B.E Semester: VIII

Mechanical Engineering

Subject Name: Machine Tool Design

A. Course Objective

- To develop a solution oriented approach by in depth knowledge of Machine Tool Design.
- To address the underlying concepts, methods and application of Machine Tool Design.

B. Teaching / Examination Scheme

SUBJECT		Teaching Scheme				Total Credit	Evaluation Scheme					Total Marks
		L	T	P	Total		THEORY		IE	CIA	PR. / VIVO	
CODE	NAME	Hrs	Hrs	Hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	
ME805-D	Machine Tool Design	4	0	0	4	4	3	70	30	20	0	120

C. Detailed Syllabus

1. Introduction-Calculation Data (Forces, Velocities and Power Requirements during metal cutting):
Turning: Cutting force, Cutting Speed and Feed Rate.
Drilling: Cutting forces, Cutting Speed and Feed Rate.
Milling: Chip Section, Cutting force, Milling with Cutter Heads.
Grinding: Grinding Forces, Cutting Speed, Feed Rate, and Depth Setting.
Planning, Shaping and Broaching.

2. General Requirements of the Machine Tool:
Accuracy of Shape, Dimensional accuracy and surface finish of the components produced. High Productivity. High Technical and Economic Efficiency.

3. Design Principles:
Stiffness and Rigidity of the Separate Constructional Elements and their Combined behavior Under Load, Static Rigidity, Dynamic Rigidity, Natural frequencies, Damping, Mode of Vibration.

4. Standardization of Spindle Speeds and Feed Rates:
Layout of Speed Change Gears. Saw Diagrams for Arithmetic Progression, Geometric Progression, Harmonic Progression and Logarithmic Progression of spindle speeds for Mechanical Stepped Drives for Machine Tools. Establishment of Gear Ratios, Layout of the Intermediate Reduction Gears, Calculation of Transmission Ratios, Pulley Diameter, Gear Wheel Diameters and Number of Teeth. Ray Diagram. Speed Diagram.

5. Electrical, Mechanical and Hydraulic Drives for the Operational Movements:
Electric Drive and Control Equipment. Mechanical and Hydraulic Drives. Drives for Producing Rotational Movements, Stepped Drives, Step less Drives. Drives for Producing Rectilinear Movements**.** Backlash Eliminator in the Feed Drive Nut.

6. Automatic Control:
Principles and Constructional Elements. Automatic Driving of the Cutting Movements, Feed Movements, and Return Movements. Automatic control of movements for Starting, Stopping and

Reversing. Automatic Clamping and Unclamping the work piece. Automatic Selection of Required Speeds, Automatic Setting of Tools. Automatic Measurement of Machined Shape and Surfaces. Transport of Components from One Machine to the Next. Applications (Examples of Automatic Machines). Control for Moving Slides into Defined, Fixed Positions. Control of Feed Movements in Producing Profiles or Surface by Continuous Path Control.

7. Design of Constructional Elements:
Machine Tool Structures, Structural Elements Design for Centre Lathe, Drilling Machine, Knee Type Milling Machine, Planning Machine, Boring Machine, and Grinding Machines.

8. Design of Slide Ways:
Design of Slide ways for Tables, Saddles and Cross-slides. Antifriction Bearings for slide ways. Hydrostatically Lubricated Slide ways.

9. Design of Spindles and Spindle Bearings:
Design of Spindles for Strength and Stiffness. Design of Spindles for Balancing. General Layout and Design of the Driving Elements and the Spindle Bearings. Selection and General Layout of Ball and Roller Bearings for Supporting Spindles.

10. Design of Secondary Drives for Machine Tools:
Design of Cutting Drives, Feed Drives and Setting Drives.

11. Design of Control and Operating Devices for Machine Tools 2

D. Lesson planning

SR. NO.	DATE/WEEK	UNIT NO.	%WEIGHTAGE	TOPIC NO.
1	1^{ST} , 2^{ND} , 3^{RD}	1, 2, 3	20	1, 2, 3
2	4^{TH} ,5^{TH} , 6^{TH}	4, 5, 6	20	4, 5, 6
3	7^{TH} ,8^{TH} , 9^{TH}	7, 8	20	7, 8
4	10^{TH} ,11^{TH} , 12^{TH}	9, 10	20	9, 10
5	13^{TH} ,14^{TH} , 15^{TH}	11	20	11

E. Instructional Method & Pedagogy

1. At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
2. Lecture may be conducted with the aid of multi-media projector, black board, OHP etc. & equal weightage should be given to all topics while teaching and conduction of all examinations.
3. Attendance is compulsory in lectures and laboratory, which may carries five marks in overall evaluation.
4. One/Two internal exams may be conducted and total/average/best of the same may be converted to equivalent of 30 marks as a part of internal theory evaluation.
5. Assignment based on course content will be given to the student for each unit/topic and will be evaluated at regular interval. It may carry an importance of ten marks in the overall internal evaluation.
6. Surprise tests/Quizzes/Seminar/Tutorial may be conducted and having share of five marks in the overall internal evaluation.
7. The course includes a laboratory, where students have an opportunity to build an appreciation for the concept being taught in lectures.
8. **Practical / Oral:** Term work shall be carried out to fulfill the practical credits related to course contents.

F. Students Learning Outcomes

- The student can identify different areas of Machine Tool Design.
- Can find the applications of all the areas in day to day life.

G. Recommended Study Materials

Text & Reference Books:

1. Design Principles of Metal-Cutting Machine Tools by F. Koenigsberger
2. Machine Tool Design by N. K. Mehta. McGraw Hill Publishing
4. Machine Tool Design by Acherkan, Mir publishing
5. Machine Tool Design by S.K, Basu, Oxford and IBH Publishing
6. Machine tool design by Sen and Bhattacharya, CBS Publications