Mechanics (BMETE11AP59)

Week	Lecture	Topic	Serway-Jewett 10th ed.
Week 1	13 Feb	Introduction: new SI units, magnitudes, significant digits.	Chapter 1 pp. 2-17
	14 Feb	Particle kinematics in one dimension: trajectory, derivative, velocity, acceleration, integration. Motion under constant acceleration, free fall.	Chapter 2 pp. 20-44
Week 2	20 Feb	Two-dimensional motion: vectors. Projectiles. Uniform circular motion. Tangential and radial acceleration. Relative velocity, relative acceleration. Inertial frames, Galilei's relativity principle, Galilei transformation.	Chapter 4 pp. 68-88
	21 Feb	Laws of motion, dynamics. Concept of force and mass, Newton's laws. Forces of friction.	Chapter 5 pp. 95-119
Week 3	27 Feb	**Dean's break**	
	28 Feb	Work, kinetic energy, work theorem. Conservative and non-conservative forces. Potential energy, energy conservation for particles. Energy diagram and equilibrium of a system.	Chapter 7 pp. 150-174
Week 4	5 Mar	Forces of friction. Non-uniform circular motion. Resistive forces. Motion in accelerated frames.	Chapter 6 pp. 127-143
	6 Mar	Conservation of energy. Isolated and non-isolated systems. Kinetic friction. Changes in mechanical energy for non-conservative systems. Power.	Chapter 8 pp. 181-203
Week 5	12 Mar	Linear momentum. Isolated and non-isolated systems. Collisions in one and two dimensions. Center of mass.	Sections 9.1-9.6 pp. 210-234
	13 Mar	Systems of many particles, momentum, and energy conservation. Deformable systems. Rocket propulsion.	Sections 9.7-9.9 pp. 234-241
Week 6	19 Mar	Rotation of a rigid object about a fixed axis. Angular position, velocity, and acceleration. Angular and translation quantities. Torque. Moment of inertia, Steiner theorem.	Sections 10.1-10.6 pp. 249-267
	20 Mar	Rotational kinetic energy. Energy considerations in rotational motion. Rolling motion. Angular momentum conservation, system of many particles. Kinematics of a rigid object. Torque on rigid object, equilibrium. Motion of gyroscopes and tops.	Sections 10.7-10.9 pp. 267-277 Chapter 11 pp. 285-302
Week 7	26 Mar	Change of vector in rotating frames. Inertial forces in rotating frames. Centrifugal and Coriolis forces on Earth.	Supplementary lecture notes
	27 Mar	Static equilibrium and elasticity.	Chapter 12 pp. 310-324
		Spring break	
Week 8	9 Apr	Newton's law of universal gravitation. Free fall. Kepler's laws and planetary motion. Gravitation potential energy. Energy considerations in planetary and satellite motion. Equivalence of inertial and gravitational mass.	Chapter 13 pp. 332-352
	10 Apr	Static fluids and gases. Pascal's law. Hydrostatic pressure. Buoyant forces and Archimedes principle.	Sections 14.1-14.4 pp. 358-368

Week 9	16 Apr	Surface tension, Laplace pressure, Young-Laplace equation. Contact angles, capillary phenomena.	Supplementary lecture notes
	17 Apr	Fluid dynamics. Continuity equation. Bernoulli's equation and its applications (wings!).	Sections 14.5-14.6 pp. 368-375
Week 10	23 Apr	Viscous flow, Newton's law. Flow of viscous fluids in pipes, Hagen-Poiseuille equation. Turbulent flows. Forces on bodies moving in fluids and gases.	Sections 14.7-14.8 pp. 375-378 + supplementary lecture notes
	24 Apr	Oscillatory motion. Object attached to spring. Simple harmonic motion, energy. Comparison to uniform circular motion.	Sections 15.1-15.4 pp. 386-400
Week 11	30 Apr	Pendulum: mathematical, physical, and torsional. Complex formalism. Superposition of harmonic oscillations. Oscillations with the same direction and frequency. Beats. Combining perpendicular oscillations. Decomposition of oscillations.	Sections 15.5-15.7 pp. 400-407 + supplementary lecture notes
	1 May	**Holiday**	
Week 12	7 May	Damped and forced oscillations. Q factor.	Supplementary lecture notes
	8 May	Resonance. Driven RLC circuit. Coupled oscillations. Matrix formalism, normal modes. Molecular oscillations.	Supplementary lecture notes
Week 13	14 May	Wave motion. Propagation of a disturbance, travelling wave. Harmonic waves in one dimension. Plane waves in three dimensions. Rate of energy transfer by wave on a string.	Sections 16.1-16.4 pp. 415-428
	15 May	Linear wave equation, on a string and for sound. Transversal and longitudinal waves. Doppler effect. Polarisation.	Section 16.5-16.9 pp. 428-443 + supplementary lecture notes
Week 14	21 May	Interference with two point sources, coherence. Standing waves, strings, and pipes. Boundary effects: reflection and transmission. Resonance. Standing waves in air columns.	Supplementary lecture notes Sections 17.1-17.6 pp. 451-469
	22 May	**Experiments with waves**	