

# GUJARAT TECHNOLOGICAL UNIVERSITY

## MECHANICAL (PRODUCTION ENGINEERING) (28)

### ADVANCE MACHINE TOOL DESIGN

**SUBJECT CODE: 3712807**

**SEMESTER: I**

**Type of course:** Program Elective I

**Prerequisite:** Nil

**Rationale:** This course provides the knowledge and practice regarding different machine Tool Drive Mechanisms. This course gives hands on practice regarding Mechanisms, regulation and Design of Machine Tool Drives & components. This course gives knowledge about the regulations of speed and feed rates of machine tool drives. Also gives insight about the Design of Multi Speed Gear Box, Machine Tool Structure and all major Elements along with their procedure of assessing dynamic stability.

#### Teaching and Examination Scheme:

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

#### Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	<b>Machine Tool Drive:</b> Working and auxiliary motion in machine, Machine tool drives, Hydraulic transmission, Mechanical transmission, General requirements of machine tool design, Layout of machine tools.	5	10
2	<b>Regulation of Speed and Feed Rates:</b> Aim of speed feed regulation, stepped regulation of speed, design of speed box, Design of feed box, Special cases of gear box design, regulation of speed and feed rates.	5	10
3	<b>Design of Machine Tool Structure:</b> Fundamentals of machine tool structures and their requirements, Design criteria of machine tool structure, Static and dynamic stiffness, Design of beds and columns, Design of housing models, Techniques in design of machine tool structure.	8	20
4	<b>Design of Guide-ways and power Screws:</b> Function and type of guide-ways, design of slide-ways, Protecting devices for slide-ways, Design of power screws. Design of antifriction recirculating ball type lead screw, linear motion	6	14
5	<b>Design of Spindles and Spindle Supports:</b> Materials for spindles, Design of spindles, Antifriction bearings, Sliding bearings.	4	12
6	<b>Dynamics of Machines Tools:</b> General procedure of assessing dynamic stability of EES, Cutting processing, Closed loop system, Dynamic characteristics of cutting Process, Stability analysis.	8	20
7	<b>Machine tool Testing:</b>	6	14

	General criteria and procedure of testing of Lathe, Milling, Shaper, Grinding, Saw etc		
	<b>Total</b>	42	100

### 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 Banglore
4. Sen and Bhattacharya,, "Principles of Machine Tools", New Central Book Agencies,1975.
5. Boothroyd,G., "Fundamentals of Metal Machining and Machine Tools", McGraw hill,1985.
6. Acherkan,, "Machine Tool Design", Vol 2 & 3, MIR Pub, 1973

### Course Outcome:

After learning the course the students would be able to acquire different learning outcomes of following topics:

- (1) Machine Tool Drive
- (2) Regulation of Speed and Feed Rates
- (3) Design of Machine Tool Structure
- (4) Design of Guide-ways and power Screws
- (5) Design of Spindles and Spindle Supports
- (6) Dynamics of Machines Tools

### List of Experiments:

1. Measurement and analysis of cutting forces in orthogonal turning.
2. Flank wear – time characteristics for single point cutting tools.
3. Checking the level of installation of a lathe in horizontal & vertical planes
4. Checking the bed ways for straightness and parallelism.
5. Testing the main spindle of a lathe for axial movement and true running.
6. Process capability determination of a center lathe.
7. Flatness checking of a surface plate.
8. A study of devices for intermittent motion used in machine tools e.g. ratchet gear
9. & Geneva Mechanism.
10. A study of Kinematics structure of lathe/milling machine.
11. A study of the drives for reciprocation used in machine tools.
12. Development the speed chart and gearing diagram for a gassed head lathe.
13. A study of the cone pulley drive in center lathe and development of its ray diagram for the speed structure.
14. Efficiency testing of lathe at various parameters-values.
15. Accuracy analysis of finished cylindrical work-pieces produced on a lathe.
16. Cutting (turning) with inclined placed tool (in tool fixture).
17. Turning with two simultaneously cutting tool (one from front on usual tool post and the other tool from back on tool-fixture on carriage)

### List of Tutorials:

1. Machine Tool Drive
2. Regulation of Speed and Feed Rates
3. Design of Machine Tool Structure
4. Design of Guide-ways and power Screws
5. Design of Spindles and Spindle Supports

## 6. Dynamics of Machines Tools

### **Open Ended Problems:**

1. Study of chip breaker on turning of stainless steel.
2. Design of light weight Machine tool and advanced control techniques.
3. Design and fabrication of nozzle required in abrasive water jet machine carrying different shapes of abrasive.

### **Major Equipments:**

1. Machine shop Basic M/C Tools
2. Multi Speed Gear Box