Savitribai Phule Shikshan Prasarak Mandal's

SKN SINHGAD COLLEGE OF ENGINEERING,
PANDHARPUR

(Approved by AICTE,New Delhi,Recognized by D.T.E .(M.S)& Affiliated to the Solapur

Accredited by NAAC with A+ Grade

Innovation in Teaching & Learning

Advanced Manufacturing Technology 3D Printing

Savitribai Phule Shikshan Prasarak Mandal's

SKN SINHGAD COLLEGE OF ENGINEERING, PANDHARPUR

(Approved by AICTE,New Delhi,Recognized by D.T.E .(M.S)& Affiliated to the Solapur

Accredited by NAAC with A+ Grade

Linking of subject Syllabus

SYLLABUS

Subject – Automation and Robotics (ME413)

Section I

Unit 1: – Introduction to Robotics **No. of lectures – 06**

History and fundamentals of Industrial Robots, Definition as per ISO & IFR, components of industrial robots, classification of robots. Collaborative Robots, Service Robots, AGVs, classification, navigation techniques, applications, Mobile robots, wheeled and tracked robots

Unit 02: Sensors, Actuators & End Effectors **No. of lectures - 09**

Sensors: Sensor classification; Internal Sensors: Position Sensors, Velocity Sensors Acceleration sensors & Force sensors External Sensors: Non-contact type- Proximity sensor,

Actuators: Compare Hydraulic, Pneumatic and Electric drives; Linear Actuators; Stepper motors, DC Motors, DC Servo Motors, AC Motors, Variable Frequency Drives, Selection of Actuator for given Application

End Effectors: End effectors & grippers, classification, applications, design, and selection criteria for end effectors.

Unit-3: Kinematics, Dynamics & Control **No. of lectures – 05**

Forward kinematics, Inverse Kinematics for 2 DOF and 3 DOF planar manipulators; Dynamics: Velocity Jacobian, singularities; Control architecture of robots, Overview of advanced control techniques such as force control, PID control adaptive control,

Section II

Unit 4 – Robot Vision/Machine Vision **No. of lectures – 08**

Machine Vision definition and system components, lighting techniques, Image processing fundamentals: Edge detection, shape analysis, segmentation, object identification,template matching, Cameras (CCD, CMOS, Area Scan, Line Scan), camera specification and selection, camera calibration.

Unit 5 – Robot Workcells & Programming **No. of lectures - 06**

Robot cell layout, considerations in workcell design, workcell control, cell safety, human machine interface, robot cell controller.

Lead through programming, walk through programming, offline programming.

Unit 6 – Industrial Robot Applications **No. of lectures – 06**

General considerations for selecting robots (including layout and workcell) for material handling, Pick and place robot and machine tending, spot welding, continuous welding, sealant application, spray painting, assembly,inspection, electronics assembly, ASRS System.

Sr. No	Title of Experiment	Course Outcome	Bloom's Level
1	Forward Kinematics of 2 DOF and 3 DOF supported by suitable open source software.	CO1	L3
2	Theory assignment on sensors, actuators, and grippers.	CO5	L2
3	Assignment on Applications of Robots for Spray painting, pick & place, Welding etc.	CO6	L2
4	Survey assignment on robots, AGVs, manufacturers and applications.	CO1	L2
5	One assignment on Basic Elements of an Automated System	CO5	L2
6	One assignment on Automated Flow lines, Methods of Work-part Transport	CO5	L2
7	One assignment on Automated Storage/Retrieval Systems	CO6	L2
8	One assignment on Types of Material Handling Equipment	CO1	L2
9	Design and Develop the prototype model of pick and place robot by using 3D Printer	CO5	L6

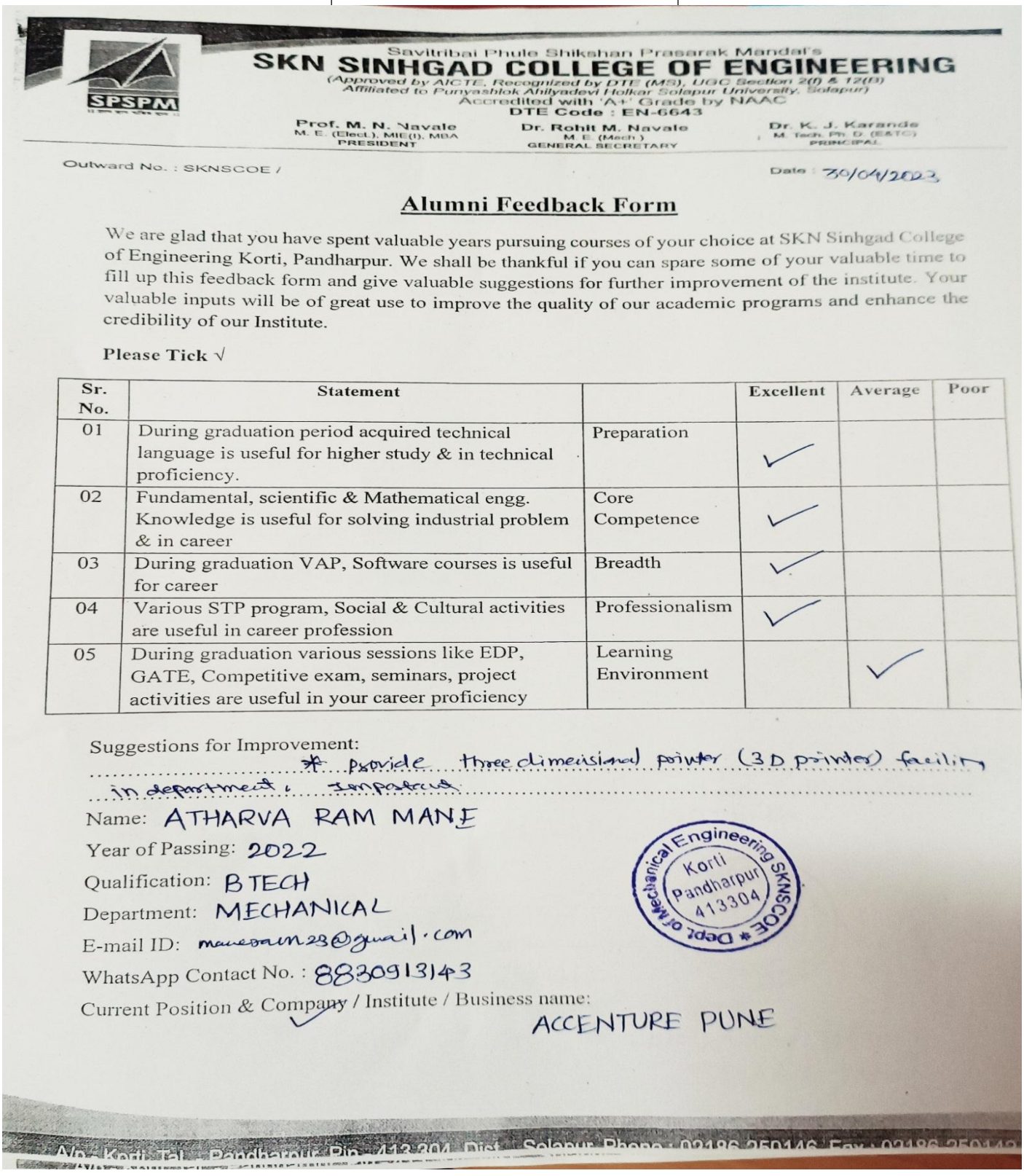
Savitribai Phule Shikshan Prasarak Mandal's

SKN SINHGAD COLLEGE OF ENGINEERING, PANDHARPUR

(Approved by AICTE,New Delhi,Recognized by D.T.E .(M.S)& Affiliated to the Solapur

Accredited by NAAC with A+ Grade

Alumni Suggestions



Savitribai Phule Shikshan Prasarak Mandal's
SKN SINHGAD COLLEGE OF ENGINEERING
(Approved by AICTE, Recognized by DTE (MS), UGC Section 2(f) & 12(B)
Affiliated to Punyashlok Ahilyadevi Holkar Solapur University, Solapur)
Accredited with 'A+' Grade by NAAC
DTE Code : EN-6643

Prof. M. N. Navale, M. E. (Elect.), MIE(I), MBA, PRESIDENT
Dr. Rohit M. Navale, M. E. (Mech.), GENERAL SECRETARY
Dr. K. J. Karande, M. Tech. Ph. D. (E&TC), PRINCIPAL

Outward No. : SKNSCOE /

Date : 30/04/2023

Alumni Feedback Form

We are glad that you have spent valuable years pursuing courses of your choice at SKN Sinhgad College of Engineering Korti, Pandharpur. We shall be thankful if you can spare some of your valuable time to fill up this feedback form and give valuable suggestions for further improvement of the institute. Your valuable inputs will be of great use to improve the quality of our academic programs and enhance the credibility of our Institute.

Please Tick √

Sr. No.	Statement		Excellent	Average	Poor
01	During graduation period acquired technical language is useful for higher study & in technical proficiency.	Preparation	✓		
02	Fundamental, scientific & Mathematical engg. Knowledge is useful for solving industrial problem & in career	Core Competence	✓		
03	During graduation VAP, Software courses is useful for career	Breadth	✓		
04	Various STP program, Social & Cultural activities are useful in career profession	Professionalism	✓		
05	During graduation various sessions like EDP, GATE, Competitive exam, seminars, project activities are useful in your career proficiency	Learning Environment		✓	

Suggestions for Improvement:
* Provide three dimensional printer (3D printer) facility in department, Impotrant

Name: ATHARVA RAM MANE

Year of Passing: 2022

Qualification: B TECH

Department: MECHANICAL

E-mail ID: manesaim23@gmail.com

WhatsApp Contact No. : 8830913143

Current Position & Company / Institute / Business name:
ACCENTURE PUNE

Mechanical Engineering Dept. of SKNSCOE Korti Pandharpur 413304

At Po. Korti, Tal. Pandharpur, Dist. Solapur, Phone : 02186-250146, Fax : 02186-250142

Savitribai Phule Shikshan Prasarak Mandal's
SKN SINHGAD COLLEGE OF ENGINEERING
(Approved by AICTE, Recognized by DTE (MS), UGC Section 2(f) & 12(B)
Affiliated to Punyashlok Ahilyadevi Holkar Solapur University, Solapur)
Accredited with 'A+' Grade by NAAC
DTE Code : EN-6643

Prof. M. N. Navale, M. E. (Elect.), MIE(I), MBA, PRESIDENT
Dr. Rohit M. Navale, M. E. (Mech.), GENERAL SECRETARY
Dr. K. J. Karande, M. Tech. Ph. D. (E&TC), PRINCIPAL

Outward No. : SKNSCOE /

Date : 25/05/2024

Alumni Feedback Form

We are glad that you have spent valuable years pursuing courses of your choice at SKN Sinhgad College of Engineering Korti, Pandharpur. We shall be thankful if you can spare some of your valuable time to fill up this feedback form and give valuable suggestions for further improvement of the institute. Your valuable inputs will be of great use to improve the quality of our academic programs and enhance the credibility of our Institute.

Please Tick √

Sr. No.	Statement		Excellent	Average	Poor
01	During graduation period acquired technical language is useful for higher study & in technical proficiency.	Preparation	✓		
02	Fundamental, scientific & Mathematical engg. Knowledge is useful for solving industrial problem & in career	Core Competence	✓		
03	During graduation VAP, Software courses is useful for career	Breadth	✓		
04	Various STP program, Social & Cultural activities are useful in career profession	Professionalism		✓	
05	During graduation various sessions like EDP, GATE, Competitive exam, seminars, project activities are useful in your career proficiency	Learning Environment	✓		

Suggestions for Improvement:
As per the my knowledge, 3D printing technology is the advance prototype modeling please, purchase fully automatic 3D printer

Name: Adinath Laxman Salunkhe

Year of Passing: 2024

Qualification: B. Tech

Department: Mechanical Engg.

E-mail ID: adisal.3130@gmail.com

WhatsApp Contact No. : 7558526541

Current Position & Company / Institute / Business name:
TE connectivity India Pvt. Ltd. Pune

Dept. of Mechanical Engineering SKNSCOE Korti Pandharpur 413304

Savitribai Phule Shikshan Prasarak Mandal's

SKN SINHGAD COLLEGE OF ENGINEERING, PANDHARPUR

(Approved by AICTE,New Delhi,Recognized by D.T.E .(M.S)& Affiliated to the Solapur

Accredited by NAAC with A+ Grade

Introduction- Process (Flow chart)

- Advanced Manufacturing Technology 3D Printing

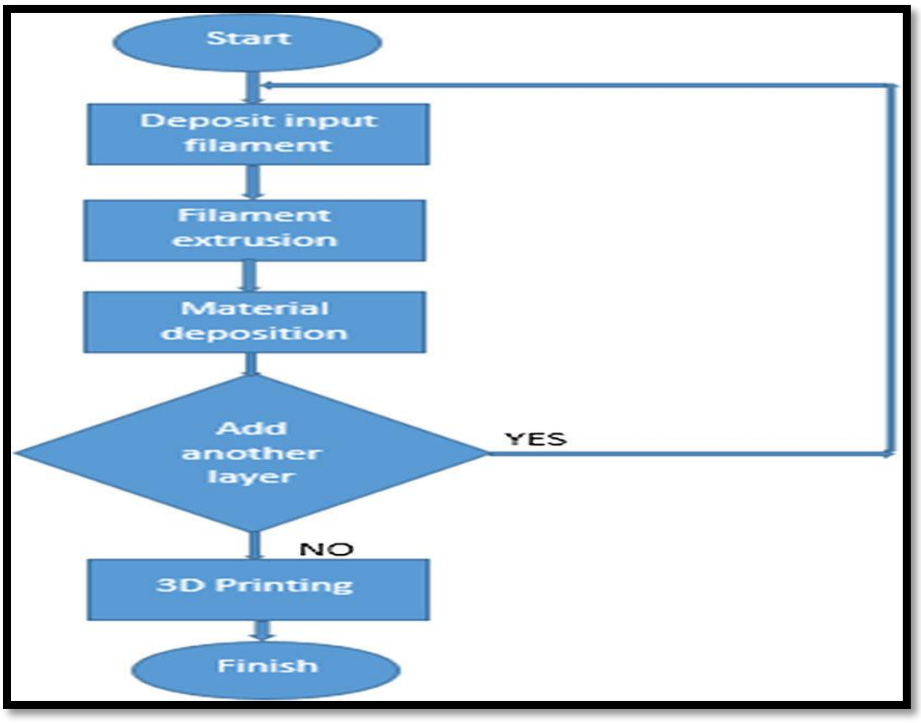
Rapid Prototyping & Rapid Manufacturing

Companies have used 3D printers in their design process to create prototypes since the late seventies. Using 3D printers for these purposes is called **rapid prototyping**.

Why use 3D Printers for Rapid Prototyping?

In short: it's fast and relatively cheap. From idea, to 3D model to holding a prototype in your hands is a matter of days instead of weeks. Iterations are easier and cheaper to make and you don't need expensive molds or tools.

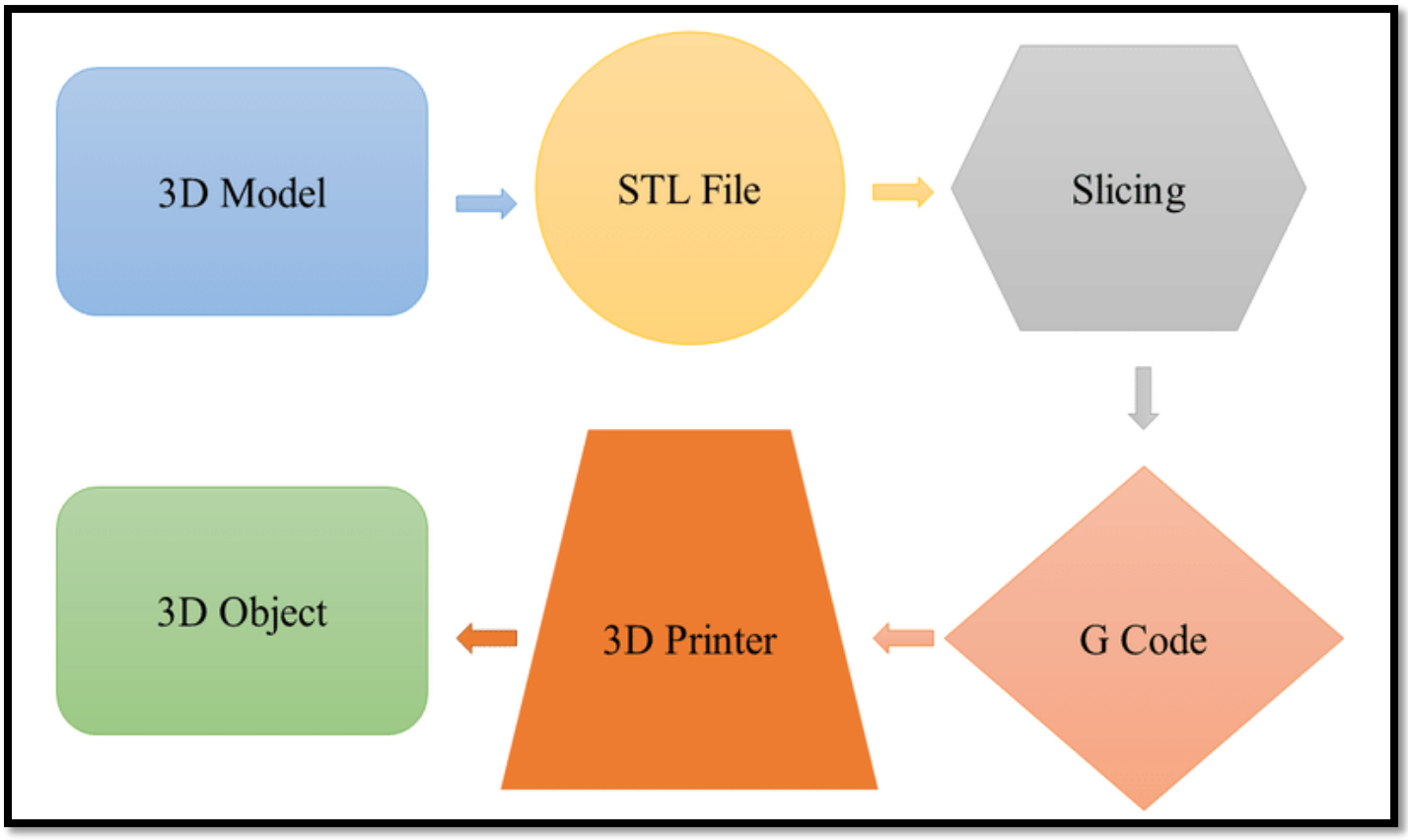
Besides rapid prototyping, 3D printing is also used for **rapid manufacturing**. Rapid manufacturing is a new method of manufacturing where businesses use 3D printers for short run / small batch custom manufacturing. (Flow **chart: 3 D Printing Process)**



Flow chart: 3 D Printing Process

Three-dimensional (3D) printing is an additive manufacturing process that creates a physical object from a digital design. The process works by laying down thin layers of material in the form of liquid or powdered plastic, metal or cement, and then fusing the layers together.

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.



Flow chart: 3 D Printing Process

Examples of 3D Printing

3D printing encompasses many forms of technologies and materials as 3D printing is being used in almost all industries you could think of. It's important to see it as a cluster of diverse industries with a myriad of different applications.

A few examples:

- – consumer products (eyewear, footwear, design, furniture)
- – industrial products (manufacturing tools, prototypes, functional end-use parts)
- – dental products
- – prosthetics
- – architectural scale models & maquettes
- – reconstructing fossils
- – replicating ancient artefacts
- – reconstructing evidence in forensic pathology
- – movie props

Material extrusion

Material extrusion technologies squeeze a material through a nozzle and onto a build plate, layer by layer. Fused deposition modeling (FDM) falls under this category and is the most widely used 3D printing technology.

Benefits

- Fast
- Low cost
- Common thermoplastics

Limitations

- Rough surface finish
- Anisotropic
- Usually requires supports
- Not scalable
- Limited accuracy

Cost of Material

3D printing will play an increasingly crucial role in advancing sustainability initiatives within the manufacturing sector. More efficient use of materials and support of circular economy principles are expected to result from 3D printing technology penetration into general manufacturing.

Basic materials such as PLA and ABS are usually affordable, with prices typically around **Rs.1000 to 1200 per kilogram**.

- Additional Facility for product development (3D Printer)

3D Printer with Filament

Technical Specifications:

- Printing Technology： FDM. Leveling
- Mode： Hands-free auto leveling.
- Build Volume： 220*220*250mm.
- File Transfer： USB drive, Wi-Fi.
- Product Dimensions： 355*355*482mm.
- Display Screen： 4.3" color touch screen.
- Package Dimensions： 441*441*578mm ...
- Net Weight： 12.4kg. ...
- Gross Weight： 16kg. ...
- Printing Speed： ≤600mm/s. ...
- Acceleration： ≤20000mm/s²

Savitribai Phule Shikshan Prasarak Mandal's

SKN SINHGAD COLLEGE OF ENGINEERING, PANDHARPUR

(Approved by AICTE,New Delhi,Recognized by D.T.E .(M.S)& Affiliated to the Solapur

Accredited by NAAC with A+ Grade

Use of ICT

3D Software

There are many different software tools available. We've created an overview on our 3D software page.We often recommend beginners to start with **CATIA, FUSION360**, and **PRO-E**. CATIA offers beginner lessons and has a built-in feature to export your model as a printable file e.g .STL.Now that you have a printable file, the next step is to prepare it for your 3D printer. This is called slicing.

Slicing: From file to 3D Printer

Slicing basically means slicing up a 3D model into hundreds or thousands of layers and is done with slicing software. When your file is sliced, it's ready for your 3D printer. Feeding the file to your printer can be done via USB, SD or Wi-Fi. Your sliced file is now ready to be 3D printed **layer by layer**

Open source software list for 3D printing.

List of 3D Printing Software[1]

Software	Use	Developer	Operating System(s)
3D Slash	Design	3D Slash	Web application, Windows, macOS, Linux
3D Systems		3D Systems	Windows
3YourMind		3YourMind	Web application
AstroPrint	Printer control, slicer, data management	3DaGoGo Inc.	Web application
Blender	Design	Blender Foundation	Windows, macOS, Linux
Cura	Slicer	Ultimaker	Windows, macOS, Linux
FreeCAD	Design	FreeCAD Community	Windows, macOS, Linux
Fusion	Design	Autodesk	Windows, macOS, web application, Android, iOS
Markforged	Slicer	Markforged	Web application
Materialise NV		Materialise NV	Windows
MatterControl	Design, slicer	MatterHackers	Windows
MeshLab	Object processing	ISTI - CNR	Windows, macOS, Linux

OctoPrint	Printer control	OctoPrint community	Windows, macOS, Linux
Onshape	Design	PTC	Windows, macOS, Linux
OpenSCAD	Design	OpenSCAD Community	Windows, macOS, Linux, FreeBSD, NetBSD, OpenBSD
Polar Cloud	Printer control, data management	Polar3D	Web application
PreForm	Slicer	Formlabs	Windows and macOS
Repetier-Host	Printer control	Hot-World GmbH & Co. KG	Windows, macOS, Linux
SelfCAD	Design, slicer	SelfCAD	Web application
Siemens NX	Design	Siemens Digital Industries Software	Windows, macOS, Unix
Slic3r	Slicer	Alessandro Ranellucci	Windows, macOS, Linux
Solid Edge	Design	Siemens Digital Industries Software	Windows
SolidWorks	Design	Dassault Systèmes	Windows

Savitribai Phule Shikshan Prasarak Mandal's

SKN SINHGAD COLLEGE OF ENGINEERING,
PANDHARPUR

(Approved by AICTE,New Delhi,Recognized by D.T.E .(M.S)& Affiliated to the Solapur

Accredited by NAAC with A+ Grade

Outcome (Products)

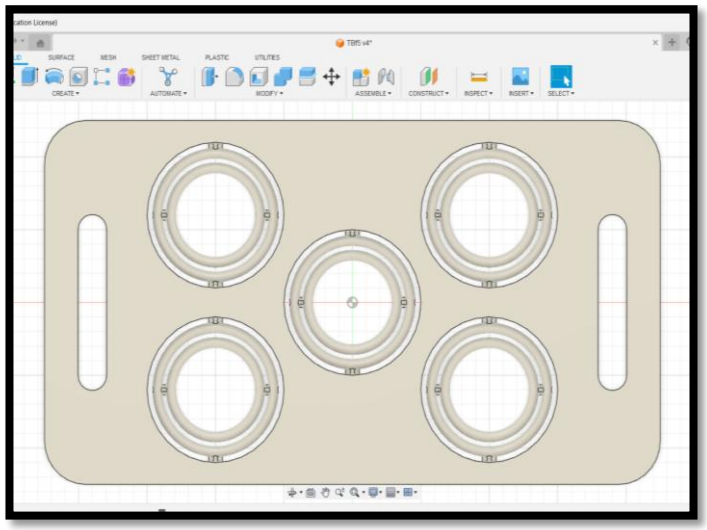
1. Our student are published patent on product which is printed on 3D Printer: -

1. Niyantaa Vinod Shendge.
2. Ashutosh Dnyaneshwar Kore.
3. Shreyash Shrikant Karanjkar.
4. Pradeep Sudhakar Khurd

Poise Tray:

ISOMETRIC VIEW

TOP VIEW



Patent published

(12) PATENT APPLICATION PUBLICATION
(19) INDIA
(22) Date of filing of Application :19/03/2024

(21) Application No.202421020500 A
(43) Publication Date : 19/04/2024

(54) Title of the invention : EVERLEVEL TRAY

(51) International classification :G06Q0010060000, G02B0027000000, A47G0023060000, A45D0034040000, B01J0019240000
(86) International Application No :NA
Filing Date :NA
(87) International Publication No : NA
(61) Patent of Addition to Application Number :NA
Filing Date :NA
(62) Divisional to Application Number :NA
Filing Date :NA

(71)**Name of Applicant :**
1)Swanand Gajanan Kulkarni
Address of Applicant :Korti road, Prashant Parichavak Nagar, Pandharpur ---------- ----------
2)SKN Sinhgad College of Engineering, Korti Pandharpur
3)KAILASH JAGANNATH KARANDE
4)ATUL SHRIPAD ARADHYE
5)SHYAM SHRIDHAR KULKARNI
6)UMESH SURESH GHOLAP
7)PRASAD PADMAKAR KULKARNI
8)Niyantaa Vinod Shendge
9)Pradip Sudhakar Khurd
10)Shreyash Shrikant Karanjkar
11)Ashutosh Dnyaneshwar Kore
Name of Applicant : NA
Address of Applicant : NA
(72)**Name of Inventor :**
1)Niyantaa Vinod Shendge
Address of Applicant :2541, Santmudra, Near Shri Virthal Temple, Mahadwar Road, Pandharpur Pandharpur ---------- ---------- ----

(57) Abstract :
The significance of a Everlevel Tray extends beyond mere convenience; it is an indispensable tool fostering stability, safety, and efficiency in the transportation of items. Its pivotal role in streamlining operations and elevating service quality across diverse industries cannot be overstated. As a reliable and user-friendly solution, an Everlevel Tray not only optimizes current workflows but also promises to adapt to evolving needs through continuous innovation. The Everlevel Tray is designed in present investigation is flexible in shape containing the tray to hold cups/tumbler as shown in Figure 1. The hole of the diameter is decided based on application. Inside each hole, a circular, square or any shape of ring is attached as per required application. Tray utilizes stability principle to maintain balance and stability. When the tray is tilted or moved, the stability effect helps to keep the cups/tumbler steady and prevents them from spilling. This tray ensures that the rings can rotate freely within the holes.

TRAY BODY: -

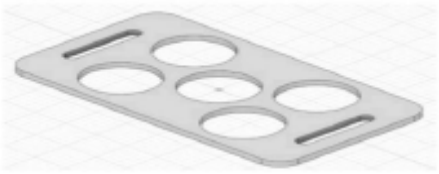


Figure 1 Tray Body

No. of Pages : 17 No. of Claims : 6

2. First prize in **AVISHKAR Project Convention**
Our Mechanical engineering students awarded **first prize** in **AVISHKAR** under category of commerce management and law.

Niyantaa Vinod Shendge.
Ashutosh Dnyaneshwar Kore.
Shreyash Shrikant Karanjkar.
Pradeep Sudhakar Khurd.

Project Guide: Prof. Umesh S Gholap.
Project Name: **Poise tray**

Certificate

Award – First prize

3. Our Mechanical engineering students print **prototype model of Industrial robot** as a Mini project work

1. Patil Rahul
2. Deshmukh Onkar
3. Langote Shubham
4. Kadam Aviraj

Robot manipulator

4. Our Mechanical engineering student Miss Akanksha Gholap print **prototype model of Ship**

Ship model

5. Our Mechanical engineering student Miss Ashwini Pawar print **prototype model of Tooth paste and tooth brush stand**

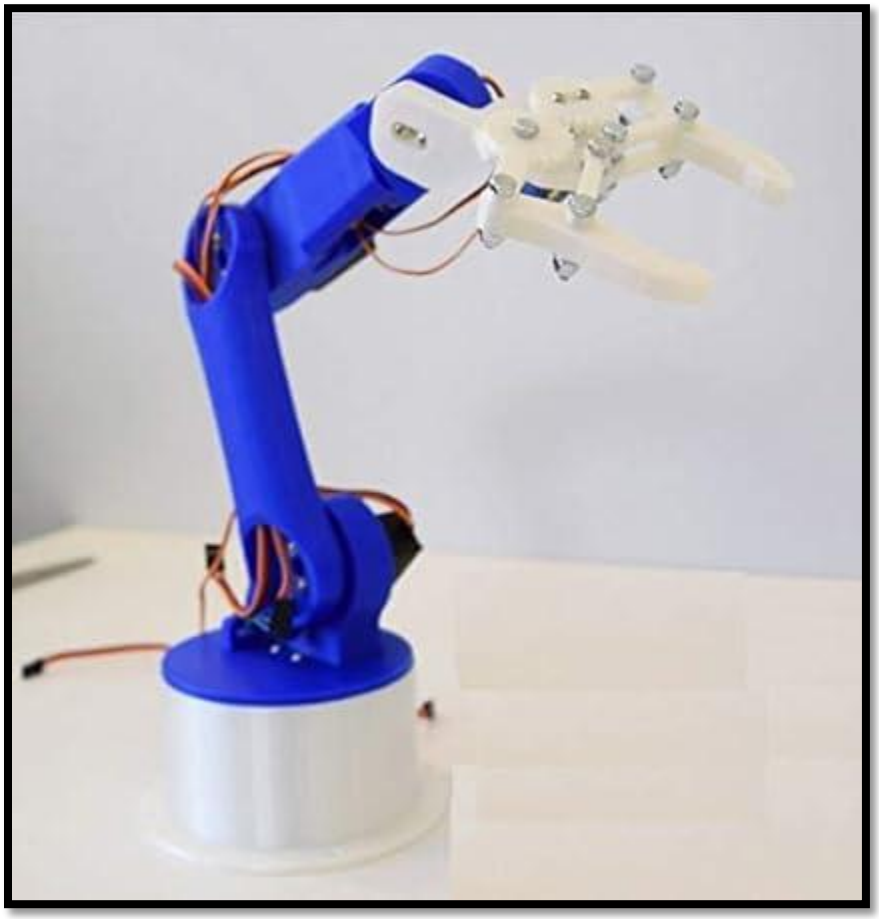
Tooth paste and tooth brush stand

6. Our Mechanical engineering students Miss Sonawane Gitanjali print **prototype model of Mobile stand**

Mobile stand

7. Our Mechanical engineering students manufacture **prototype model of pick and place robot** as a Mini project work

1. Antrolikar Riya
2. Deshmukh Priyanka



Pick and place Robot arm (Mini project)