COURSE STRUCTURE

Course Code	**CVE101B**			
Course Category	*Basic Science*			
Course Title	Mechanics			
Teaching Scheme and Credits	**L**	**T**	**Laboratory**	**Credits**
Weekly load hrs.	**4**	**---**	**2**	**3+1=4**

Pre-requisites:H.S.C-Physics and Mathematics

Course Objectives:

1. To import the knowledge about force systems, equilibrium and centroids.

2. Analyse the beams, trusses, frames, cables using principle of equilibrium.

3. Demonstrate the concept of friction and system of forces in space.

4. To impart problem solving ability using concept of kinetic and kinematics of particle and rigid body, work, energy and impact.

Knowledge:

(i)Student learn to classify various force systems, employ, and composition of resolution of forces.

(ii) Student interpret and understand various laws of friction, motion, energy, work and power.

Skill:

(i) Student learn to apply various laws of mechanics in solving problem on statics and dynamics.

(ii) Students learn to prove various theorems experimentally.

Attitude:

(i) Students develop positive attitude and show motivated behaviour in learning principals of mechanics.

Course Outcomes:

On the completion of the course, learner will be able to:

1. Determine the resultant of various force systems and centroid.

2. Determine the reaction of beams, trusses and forces in the members and cables.

3. Solve the problem related to friction and apply principle of equilibrium to forces in space.

4. Calculate position, velocity and acceleration of particle and rigid body, work, energy and impact.

CourseContents:

Module-1

Introduction and Operations with Forces: Introduction to Engineering Mechanics, effects of forces on bodies, basic concepts [Space, Time, Mass, Force], Idealization of bodies in Engineering Mechanics, Axioms in Engineering Mechanics, Resolution and Composition of Forces, Moment of a force about a point and about a line, Varignon's theorem of moments, couples, different types of force systems.Concept of resultant of a force systems, Equivalent systems, Resultant of concurrent and parallel force systems (Coplanar only), Resultant of general coplanar force systems, Centre of gravity and Centroids: Centroids of linear objects (1-D), Centroids of of laminar objects (2-D), Concept of equilibrium, free body diagram, physical, Analytical and graphical conditions of equilibrium, Types of supports, Equilibrium of two forces, Equilibrium of three forces, Analysis of bodies in equilibrium: bodies subjected to general coplanar force systems.

Module-2

Analysis of Plane Structures: Beams: Reactions of determinate beams subjected to different types of transverse loads, Analysis of Cables subjected to concentrated loads. Analysis of Trusses: Concept of two force member, Introduction to trusses, Assumptions, Types of Trusses, Deficient, Perfect and Redundant Trusses. Analysis of Trusses: Method of Joints, Method of section,Analysis of Frames: Two force member of a frame, multi force members, analysis by method of members.

Module-3

Friction : Introduction to frictional force, preliminary concepts, laws of friction, Ladder, Analysis of equilibrium of bodies including frictional forces, Block and wedge friction, Belt Friction (Flat Belt only), Band Brakes.

Space Forces: Force as a vector (3-D): Operations with space forces, Moment of a force about a point and about a line, Resultant and equilibrium of concurrent space force systems, Resultant and equilibrium of parallel space force system.

Module-4

Dynamics: Kinematics of Particles: Introduction to Dynamic's, Kinematics and Kinetics, Rectilinear motion: uniform motion, uniformly accelerated motion, motion under gravity, Rectilinear motion with Variable acceleration: a=f(t), a=f(v), a=f(x), Simple harmonic motion, Analysis of Rectilinear motion using Graphical representation i.e. Motion curves, Dependent motion, Curvilinear Motion: Rectangular coordinate system, motion of projectiles, Curvilinear motion: Path variables (Normal and Tangential components of acceleration), Curvilinear motion: Polar co-ordinates (Radial and transverse components of velocity and acceleration), Relative Motion

Module-5

Kinetics of particles:Concept of Dynamic Equilibrium, Newton's second law of motion applicable to Rectilinear motion, Rectangular co-ordinates, Newton's 2nd law of motion: Curvilinear motion (Path variables), Newton's 2nd law of motion: Curvilinear motion (Polar co-ordinates), Work of a force: W.D. by Gravitational force (GPE), W.D. by a spring force (EPE), K.E., efficiency, Conservative Forces, Conservation of Energy. Conservation of Momentum, Direct central impact, Coefficient of restitution, elastic, semi-elastic and plastic impact.

Module-6

Kinematics of Rigid Bodies: Planar rigid body motion, translation of R.B., rotation about a fixed axis, Absolute motion analysis, and Relative motion analysis: velocity, instantaneous centre of zero velocity (I.C.R.), And Relative motion analysis: Acceleration, Relative motion analysis using rotating axes (Coriolis Acceleration).

Laboratory Exercises / Practical:

1. Reaction of simple and compound beams.
2. Determination of coefficient of friction between flat belt and pulley.
3. To find the law of machine of a simple lifting machine.
4. Determination of forces in space force system.
5. Study of curvilinear motion
6. Moment of Inertia of Fly wheel.
7. Determination of coefficient of restitution.
8. Graphical solution of resultant of concurrent coplanar force system.
9. Reactions of beams by Graphical method.
10. Analysis of truss using Graphical method.
11. Graphical representation of rectilinear motion (Motion curves).
12. Graphical solution of relative motion.
13. Graphical solution of instantaneous center of rotation.

LearningResources:

Reference Books (Latest Editions)

1. Vector Mechanics for Engineers: Statics and Dynamics by F.P. Beer and E.R.Johnson, Tata McGraw-HillPublication.
2. Engineering Mechanics: Statics and Dynamics by J.L.Meriam and Craige, John Willey and sonspublication.
3. Engineering Mechanics: Statics & Dynamics by R.C. Hibbeler, McMillanpublication.
4. Engineering Mechanics by F L Singer, Harper and Rowepublication
5. Engineering Mechanics by Shame I.H., P H IIndia

References for project based learning (BPL)

1 How things work: The physics of everyday life by louis A. Bloom Field John wiley and sons.

2 Flying Circle of Physic by jearl walker, john wiley and sons 2011

3 Riddles in your tea cup- parthaghose, rupa publication (book published based on Doordarshan serial Quest)

4 www.howstuffworks.com

5 www.youtube.com/watch?y=UZDG54sDA9w

Web Resources

1 Equilibrium: http://nptel.ac.in/courses/1121031019/2

2 Trusses http://nptel.ac.in/courses/1121031019/3

3 Cables http://nptel.ac.in/courses/1121031019/8

4 Friction http://nptel.ac.in/courses/1121031019/9

5 kinematics of particle http://nptel.ac.in/courses/1121031019/27

6 kinematics of particle http://nptel.ac.in/courses/1121031019/25

7 work energy

8 impulse of momentum http://nptel.ac.in/courses/1121031019/23

Pedagogy:

- Co teaching method
- Use PPT, Video
- Group activity, guest lecture

AssessmentScheme:

Class Continuous Assessment (CCA): 100 Marks

Attendance	Assignments	Mid Term Test	Group Activity
5 marks (5%)	60 Marks 60%	15 Marks 15%	20 Marks 20%

Laboratory Continuous Assessment (LCA): 50 Marks

Attendance and Performance	Journal completion and presentation	Oral based practical
10 Marks 20%	20 Marks 40%	20 Marks 40%

Term End Examination : 50Marks

Syllabus:

Module No.	Contents	Workload in Hrs		
		Theory	*Lab*	*Assess*
1	Introduction and Operations with Forces	10	4	
2	Analysis of Structures	6	6	
3	Friction and space forces	7	4	
4	Kinematics of Particles	8	8	
5	Kinetics of particles	9	**2**	
6	Kinematics of rigid bodies	5	**2**	

Prepared by	Checked by	Approved by
Prof. S.S. Sathe	Prof. S. R Bendale.	Dr. M.S. Kulkarni
Course-Coordinator	for Course-Coordinator	HOS
School of Civil	School of Civil	School of Civil
MIT WPU	MIT WPU	MIT WPU