GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: PG

Branch: Mechanical Engineering

Course / Subject Code : ME01000531

Course / Subject Name : Advance Machine Tool Design

w. e. f. Academic Year:	2024-25
Semester:	1st Semester
Category of the Course:	PEC

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.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	Study Machine Tool Drive and Regulation of Speed and Feed Rates	Understanding
2	Design of Machine Tool Structure	Analyze
3	Design of Guide-ways, power Screws, Spindles and Spindle supports	Analyze
4	Analysis of Dynamics of Machines Tools	Analyze
5	Performance on Machine tool testing	Evaluate

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	Machine Tool Drive: Working and auxiliary motion in machine, Machine tool drives, Hydraulic transmission, Mechanical transmission, General requirements of machine	5	12

	tool design, Layout of machine tools.		
2.	Regulation of Speed and Feed Rates: 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	12
3.	Design of Machine Tool Structure: 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.	Design of Guide-ways and power Screws: 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.	7	15
5.	Design of Spindles and Spindle Supports: Materials for spindles, Design of spindles, Antifriction bearings, Sliding bearings.	5	10
6.	Dynamics of Machines Tools: General procedure of assessing dynamic stability of EES, Cutting processing, Closed loop system, Dynamic characteristics of cutting Process, Stability analysis.	8	16
7.	Machine tool Testing: General criteria and procedure of testing of Lathe, Milling, Shaper, Grinding, Saw etc.	7	15
	Total	**45**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
10	**20**	**20**	**30**	**10**	**10**

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) 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

Suggested Course Practical List:

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 & Geneva Mechanism.
9. A study of Kinematics structure of lathe/milling machine.
10. A study of the drives for reciprocation used in machine tools.
11. Development the speed chart and gearing diagram for a gassed head lathe.
12. A study of the cone pulley drive in center lathe and development of its ray diagram for the speed structure.
13. Efficiency testing of lathe at various parameters-values.
14. Accuracy analysis of finished cylindrical work-pieces produced on a lathe.
15. Cutting (turning) with inclined placed tool (in tool fixture).
16. 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 Laboratory/Learning Resources Required:

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

Suggested Project List:

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.

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