## METAL CUTTING AND MACHINE TOOLS

| Course Code | 19ME3501 | Year | III | Semester | I |
|---|---|---|---|---|---|
| Course Category | Program Core | Branch | ME | Course Type | Theory |
| Credits | 3 | L – T – P | 3 – 0 – 0 | Prerequisites | Nil |
| Continuous Internal Evaluation | 30 | Semester End Evaluation | 70 | Total Marks | 100 |

| Course Outcomes | | Levels |
|---|---|---|
| After successful completion of the course, the student will be able to | | |
| CO1 | Illustrate Geometry of single point cutting tool and Mechanics of machining. | L3 |
| CO2 | Describe Tool reliability, materials and identify suitable cutting fluid for a machining operation. | L3 |
| CO3 | Comprehend working principle, mechanism and various operations performed on lathe, shaper and planner | L2 |
| CO4 | Discuss Drilling machines, milling machines, and various operations performed. | L2 |
| CO5 | Specify suitable finishing process for a component and learn basics of CNC machines. | L2 |

**Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3-High, 2: Medium, 1: Low)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | | | 1 | 1 | | | 1 | | 2 | 3 | 1 |
| CO2 | 3 | 2 | 1 | | | 1 | 1 | | | 1 | | 2 | 3 | 1 |
| CO3 | 3 | 2 | 1 | | | 1 | | | | 1 | | 2 | 3 | 1 |
| CO4 | 3 | 2 | 1 | | | 1 | | | | 1 | | 2 | 3 | 1 |
| CO5 | 3 | 2 | 1 | | | 1 | | | | 1 | | 2 | 3 | 1 |

**Syllabus**

| Unit No. | Contents | Mapped COs |
|---|---|---|
| I | **GEOMETRY OF CUTTING TOOLS:** Geometry of single-point cutting tool: Tool-in hand system, ASA system, Significance of various angles of single point cutting tools, Orthogonal Rake System (ORS). **MECHANICS OF MACHINING PROCESSES:** Orthogonal and Oblique cutting, Mechanics of Chip formation: Types of chips, chip-breakers, Chip reduction coefficient, shear angle, shear strain, Built-Up-Edge and its effect in metal cutting, Merchant's analysis of metal cutting process - Various forces, power and specific energy in cutting, Problems on Tool Geometry and Mechanics of Machining, Theories of Metal Cutting: Ernst & Merchant, theory, Modified Merchant's theory, Lee & Shaffer Theory, Stress distribution at Chip-Tool Interface. | CO1 |
| II | **TOOL WEAR, TOOL LIFE, MACHINABILITY AND MACHINING ECONOMICS:** Wear Mechanisms, Types of tool wear, Tool Life and Machinability, Problems on Economics of Machining. | CO2 |

| | | |
|---|---|---|
| | **CUTTING TOOL MATERIALS:** Desirable Properties of tool materials, Characteristics of Cutting Tool Materials, indexable inserts, coated tools. **CUTTING FLUIDS:** Functions, characteristics and types, selection of cutting fluids. | |
| **III** | **LATHE:** Types, Parts, Feed Mechanisms, Specifications of lathe, Lathe Operations, Accessories and Attachments, Machining time estimation, Capsten and Turret Lathes. **SHAPER AND PLANER:** Types, Specifications, Crank and slotted link mechanism, Stroke length and position adjustments, Automatic feed mechanisms, Shaper Vs Planer, Machining time estimation | CO3 |
| **IV** | **DRILLING:** Types, Operations, Nomenclature of a Twist drill, Machining time estimation. **MILLING:** Types, Up Milling Vs Down Milling, Types of milling cutters, Operations, Dividing head, Types of Indexing and problems on indexing. | CO4 |
| **V** | **FINISHING PROCESSES**: Theory of grinding – classification of grinding machines, cylindrical and surface grinding machines, tool and cutter grinding machines, different types of abrasives, bonds, specification and selection of a grinding wheel. Lapping, Honing & Broaching operations, comparison to grinding. **CNC MACHINE TOOLS:** CNC Machines, working principle, classification, constructional features of CNC machines, CNC controller, types of motion controls in CNC machines, applications of CNC machines. | CO5 |

**Learning Recourse(s)**

**Text Books**

1. Production Technology by R.K. Jain and S.C. Gupta. Khanna Publications, New Delhi
2. Workshop Technology Vol II, (10th edition), by B.S.Raghu Vamshi, Dhanpat Rai & co (p) Ltd., 2009

**Reference Books**

1. Mikell Metal cutting Principles, by M.C. Shaw, 3rd ed., Oxford, 1957.
2. Production Technology, by HMT, (Hindustan Machine Tools), TMH publications 2001.
3. Manufacturing Science, by Amitabha Ghosh and Asok Kumar Mallik, East West Press, 2nd Edition, 2010.

**e- Resources & other digital material**

https://nptel.ac.in/courses/112/105/112105233/