



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

| MACHINING PROCESSES AND METROLOGY | | | | | | | | |
|---------------------------------------|----------|---------------------|---|-----------------------|---------|------------------------|-----|-------------------|
| IV Semester: ME | | | | | | | | |
| Course Code | Category | Hours / Week | | | Credits | Maximum Marks | | |
| | | L | T | P | C | CIA | SEE | Total |
| AMED15 | Core | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| | | Contact Classes: 48 | | Tutorial Classes: Nil | | Practical Classes: Nil | | Total Classes: 48 |
| Prerequisite: Manufacturing Processes | | | | | | | | |

I. COURSE OVERVIEW:

The core course "Machining Processes and Metrology" is designed to equip individuals with the skills necessary for shaping metal parts using various machines, including lathes, grinders, drill presses, milling machines, and shapers. The course places a strong emphasis on safety, computational aspects related to work dimensions, and the testing of feeds and speeds using precision measuring instruments. Metrology, a key component of the course, holds significant value for students and practitioners in mechanical and allied engineering fields. The course aims to provide knowledge for the development of measurement procedures and the execution of metrological experiments, ensuring a comprehensive understanding of precision manufacturing and quality control.

II. COURSES OBJECTIVES:

The students will try to learn

- I. The fundamental concepts of the metal cutting principles to study the behavior of various machining processes.
- II. The importance of tool materials, cutting parameters, cutting fluids and tool wear mechanisms for optimized machining.
- III. The principles of linear and angular measuring instruments for accurate measurement of a given component.

III. COURSE OUTCOMES:

At the end of the course students should be able to:

- CO1 Recall the importance of geometry of cutting tools, coolants and tool materials for the analysis of material behavior during manufacturing processes.
- CO2 Explain the operational principles of different lathe machines and various reciprocating machines for quality machining.
- CO3 Explain the working principles of Milling, drilling and surface grinding machines for manufacturing the components of their requirement.
- CO4 Choose an appropriate measuring instrument for accurate inspection of the dimensional and geometric features of a given component.
- CO5 Apply the various methods for the measurements of screw threads, surface roughness parameters and the working of optical measuring instruments.
- CO6 Apply the principles of limits, fits and tolerance while designing and manufacturing the components of their requirement.

IV. COURSE CONTENT:

MODULE – I: FUNDAMENTAL MECHANISM OF METAL CUTTING (10)

Elementary treatment of metal cutting theory, element of cutting process, geometry of single point tool and angles chip formation and types of chips, built up edge and its effects, chip breakers: Mechanics of orthogonal cutting, Merchant's force diagram, cutting forces, cutting speeds, feed, depth of cut, tool life, coolants, machinability, tool

materials.

MODULE – II: MACHINE TOOL – I (09)

Engine lathe, Principle, specification, types, work and tool holding devices, Automatic lathes, classification: Single spindle and multi-spindle automatic lathes and its tool layouts; Shaping, slotting and planing machines, Principles of working, specification, operations performed, Kinematic scheme.

MODULE – III: MACHINE TOOL – II (10)

Milling machine, classifications, specifications, working principles of milling machines; Geometry of milling cutters, methods of indexing, kinematic scheme of milling machines.

Drilling and boring machines, principles of working, specifications, types, operations performed, twist drill; Kinematics scheme of the drilling and boring machines.

MODULE – IV: GEOMETRICAL DIMENSIONING AND TOLERANCES (09)

Systems of Limits and Fits: Introduction, normal size, tolerance limits, deviations, allowance, fits and their types, unilateral and bilateral tolerance system, hole and shaft basis systems, Interchangeability and selective assembly; Linear Measurement: Slip gauges, dial indicator, micrometers; Measurement of angles and tapers: Bevel protractor, angle slip gauges, spirit levels, sine bar.

MODULE – V: MEASURING INSTRUMENTS (10)

Optical measuring instruments: Tool maker's microscope and its uses, collimators, optical projector, interferometer; Screw thread measurement: Element of measurement, errors in screw threads, measurement of effective diameter, angle of thread and thread pitch, profile thread gauges; Surface roughness measurement: Numerical assessment of surface finish: CLA, R.M.S Values, Rz values, methods of measurement of surface finish: profilograph, talysurf - ISI symbol for indication of surface finish.

V. TEXT BOOKS:

1. Dr. R. Kesavan, "Machine Tools", Laxmi publications, 4th edition, 2021.
2. N. K Mehta, "Metal Cutting and Design of Cutting Tools, Jigs and Fixtures", McGrawHill Education, 5th edition, 2020.
3. R. K. Jain, Engineering Metrology, Khanna Publishers, 1st Edition, 2013.4. R. K. Jain, Engineering Metrology, Khanna Publishers, 6th edition, 2022.

VI. REFERENCE BOOKS:

1. Geoffrey, "Fundamentals of metal machining and machine tools", Tata McGraw Hill Education, 4th edition, 2019.
2. M Mahajan "A Textbook of Metrology ", Dhanpatrai, 5th edition, 2019

VII. ELECTRONIC RESOURCES:

1. <https://nptel.ac.in/courses/112106286>.
2. https://akanksha.iare.ac.in/index?route=course/details&course_id=33.
3. https://akanksha.iare.ac.in/index?route=course/details&course_id=31.
4. https://akanksha.iare.ac.in/index?route=course/details&course_id=1293.

VIII. MATERIALS ONLINE:

1. Course template
2. Tutorial question bank
3. Tech-talk topics
4. Open-ended experiments
5. Definitions and terminology
6. Assignments
7. Model question paper – I
8. Model question paper – II
9. Lecture notes
10. PowerPoint presentation
11. E-Learning Readiness Videos (ELRV)