3D Printing Club

INDEX

3D Printing Club

This club is planned to establish on october-2018 and officially inaugurated on February-2019 by Dr. Y. Ravi Kumar, Professor from NIT-Warangal.

Objective of the 3D Printing Club: The objective of the 3D Printing Club is to provide students with a platform to explore and learn about the exciting world of 3D printing. The club aims to foster creativity and innovation by offering opportunities for students to design, prototype, and bring their ideas to life using 3D printing technology. It also seeks to promote collaboration and teamwork among members and encourage them to think critically about the applications of 3D printing in various fields.

Eligibility : B.Tech and M.Tech students

Activities for Students/ Participants in 3D Printing Club:

1. **Introductory Workshops**: Organize workshops to introduce students to the basics of 3D printing, including how the technology works, different types of 3D printers, and software for designing 3D models.

2. **Design Challenges:** Host design challenges where students are given specific themes or problems to solve using 3D printing. This encourages them to think creatively and apply their knowledge to real-world scenarios.

3. **CAD (Computer-Aided Design) Training**: Provide training sessions on various CAD software to teach students how to design and create their own 3D models. This could include software like Rhinoceros, Soliworks, Tinkercad, Fusion 360, or Blender.

4. **Guest Speakers**: Invite experts and professionals from the 3D printing industry to share their experiences, insights, and the latest advancements in the field.

5. **3D Printer Maintenance and Troubleshooting**: Teach students how to properly maintain 3D printers and troubleshoot common issues that may arise during printing.

6. **Community Projects**: Collaborate with other clubs or organizations on campus to work on community-based projects. For example, the club could create 3D printed assistive devices for people with disabilities or educational aids for local schools.

7. **3D Printing Competitions**: Participate in regional or national 3D printing competitions, challenging students to compete against other universities or schools. This fosters healthy competition and motivates students to excel in their skills.

8. **Material Exploration**: Experiment with different types of 3D printing materials like PLA, ABS, PETG, etc., to understand their properties and applications.

9. **Reverse Engineering**: Encourage students to reverse engineer objects by 3D scanning and recreating them with 3D printing technology.

10. **Distinguished Projects**: Recognize outstanding projects or designs created by club members through awards or certificates to appreciate their efforts and motivate others.

11. **Research and Development**: Undertake research projects related to 3D printing, exploring cutting-edge applications or new materials.

Remember to adapt the activities based on the club's resources and the interests of its members. Encouraging an open and collaborative environment will help students fully enjoy their experience in the 3D Printing Club.

Equipment:

Fig: Flash Forge Creator Pro: FDM printer

Faculty Coordinators:

1. Dr. V Phanindra Bogu, Associate Professor, MED
2. Mr. Pradeep Kumar, Assistant Professor, MED

S.No.	List of Activities Conducted
1	Workshops Conducted at VJIT 1. 3D Printing in Product Development on : 6th October, 2018 2. 3D printing& Applications during 18-19th February 2019
2	Student Projects on 3D Printing 1. Design and Developing of Syringe Based Extruder for Bio-Printing during 2019-20 2. Experimental Investigation of Additive Manufactured Cellular Lattice Structures in May 2018
3	VJIT Interdepartmental Projects 1. Fully Functional Replica of Nano Satellite on March 11, 2023 2. CANSAT during Aug to Dec 2022
4	Reverse Engineering
5	Faculty Training 1. Reverse Engineering in Aug 2022

Workshops Conducted

Title: 3D Printing in Product Development

Speakers: Mr. Amarnath & Mr. Subramanyam, Quanint Tech Soft Pvt. Ltd

Date: 6th October, 2018.

In the workshop, it was emphasized that the 3D printing, or additive manufacturing, revolutionizes product development by creating objects layer by layer from digital designs. Its key advantages include rapid prototyping, enabling swift iterations and cost-efficient design testing. The technology reduces material waste during prototyping, cutting costs and minimizing environmental impact. Customization becomes effortless, allowing tailored products for individual customers without additional tooling expenses. Additive manufacturing enables complex geometries, fostering innovation and efficiency in design. Accelerated product development cycles decrease time to market, boosting competitiveness in dynamic industries. The iterative design process enhances product quality, reducing the risk of errors. Moreover, 3D printing aids in creating custom tooling and manufacturing aids, streamlining production processes. On-demand manufacturing, where products are made as needed, reduces inventory overheads and is beneficial for low-volume production. While 3D printing has limitations, constant advancements in technology and materials expand its applications, further transforming product development processes.

Title: A Two-day workshop on '3D printing& Applications'

Date: 18-19th February 2019.

Speakers: The Elite Resource Persons from NIT Warangal and IIT Hyderabad, who are in the 3D printing practice, will deliver lectures and hands-on sessions. List of external resource persons based on session is as follows:

1. Dr. Y. Ravi Kumar, Associate professor, NIT Warangal.
2. Dr. S. Surya Kumar, Associate Professor, IIT Hyderabad.
3. Dr. FalguniPati, Assistant Professor, IIT Hyderabad.

The workshop provided a clear and comprehensive coverage of this exciting new technology. 3D printing is defined by the ASTM F42 committee as the fabrication of objects through the deposition of a material layer by layer fashion. 3D Printing is used to build physical models, prototypes, patterns, tooling components and production parts in plastic, metal, ceramic, glass, and composite materials. 3D Printing systems use thin, horizontal cross sections from computer-aided design (CAD) models, 3D-scanning systems, medical scanners, and video games to produce parts in about every shape imaginable. Design and manufacturing organizations use 3D Printed parts for products in the consumer, industrial, medical, and military markets, to name just a few. Digital cameras, mobile phones, engine parts, interior trim for automobiles, parts and assemblies for airplanes, power tools, and medical implants are just the beginning of a very long list of products that have benefited from 3D Printing technology.

COURSE CONTENTS

Introduction to 3D Printing & AM

- Modelling of CAD designs, working with STL files, support structure generation and build setup preparation
- 3D Printing & AM Processes
- Vat Photo polymerization
- Material Jetting
- Binder Jetting
- Extrusion-based
- Powder Bed Fusion
- Directed Energy Deposition

3D Printing & AM Applications

- Automotive, Aerospace, Medical & Dental Applications
- Business Opportunities and Future Directions of 3D Printing & AM
- Metal Additive manufacturing and its applications.
- Bio-Printing and its applications.


VIDYA JYOTHI INSTITUTE OF TECHNOLOGY

Student Projects

Title: Design and Developing of Syringe Based Extruder for Bio-Printing

Project students: Mr. Karthik and Sai, M.Tech (CAD/CAM)

Date: 2019-2020

Guide: Dr. V. Phanindra Bogu.

Syringe-based extrusion is an additive manufacturing technique utilized in bioprinting and paste extrusions. A syringe with a 32 mm diameter contains printable material, and a plunger, driven by a gear system connected to a stepper motor, facilitates extrusion through a 0.28 mm needle. The CATIA software designs essential components, including herringbone gears, gear covers, bolts, syringe holders, plunger seal caps, and 'T' shaped stepper motor holders. The herringbone gear features a gear ratio of 1:45. Cost-effective design and development allow testing with various printable parameters, such as flow rate, print speed, travel speed, and the crucial extrusion multiplier. The optimal parameters are identified as flow rate 100mm/s, print speed 20mm/s, travel speed 100 mm/s, with an extrusion multiplier value of 9.066. The application of this technique is primarily in the biomedical field, specifically for bioprinting bone and cell tissues, promising advancements in tissue engineering and regenerative medicine.

Hydrogel: Hydrogels are bioinks that are useful in bioprinting due to their properties, which include high levels of hydration and shear thinning. Bio-compatible hydrogels are used in bioprinting to show printing properties that are beneficial for cells within the ink.

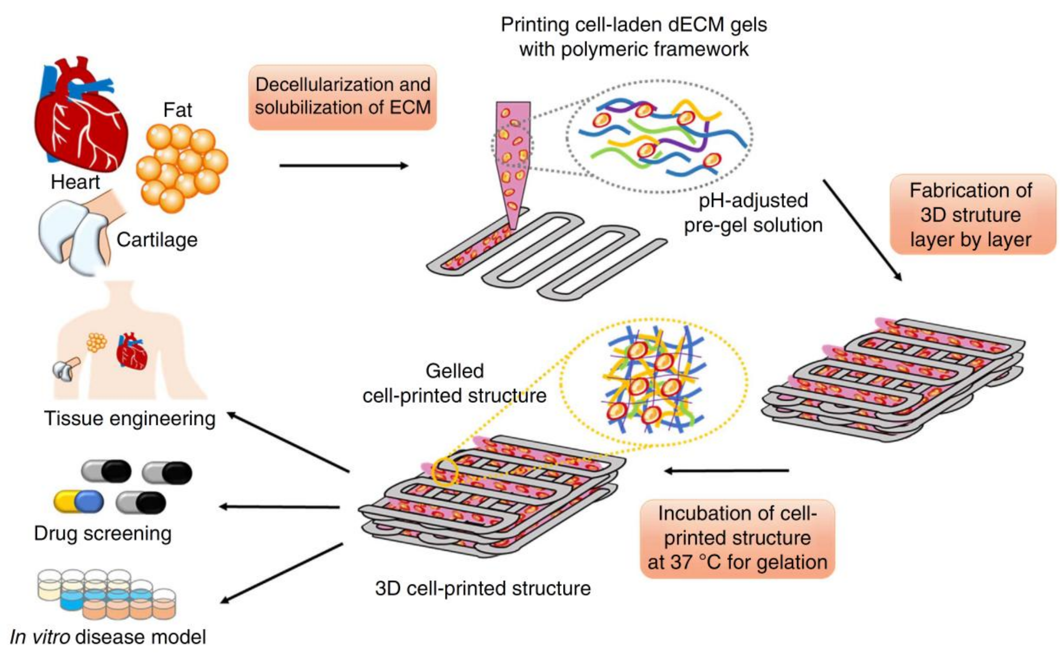
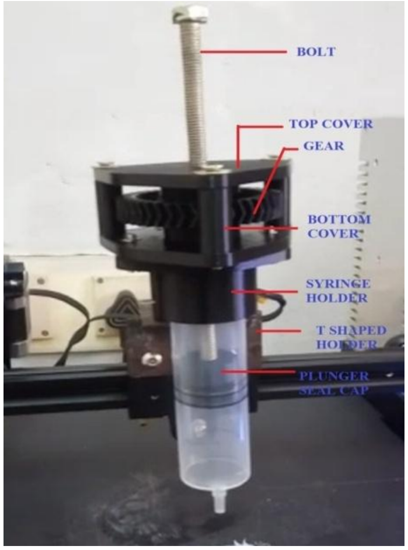
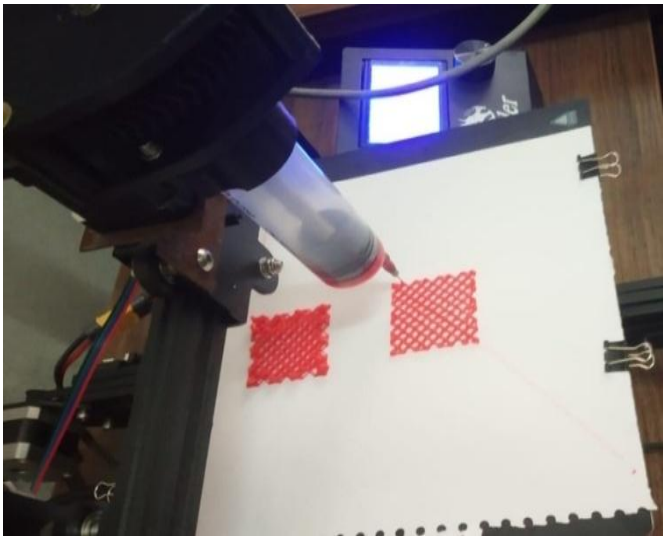
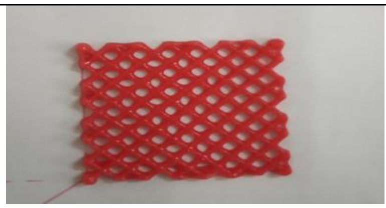
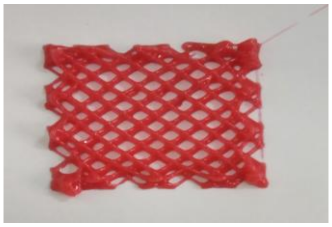
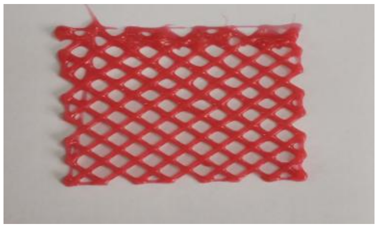


Figure: Schematic elucidating the tissue printing process using dECMbioink





S.no	Flow rate	Travel speed	Print speed	Acceleration control	Scaffolds
1	100 mm/sec	100 mm/sec	20 mm/sec	Disabled	
2	150 mm/sec	100 mm/sec	10 mm/sec	Disabled	
3	100 mm/sec	100 mm/sec	10 mm/sec	Disabled	

Title: Experimental Investigation of Additive Manufactured Cellular Lattice Structures
Project students: Mr. Srikanth, B.Tech, Mechanical
Date: 2018
Guide: Dr. V. Phanindra Bogu.

Lattice structures are low dense, highly porous, and effective in strength to weight ratio. Due to these properties the lattice structures sustain high compressive loads and exhibits better mechanical properties. Additive manufacturing facilitates to manufacture the complex lattice structures with fewer material consumptions and gives the necessary strength of the product. The present work analyses the mechanical behavior of unit cell based lattice structures such as "face-centered cubic" and "star" lattice structures. The lattice structures are fabricated through the fused deposition method with polylactic acid material. The mechanical properties called modulus of elasticity, and compressive strength and strains are calculated experimentally in X, Y, and Z directions.

Linear elastic region: The elastic deformation is occurred due to the bending struts and this linear elasticity is characterized by elastic modulus.

Plateau stress region: The unit cell struts begin to collapse and become denser under compressive loads. Due to densification, energy absorption is more in this region.

Densification region: The stiffness of the lattice structure is increasing due to struts contact with each other.

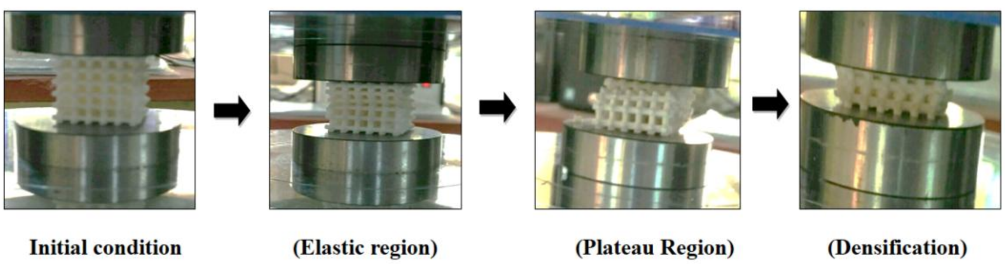


Figure: Representation of different regions in FCC lattice structure

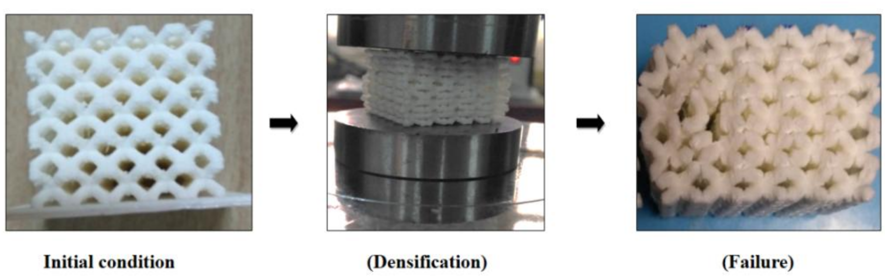


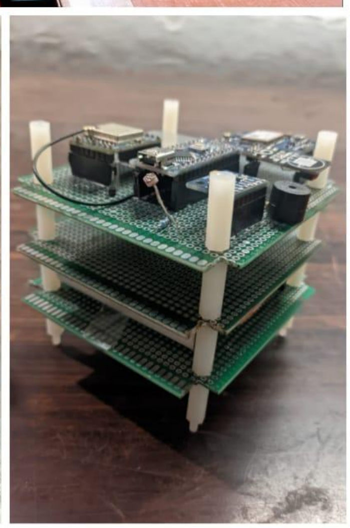
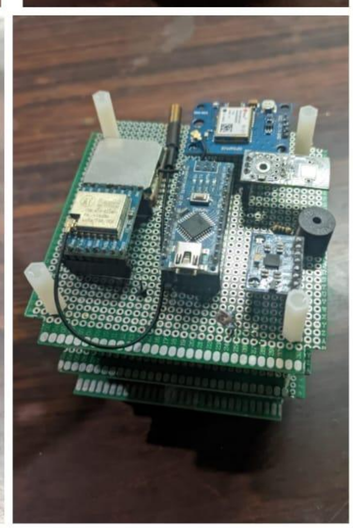
Figure: Representation of densification region for star lattice structure

VJIT Interdepartmental Projects

Title: Fully Functional Replica of Nano Satellite
Date: March 11, 2023
Frame Design and Manufacturing: Dr. G. Sreeram Reddy, Dr. V Phanindra Bogu

A functional replica of a nanosatellite with a 3D-printed frame is achieved through additive manufacturing technology at VJIT Mechanical R&D Lab. The frame is produced using 3D printing, ensuring precision and lightweight design. This replication enables cost-effective prototyping and testing of satellite components, leading to faster development cycles. The nanosatellite's 3D-printed frame demonstrates the potential for future space missions, where innovative manufacturing techniques can facilitate the production of small, agile, and cost-efficient satellites for various applications, including Earth observation, communication, and scientific research.



Program: CANSAT

Students: Madhurima Sinha, Miss Lakshya R, Miss Pranitha Rajput, B.Tech, ECE.

Date: Aug to Dec 2022

Container Design and Manufacturing: Dr. G. Sreeram Reddy, Dr. V Phanindra Bogu

A CanSat is a type of small-scale satellite designed to fit inside a standard-sized soda can. It is a educational and space technology development project used to teach students about satellite technology, space science, and engineering. CanSats typically consist of various sensors, communication systems, and a data logger, all packed into the compact can-sized container. The container was developed at VJIT Mechanical R&D Lab.

Reverse Engineering

Reverse engineering components using 3D printing is a fascinating and practical application of the technology. Here's a step-by-step guide on how to reverse engineer components using 3D printing:

1. Obtain the Component: The first step is to get hold of the physical component you want to reverse engineer. This can be an existing product, a spare part, or even a custom-designed object.

2. 3D Scanning: To create a digital model of the component, you'll need a 3D scanner. There are different types of 3D scanners available, ranging from handheld scanners to more sophisticated stationary scanners. The scanner captures the shape and dimensions of the component, converting it into a 3D digital file.

3. Create a 3D Model: Once you have the 3D scan data, you'll need to process it using 3D modeling software to create a clean and accurate 3D model. This step may involve removing any noise or errors from the scan data and ensuring that the resulting model represents the component accurately.

4. CAD Software: Import the 3D scan data into Computer-Aided Design (CAD) software. Depending on the complexity of the component and the quality of the scan, you may need to use CAD tools to refine and optimize the model further.

5. Design Optimization: At this stage, you have the flexibility to make design improvements or modifications to the component. For example, you could optimize the design for 3D printing, add additional features, or adjust tolerances.

6. Prepare for 3D Printing: Once the 3D model is finalized, prepare it for 3D printing. This involves ensuring the model is in the right file format (such as STL) and making any necessary adjustments for printing, such as adding support structures or adjusting the orientation for better print quality.

7. Select Appropriate Material: Choose the 3D printing material that suits the requirements of the component. There are various materials available, including PLA, ABS, PETG, nylon, and more, each with its specific properties and applications.

8. 3D Print the Component: Use a 3D printer to bring the 3D model to life. Depending on the complexity and size of the component, this step can take some time. Monitor the printing process to ensure it goes smoothly.

9. Post-Processing: After 3D printing, the component may require some post-processing, such as removing support structures, sanding rough edges, or applying finishing touches to improve the appearance and functionality.

10. Test and Validate: Test the 3D printed component to ensure it functions as expected and meets the necessary requirements. If any issues are identified, return to the design phase and make necessary modifications.

11. Iterate and Improve: Depending on the results of testing, iterate on the design and 3D print new versions until you achieve the desired outcome.

By following these steps, you can successfully reverse engineer components and use 3D printing to create functional prototypes, spare parts, or customized objects. Keep in mind that the accuracy of the reverse-engineered component will depend on the quality of the 3D scanning and the expertise in 3D modeling and design.

Fig: Reverse Engineering (scanner) and 3D Printed components

Faculty Training at VJIT: Faculty training on reverse engineering equips educators with knowledge and skills to teach the principles and techniques, including tools, data acquisition, CAD modeling, disassembly, analysis, and ethical considerations. The goal is to deliver engaging and practical learning experiences, fostering critical thinking and problem-solving skills in students while preparing them for modern industries.