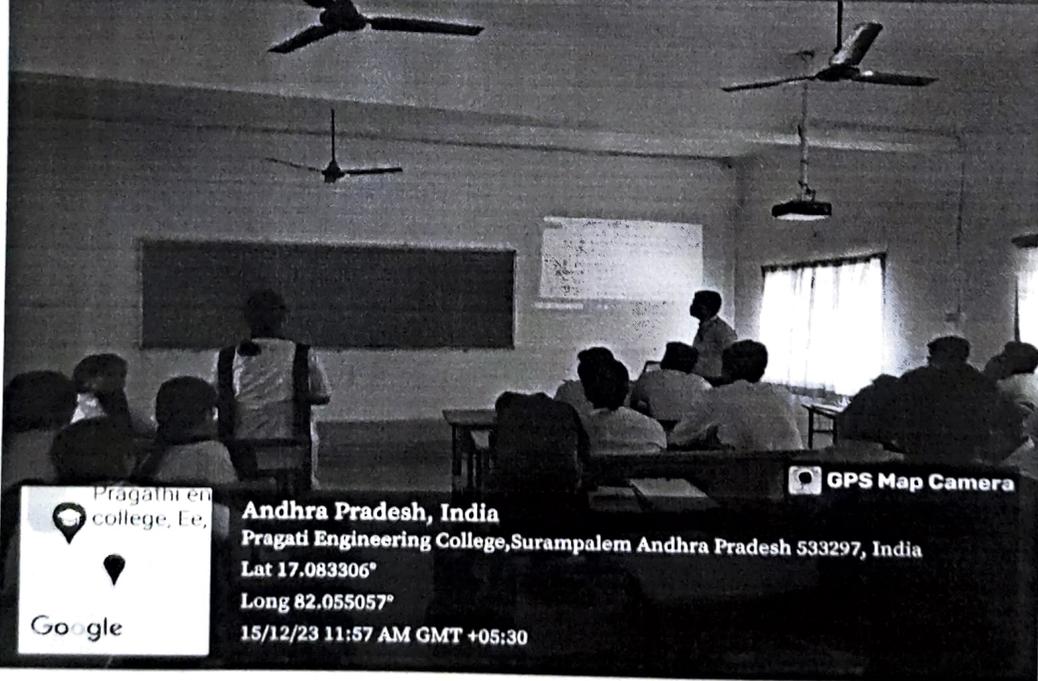
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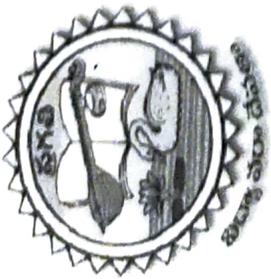
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association with Career Guidance Cell on 15th Dec 2023.

P. Ram Prasad
Mr. P. Ram Prasad
Convener



Dr. G. Avinash
HOD-ME

PRAGATI ENGINEERING COLLEGE (Autonomous)

STUDENT SESSION FEED BACK

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

Topic: Overview on the 3D printing Technology. Date: 15/12/2023

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!

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