

**DOMAIN TITLE: Manufacturing (Conventional, CNC and Additive)  
CMCU2150**

Sl. No.	Course Code	Course Title	Course Type	T-P-Pr	Credits
1	CUCM2150	Manufacturing Requirements and Planning (Jigs & Fixtures; Process Planning & Cost Estimation)	Theory	2-0-0	2
2	CUCM2151	Conventional Machining for Cylindrical and Prismatic Shape Components	Practice+ Project	0-4-2	6
3	CUCM2152	CNC Machining (0-6-2)	Practice+ Project	0-6-2	8
4	CUCM2153	Non-Traditional Machining and 3D Printing 0-2-2	Practice+ Project	0-2-2	4
5	CUCM2154	Wood Engineering (0-2-0)	Practice	0-2-0	2
6	CUCM2155	Internship	Project	0-0-4	4
<b>Total</b>					<b>26</b>

**Domain Track Objectives:**

To provide in-depth technical training & knowledge of machining technologies and machinery which would strengthen product development and industrial-institutional partnership.

**Domain Track Course outcomes:**

Students will be able to

1. Operative machine tools effectively & efficiently
2. Produce components/products by executing various operations with desired accuracy & finish

**Manufacturing Requirements and Planning (Jigs & Fixtures; Process Planning & Cost Estimation) 20 Hrs**

<b>Course Title</b>	<b>Course Code</b>	<b>Type of Course</b>	<b>T-P-Pr</b>	<b>Pre-Requisite</b>
Manufacturing Requirements and Planning (Jigs & Fixtures; Process Planning & Cost Estimation)	CUCM2150	Theory	2-0-0	Nil

**Objective**

- To learn basic concepts, functions and design principles of Jigs and Fixtures
- To know the importance of work piece location & clamping
- To learn fundamentals and execution of process planning and cost estimation for a component need to be manufactured

**Course outcome**

- Necessitate the need of jigs, fixtures and special tools in modern day production
- Identify appropriate combination of tools, jigs and fixture, suitable for a particular machining operation

**Course content (20 Hrs)**

**Module I Introduction to Jigs & Fixtures (2 Hrs)**

**Theory**

Fundamental Concept and Need of Jigs and Fixtures; Jigs and Fixtures design principles and factors; Materials used in jigs & Fixtures.

**Module II Locators (3 Hrs)**

**Theory**

General Principles of Degrees of Freedom and Constraints; Foolproofing; Basic rules for location; Locating methods, Types of locators.

**Module III Clamps & Indexing Devices (3 Hrs)**

**Theory**

Principles of clamping, Types of clamps, Liner indexing, precision linear indexing and rotary indexing

**Module IV Various Jigs & Fixtures (3 Hrs)**

**Theory**

Components of Jigs, Types of Jigs, Selection of Jigs

**Module V Types of Fixtures (3 Hrs)**

**Theory**

Salient features of milling fixtures, Classification of milling fixtures, Facing fixtures, Slotting Fixtures. Turning (Standard chucks, Spring collets, Cylindrical liners, Mandrels, Turning Fixtures), Grinding, broaching, welding and modular fixtures

**Module VI Process Planning: Introduction (3 Hrs)****Theory**

Objectives and Approaches to Process Planning; Process Planning Activities; Process Planning & Production Planning; Operating Sequences, Setup Documents for Process Planning.

**Module VI Introduction to Cost Estimation (3 Hrs)****Theory**

Objectives of Cost Estimation; Components of a Cost Estimate; Cost Estimation Procedure; Classification of Costing; Elements of Cost; Expenses; Cost accounting, Types of Cost Estimates; Methods of Cost Estimates; Data Requirements and Sources of information; Allowances in Estimation (of Standard Time)

**Text Books**

1. Joshi, P H, Jigs & Fixtures, 2010, 3<sup>rd</sup> Edition, McGraw Hill.
2. Nagpal, G R, Tool Engineering & Design, 2000, Khanna Publishers.

**Reference Books**

1. Venkataraman, K, Design of Jigs, Fixtures & Press Tools, 2015, Wiley & Sons
2. Mehta, N K, Metal Cutting and Design of Cutting Tools, Jigs & Fixtures, 2015, McGraw Hill

**Conventional Machining for Cylindrical and Prismatic Shape Components (75 Hrs)**

Course Title	Course Code	Type of course	T-P-Pr	Pre-Requisite
Conventional Machining for Cylindrical and Prismatic Shape Components	CUCM2151	Practice+ Project	0-4-2	

**Objective**

- To practise principles & requirements of machining and machine tools to get cylindrical surfaces
- To get knowledge on latest technologies used in automobile engineering

## Course outcome

- To operate machine effectively & efficiently.
- To produce a component by executing various operations with desired tolerance

## Course content

### Course Outline

1. Cylindrical Turning Operations ( Both Internal and External), Knurling, Thread Cutting, Stepped Turning)
2. Kinematic Study of Centre Lathe
3. Hole Making Operation in Turret Lathe
4. Work Holding and Tool Holding Devices For Turning Operations
5. Kinematic Study of Pillar Drilling Machine, Radial Drilling Machine and Boring Machine
6. Counter Boring , Counter Sinking and Threading Operations
7. Finishing Operations
8. Kinematic Study of Shaping Machines and Planning Machine
9. Work Holding and Tool Holding Devices Used for Shapers, Planers and Grinders
10. Machining Operations Using Flat Grooves, Flat and Bevel Surfaces, Dovetailed Surfaces
11. Kinematic Study of Horizontal Milling Machine, Vertical Milling Machine
12. Surface Grinding Machines
13. Work Holding and Tool Holding Devices Employed in Milling Machines
14. Flats, Grooves, Slots and Keyways Cutting Using Milling Machine
15. Gear Cutting Using Milling Machine
16. Process Planning of Prismatic Components, Logical sequencing of Operations
17. Estimation of Machining Operations Time and Cost

### Text Books

1. Rajput, R K, A Text Book of Manufacturing Technology, 2007, 1<sup>st</sup> Edition, Laxmi Publications.
2. Rao, P N, Manufacturing Technology, Volume 2, 2009, 2<sup>nd</sup> Edition, McGraw Hill.

### Reference Books

1. Abdel, H, Fundamentals of Machining Processes: Conventional and Nonconventional Processes, 2008, CRC Press.
2. Sharma, P C, A Text Book of Production Technology: Manufacturing Processes, 2009, S Chand Publishers.

## CNC Machining (100 Hrs)

Course Title	Course Code	Type of Course	T-P-Pr	Pre-requisite
CNC Machining	CUCM2152	Practice+ Project	0-6-2	8

### Objective

- To acquire CNC operations skills and accomplish various jobs with desired dimensional accuracy

### Course outcome

- Do manual part programming effectively.
- Operate CNC machine to produce component with desired dimensional accuracy

## Course Outline

### Module I Introduction to CNC (5 Hrs)

Numerical control, Functions of Machine Tool, Concept of numerical control, Feature of CNC, Machine control unit for CNC, Classification of CNC Machine Tool.

### Module II CNC Fanuc Controller (20 Hrs)

CNC Fanuc Controller: Fanuc Control Panel, Modes of Control Panel, Hard Key, Soft Key, Chock, Hard Jaw, Soft Jaw, Job setting.

### Module III Cutting Tools (10 Hrs)

Nomenclature of CNC Cutting Tools, Identification of Cutting Tools, Manual Cutting Operations, Offsetting and its Types.

### Module IV Production Drawing (15 Hrs)

Concept of Projection, Understanding the Views, Orthographic view & Isometric View, Reading of Dimensional Tolerance and Geometrical Tolerance.

### Module V NC Programming (35 Hrs)

Developing program for Facing, Turning, Taper Turning, Drilling, Boring and Threading by following Process Plan.

### Module VI CNC Milling (5 Hrs)

Fundamentals of CNC Milling, Tool Magazine, ATC, Manual Part Programming for Pocketing.

### Module VII 5-Axis Machining (10 Hrs)

Fundamentals of 5-Axis Machining and Turn-Mill Machining.

**Text Books**

1. Groover, M P, CAD/CAM Computer-Aided Design and Manufacturing, 2008, Pearson Education.
2. Radhakrishnan, P, CAD/CAM/CIM, 2018, New Age International.

**Reference Books**

1. Jain, R K, Production Technology, 2008, 17<sup>th</sup> Edition, Khanna Publishers.
2. Agarwal, P M, CNC Fundamentals & Programming, 2014, 2<sup>nd</sup> Edition, Charotar Publishers.

**Non-traditional Machining and 3D Printing (50 Hrs)**

Course Title	Course Code	Type of Course	T-P-Pr	Pre-Requisite
Non-traditional Machining and 3D Printing	CUCM2153	Practice + Project	0-2-2	Nil

**Objective**

- To understand the principle, mechanism of metal removal of various unconventional Machining processes

**Course outcome**

- Identify different Non-traditional machines and its working principle
- Choose suitable non-traditional machine by identifying different man-machine-material

**Course Outline**

**Module I Introduction (5 Hrs)**

Need of Non -traditional Machining, Classification of NTM.

**Module II Electric Discharge Machining (20 Hrs)**

Electric Discharge Machining Fundamentals, Machine Structure, Machine Control Panel, Machine Input and Output Parameters.

**Module III EDM Process Parameters (5 Hrs)**

Machining Parameters, Plotting of Output graphs, Machining of Brass and Bright Steel. Performance Characteristics, Dielectric Fluid.

#### **Module IV Additive Manufacturing (10 Hrs)**

Concept, Rapid Prototyping Process, Various Rapid Prototyping Technologies: SLA, LOM, SLS and FDM.

#### **Module V 3D Printing (10 Hrs)**

Fundamentals of 3D Printing, Machine structure and its Controller. Advantage, Disadvantage and its Applications, Performance Evaluation.

#### **Text Books**

1. Pandey, P C, Modern Machining Processes, 2008, McGraw Hill
2. Jain, V K, Advanced Machining Processes, 2010, Allied Publishers

#### **Reference Books:**

1. Abdel, H, Advanced Machining Processes: Nontraditional and Hybrid Machining Processes, 2005, McGraw Hill
2. Rao, P N, Manufacturing Technology, Volume 1, 2009, Tata McGraw Hill Publication.

### **Wood Engineering (25 Hrs)**

<b>Course Name</b>	<b>Code</b>	<b>Type of course</b>	<b>T-P-P</b>	<b>Prerequisite</b>
Wood Engineering	CUCM2154	Practice	0-2-0	Nil

#### **Course Objective**

- To provide in-depth technical training & knowledge of latest processing technologies and machineries used in wood science and engineering which strengthen the Industrial-Institutional partnership

#### **Course Outcome**

- Develop manufacturing logic and knowledge
- Operate machines and to use jigs-fixtures effectively
- Build small-scale structures of wood having broader social and institutional context of sustainability

#### **Course Outline**

1. Introduction, Safety and serviceability, Measurements & Marking
2. Identification of Timber & Hand Tools
3. Maintenance & Sharpening of Tools, Fasteners Carpentry hand tools and their maintenance.
4. Wood joints and Structural assemblies
5. Advanced Tools in Tool Engineering (Basic working principles and Operations)
6. Product Development: Interior Designs, Furniture, Structures & construction.

**Text Books**

1. Williamson, T G, Wood Engineering and Construction Handbook, 2016, McGraw Hill.
2. Garg, S K, Comprehensive Workshop Technology (Manufacturing Processes), 2008, Laxmi Publications.

**Reference**

1. John, K C, Mechanical Workshop Practice, 2<sup>nd</sup> Edition, 2010, PHI Learning Pvt.Ltd.
2. Hasluck, P N, Working with Hand Tools: Essential Techniques for Woodworking, 2012, Skyhorse Publishing.