

NIRMA UNIVERSITY

Institute:	Institute of Design
Name of Programme:	Bachelor of Design (Product and Interaction Design Prog.)
Course Code:	2DD203CC25
Course Title:	Introduction to Mechanics
Course Type:	Core
Year of introduction:	2025-26

L	T	Practical component				C
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Course Learning Outcomes (CLO):

At the end of the course, the student will be able to:

1. Explain fundamental mechanical concepts and material behavior relevant to product design (BL 2)
2. Apply stress–strain relationships and force distribution to evaluate everyday products (BL 3)
3. Analyze basic mechanisms to determine functional performance (BL 4)
4. Construct a working model demonstrating a selected mechanical principle (BL 6)

Contents

**Teaching
Hours
(Total 75)**

Unit 1	Understanding Forces and Motion in Design:	3
	<ul style="list-style-type: none"> • What is Mechanics? Introduction to forces, motion, and their relevance in design. • Force Systems: Types of forces (push, pull, tension, friction), Free Body Diagrams (FBD). • Equilibrium & Stability: Why objects stand or fall—balance and center of gravity. • Friction & Contact Forces: How objects interact — examples from daily life. • Basic Motion Principles: Linear and rotational motion, speed, acceleration, and how they influence design. 	
Unit 2	Materials, Strength, and Stability in Products:	3
	<ul style="list-style-type: none"> • How Strong is a Material? Understanding stress, strain, and material behavior. • Choosing the Right Material: Basics of metals, plastics, and composites in product design. • Loads & Stability: What happens when materials bend, stretch, or break? • Basic Structural Principles: How chairs, tables, and bridges support weight. 	

Unit 3	Introduction to Basic Mechanisms:	3
	<ul style="list-style-type: none"> • How Things Move: An introduction to basic machines and mechanical movement. • Simple Mechanisms in Everyday Life: Levers (scissors, doors), pulleys (elevators), gears (clocks, bicycles). • Linkages and Motion Control: Understanding simple moving parts in products. • Transforming Motion: Rotational to linear motion (cranks, cams). 	
Unit 4	Applied Mechanics Project – Building a Simple Mechanical Model:	6
	<ul style="list-style-type: none"> • Concept Development: Selecting a principle/mechanism and develop multiple concepts. • Tinkering and Building: Creating low fidelity kinetic models of the selected concept. • Prototyping: Multiple iterations of the selected principle/mechanism. 	

Suggested List of Practical

60 hours

Sr. No.	Practical Work
1.	Identify different types of forces in everyday objects and draw simple Free Body Diagrams (e.g., chair, door, bottle).
2.	Experiment to find the center of gravity of irregular-shaped objects.
3.	Measure and compare the friction of different surfaces using a sliding block, spring scale, and weights.
4.	Test bending and compression strength of simple materials using small weights until deformation.
5.	Build and test a simple lever to measure mechanical advantage and efficiency for different load positions.
6.	Create and operate a basic pulley system to lift small weights and record effort required for different pulley arrangements.
7.	Study gear ratio and motion transfer by assembling toy gears or LEGO sets and measuring input/output rotations.
8.	Demonstrate rotational-to-linear motion using a crank-slider or cam model made from cardboard or prototyping kits.

Self Study:**Suggested Readings/References:****Books:**

1. Hugh D. Young & Roger A. Freedman (2019). University Physics with Modern Physics. Pearson.
2. J. L. Meriam & L. G. Kraige (2017). Engineering Mechanics: Dynamics (8th Edition). Wiley.
3. Arthur G. Erdman & George N. Sandor (2001). Mechanism Design: Analysis and Synthesis (4th Edition). Pearson.
4. Ferdinand P. Beer & E. R. Johnston (2015). Vector Mechanics for Engineers: Statics & Dynamics. McGraw-Hill.
5. James Gere & Barry Goodno (2012). Mechanics of Materials (8th Edition). Cengage Learning.

Online Resources:

1. MIT OpenCourseWare – Basic Mechanics & Motion Lectures.
2. Khan Academy – Introduction to Physics & Motion – Forces, friction, and mechanical systems.
3. NPTEL – Engineering Mechanics – Lecture series for beginners in mechanics.
4. YouTube: Smarter Every Day, Veritasium, The Engineering Mindset – Practical demonstrations of mechanics concepts.

