GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3161921
Machine Tool Design
6th SEMESTER

Type of course: Departmental elective

Prerequisite: None

Rationale:

To develop comprehensive knowledge and understanding of working principles of machine tools. Students will be able to analyze the speed and feed regulation mechanisms of machine tools. Students will be able to design machine structures and guideways for better stability and precision.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	**Introduction to Machine Tool Drives:** Types and capabilities of machine tools, Constructional and operational features, General Requirements of Machine Tool Design, Working and Auxiliary Motions in Machine Tools, Kinematics of Machine Tools, Motion Transmission, mechanical, hydraulic and electric drives.	**03**
2	**Regulation of Speed and Feed Rates:** Speed and Feed Regulation, Layout of Speed Change Gears, Saw Diagrams for Arithmetic, Geometric, Harmonic and Logarithmic Progression of spindle speeds. 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 Chart., Design of Speed Gear Boxes, Feed Drives, Feed Box Design.	**10**
3	**Design of Machine Tool Structures:** Functions of Machine Tool Structures and Their Requirements, Design criteria for Machine Tool Structures, Materials of Machine Tool Structures, Static and Dynamic Stiffness, Profiles of Machine Tool Structures, Basic Design Procedure of Machine Tool Structures, Design of Beds, Columns, saddles, carriages, Bases and Tables.	**06**
4	**Design of Guideways and Power Screws :** Functions and Types of Guide ways, Design of Slide ways, clearance adjustment in slideways. Design of Anti-Friction Guide ways, Combination Guide ways and Aerostatic guideways. Design of Power Screws and Recirculating ball screws	**06**
5	**Design of Spindles and Spindle Supports:** Functions of Spindles and Requirements, Effect of Machine Tool Compliance on Machining Accuracy, Design of Spindles, Antifriction Bearings.	**05**
6	**Dynamics of Machine Tools:** Machine Tool Elastic System, Static and Dynamic Stiffness, Effects of vibration, stability	**05**

	analysis. Methods to reduce instability in machine tool like dampers, vibration absorbers, Machine Tool Chatter.	
7	**Control Systems in Machine Tools:** Machine tool control systems, Control Systems for Speed and Feed Changing, Adaptive Control Systems,	**04**
8	Ergonomics and aesthetic design of machine tool, Recent trends of machine tool.	**03**

Reference Books:

References:

1. Machine Tool Design and Numerical Control, N K Mehta, McGraw-Hill.
2. Machine Tool Design Handbook, Central Machine Tool Institute, McGraw-Hill
3. Design of Machine Tools, S.K. Basu, D K Pal, Oxford and IBH Publishing.
4. Principles of Machine Tools, G C Sen, A Bhattacharya, New Central Book Agency.

Distribution of marks weightage for cognitive level

Bloom's Taxonomy for Cognitive Domain	Marks % weightage
Recall	10
Comprehension	10
Application	30
Analysis	40
Evaluate	10
Create	00

Course Outcome:

After learning the course the students will able to:

Sr. No.	CO statement	Marks % weightage
CO-1	Summarize principals of machine tool kinematics, motion transmission and control systems in machine tools.	20
CO-2	Examine various possible speed charts and select appropriate combination of gears to obtain various speeds and feeds in machine tools.	30
CO-3	Make use of machine design fundamentals to design the machine tool structure, guide ways and spindle.	40
CO-4	Evaluate effect of machine components' stiffness and dampers on machine tool vibration.	10

List of Experiments:

1. Study of motion transmission mechanisms in various machine tools.
2. Design and drawing of gear box and feed box for speed and feed transmission.
3. Design and analysis of machine structures.
4. Vibration analysis of machine tools.
5. Design and drawing of machine spindles and its supports.
6. Control analysis of machine tools.

Major Equipment:

1. Mechnical Workshop.
2. Drawing hall

List of Open Source Software/learning website:

1. http://nptel.ac.in