III B. Tech – I Semester

(20ME5639) TOOL ENGINEERING AND DESIGN

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	1	-	4

Pre-Requisites: Machine tools, Material science

Course Objectives:

The Students will acquire the knowledge

- To interpret various influencing factors in metal cutting.
- To discuss the usefulness of Ernst Merchant Theory.
- To outline the concepts of machinability and its criteria.
- To discuss the general considerations in cutting tool design.
- To outline the Important considerations in jigs and fixture design.

UNIT – I:

Introduction:

Definition of feed, depth of cut and cutting speed. Concept of specific cutting energy in metal cutting and Numerical based on calculation of machining time on lathe, drilling machine, shaper, milling machine and grinding machines considering specific cutting energy of materials. Theory of Metal Cutting: Orthogonal and oblique cutting, tool geometry (ASA & ISO), types of chips, Factors affecting the chip formation, Cutting forces in orthogonal cutting and their measurement, Merchant circle and derivation of relationships between the cutting forces, chip thickness ratio, shear angle, stress and strain in the chip, work done and power required in metal cutting and 'size effect', apparent mean shear strength of work material.

UNIT – II: ERNST Merchant Theory:

Ernst Merchant Theory, its assumptions and modifications. Relationship between cutting velocity, shear velocity and chip flow velocity. Mechanism of friction at chip-tool interface.Numericals based on metal-cutting. Lee & Shafer Theory – slip line method, determination of shear angle by Mohrs circle. Heat Generation in Metal Cutting: Heat generation and temperature distribution in metal cutting.Calculation of temperature in primary and secondary deformation zones and their measuring methods.

UNIT – III: Machinability:

Machinability and its criteria, forms of tool-wear in metal cutting, tool-life and its criteria, effect of different cutting parameters on tool-life. Economics of machining and numericals. Cutting fluids, their physical action and applications. Grinding: Specifications of grinding wheel, Mechanics of grinding, effect of grinding conditions and type of grinding on wheel behaviour, equivalent diameter of grinding wheel.

UNIT – IV: Cutting Tool Design:

General considerations, study of angle for single point cutting and drill. Principles of different cutting tool materials and their important characteristics. Geometry of a drill. Basic principles of design of a single point and multiple point tools i.e broaches and twist drill.

UNIT – V: Jigs & Fixtures:

Important considerations in jigs and fixture design. Main principles of designing of jigs & fixtures, elements of Jigs and fixtures. Different devices and methods of locations. Different types of clamps used in jigs & fixtures.

Course Outcomes:

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

S. No	Course Outcome	BTL
1.	Illustrate the concepts of various influencing factors in metal cutting.	L2
2.	Explain the usefulness of Ernst Merchant Theory.	L2
3.	Summarize the concepts of machinability and its criteria.	L2
4.	Describe the theory of the general considerations in cutting tool design.	L3
5.	Outline the concepts of Important considerations in jigs and fixture design.	L3

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

TEXT BOOKS

1. B.L. Juneja, G. S. Sekhon, Nitin Seth" Fundamental of Metal Cutting and Machine Tools", NewAge International 2nd edition,
2. P. H. Joshi" Jigs and Fixtures", 2nd Edition TMH

REFERENCE BOOKS:

1. Geoffrey Boothroyd, "Fundamentals of Metal Machining & Machine Tools", TMH
2. P.N. Rao, "Manufacturing Technology", Tata McGraw Hill Publication Ltd.
3. B.J. Ranganath, "Metal Cutting & Tool Design" Vikas Publishing House Pvt. Ltd
4. A.B. Chattopadhyay "Machining and Machine Tools" Wiley India
5. G.K. Lal "Introduction to Machining Science", New age International.