

Course Name : Civil, Mechanical and Electrical Group

Course Code : CE/CS/CR/ME/PT/PG/AE/EE/EP/MH/FE/CV/MD

Semester : Second

Subject Title : Engineering Mechanics

Subject Code : 9011

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme						
TH	TU	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
03	--	02	03	80	20	---	---	25@	125

Rationale:

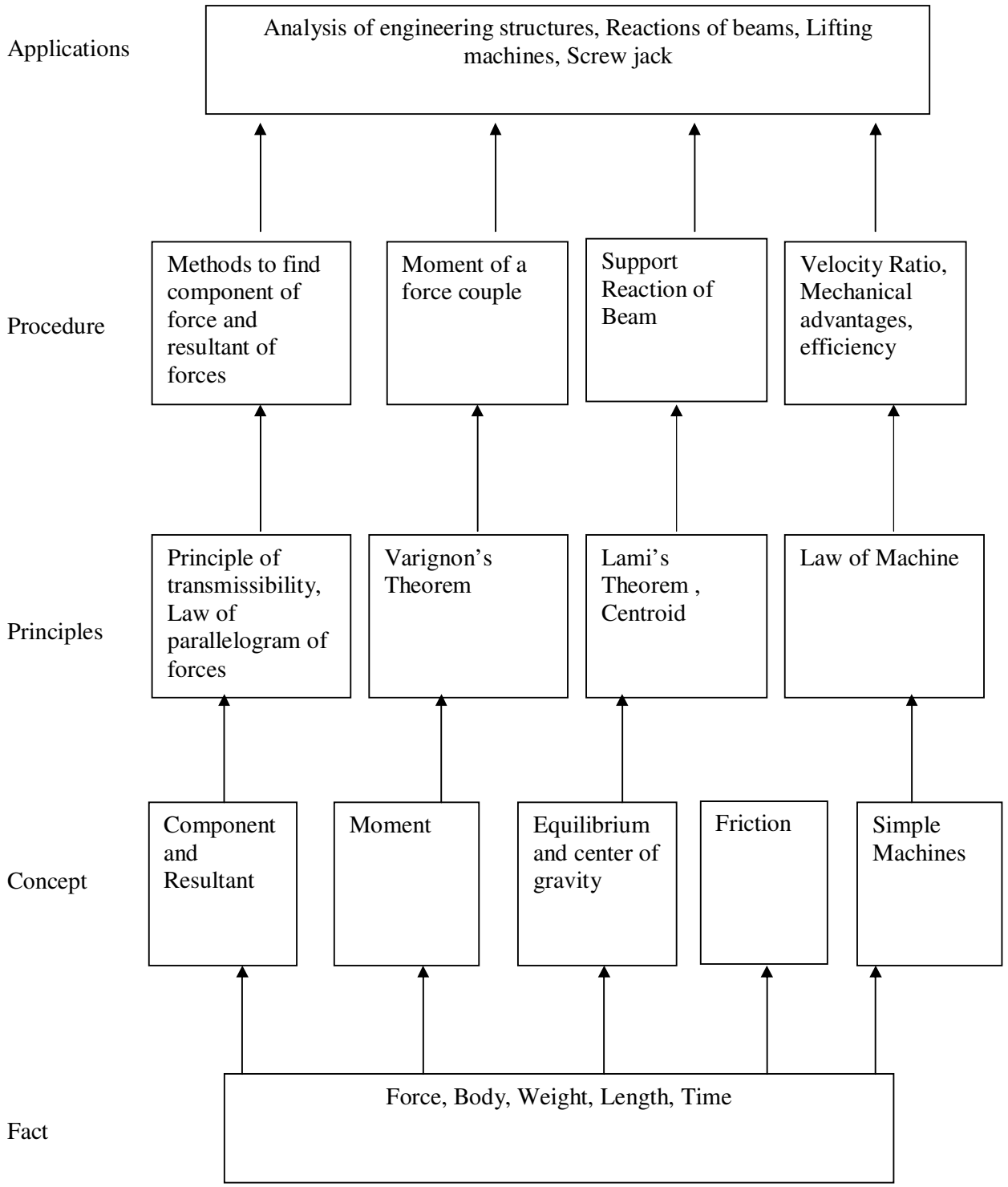
The Subject is grouped under basic engineering courses, which helps the students to understand facts, concepts, principles and techniques of scientific investigation in the field of Civil Engineering. The subject describes analysis of structure and mechanisms, principles which are commonly used in Civil Engineering Structures and also used in the machines and measuring instruments.

Objectives:

The students will able to:

1. Resolve the forces.
2. Find the resultant of given force system.
3. Find the reactions of beam.
4. Find the center of gravity of composite solids.
5. Find M.A., V.R., Efficiency and establish law of machine.

Learning Structure:



Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	<p>Force</p> <p>a. Fundamentals: - Definitions of mechanics, statics, dynamics. Engineering Mechanics, body, rigid body, mass, weight, length, time, scalar and vector, fundamental units, derived units, S.I. units.</p> <p>b. Force: - Definition of a force, unit force, Newton, S.I. unit of a force, representation of a force by vector and by Bow's notation method. Characteristics of a force, effects of a force, principle of transmissibility.</p> <p>c. Resolution of a force: Definition, Method of resolution, Types of component forces, Perpendicular components and Non-perpendicular components.</p> <p>d. Moment of a force: - Definition, measurement of moment of a force, S. I. unit, geometrical meaning of moment of a force, classification of moments according to direction of rotation, sign convention, law of moments Varignon's theorem of moment and its use, couple – definition, S.I. unit, measurement of a couple, properties of couple.</p> <p>e. Force system: - Definition, classification of force system according to plane and line of action</p> <p>f. Composition of Forces: - Definition, Resultant force, methods of composition of forces, I - Analytical method – (i) Trigonometric method (law of parallelogram of forces) (ii) Algebraic method (method of resolution), II - Graphical method: - Introduction, space diagram, vector diagram, polar diagram, and funicular polygon. Resultant of concurrent, non-concurrent and parallel force system by analytical and graphical method.</p>	12	20

02	<p>Equilibrium:</p> <p>2.1 Definition, conditions of equilibrium, analytical and graphical conditions of equilibrium for concurrent, non-concurrent and parallel force system, free body and free body diagram.</p> <p>2.2 Lami's Theorem – statement and explanation, Application of Lami's theorem for solving various engineering problems.</p> <p>2.3 Equilibrant – Definition, relation between resultant and equilibrant, equilibrant of concurrent and non-concurrent force system.</p> <p>2.4 Beams – Definition, Types of beams (cantilever, simply supported, overhanging, fixed, continuous), Types of end supports (simple support, hinged , roller), classification of loads, point load, uniformly distributed load. Reactions of a simply supported and over hanging beam by analytical and graphical method.</p>	10	16
03	<p>Friction:</p> <p>3.1 Definition of friction, force of friction, limiting frictional force, coefficient of friction, angle of friction, angle of repose, relation between angle of friction angle of repose and coeff. of friction. cone of friction, types of friction, laws of friction, advantages and disadvantages of friction.</p> <p>3.2 Equilibrium of bodies on level plane –external force applied horizontal and inclined up and down.</p> <p>3.3 Equilibrium of bodies on inclined plane – external forces is applied parallel to the plane, horizontal and incline to inclined plane.</p> <p>3.4 Ladder friction, Wedge and block.</p>	08	16
04	<p>Centroid and Centre Of Gravity:</p> <p>4.1 Centroid: Definition of centroid. moment of an area about an axis. centroid of basic geometrical figures such as square, rectangle, triangle, circle, semicircle and quarter circle. centroid of composite figure.</p> <p>4.2 Center of gravity: Definition, center of gravity. of simple solids such as cylinder, sphere, hemisphere, cone, cube, and rectangular block. centre of gravity of composite solids.</p>	08	12

05	<p>Simple Machines:</p> <p>5.1 Definitions of simple machine, compound machine , load , effort , mechanical advantage , velocity ratio , input on a machine ,output of a machine ,efficiency of a machine , expression for mechanical advantage , velocity ratio and efficiency of a machine. ideal machine, ideal effort and ideal load, friction in machines, effort lost in friction and frictional load.</p> <p>5.2 Law of machine, maximum mechanical advantage and maximum efficiency of a machine, reversibility of a machine, condition for reversibility of a machine, self locking machine.</p> <p>5.3 Study of simple machines : Simple axle and wheel, differential axle and wheel, Weston’s differential pulley block, single purchase crab, double purchase crab, worm and worm wheel, geared pulley block, screw jack, pulleys : First, second and third system of pulleys, gear train, hoist mechanism.</p>	10	16
	Total	48	80

Practical:

Skills to be developed:

Intellectual Skill:

1. Calculate the forces on given structure
2. Interpret the results
- 3.

Motor Skills:

1. Handle the equipment carefully
2. Draw graph

The term work consist of any five experiments from Group A,B and graphical solution in Group C

Group A:

- 1) Verify law of polygon of forces
- 2) Verify law of moments
- 3) Verification of Lami’s theorem
- 4) Forces in members of a jib crane.

- 5) Comparison of coefficient of friction of various pair of surfaces and
- 6) determination of angle of repose
- 7) Equilibrium of parallel forces – simply supported beam reactions.
- 8) Experimental location of center of gravity of plane plate of uniform thickness.

Group B: To find MA, VR, Efficiency, Ideal Effort, Effort lost in friction for various loads and establish law of machine and calculate maximum efficiency.

Also check the reversibility of a machine (Any five):

- 1) Differential axle and wheel
- 2) Weston's differential pulley block
- 3) Geared pulley block
- 4) Single purchase crab
- 5) Double purchase crab
- 6) Worm and worm wheel
- 7) Two sheave and three sheave pulley block
- 8) Screw jack.

Group C: A 2 Size drawing sheets containing graphical solutions for –

- 1) Concurrent force system : Two problems
- 2) Parallel force system : Two problems
- 3) Reactions of a beam : Two problems

Learning Resources:

Books:

Sr. No.	Author	Title	Publisher
01	Beer – Johnson	Engineering Mechanics	Tata McGraw Hill, Delhi
02	Basu	Engineering Mechanics	Tata McGraw Hill, Delhi
03	Joseph F. Shelley	Vector Mechanics for Engineers Vol. I & II	Tata McGraw Hill, Delhi

