MACHINE TOOLS AND METROLOGY

V Semester: ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AMEC19	Core	3	1	0	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

Prerequisite: Manufacturing Processes

I. COURSE OVERVIEW:

Manufacturing Technology is an instructional program that prepares individuals to shape metal parts on machine tools such as lathes, grinders, drill presses, milling machines and shapers. This course includes instruction in safety, making computations related to work dimensions testing feeds and speeds of machines using precision measuring instruments. Metrology is highly valuable for the students and practitioners, specifically from mechanical and allied engineering stream. This course is designed to impart the knowledge about the various machining processes like turning, shaping, planning, drilling, milling and grinding and to develop measurement procedures, conduct metrological experiments.

II. COURSE 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.
IV. The mechanics of machining process and optimization of various significant parameters in order to yield the optimum machining.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Recall** the importance of geometry of cutting tools, coolants and tool materials for the analysis of material behavior during manufacturing processes.	Remember
CO 2	**Explain** the operational principles of different lathe machines and various reciprocating machines for quality machining.	Understand
CO 3	**Explain** the working principles of Milling, drilling and surface grinding machines for manufacturing the components of their requirement.	Understand
CO 4	**Apply** the principles of limits, fits and tolerance while designing and manufacturing the components of their requirement.	Apply
CO 5	**Choose** an appropriate measuring instrument for accurate inspection of the dimensional and geometric features of a given component.	Apply
CO 6	**Apply** the various methods for the measurements of screw threads, surface roughness parameters and the working of optical measuring instruments.	Apply

IV. COURSE SYLLABUS:

MODULE-I: BASIC MECHANISM OF METAL CUTTING (12)

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 (12)

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 planning machines, Principles of working, specification, operations performed, Kinematic scheme.

MODULE –III: MACHINE TOOL-II (12)

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 (12)

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 and sine bar.

MODULE –V: MEASURING INSTRUMENTS (12)

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; Surface roughness measurement: Numerical assessment of surface finish: CLA, R.M.S Values, Rz values.

VI. TEXT BOOKS:

1. R. Kesavan, Dr. R. Kesavan, "Machine Tools" Laxmi publications, 2nd Edition, 2016.
2. N. K Mehta, "Metal Cutting and Design of Cutting Tools, Jigs & Fixtures", McGraw-Hill Education, 1st Edition, 2014.
3. R. K. Jain, Engineering Metrology, Khanna Publishers, 1st Edition, 2013.

VII. REFERENCE BOOKS:

1. B.L. Juneja, G.S. Sekhon, Nitin Seth, "Fundamentals of Metal Cutting and Machine Tools ", New Age Publishers, 2nd Edition, 2014.
2. Geofrey, "Fundamentals of metal machining and machine tools", Tata McGraw Hill Education, 1st Edition, 2013.
3. R. S. Sirohi, H. C. Radha Krishna, "Mechanical Measurements", New Age Publishers, 3rd Edition, 2011.
4. M.Mahajan "A Textbook of Metrology ", Dhanpatrai and Co, 2nd Edition, 2013.

VIII. WEB REFERENCES:

1. https://www.ocw.mit.edu/courses/mechanical-engineering/
2. http://www.nptel.ac.in/courses/112106138.