SILIGURI INSTITUTE OF TECHNOLOGY
ENGINEERING

COURSE FILE

3RD SEM, 2ND YEAR, 2022-23

PAPER DESCRIPTION : ENGINEERING MECHANICS

PAPER CODE : ES(ME)301

Course Description

Course Title: Engineering Mechanics

Code: ES(ME)301

Semester : 3rd Year: 2nd

Name of the Faculty: Mr. Pinaky Bhadury & Mr. Bhaskarananda Dasgupta

E-mail :

Class Schedule:		
Lecture		
Mon: 03.50pm-4.40pm	**Tue: 10.00am-10.50am**	**Fri: 10.50am-11.40am**

Hours for meeting students:
By appointment or when mutually available

i) Course Objective

The students will be able to acquire skills to analyze the static and dynamic aspects of rigid bodies and the effect of forces on deformable structures.

ii) Course Outcomes

i. After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes.

The student will be able to:

	COURSE OUTCOME	Target
CO1	Understanding the basic mathematical tools to deal with physical bodies.	60%
CO2	Estimating the effect of forces on physical bodies due to application of external forces with mathematical techniques.	60%
CO3	Using the concept related to motion of bodies, to study problems.	60%
CO4	Study the effect of different types of forces acting on rigid bodies.	60%
CO5	Determine effect of forces on bodies undergoing deformation.	60%

ii. Once the student has successfully complete this course, he/she must be able to answer the following questions or perform/demonstrate the following:

iii) Topic/Unit/Chapter Layout

Sl No.	Topic	Lecture Hours
1.	Introduction to vectors and tensors and coordinate systems: Vector and tensor algebra; Indical notation; Symmetric and anti-symmetric tensors; Eigen values and Principal axes.	5 HRS.
2.	Three Dimensional rotation: Euler's Theorem, Axis angle formulation and Euler angles; Coordinate transformation of vectors and tensors.	4 HRS.
3.	Kinematics of Rigid bodies: Dentition and motion of a rigid body; Rigid bodies as coordinate systems; Angular velocity of a rigid body, and its rate of change; Distinction between two-and three dimensional rotational motion; Integration of angular velocity to find orientation; Motion relative to a rotating rigid body: Five term acceleration formula.	6 HRS.
4.	Kinetics of Rigid bodies: Angular momentum about a point, Inertia tensor: Dentition and computation, Principal moments and axes of inertia, Parallel and perpendicular axes theorems; Mass moment of inertia of symmetrical bodies, cylinder, sphere, cone etc., Area moment of inertia and Polar moment of inertia, Forces and moments; Newton-Euler's laws of rigid body motion.	5 HRS.
5.	Free Body Diagram: Examples on modeling of typical supports & joints and discussion on kinematic and kinetic constraints that they impose.	1 HRS.
6.	General Motion:Examples & problems. General planer motions. General 3-D motions. Free Precession, Gyroscopes, Rolling Coin.	9HRS
7.	Bending moment: Transverse loading on beams, shear force & bending moment in beams, analysis of cantilevers, simply supported beams and overhanging beams, relationships between loading, shear force and bending moment,	5HRS

	shear force and bending moment diagrams.	
8.	Torsional motion: Torsion of circular shafts, derivation of torsional equation, stress & deformation in circular & hollow shafts.	2HRS
9.	Friction: Concept of Friction: Laws of Coulomb friction, Angle of Repose; Coefficient of friction	3HRS

iv) Textbooks

1. Engineering Mechanics by Dr. D.S. Kumar, Katson Books.

2. Strength of Materials by R.K. Rajput, S. Chand & Co. Ltd.

3. Theory and problems of Vector Analysis and an introduction to Tensor Analysis by Murrey R Spiegel.

Reference Books:

1. Engineering Mechanics by Timoshenko, Young and Rao, Revised 4th ed. – TMH.

2. Engineering Mechanics [Vol-I & II] by Meriam & Kraige, 5th ed. – Wiley India.

3. Elements of Strength of Materials by Timoshenko & Young, 5th ed. – E.W.P.

(v) Evaluation Scheme

1) Theory

Evaluation Criteria	Marks
Continuous Evaluation (CA1, CA2, CA3, CA4)	30
University Exam/External Exam	70
Total	100

* Two internal examinations are conducted; based on those two tests, average of them are considered in a scale of 15.

Course target attainment levels:

Attainment Level	Inference
Attainment Level 1	50% of the students have attained more than the target level of that CO
Attainment Level 2	60% of the students have attained more than the target level of that CO
Attainment Level 3	70% of the students have attained more than the target level of that CO

University Grading System:

Grade	Marks
O	90% and above
E	80 – 89.9%
A	70 – 79.9%
B	60 – 69.9%
C	50 – 59.9%
D	40 – 49.9%
F	Below 40%

(vii) Assessment Methodology

Outcome	Assessment Tool
CO1	Continious evaluation by IE-I,IE-II,Assignments, Quiz, Term Paper, Presentation, Attendance.
CO2	Continious evaluation by IE-I,IE-II,Assignments, Quiz, Term Paper, Presentation, Attendance.
CO3	Continious evaluation by IE-I,IE-II,Assignments, Quiz, Term Paper, Presentation, Attendance.
CO4	Continious evaluation by IE-I,IE-II,Assignments, Quiz, Term Paper, Presentation, Attendance.
CO5	Continious evaluation by IE-I,IE-II,Assignments, Quiz, Term Paper, Presentation, Attendance.

(VIII) A. Weekly Lesson Plan

Week	Lectures
1	Introduction to vectors and tensors and co-ordinate systems

2	Three-dimensional rotation: Euler's theorem, Axis-angle formulation and Euler angles; Coordinate transformation of vectors and tensors.
3	Kinematics of rigid bodies: Dentition and motion of a rigid body; Rigid bodies as coordinate systems; Angular velocity of a rigid body, and its rate of change; Distinction between two-and three dimensional rotational motion; Integration of angular velocity to find orientation; Motion relative to a rotating rigid body: Five term acceleration formula.
4	Kinetics of rigid bodies: Angular momentum about a point; Inertia tensor: Dentition and computation, Principal moments and axes of inertia, Parallel and perpendicular axes theorems; Mass moment of inertia of symmetrical bodies, cylinder, sphere, cone etc., Area moment of inertia and Polar moment of inertia, Forces and moments; Newton-Euler's laws of rigid body motion.
5	Free body diagrams; Examples on modelling of typical supports and joints and discussion on the kinematic and kinetic constraints that they impose.
6	General Motion: Examples and problems. General planar motions. General 3-D motions. Free precession, Gyroscopes, Rolling coin.
7	Transverse loading on beams, shear force and bending moment in beams, analysis of cantilevers, simply supported beams and overhanging beams, relationships between loading, shear force and bending moment, shear force and bending moment diagrams.
8	Torsion of circular shafts, derivation of torsion equation, stress and deformation in circular and hollow shafts
9	Concept of Friction; Laws of Coulomb friction; Angle of Repose; Coefficient of friction.