COURSE STRUCTURE

Course Code	**CIV1PM01A**				
Course Category	**Program Major**				
Course Title	**Engineering Mechanics**				
Teaching Scheme	**Lectures**	**Tutorials**	**Laboratory / Practical**	**Project**	**Total**
Weekly load hours	**2**	**-**	**2**	**-**	**4**
Credits	**2**	**-**	**1**	**-**	**3**
Assessment Schema Code	TL4				

Prerequisites: H.S.C-Physics and Mathematics

Course Objectives:

1. To impart knowledge about force systems, classify various force systems, composition, resolution of forces and the concept of center of mass and centroid.
2. To impart knowledge to determine reaction of beams, calculate member forces in trusses, and cables using principles of equilibrium
3. To interpret and understand various laws of friction and principle of equilibrium to the forces in space.
4. To learn to solve problems related to particle mechanics using principles of kinematics, kinetics and work, power, energy and impact

Course Outcomes:

After completion of this course students will be able to:

1. Understand the procedure to calculate the resultant of various force systems and centroid. (CL-II)
2. Calculate the reaction of beams, trusses and forces in the members and cables. (CL-II)
3. Apply and analyzed the problem related to friction and principle of equilibrium to forces in space. (CL-II)
4. Calculate position, velocity and acceleration of particle in kinematics and kinetics, work, energy and impact. (CL-II)

Course Contents:

Unit 1: Introduction and Operations with Forces:

Introduction to Mechanics, Laws of mechanics, System of Forces, Parallelogram and triangular Law of forces, Resolution of coplanar forces, Resultant of Forces, Moment of a force, Varignon's theorem, Moments and Couples, Equivalent system of forces, Free body diagram, Requirements of stable equilibrium, Equilibrium of bodies subjected to two, and three force system, Lami's theorem, Center of Gravity and Centroid - linear objects (1-D), laminar objects (2-D).

Unit 2: Analysis of Plane Structures:

Analysis of Beams: Types of supports, Reactions of determinate beams subjected to different types of transverse loads.

Analysis of Cables: Cables subjected to concentrated loads only.

Analysis of Trusses: Introduction to trusses, Assumptions, Types of Trusses, Deficient, Perfect and Redundant Trusses, Method of Joints, Method of section.

Unit 3: Friction and Space Forces

Friction: Introduction to frictional force, laws of friction, Angle of repose, Force required to move a body along horizontal and inclines planes, Analysis of ladder, wedge and belt friction.

Space Forces: Resultant and equilibrium of concurrent space force systems, Resultant and equilibrium of parallel space force system.

Unit 4: Dynamics: Kinematics of Particles:

Rectilinear Motion: Uniform motion, Motion under gravity, uniformly accelerated motion, Motion with Variable acceleration, Motion curves, Dependent motion, Relative Motion

Curvilinear Motion: Rectangular coordinate system, Path variables (Normal and Tangential components of acceleration)

Unit 5: Kinetics of particles:

Newton's Second Law of Motion, Equations of Motions, Dynamic Equilibrium, Work of a force: W.D. by Gravitational force, W.D. by a spring force, W.D. by friction, W.D. by K.E., Principle of Work and Energy, Principle of Impulse and Momentum, Impact of bodies.

Laboratory Exercises / Practical:

Every student will carry out minimum *Six Practical*/exercises based on the above units and submit the journal, which will be evaluated as part of continuous assessment.

1. Verification of law of parallelogram of forces/polygon of forces.

2. To find the member forces of Jib Crane.

3. To verify the law of moments by bell crank lever.

4. Force Table Apparatus to analyze equilibrium conditions for concurrent forces and finding out resultant.

5. To determine support reaction of simple and compound beams and verify the reaction by analytical (By Equilibrium Conditions) and graphical Methods.

6. To find Force transmitted by member of given truss/Simple roof Truss and verify the forces by analytical and graphical method.

7. Determination of coefficient friction of inclined plane and Determination of coefficient friction of belt (Flat Belt)

8. To determine forces in the members of space force system and verify with analytical Method.

9. Moment of Inertia of Flywheel.

10. To study the curvilinear motion and verify with analytical method.

11. Determination of coefficient of restitution between two colliding bodies for different materials (Rubber, Steel, Aluminum and wood).

12. To find the law of a simple lifting machine. (Worm-wheel and second system of pulley)

Learning Resources:

Reference Books

1. Engineering Mechanics: Statics & Dynamics by Russell C. Hibbeler, Publication Year: 2016 (14th edition)

2. Vector Mechanics for Engineers: Statics and Dynamics" Author: Ferdinand P. Beer, E. Russell Johnston Jr., David Mazurek, Phillip J. Cornwell Publication Year: 2019 (12th edition)

3. Engineering Mechanics by Andrew Pytel and Ferdinand L. Singer, Publication Year 2007 (4th edition)

4. Engineering Mechanics: Statics and Dynamics by J.L. Meriam, L.G. Kraige, John Wiley & Sons Publication Year 2015 (8th edition)

Supplementary Reading:

1. Engineering Mechanics by S. Timoshenko, D.H. Young, J.V. Rao and Sukumar Pati, Publisher: McGraw Hill Education, published in 2019 (5th edition).

2.Engineering Mechanics - Statics and Dynamics by Irving H. Shames Publisher: Prentice Hall of India Private Limited, published in 2002 (4th edition).

Web Resources:

Weblinks:

1.Fundamental of Engineering Mechanics by Prof. U.S. Dixit, Dr. G. Saravana Kumar, IIT Guwahati Link: http://nptel.ac.in/courses/112103108/

2.Equation of equilibrium and analysis of truss by Prof. U.S. Dixit, IIT Guwahati Link: http://nptel.ac.in/courses/112103109/

3.Momentum and Work-Energy by Prof. Manoj K Harbola, IIT Kanpur Link: http://nptel.ac.in/courses/122104014/

4. Statics and Dynamics by Prof. Mahesh Panchagnula Link: http://nptel.ac.in/courses/112106180

MOOCs: Online courses for self-learning

1. Engineering Mechanics (Statics and dynamics-basic course) by Prof. K. Ramesh, IIT Madras (https://onlinecourses.nptel.ac.in/noc20_me46/preview)

2. Introduction to Engineering Mechanics (Force, Moment Freebody diagram and Equilibrium) by Dr. Wayne Whiteman (https://www.coursera.org/learn/engineering-mechanics-statics)

Pedagogy: (You can add your own methods as applicable)

- PowerPoint presentations
- Scientific animations and videos
- Assignments and Class tests