

Admission to the Engineering Programme : Bachelor Track

2020 Session

Syllabus for Mechanical Engineering

1 Newtonian Mechanics

1.1 Fundamental principles

Newton's Law, conservation of energy, linear and angular momentum.

1.2 Forces

Central forces, conservative forces, elastic forces, friction and viscosity.

1.3 Gravity field and planetary motion

1.4 Harmonic oscillators

Free and forced vibrations, harmonic response, damping.

2 Thermodynamics

2.1 First and second principles of thermodynamics

2.2 Application to ideal gases

Kinetic theory, state law, heat capacity, entropy.

2.3 Reversible cycles and irreversible processes

Ideal Carnot engine, Joule-Thomson expansion, mixture of ideal gases.

3 Fluid Mechanics

3.1 Statics of fluids

Pressure, fundamental law of statics, buoyancy

3.2 Kinematics of continuous media

Eulerian and Lagrangian description of motion, material derivative, trajectories, streamlines

3.3 Dynamics of ideal fluids

Conservation laws (mass, momentum, energy), Euler equations, Bernoulli theorem and applications

3.4 Dynamics of incompressible viscous fluids

Newton's law of viscosity, application to simple flows, Reynolds number.

4 Rigid body Dynamics

4.1 Kinematics

Rotations, Euler angles, Euler parameters, composition of rotations, angular velocity vector, composition rules, acceleration, angular acceleration, kinematic constraints, moment of inertia, matrix of inertia.

4.2 Statics of rigid bodies

Net forces and Torques, connecting forces and torques on mechanical linkage, ideal joints, assembly of rigid bodies, mobility.

4.3 Dynamics

Linear and angular momentum of a rigid body, Newton and Euler equations of motion, inertial and non-inertial frames of reference (Lagrangian formalism is not part of the syllabus).