

As Per NEP 2020

University of Mumbai



Syllabus for Basket of OE	
Board of Studies in Mechanical Engineering	
UG Second Year Programme	
Semester	III/IV
Title of Subject	Credits
Introduction to 3D Printing	2
From the Academic Year	2024-25

Vertical –3
Open Elective

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
2043311	Introduction to 3D Printing	2	-	-	2	-	-	2

		Theory					Term work	Pract / Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (in Hrs)			
		Test 1	Test 2	Total					
2043311	Introduction to 3D Printing	20	20	40	60	2	--	--	100

Rationale:

This course offers introduction to 3D printing technology, covering its fundamentals, history, and evolution. Students will gain a comprehensive understanding of the principles and processes involved in creating three-dimensional objects from digital models. There is a growing demand for professionals skilled in 3D printing, as industries seek to adopt this technology for its cost-effectiveness, flexibility, and ability to reduce time-to-market.

Course Objectives:

1. To study the fundamentals of 3D printing.
2. To study basic concepts of 3D printing and their application in product development.
3. To study different working materials and systems used in 3D printing
4. To understand matrix of 3D printer, scanning systems and suitable processing materials

Course Outcomes:

1. Describe working principles of additive manufacturing techniques
2. Select proper 3D printing techniques for specific technical applications.
3. Select an appropriate material and tools to develop a given product using 3D printer.
4. Articulate process plan for printing 3D component

Prerequisite: Knowledge of physics and mathematics of 12th Science Level.

DETAILED SYLLABUS:

Sr. No.	Name of Module	Detailed Content	Hours	CO Mapping
0	Prerequisite	Knowledge of physics and mathematics of 12th Science Level.		
I	Introduction to 3D Printing and 3D Modeling	Development by additive ways in nature. History of 3D printing: Technology and Invention, Additive/Subtractive manufacturing and their use cases. • Introduction on Potential Field Applications of 3D printings in: Automotive, Jewelry, Bio-Medical, Toy Making, Hobbyists, Dental implants, aerospace etc. Generalized 3D printing process chain, Generalized Subsystems of 3D Printer. CAD Softwares for 3D modeling.	4	CO1
II	Liquid Based 3D Printing System	Types of Liquid Based 3D Printing Systems. Basic working Principles of Liquid Based 3D Printing Systems. Matrix of 3D printer and Materials for above types Case studies of Parts developed using Solid Based 3D Printing Systems	9	CO2
III	Solid Based 3D Printing System	Types of Solid Based 3D Printing Systems. Basic working Principles of Solid Based 3D Printing Systems. Matrix of 3D printer and Materials for above types Case studies of Parts developed using Solid Based 3D Printing Systems	4	CO3
IV	Powder Based 3D Printing System	Types of Powder Based 3D Printing Systems. Basic working Principles of Powder Based 3D Printing Systems. Matrix of 3D printer and Materials for	9	CO4

		above types Case studies of Parts developed using Powder Based 3D Printing Systems		
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Text Books:

1. Chua C.K., Leong K.F., and Lim C.S., "Rapid Prototyping Principles and Applications", World Publishing Co. Pte.Ltd.
2. James O. Hamblen, and Michael D. Furman, "Rapid Prototyping of Digital Systems", KluwerAcademic Publishers.
3. Kenneth G. Cooper, "Rapid Prototyping Technology Selection and Application", 2001, Marcel Dekker Inc, New York.
4. Ali Kamrani, EmadAbouel Nasr, "Rapid Prototyping Theory and Practice", 2006, Springer Inc.
5. BopayaBidanda, Paulo J. Bartolo, "Virtual Prototyping and Bio Manufacturing in Medical Applications", 2008, Springer Inc.
6. I. Gibson, D.W. Rosen, and B. Stucker, "Additive Manufacturing Technologies Rapid Prototyping to Direct Digital Manufacturing", 2010, Springer Inc.

References:

1. "Additive Manufacturing: Materials, Processes, Quantifications and Applications" by Jing Zhang, Yeon-Gil Jung, Butterworth-Heinemann, 2018.
2. "Additive Manufacturing: 3D Printing for Prototyping and Manufacturing" by Andreas Gebhardt, Jan-Steffen Hötter, Hanser Publications, 2023.
3. "Fundamentals of Additive Manufacturing for the Practitioner" by Sheku Kamara, Wiley, 2021.
4. "Additive Manufacturing: Design, Methods, and Processes" by Steinar WesthrinKilli, Olaf Diegel, CRC Press, 2019.
5. "Laser Additive Manufacturing: Materials, Design, Technologies, and Applications" edited by Milan Brandt, Woodhead Publishing, 2016.
6. "Additive Manufacturing of Metals: Fundamentals and Testing of 3D and 4D Printing" by Li Yang, M. Ian G. Durney, Elsevier, 2020.
7. "Additive Manufacturing Handbook: Product Development for the Defense Industry" edited by Adedeji B. Badiru, CRC Press, 2017.

Assessment:

Internal Assessment (IA) for 20 marks:

- IA will consist of Two Compulsory Internal Assessment Tests. Approximately 40% to 50% of syllabus content must be covered in First IA Test and remaining 40% to 50% of syllabus content must be covered in Second IA Test

☐ **Question paper format**

- Question Paper will comprise of a total of **six questions each carrying 20 marks** Q.1 will be **compulsory** and should **cover maximum contents of the syllabus**
- **Remaining questions** will be **mixed in nature** (part (a) and part (b) of each question must be from different modules. For example, if Q.2 has part (a) from Module 3 then part (b) must be from any other Module randomly selected from all the modules)
- A total of **Three questions** need to be answered

Dr. S.M.Khot

BoS-Chairman-Mechanical Engg

Faculty of Technology

Dr. Deven Shah

Associate Dean

**Faculty of Science &
Technology**

Prof. Shivram S. Garje

Dean

**Faculty of Science &
Technology**