

CE151R ENGINEERING MECHANICS

Teaching Scheme : 03 L + 00 T; Total: 03 hours/week

Credits : 03

Evaluation Scheme : 10 ISA + 30 MSE + 60 ESE

Total Marks : 100

ESE Duration : 3 Hrs.

COURSE DESCRIPTION

This course provides the elementary level knowledge of Engineering and Engineering mechanics which includes study of forces and force systems, Resultant and equilibrium of coplanar force systems, friction, Kinematics and kinetics of bodies.

DESIRABLE AWARENESS / SKILLS

Knowledge of basics of material science and mathematics.

COURSE OUTCOMES

On the successful completion of this course; student shall be able to -

1. Compute the rectangular components of a force and Identify and/or list the different types of force systems. .
2. Define and calculate the resultant of coplanar force systems and Understand condition of equilibrium for coplanar forces.
3. Calculate the centroid and moment of inertia of composite plane figures.
4. Define friction, friction force, static friction, kinetic friction, normal force, coefficient of friction, angle of friction, and angle of repose.
5. Analyze beams and trusses.

RELEVANCE OF COURSE OUTCOMES (COs) WITH POs AND PSOs (WITH STRENGTH OF CO-RELATION)

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3			3		3	2						1		1
2	2			2		3	2						1		1
3	2					3	1						2		1
4	2					3	1						1		2
5	3			3		3	2						1		1

1-Weakly correlated

2 – Moderately correlated

3 – Strongly correlated

COURSE CONTENT

Introduction to Engineering Mechanics

Objectives of Engineering Analysis and Design, Idealization of Engineering Problems Principles of Mechanics, Basic concept and fundamental laws

Equilibrium of coplanar force system

Force types and Force System, composition and Resolution of forces, Resolution of Concurrent force System in Plane, Moment of forces/ Couple, Meaning of equilibrium, free body diagrams, Equations of equilibrium, Varignon's theorem, Equivalent Force system, Resultant of Non-Concurrent Force System in plane, Introduction to Space forces, Resultant of Concurrent Forces system in Space.

Equilibrium of Force System

Introduction, body constraints, type of supports, beams & loads, free body diagram, conditions of equilibrium, equilibrium of two, three forces in plane, Lami's theorem, equilibrium of forces in plane, reaction of determinate beam.

Center of Gravity

Introduction, center of Gravity / centroid of simple figures / composite sections, centre of gravity and its implications.

Moment of Inertia

Introduction, definition, moment of inertia of plane sections / standard sections / composite sections, theorem of moment of Inertia, mass moment of inertia of circular plate, cylinder, cone, sphere and hook.

Trusses

Definitions, assumptions, types, Analysis of simple plane perfect trusses by method of joints and method of section.

Friction

Introduction, Types of Friction, Co-efficient of Friction, Angle of Friction, Cone of Friction, Coulomb's Laws of Friction, Angle of Repose, Equilibrium of a Body Lying on a Rough Inclined Plane, wedge friction, screw jack / differential screw jack.

Kinematics of Particles

Motion related to cartesian coordinates.

Kinetics of Particles

Newton's second law, energy principles, Impulse momentum principle.

Virtual Work and Energy Method

Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies.

Text Books:

1. Engineering Mechanics, Bhavikatti S.S, 4th edition, New Age International Publications, 2013
2. Vector Mechanics for Engineers Vol I-Statics, Vol. II-Dynamics, F. P. Beer and E. R. Johnston, 9th Edition, , Tata McGraw Hill, 2011
3. A Text Book of Engineering Mechanics, R. K. Bansal, 6th edition, Laxmi Publication New Delhi, 2013

Reference Books

1. Engineering Mechanics, Irving H. Shames, 4th Edition, Prentice Hall, 2006
2. Engineering Mechanics, R.C.Hibbler, 4th edition, Pearson Press, 2006
3. Introduction to Statics and Dynamics, Andy Ruina and Rudra Pratap, Oxford University Press, 2011

Useful Links

1. NPTEL, www.nptel.ac.in
2. www.sasi.ac.in/mech
3. myengineeringmechanics.com

CE152R ENGINEERING MECHANICS LAB

Teaching Scheme : 02 P; Total: 02 hours/week

Credits : 01

Evaluation Scheme : 50 ICA

Total Marks : 50

COURSE DESCRIPTION

The laboratories cover experiments related to basic principles of Statics, Dynamics, and solution with computer programs/software's.

DESIRABLE AWARENESS / SKILLS

Knowledge of basics of material science and mathematics.

COURSE OUTCOMES

On the successful completion of this course; student shall be able to

1. To understand basic laws of engineering mechanics & apply the same to solve problems.
2. Understand the conditions of equilibrium of forces.
3. Describe frictional forces, limiting friction, coefficient of friction and verify law of friction
4. Apply graphical methods to solve problems
5. verify principles of mechanics through experiments

RELEVANCE OF COURSE OUTCOMES (COs) WITH POs AND PSOs (WITH STRENGTH OF CO-RELATION)

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2					2	2	2					2		1
2	2					2	3	3					1		2
3	2					2	2	3					2		1
4	2					2	2	2					1		2
5	2		2			3	3	3					2		1

1-Weakly correlated

2 – Moderately correlated

3 – Strongly correlated

COURSE CONTENT

Minimum eight experiments / assignments shall be performed to cover entire curriculum of course CE152R. At least one experiment may be performed using software or program. The list given below is just a guideline.

List of Experiments

- Reaction of Beam.
- Belt friction/ Simple frictions on horizontal and inclined planes.
- Forces in plane truss – jib crane.
- Verification of Law of parallelogram of forces.

- Verification of Law of polygon of forces.
- Verification of equilibrium equation for spatial forces.
- Study of Simple machines and verification of Law of Machine (any one).
- Moment of Inertia of Fly Wheel.
- Compound Pendulum /Torsion of Pendulum.
- Analysis of truss using software.
- Demonstration of concept of - Impact of elastic bodies and coefficient of restitution.
- Demonstration of concept of - Rolling of various bodies.
- Study of space force.
- Graphical work: problems of graphical solution of Static Problems

Evaluation Methodology:

- **ICA** – It shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (journal) based on practical performed by him/her. The performance shall be assessed experiment wise using the prescribed internal continuous assessment format.
-