

# GUJARAT TECHNOLOGICAL UNIVERSITY

## MECHATRONICS ENGINEERING (20)

DESIGN OF MECHANISMS - I

**SUBJECT CODE:** 2162001

B.E. 6<sup>th</sup> Semester

**Type of course:** Engineering Science

**Prerequisite:** NA

**Rationale:** Course gives idea about the basic design procedure. Design steps of various mechanical elements are discussed.

**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)		
				PA	ALA	ESE	OEP			
4	0	2	6	70	20	10	20	10	20	150

**Contents:**

Sr No	Contents	Teaching Hrs	Weightage (%)
1	Generalized design procedure, Preferred Numbers, Standardization, Material Selection, Factor of safety, Allowable stresses, Stress Concentration and Remedies	5	10
2	Basic Loads and Stresses such as tensile, compressive, bending, shear, bearing, torsion etc., combine and eccentric loading, Principal Stresses and Strains, Theories of elastic failures	8	16
3	Design of Operational Joints such as Socket and Spigot Joint of Cotter type, Sleeve and cotter Joint, Knuckle Joint, Turn Buckle etc	6	12
4	<b>Design of Columns:</b> Slenderness Ratio, Euler's Formula, End fixity coefficients, Rankine Formula, Design of Push Rod	4	8
5	<b>Design of Springs:</b> Closed Coil Helical Springs, Concentric Springs, Introduction to Leaf Springs	4	8
6	Design of Screw Jack, Lead screw, Toggle Jack	6	12
7	Design of Hand and Foot Lever, Lever of Lever Loaded Safety Valve, Rocker Arm, Bell Crank Lever	5	10
8	<b>Design of shaft and Key:</b> Hollow and Solid Shaft Design based on strength and rigidity, Rectangular and Square Key design, Introduction to Splines	6	12
9	Design of Bolted Joints with cases a) Eccentric load acting parallel to the axis of bolts b) Eccentric load acting perpendicular to the axis of bolts c) The load is inclined to the plane of bolts	4	8

10	Design of Thin Cylinders	2	4
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**Suggested Specification table with Marks (Theory):**

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
40	20	20	10	5	5

**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. U C Jindal, Machine Design, Pearson Education
2. Bhandari V. B., Introduction to Machine Design, Tata McGraw Hill
3. Shigley J. E, Mechanical Engineering Design McGraw Hill
4. Robert L. Norton, Machine Design: An Integrated Approach, Pearson Education Publication
5. Pandya & Shah, Machine Design, Charotar Publishing House
6. Bernard J. Hamrock, B. O. Jacobson, Steven R. Schmid, Fundamentals of Machine Elements, McGraw Hill International Edition

**Course Outcomes:**

After successful completion of the course the students shall be able to:

- a) Understand material-strength relationships.
- b) Understand forces acting on various mechanical components and stresses induced in them.
- c) Apply the concept of standardization and graphical representation in designing of mechanical components.

**List of Experiments:**

1. Detail and Assembly of machine tool mechanism- Case study
2. Assembly drawing
3. Design and Drawing of Various Joints
4. Design and Drawing of Screw Jack, Toggle Jack
5. Design and Drawing of levers

**Open ended problem**

Student may be given a task to exhibit the knowledge of the course studied during the academic year.

**List of Open Source Software/learning website:**

The website of NPTL may be utilized for additional learning.

**Active learning Assignments (AL) :** Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ part of chapters to groups of students so that the entire syllabus of subject can be covered. The power-point slides should be put up on the web-site of the college/Institute, along with the name of the group, the name of faculty, Department and College on the first slide. The best three works should be sent on [achievements@gtu.edu.in](mailto:achievements@gtu.edu.in).