




**Ahmedabad  
University**



Ahmedabad

University

Course	ENR204 Mechanics of Rigid Bodies	Semester	Monsoon Semester 2024	
Faculty Name(s)	Bimal Das	Contact	bimal.das@ahduni.edu.in	
School	SEAS	Credits	2	
GER Category:		Teaching Pedagogy Enable:NO	P/NP Course: Can not be taken as P/NP	
Schedule	Section 1	09:00 am to 10:00 am	Mon	30-09-24 to 26-11-24
		10:00 am to 11:00 am	Mon	30-09-24 to 26-11-24
		09:00 am to 10:00 am	Wed	30-09-24 to 26-11-24
		10:00 am to 11:00 am	Wed	30-09-24 to 26-11-24
Prerequisite	Not Applicable OR Intermediate physics, Math			
Antirequisite	Not Applicable			
Corequisite	Not Applicable			

Course Description	<p>Evolution of Structural Engineering, Tacoma Narrows Bridge Collapse, Continuum Mechanics and Classification Distinction between statics and dynamics.</p> <p>Idealizations in engineering, Degree of freedom, Rigid Body and deformable body, Force and load, Transmissibility of a Force, Resolution of Forces, Body and Surface Forces, External and internal forces</p> <p>Equilibrium of a particle, Free-Body Diagram, Equilibrium of rigid bodies, Statically indeterminacy</p> <p>Work, Principle of virtual work, Center of gravity of a two-dimensional body</p> <p>Rectangular moment of inertia, Polar moment of inertia, Radius of gyration, Parallel-axis theorem</p> <p>Elastic potential energy, Gravitational potential energy, Stability of equilibrium, Equilibrium in terms of potential energy, Condition for equilibrium,</p> <p>Axial, Bending, torsion, shear load, Real-world structures</p> <p>Definition of the beam, Slender members, Forces transmitted in a slender member,</p> <p>Shear and bending moment in beam, Relations among load, shear, and bending moment, Torsion in a shaft</p> <p>Average normal and shear stress, bearing stress, torsional stress, allowable stress, factor of safety, Thermal stress</p> <p>Normal and shear strain, Poisson's ratio. elastic deformation of axially loaded members</p>
Course Objectives	<p>The primary purpose of the study of engineering mechanics is to develop the capacity to predict the effects of force and motion while carrying out the creative design functions of engineering. The ability to visualize physical configurations in terms of real materials, actual constraints, and the practical limitations which govern the behavior of machines and structures. One of the primary objectives in a mechanics course is to help the student develop this ability to visualize, which is vital to problem formulation.</p>
Learning Outcomes	<ul style="list-style-type: none"> <li>• Understand the fundamentals of mechanics of solids.</li> <li>• Create and develop engineering sense.</li> <li>• Identify, articulate and solve complex engineering open-ended &amp; real-world problems.</li> <li>• Demonstrate the fundamentals of stress and strains.</li> <li>• Design beams &amp; shafts, and solve problems relating to uniaxial and complex bending.</li> <li>• Realize the concept of buckling and be able to solve the problems related to isolated bars.</li> <li>• Understand materials testing techniques and their limitations.</li> <li>• Work in a team.</li> </ul>

Pedagogy	<ul style="list-style-type: none"> <li>• Two lectures a week,</li> <li>• Ask questions, Do set Problems,</li> <li>• Project based learning,</li> <li>• PPTs, Lecture notes,</li> </ul>
Expectation From Students	<ul style="list-style-type: none"> <li>• Students must be interactive in the classroom.</li> <li>• Students should submit the home assignments on time.</li> <li>• Students should be ready to work in groups.</li> </ul>
Assessment/Evaluation	<ul style="list-style-type: none"> <li>• Mid-Semester Examination:             <ul style="list-style-type: none"> <li>◦ Assignment - 25%</li> </ul> </li> <li>• End Semester Examination:             <ul style="list-style-type: none"> <li>◦ Quiz - 25%</li> <li>◦ Written - 50%</li> </ul> </li> </ul>
Attendance Policy	As per Ahmedabad University Policy.
Project / Assignment Details	<ul style="list-style-type: none"> <li>• Students will be asked to do the projects within the course domain and submit a report.</li> <li>• Project definition and expected outcomes will be well defined and discuss with students in advance</li> <li>• Projects will be evaluated in terms of viva-voce or class presentations</li> </ul>
Course Material	
Additional Information	

## Session Plan

NO.	TOPIC TITLE	TOPIC & SUBTOPIC DETAILS	READINGS,CASES,ETC.	ACTIVITIES	IMPORTANT DATES
1	Introduction	Review of the methods of static, Free body diagrams,	PPTs, Text Book Chapter (TBC) 1 & 2	Lecture	
2		Equilibrium force and moment equations, Concept of simple and shear Stress	-do-		
3	Mechanical Properties of Materials	Concept of strain, Stress-strain behavior of Ductile and Brittle materials, Hooke's Law,	PPTs , TBC 3	Lecture	
4		Poisson's ratio, Shear Stress-Strain Diagram, failure of materials due to Creep and Fatigue	-do-		
5	Stress and Strain – Axial Loading	Saint-Venant's principle, Principle of Superposition, Elastic deformation of an Axially Loaded Member, The force method of analysis of axially loaded members	PPTs , TBC 4	Lecture	
6		, Thermal Stress, Stress concentration, Thermal stress, Stress concentrations, Inelastic axial deformation	-do-		
7	Test 1	Multiple choice questions			
8	Torsion	Introduction, circular shafts, Torsion in shafts , Power transmission and induced torsion, torsion of tapered shaft	PPTs, TBC 5	Lecture	
9	Continuation	combined bending and torsion, Strain energy in torsion , Introduction of Project definition and discussion of expected outcomes	-do-, PPTs	Lecture	

10		Continuation	-do	Reflections and Review, Project	
11	Bending of beams	Bending of beams due to various types of loads,	PPTs, TBC 6	Lecture	
12		Bending deformation of straight member, the flexure formula, Unsymmetric bending, composite beams	-do-		
13		continuation	-do-		
14	Midterm				
15	Deflection in beams and shafts	Calculating deflection in beams and shafts, slope and displacement by integration , statically indeterminate Beams,	PPTs, TBC 11	Lecture	
16	Buckling of columns	Understanding critical load and buckling, Ideal column with Pin support, Column having various types of supports	PPTs, TBC 13	Lecture, Test2	
17		Concentrically loaded columns, practice Q & A , Column for eccentrically loading Q & A	-do-	Lecture	
18	Testing of Materials	Factor of Safety, Tensile Testing, Compression Testing, Column Testing, Fatigue Testing, Torsion Testing, Hardness Testing, Impact Testing,	Notes, PPTs	Lecture	
19		Viva or PPT presentation		Reflections and Review , Project Viva,	
20	End term exam				



