M.D. UNIVERSITY, ROHTAK
SCHEME OF STUDIES AND EXAMINATION
Certificate Course in 3D Printing and Design

Scheme and Syllabus

Course Code	Course Name	No. of Credits	Hours/ week (L+T+P)	Internal Assess.	Theory	Practical	Max. marks	Duration of Exam
23UMEEEC01	3D Printing & Design	3	(2+0+1)	15	35	25(5+20)	75	3 Hrs

Total Internal marks (Theory+ Practical) =20
Total External marks (Practical) =20
Theory Exam=35

Program Name	Certificate Course in 3D Printing and Design		
Course Name	3D Printing and Design	Course Code	23UMEEEC01
Credits	3	No. of hours/Week(L+T+P)	(2+0+1)
Duration of End term examination	03 hrs	Max. marks	**Th: 35** **IA: 15** **Practical:25** **IA:05** **EA:20**

Note: Examiner will set nine questions in total. Question one will have 7 parts of 1 marks each from all units and remaining eight questions of 7 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Objectives:

- The objective of this '3D printing and design' course is to introduce students to additive manufacturing, a fast developing and widely utilised fabrication technology.
- It is aimed to make the students aware of the technology for conceptual modelling, prototyping and rapid manufacturing. It is also aimed to introduce reverse engineering (RE).
- Its goal is to provide in-depth understanding of the many uses and benefits of additive manufacturing (AM) in industry and society, with a focus on major applications including rapid tooling, manufacturing, and healthcare.

Course Outcomes:

The course imparts training in core additive manufacturing technology i.e. Fused deposition modeling (FDM) which is commonly used for modeling, prototyping, and production applications.The course equips to use digital tools and techniques necessary for exploring 3D designs and 3D printing.

Upon the completion of this course

- Students will able to understand about various additive manufacturing techniques
- Students will able to knowdetail steps to perform FDM 3D Printing and its process parameters, 3D scanning and cad modelling.
- Students will able to know the wide applications of Additive Manufacturing (AM) in industry and society.

UNIT 1: INTRODUCTION

Introduction to layered manufacturing, Importance of Additive Manufacturing, Additive Manufacturing in Product Development, Classification of additive manufacturing processes, Common additive manufacturing technologies; Vat photopolymerisation, Material Extrusion, Material Jetting, Binder Jetting, Powder bed fusion, Direct energy deposition and Sheet lamination., Selective Laser Sintering, Direct Metal Selective laser Sintering

UNIT 2:3D PRINTING, SCANNING &CAD MODELLING:

3D Scanning and digitization, data handling &reduction Methods, AM Software: data formats and standardization, Slicing software, Process-path generation ,Part Orientation and support generation.

UNIT 3: FDM PRINTING

Principle of FDM/FFF printing, Basic steps to perform FDM printing, Significant process parameters of FDM printing, layer height, raster angle, raster width, build temperature, Nozzle temperature, orientation, printing speed etc

Types of FDM printer: Cartesian, Polar, delta, Robotic (SCARA), continuous, dual extruder, independent dual extruder

FDM Materials: PLA, ABS, PETG, Nylon, PVA, PC, TPU, Carbon reinforced nylon, ceramics, metals, Dual and multi material etc

UNIT 4:APPLICATIONS FOR ADDITIVE MANUFACTURING

The Use of AM to Support Medical Applications 1. Surgical and Diagnostic Aids 2. Prosthetics Development 3. Manufacturing 4. Tissue Engineering and Organ Printing; Automotive Industries, Aerospace IndustriesArchitectural Engineering

Students have to perform the following activities in lab (3D Printing and Design Practicals):
Practical:25
IA(Internal Assessment):05
EA(External Assessment):20

1. Make a cube of any dimension using FDM 3D Printer.
2. Slicing Software basics-I. Setting up the build temperature, nozzle temperature, speed, material, layer height
3. Slicing Software basics-II Setting up infill density, infill pattern, orientation of object, support material wall thickness, converting .stl file to .G-code file etc.
4. Download a .stl file of simple object from internet, convert into G-code and print with FDM 3D Printer at 30% infill density.
5. Download a .stl file of simple object which require support material from internet, convert into G-code and print with FDM 3D Printer.
6. Design the Key ring of your own name in a CAD software and print it using FDM printer.
7. Print a cube using SLA/DLP printer
8. Emboss / engrave your name on a 3D object and print it with ABS material.
9. Reverse engineering- Scan your own face by 3D Scanner and then 3D print it.

Reference Books

1. Ian Gibson, Ian Gibson. "Additive manufacturing technologies 3D printing, rapid prototyping, and direct digital manufacturing." Springer International Publishing, 2010
2. Harshit K. Dave, J. Paulo Davim Fused Deposition Modeling Based 3D Printing, Springer International Publishing, 2021.
3. Manu Srivastava, Sandeep Rathee, Sachin Maheshwari, TK Kundra Additive Manufacturing Fundamentals and Advancements CRC press, 2019/
4. Chua, C.K., Leong K.F. and Lim C.S., "Rapid prototyping: Principles and applications", second edition, World Scientific Publishers, 2010.
5. Kamrani, A.K. and Nasr, E.A., "Rapid Prototyping: Theory and practice", Springer, 2006.