

GUJARAT TECHNOLOGICAL UNIVERSITY

BRANCH NAME: MANUFACTURING ENGINEERING

SUBJECT NAME: DESIGN OF MACHINE TOOLS

SUBJECT CODE: 2173408

B.E. 7TH SEMESTER

Type of course: Theoretical + Practical (Regular)

Prerequisite: Zeal to learn the Subject

Rationale:

- To increase to calculations and performances of machine working and efficiencies.
- To make the students understand the concepts & broad principles of machine tool design, regulation of speed and speed regulation, design of machine tool structure, dynamics of machine tools.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P		Theory Marks			Practical Marks			
			ESE (E)	PA (M)		PA (V)		PA (I)		
				PA	ALA	ESE	OEP			
3	2	0	5	70	20	10	30	0	20	150

L- Lectures; T- Tutorial/Teacher Guided Student Activity; P- Practical; C- Credit; ESE- End Semester Examination; PA- Progressive Assessment; OEP-Open Ended problem; AL-Active learning;

Sr. No.	Content	Total Hrs	% Weightage
1	GENERAL PRINCIPLES OF MACHINE TOOL DESIGN: Introduction to machine tool, General requirements of machine tool design, Specifications and layout of machine tools, Machining range diagram, Interference diagram, Parameter defining working motions of a machine tool. Working and auxiliary motion in machine, Machine tool drives, Hydraulic transmission, Mechanical transmission,	5	10
2	REGULATION OF SPEED AND FEED RATES: Aim of speed feed regulation, classification of speed and feed boxes, stepped regulation of speed, design of speed box, Design of feed box, Special cases of gear box design, regulation of speed and feed rates.	10	20
3	DESIGN OF MACHINE TOOL STRUCTURE: Fundamentals of machine tool structures and their requirements, Design criteria of machine tool structure, Materials for machine tool structure, Static and dynamic stiffness, Structure profiles, Design of beds and columns, Design of housing models, bases and tables, Design of saddle, carriages and rams.	07	20
4	DESIGN OF GUIDE-WAYS AND POWER SCREWS:	07	20

	Function and type of guide-ways, design of slide-ways, Protecting devices for slide-ways, Design of power screws. .		
5	DESIGN OF SPINDLES AND SPINDLE SUPPORTS: Materials for spindles, Design principles of spindles, Antifriction bearings, Sliding bearings.	07	20
6	DESIGN OF HOISTS: Drives for hoisting, components, and hoisting mechanisms; rail traveling components and mechanisms; hoisting gear operation during transient motion; selecting the motor rating and determining breaking torque for hoisting mechanisms.	06	10
	Total	42	100%

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	15	15	10	10	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference books:

1. Machine Tool Design- N.K. Mehta Tata McGraw Hill.
2. Design Principles of Metal Cutting Machine tool- F. Koenigsberger - Pergamon press
3. Machine Tool design Handbook CMTI Bangalore, McGraw-Hill
4. Sen and Bhattacharya,, "Principles of Machine Tools", New Central Book Agencies.
5. Boothroyd, G., "Fundamentals of Metal Machining and Machine Tools", McGraw hill.
6. Acherkan, "Machine Tool Design", Vol 2 & 3, MIR Pub, Russia.
7. Machine Tool Design, S.K. Basu, Oxford and IBH Publishing.
8. Machine Tool Design: Sen and Bhattacharya , CBS Publications

List of Tutorials:

1. To study about Machining Range Diagram
2. To study about Interference Diagram
3. To study about design procedures of machine tool structure
4. To study about design selection procedures of slide ways
5. To study about design selection procedures of ball screws
6. To study about design selection procedures of spindle bearings
7. To study about design selection procedures of spindle.

Course Outcome:

Students can know about designing guide ways, power screws, spindle and their supports.

1. Structural diagram of a speed gear box
2. Design of a gear box
3. Evaluate machine tool with all geared headstock and Norton gear box.
4. Evaluation of machine tool slideways

5. Design evaluation of machine tool housings, columns and tables
6. Design evaluation of spindle of general purpose and high speed machine tools

Design based Problems (DP)/Open Ended Problem:

1. From the stated requirement of a machine tool, design a gearbox and gears for the same. Compare your design with the one available in machine tool and reason differences.
2. Design Machine tool components and prepare a CAD model. Verify the assembly in CAD software.
3. Design a machine tool for given capacity and capability.

Major Equipment:

1. Students may be exposed to following software/tools used for the design of various components.
 - a. <http://www.mitcalc.com>
 - b. <http://www.kisssoft.ch/english/home/index.php>
 - c. <https://www.machinedesignonline.com/>
2. Design Data book.
3. Computer

Review Presentation (RP): The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after up loading of the best 3 presentations.

List of Open Source Software/learning website:

1. www.nptel.ac.in/

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.