

GUJARAT TECHNOLOGICAL UNIVERSITY

B.E. SEMESTER : VIII

MECHANICAL ENGINEERING

Subject Name: **MACHINE TOOL DESIGN**

| Sr. No. | Course Contents | Total Hrs |
|---------|--|-----------|
| 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. | 6 |
| 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. | 4 |
| 3. | Design Principles: Stiffness and Rigidity of the Separate Constructional Elements and their Combined behaviour Under Load, Static Rigidity, Dynamic Rigidity, Natural frequencies, Damping, Mode of Vibration | 4 |
| 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. | 6 |
| 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, Stepless Drives. Drives for Producing Rectilinear Movements. Backlash Eliminator in the Feed Drive Nut. | 4 |
| 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. | 6 |
| 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. | 4 |
| 8. | Design of Slideways: Design of Slideways for Tables, Saddles and Cross-slides. Antifriction Bearings for slideways. Hydrostatically Lubricated Slideways. | 4 |
| 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. | 4 |
| 10. | Design of Secondary Drives for Machine Tools: Design of Cutting Drives, Feed Drives and Setting Drives. | 4 |
| 11. | Design of Control and Operating Devices for Machine Tools | 2 |

Term Work: The term work shall be based on the topics mentioned above.

Practical / Oral: The candidate shall be examined on the basis of term-work.

Text Books:

1. Design Principles of Metal-Cutting Machine Tools by F. Koenigsberger.
2. Machine Tool Design by N.K.Mehta.Tata McGraw Hill Publishing

Reference Books:

1. Machine Tool Design by Acherkan, Mir publishing
2. Machine Tool Design by S.K.,Basu, Oxford and IBH Publishing
3. Machine tool design by Sen and Bhattacharya , CBS Publications