

ENGINEERING MECHANICS (3ME3-04)

CO-1	To describe fundamental laws of forces, FBD, Trusses and virtual work.
CO-2	To identify problem associated with Centre of gravity and Moment of Inertia and lifting machines.
CO-3	To understand the basic concept of Friction with belt and rope drive.
CO-4	To describe the laws of motion, kinematics of rigid bodies, work, energy and power.

CO MAPPING WITH PO-PSO

SUBJECT CODE	subject name	CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
3ME3-04	ENG. MECH.	CO-1	3	2	3	1	1	1	2	1	1	3	2	2	2	2
		CO-2	3	3	3	1	1	1	2	1	1	3	2	2	2	2
		CO-3	3	2	3	1	0	1	2	1	1	3	2	1	2	2
		CO-4	3	2	3	1	0	1	2	1	1	3	2	2	2	2

LECTURE PLAN
Subject: Engineering Mechanics [3ME3-04]
Faculty: Akhilesh Paliwal

Vision and Mission of Institute:

Vision: To become a renowned center of outcome based learning, and work towards academic, professional, cultural and social enrichment of the lives of individuals and communities.

Mission:

M1: Focus on evaluation of learning outcomes and motivate students to inculcate research aptitude by project based learning.

M2: Identify, based on informed perception of Indian, regional and global needs, areas of focus and provide platform to gain knowledge and solutions.

M3: Offer opportunities for interaction between academia and industry.

M4: Develop human potential to its fullest extent so that intellectually capable and imaginatively gifted leaders can emerge in a range of professions.

Vision and Mission of Department:

Vision: The Mechanical Engineering Department strives to be recognized globally for outcome based technical knowledge and to produce quality human resource, who can manage the advance technologies and contribute to society.

Mission:

M1: To impart quality technical knowledge to the learners to make them globally competitive mechanical engineers.

M2: To provide the learners ethical guidelines along with excellent academic environment for a long productive career.

M3: To promote industry-institute relationship.

Course Outcomes:

CO1: Students will be able to describe fundamental laws of forces, FBD, Trusses and virtual work.

CO2: Students will be able to identify problem associated with Centre of gravity and Moment of Inertia and lifting machines.

CO3: Students will be able to understand the basic concept of Friction with belt and rope drive.

CO4: Students will be able to describe the laws of motion, kinematics of rigid bodies, work, energy and power.

S. No.	Lecture	Topic to be discussed	Relevant COs	Objective of Unit	Outcome of Lecture (After completion of this lecture students will be able to)	Method	Book referred	From page to
1	1	Introduction to subject	CO1	To develop an ability to understand the fundamental laws of forces, equilibrium condition, trusses and virtual work	differentiate the kinetics and kinematics	Chalk and Talk	Basudeb Bhattacharya	3
2	2	System of Forces, composition of forces	CO1		understand system of forces and composition of forces.	Projector	Basudeb Bhattacharya	5
3	3	Principle of transmissibility, Fundamental law of mechanics, Free body diagram	CO1		describe fundamental laws of mechanics, understand FBD.	Chalk and Talk	Basudeb Bhattacharya	7-8, 52-53
4	4	Lami's theorem, moment & couple	CO1		understand Lami's theorem and moment	Chalk and Talk	Basudeb Bhattacharya	46-47
5	5	Varignon theorem, Condition of equilibrium	CO1		understand varignon's theorem	Chalk and Talk	Basudeb Bhattacharya	47-48
6	6	Principle of virtual work, Active Force and Active force diagram	CO1		understand the virtual work, differentiate the active force and reactive force.	Chalk and Talk	Basudeb Bhattacharya	51-52, 366-369
7	7	Beams and Truss	CO1		understand truss with method of joint and method of section	Chalk and Talk	Basudeb Bhattacharya	98-100, 105-111
8	8	Location of Centroid, C.G., Parallel and perpendicular Axis theorem	CO2	To develop an ability to understand the centroid, centre of gravity and MOI and lifting machines	locate the centroid, C.G.	Chalk and Talk	Basudeb Bhattacharya	287-289, 293-295
9	9	Radius of gyration, Polar MOI	CO2		find out polar MOI, radius of gyration	Chalk and Talk	D S Kumar	247-251
10	10	Mechanical Advantage, velocity ratio, efficiency of machine	CO2		Calculate M.A. and velocity ratio and efficiency	Chalk and Talk	D S Kumar	323-335
11	11	Law of Machine, Reversibility of machine and system of pulleys	CO2		understand law of machine and pulley system	Chalk and Talk	D S Kumar	336-344
12	12	worm and worm wheel, screw jack, differential screw jack	CO2		understand worm and worm wheel and screw jack	Chalk and Talk	D S Kumar	349-368
13	13	Laws of Friction	CO3	To develop an ability to understand the friction with belt and rope drive system	understand the laws of friction	Chalk and Talk	Basudeb Bhattacharya	219-220
14	14	Angle of friction, angle of repose	CO3		understand the meaning of creativity	Chalk and Talk Projector	Basudeb Bhattacharya	221-222
15	15	Ladder Friction, Wedge Friction	CO3		understand the concept of ladder friction, wedge friction	Chalk and Talk	D S Kumar	319-324
16	16	Belt Friction	CO3		understand the type of belt, drives and velocity ratio, effect of slip on belt, crowning of pulley	Chalk and Talk	D S Kumar	633-636
17	17	Belt Friction and rope friction	CO3		find out length of open and cross belt, tension ratio, power transmitted by v and flat belt.	Chalk and Talk	D S Kumar	639-650
18	18	Velocity, acceleration, types of motion, Equation of motion, components of velocity & acceleration	CO4	Students will be able to Understand the Kinematics, Dynamics and Vibration.	understand velocity, acceleration and classification of motion and find out the equation of motion.	Chalk and Talk	Basudeb Bhattacharya	457-461, 462-463
19	19	Angular velocity & acceleration, Radial velocity & acceleration, Transverse velocity & acceleration	CO4		understand angular velocity and acceleration	Chalk and Talk	Basudeb Bhattacharya	463-464
20	20	Projectile motion	CO4		understand Projectile motion.	Chalk and Talk	Basudeb Bhattacharya	468-470
21	21	Newton's law of motion, equation of motion in rectangular coordinate	CO4		understand Newton's law of motion	Projector	Basudeb Bhattacharya	555-556
22	22	Equation of motion in radial & transverse component and for a rigid body	CO4		understand the equation of motion in radial and transverse component	Chalk and Talk	NPTEL, Basudeb Bhattacharya	512-513
23	23	D'Alembert Principle	CO4		understand the D'Alembert's principle.	Chalk and Talk	Basudeb Bhattacharya	561-562
24	24	Work of a force, weight, spring force and couple	CO4		understand work of a force	Projector	Basudeb Bhattacharya	622-623
25	25	Energy (potential, Kinetic, Spring), Power, Efficiency	CO4		classify energy and understand Power	Chalk and Talk	Basudeb Bhattacharya	626-627
26	26	Work, energy relation, Laws of conservation of energy	CO4		establish work energy relation and understand the laws of conservation of energy	Chalk and Talk	Basudeb Bhattacharya	627-628, 629-630
27	27	Introduction of Impulse, Momentum and relation	CO4		understand Impulse, momentum	Chalk and Talk	Basudeb Bhattacharya	669-671

Details of Books			
S.NO.	Name of Books	Author	Publication
1	Vector Mechanics for Engineers	Beer and Johnston	Tata McGraw-Hill
2	Engineering Mechanics	Hibbeler	Pearson Education
3	Engineering Mechanics	Basudeb Bhattacharya	Oxford University Press
4	Engineering Mechanics	D. S. Kumar	Katson Publication
5	Mechanical Vibration	G.K. Grover	Nem Chand and Bros

SYLLABUS

3ME3-04: ENGINEERING MECHANICS

B.Tech. (Mechanical) 3rd Semester

Max. Marks: 100

2L+0T+0P

End Term Exam: 2 Hour

SN	Contents	Hours
1	Statics of particles and rigid bodies: Fundamental laws of mechanics, Principle of transmissibility, System of forces, Resultant force, Resolution of force, Moment and Couples, Varignon's theorem, Resolution of a force into a force and a couple, Free body diagram, Equilibrium, Conditions for equilibrium, Lami's theorem. Plane trusses: Types of structures, Trusses, Support Conditions, Types of Loadings, Classification of trusses, Determinacy of trusses, Basic assumptions of truss analysis, Method of joints, Method of sections. Virtual work: Principle of Virtual Work, Active forces and active force diagram, Stability of equilibrium.	5
2	Centroid & Moment of inertia: Location of centroid and center of gravity, Moment of inertia, Parallel axis and perpendicular axis theorem, Radius of gyration, M.I of composite section, Polar moment of inertia, M.I of solid bodies. Lifting machines: Mechanical advantage, Velocity Ratio, Efficiency of machine, Ideal machine, Ideal effort and ideal load, Reversibility of machine, Law of machine, Lifting machines; System of pulleys, Simple wheel and axle, Wheel and differential axle, Weston's differential pulley block, Worm and worm wheel, Single purchase winch crab, Double purchase winch crab, Screw jack, Differential screw jack.	5
3	Friction: Types of Friction, Laws of friction, Angle of friction, Angle of repose, Ladder, Wedge, Belt Friction. Belt and Rope drive: Types of belts, Types of belt drives, Velocity ratio, Effect of slip on Velocity ratio, Crowing of pulleys, Length of belt, Ratio of tensions in flat belt drive, Power transmission by belt drives, Advantage and disadvantages of V-Belt over Flat Belt.	5
4	Kinematics of particles and rigid bodies: Velocity, Acceleration, Types of Motion, Equations of Motion, Rectangular components of velocity and acceleration, Angular velocity and Angular acceleration, Radial and transverse velocities and accelerations, Projectiles motion on plane and Inclined Plane, Relative Motion. Kinetics of particles and rigid bodies: Newton's second law, Equation of motion in rectangular coordinate, Equation of motion in radial and transverse components,	5

	Equation of motion in plane for a rigid body, D'Alembert principle.	
5	<p>Work, Energy and power: Work of a force, weight, spring force and couple, Power, Efficiency, Energy, Kinetic energy of rigid body, Principle of work and energy, Conservative and Non-conservative Force, Conservation of energy.</p> <p>Impulse and momentum: Linear and angular momentum, Linear and angular impulse, Principle of momentum for a particle and rigid body, Principle of linear impulse and momentum for a particle and rigid body, Principle of angular momentum and Impulse, Conservation of angular momentum, Angular momentum of rigid body, Principle of impulse and momentum for a rigid body, Central impact, Oblique impact, System of variable mass, Rocket.</p>	6
	TOTAL	26