

Course Code	Course Name	Credits
MESBL401	Skill based Lab: CNC and 3-D Printing	02

Objectives:

1. To familiarize with subtractive manufacturing process in particular CNC systems.
2. To acquaint with basic part programming process for specific operations.
3. To familiarize with additive manufacturing process in particularly 3D printing.
4. To acquaint with basic process of 3D modeling using biomedical data.

Outcomes: Learner will be able to....

1. Develop and execute part programming for any given specific operation.
2. Build any given object using various CNC operations.
3. Demonstrate CAM Tool path and prepare NC- G code.
4. Develop 3D model using available biomedical data
5. Build any given real life object using 3D printing process.
6. Convert 2D images into 3D model

Sr. No.	List of Exercises	Hrs.
1	Part programming and part fabrication on CNC Turning trainer (Involving processes like Step turning, facing, Taper turning, threading, etc.) (One job in a group of 4-5 students)	24
2	Part programming and part fabrication on CNC Milling trainer (Involving processes like contouring, drilling, facing, pocketing etc.) (One job in a group of 4-5 students)	
3	Part Programming Simulation for any Unconventional Machining Process (Electric Discharge Machining, laser cutting Machining, Plasma Cutting Machining etc.)	
4	Tool-path generation by translation of part geometry from computer aided design (CAD) to computer aided manufacturing (CAM) systems.	
5	Post processing of Code generated via CAM system	
6	Case Study: Report on a visit conducted to any Commercial CNC Machining Centre explaining the Design features, pre processing in CAM software and its capabilities.	
7	Development of physical 3D mechanical structure using any one of the rapid prototyping processes.	24
8	Check the constraints of any two RP systems for features like layer thickness, orientation of geometry, support generation, post processing etc.	

9	Design an object with free form surface & printing it using any RP process.
10	Segmentation in Slicer's Segment Editor module for the purpose of 3D printing (3D Slicer open source) (Application: Any Bone part as per available Dicom files)
11	Creation of 3D model from 2D images using any image processing software and printing it. (3D Slicer open source) (Application: Any body organ like Heart, Gallbladder etc. as per available Dicom files)
12	Case Study: Usability of rapid tooling integrated investment casting process, with their advantages and limitations in any one of emerging areas of dentistry, jewelry, surgical implants, turbine blades, etc.

Assessment:

Term work shall consist of

- Any **4 exercises from 1 to 6 and 3 exercises from 7 to 11 of the above list**
- Exercise 12 is mandatory.

The distribution of marks for term work shall be as follows:

1. Part A Exercises: 10 Marks
2. Part B Exercises: 10 Marks
3. Attendance: 05 Marks

Practical/Oral examination

1. Each student will be given a practical assignment on the basis of the above exercises which will be completed within a given time and assessed by examiners during the oral examination.
2. The distribution of marks for oral-practical examination shall be as follows:
 - a. Practical Assignment : 15 marks
 - b. Oral : 10 marks
3. Evaluation of practical/oral examination to be done based on the performance of practical assignment.
4. Students work along with evaluation report to be preserved till the next examination

References:

1. CAD/CAM Principles and Applications, P. N. Rao, Tata McGraw Hill Publications
2. CNC Technology and Programming, Krar, S., and Gill, A., McGraw Hill Publishers.
3. CNC Programming for Machining, Kaushik Kumar, ChikeshRanjan, J. Paulo Davim, Springer Publication.
4. Medical Modelling The Application of Advanced Design and Rapid Prototyping Techniques in Medicine, Richard Bibb, Dominic Eggbeer and Abby Paterson, Woodhead Publishing Series in Biomaterials: Number 91, Elsevier Ltd.

5. Biomaterials, artificial organs and tissue engineering, Edited by Larry L. Hench and Julian R. Jones, Woodhead Publishing and Maney Publishing, CRC Press 2005
6. Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, I. Gibson | D. W. Rosen | B. Stucker, Springer Publication.
7. Rapid Prototyping and Manufacturing, P. F. Jacobs, Society of Manufacturing Engineers

muquestionpapers.com