C.V. Raman Global University Odisha			
Department(s): Mechanical Engineering			
Academic Year : 2025-26			
Semester: 2nd	Section(s): 1, 3, 5, 7, 9	Lectures: 42 +14	
Course: B Tech		Code: IME (ME101)	
Course Instructor(s): Dr. Hillol Joardar, Dr. Taraprasad Mohapatra, Dr. Arka Ghosh, Dr. Mainak Das, Dr. Ananta Dutta, Dr. Shaik Mozammil, Dr. Smruti Rekha Swain			
Course duration: 56 hrs			
Course Site: link to content uploaded by the teacher			
https://drive.google.com/drive/folders/1u3JuZsG45jpAnsBkNjuWLIiYc5wT7mJW?usp=drive_link			

Vision and Mission	**VISION** of Mechanical Engineering Department, CGU: The vision of the Department of Mechanical Engineering at the C.V. Raman Global University is to be recognized as one of the top tier department for its outstanding education, research, and outreach programmes, and is renowned for the high quality of its graduates. **MISSION** of Mechanical Engineering Department, CGU: **M1:** To provide a high quality education to the students and enhancing their skills that enables them to become leaders in their chosen professions. **M2:** To establish and maintain state of the art research facilities to provide its students and faculty with opportunities to create, interpret, apply and disseminate knowledge in engineering and science through undergraduate and graduate research. **M3:** To provide beneficial service to the local, state, national industries, and communities via educational, technical, entrepreneurial, and professional activities. **M4:** To develop linkages with world class R&D organizations and educational institutions in India and abroad for excellence in teaching, research and consultancy practices.
Course Objectives/ Expectations	• Solution of constrained body problems with or without friction using basic principles of statics. • Calculation of the centroid, centre of gravity, and moment of inertia for various one- and two-dimensional objects • Determination of forces acting on the members of a truss using joint and section methods • Energy and their conversion in real life using first law of thermodynamics • Understanding of second law of thermodynamics applicable to heat engine, refrigerator, and heat pump
Prerequisites	+2 physics

Course outcomes	• Apply laws of mechanics and condition of equilibrium to determine forces acting on a static body with or without friction • Determine the Centre of gravity and moment of inertia of different shapes • Analyze forces in different members of a truss using method of joints and method of section principles. • Analyse fixed mass and control volume systems using the conservation of energy principle • Determine the efficiency and COP of heat engines, refrigerators, heat pumps using second law of thermodynamics principles.

NOTE: First one to two classes should be marked for
Vision and Mission of department
Course Objectives and Outcomes.

Course utilization Plan/Lesson Plan				
Module No	**Syllabus**	**Required contact Hours**	**COs addressed**	**References book Used**
Module-1	**Statics of Particles:** Force, Classification & representation, Force as a vector, Parallelogram law, Resolution and composition of forces, Principle of superposition, and Transmissibility of forces. **Statics of Rigid bodies:** Equilibrium of coplanar force system, Free body diagrams, Determination of reactions, Equilibrium of a body under three forces, Lami's theorem. Moment of a force about a point and an axis, Moment of coplanar force system, Varignon's theorem. **Friction:** Introduction, Limiting friction, Angle of friction, Laws of dry friction, Friction in inclined planes, Angle of repose, Cone of friction.	**10**	**1**	**1-7**
Module-2	**Parallel and Distributed forces:** Parallel forces in a plane, Distributed Parallel forces in a plane, Couple, Resolution of a force into a force and a couple, Moment of a couple. **Centroid and Moment of Inertia:** Determination of center of gravity, Center of mass, and centroid by direct integration and	**9**	2	**1-7**

	by the method of composite bodies, Area moment of inertia of composite plane figures and mass moment of inertia, Radius of gyration, Perpendicular and parallel axis theorem, Pappus theorems, Polar moment of inertia.			
Module-3	**Basic Structural Analysis:** Plane truss, Difference between truss and frame, Perfect and imperfect truss, Assumptions and analysis of plane truss, Zero force members, Analysis of perfect plane trusses by the method of joints, method of section.	**7**	3	**1-7**
Module-4	**Fundamental concepts and definitions in Thermodynamics:** Scope of Thermodynamics, Macroscopic and Microscopic approaches, Systems, Properties, Process, State, Cycle, Thermodynamic equilibrium, Pressure, Zeroth Law of thermodynamics, Concepts of temperature, Energy and its form, Work and heat, Enthalpy.	**8**	4	**1-7**
Module-5	**First law of Thermodynamics:** 1st law of TD for closed and open systems, Flow processes and control volume, Flow work, Steady flow energy equation. **Second Law of Thermodynamics:** Statements, Heat Engine, Refrigerator, Heat Pump, and Carnot cycle, Entropy. **Application of Thermodynamics:** Steam Power Plant, Refrigerators and Heat pump, I.C. Engines (Brief Description of different components with Schematic diagram only).	**8**	5	**1-7**
	TOTAL	**42 HOURS**		

Sl. No.	Topic	No. of hours Required	Outcome	Mode of Teaching
1	Vision and Mission of department Course Objectives and Outcomes Student assessment, Information regarding Syllabus, Evaluation scheme, Assessment techniques, Experiential Learning, Introduction to Mechanics, Basic Terminologies	1	Know about Vision and Mission Apply laws of mechanics and condition of equilibrium to determine forces acting on a static body with or without friction	Offline
2	Statics, Principle of Statics, and Newton's laws of mechanics	2		Offline
3	Parallelogram, Triangle, and Polygon Law of Forces	1		Offline
4	Method of Resolution and Composition of Forces, Equilibrium of Forces and Principle of Transmissibility of Forces.	1		Offline
5	Moment of a force, Varignon's Theorem, and Principle of moment.	2		Offline
6	Friction, Limiting friction, Laws of static friction, Angle of friction, repose and cone.	3		Offline
7	Parallel forces in a plane, Distributed Parallel forces in a plane	2	Determine the Centre of gravity and moment of inertia of different shapes	Offline
8	Couple, resolution of a force into a force and a couple, moment of a couple	2		Offline
9	Determination of center of centroid by direct integration method	3		Offline
10	Determination of centroid by the method of composite bodies	1		Offline
11	Area moment of inertia of composite plane figures and mass moment of inertia, radius of gyration	1		Offline
12	Plane truss, difference between truss and frame, perfect and imperfect truss	1	Analyze forces in different members of a truss using method of joints and method of	Offline
13	Assumptions and analysis of plane truss, zero force members	2		Offline

14	Analysis of perfect plane trusses by the method of joints	5	section principles	Offline
15	Introduction, Scope of Thermodynamics, Macroscopic and Microscopic approaches	1	Analyse fixed mass and control volume systems using the conservation of energy principle	Offline
16	Thermodynamic Systems, boundary and surrounding, Types of TD system	1		Offline
17	Properties, Process, State, Cycle, Thermodynamic equilibrium, Quasi-static process, Reversible and irreversible process	2		Offline
18	Pressure measuring instruments, Bourdon's tube pressure gauge, Manometers and types, Simple U-tube manometers	1		Offline
19	Work transfer, Displacement work in various non-flow processes	2		Offline
20	Heat transfer, Different modes of heat transfer, Application of heat transfers	1		Offline
21	First law of TD (Closed system), Specific heats, Enthalpy, PMM1	1	Determine the efficiency and COP of heat engines, refrigerators, heat pumps using second law of thermodynamics principles.	Offline
22	First law of TD (Open system), S.F.E.E, Examples of steady flow process	1		Offline
23	Limitations of 1st law of TD, Cyclic HE, Thermal Energy Reservoir	1		Offline
24	Kelvin-Planck statement, PMM2, Clausius statement	1		
25	Refrigerator, Heat pump	1		
26	Carnot cycle	1		
27	Steam Power Plant, Refrigerators and Heat pump (Brief Description of different components with Schematic diagram only).	1		
28	Steam Power Plant, Refrigerators and Heat pump (Brief Description of different components with Schematic diagram only).	1		

Text Books	
	1. S. Timoshenko, D. H. Young & J. V. Rao, Engineering Mechanics, Tata McGraw Hill, 2013 **2.** B. Bhattacharyya, Engineering Mechanics, Oxford University Press, 2009 **3.** P. K. Nag, Engineering Thermodynamics, McGraw Hill Education, 2017
Reference Books	
	4. Meriam & Kraige, Engineering Mechanics [Vol-I & II], Wiley India, 2009 **5.** R. C. Hibbeler, Engineering Mechanics, Pearson Education Inc., 2009 **6.** Sonntag, Borgnakke, & V. Wylen, Fundamentals of Thermodynamics, Wiley, 2007 **7.** Y. A. Çengel & M. A. Boles, Thermodynamics: An Engineering Approach, McGraw Hill, 2017

Syllabus for Internal Assessment Tests (IAT*)

Module 1-3

Evaluation :Quiz/Assignment/Seminar/Mini Project/Viva

Evaluation	Continuous assessments (assignments, quizzes), Mid-semester exam, End-semester exam
Evaluation tools/method	Online quizzes via google form
Innovative pedagogy List of topics	Flipped classroom Video simulations
Mention best practices adopted in teaching the course	• Use of theory explanation combined with discussions to promote interactive learning. • Incorporation of **problem-solving sessions** alongside lectures to reinforce concepts. • Conducting **quizzes during classes** to check understanding and maintain engagement. • Providing **study materials for asynchronous learning** to support self-paced study. • Ensuring **teacher-led explanations** to clarify difficult concepts. • Emphasizing **practical applications** of theoretical concepts (e.g.,

	thermodynamics, power plants, heat engines). • Mixing **synchronous (live classes)** with **asynchronous (self-study)** modes for blended learning. • Encouraging **student participation** through discussions and Q&A. • Integrating **real-world examples and case studies** where possible. • Periodic **assessment and feedback** to monitor student progress.
Mention the Importance of this subject along with Real Time Applications	**Importance of the Subject** • Provides a **foundation of core mechanical engineering concepts** such as thermodynamics, fluid mechanics, materials, and manufacturing. • Helps students **understand engineering principles** that are essential for designing and analyzing machines and systems. • Develops **problem-solving and analytical thinking** by combining theory with practical examples. • Acts as a **gateway to advanced mechanical engineering courses** like Machine Design, Heat Transfer, Fluid Dynamics, etc. • Encourages **interdisciplinary learning**, as mechanical principles are applied in aerospace, automotive, robotics, energy systems, and biomedical fields. • Strengthens the ability to **link mathematics and physics with engineering solutions**. **Real-Time Applications** • **Automobile Industry**: Design and functioning of engines, brakes, transmission, and suspension systems. • **Power Plants**: Application of thermodynamics in steam turbines, boilers, and energy generation. • **Refrigeration & Air Conditioning**: Principles of heat transfer and thermodynamics in cooling systems. • **Aerospace Engineering**: Jet engines, propulsion systems, and aerodynamics. • **Manufacturing Sector**: Use of materials, machining, and production processes in industries. • **Robotics & Automation**: Mechanical linkages, actuators, and motion systems. • **Biomedical Devices**: Prosthetics, implants, and medical instruments designed using mechanical principles. • **Renewable Energy**: Wind turbines, solar thermal systems, and hydroelectric plants.

Course Outcomes		Blooms Level	Modules covered	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO-1		**L1**	3	3	1	0	0	0	1	0	2	1	0	1	3	3	1	0
CO-2		**L2**	3	3	2	1	0	1	1	1	2	1	0	1	3	3	2	1
CO-3		**L3**	3	3	2	1	0	1	1	1	2	1	0	1	3	3	2	1
CO-4		**L4**	3	3	1	0	1	0	1	0	2	1	0	1	3	3	1	0
CO-5		**L5**	3	3	1	0	0	1	1	1	2	1	0	1	3	3	1	0

MAPPING OF COURSE OUTCOME TO PROGRAM OUTCOME (CO –PO MAPPING) [Course articulation matrix]

Learning Assessments							
Bloom's Taxonomy		Teacher Assessment / Formative Assessment (40 %)				Summative Assessment (60 %)	
		Quiz (10%)	Assignment (10%)	Experiential learning * (10%)	Attendance (10%)	Mid Sem (20%)	End Sem (40%)
Level-1	Remembering	40%	40%	20%		40%	30%
Level-2	Understanding						
Level-3	Applying	60%	40%	40%		60%	50%
Level-4	Analyzing						
Level-5	Evaluating		20%	40%			20%
Level-6	Creating						
Total			100%	100%	100%		100%

***NOTE: Experiential Learning: class test/simulation project/survey paper/ case study presentation/team project**

Course Prepared By: Dr. Hillol Joardar

Course Verified By: Dr. T P Mohapatra

Identified curriculum gap if any and Justification:

Identified Gap	Justification
Emerging Technologies Not Covered: Modern advancements such as robotics, automation, 3D printing, electric vehicles, and renewable energy systems are not explicitly included.	**Future-Oriented Learning**: Mechanical engineering is rapidly evolving with automation, AI, and green technologies. Including these will future-proof the curriculum.
Interdisciplinary Integration: The course primarily emphasizes traditional mechanical engineering, with minimal links to electronics, computer science, and AI applications in mechanical systems.	**Holistic Education**: Interdisciplinary integration encourages problem-solving across domains (e.g., mechatronics, biomedical devices).

Proposed Actions to fill the identified gaps:

- **Introduce Laboratory/Workshop Sessions**
- **Integration of Software Tools**
- **Industry Interaction**
- **Interdisciplinary Integration**

Contents taught beyond the syllabus.

Introduction to Emerging Technologies

- Overview of **3D printing, robotics, and automation** in modern mechanical engineering.
- Awareness about **electric vehicles and renewable energy systems** as future trends.

Industry Applications & Case Studies

- Real-world examples from **automobile, aerospace, and manufacturing sectors**.
- Case studies on energy efficiency, sustainability, and green technologies.